Uttar Pradesh Rajarshi Tandon
Open University, Prayagraj

MFN-109

Advance Community Nutrition

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Uttar Pradesh Rajarshi Tandon Open University

MFN- 109 ADVANCE COMMUNITY NUTRITION

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Advance Community Nutrition

Course Introduction:

This course deals with the concept and scope of Community Nutrition, Food availability and its consumption. Community Nutrition deals with improving nutrition and population in both poor and industrialized countries. It includes a variety of activity such as understanding and raising awareness regarding etiology, symptoms and treatment of nutrition problems and related health disorders in the society.

It also explains the nutritional requirements and dietary guidelines for population and innumerate's the programs and interventions run by the government for health and nutritional upliftment of the community. All course contents are divided into four blocks and 12 Units.

Block I consist of three units:

Unit 1 is concept and scope of community nutrition. After going through this unit the students would be able to understand the meaning and concept of community nutrition and will also understand its scope. In Unit 2 the students shall go through the food availability and factors affecting food availability and its consumption. There are several factors like the amount of agricultural production, post harvest handling, marketing and distribution, the affect of population and the affect of economic factors and industrialization. Unit 3 is nutritional problems of the community and implications for public health. India is a country where a large section of the population still faces the problems of poverty, ignorance, hunger and malnutrition.

Block II deals with Nutrition Policy, hazards to community health and Nutritional Status.

In our country a large group of population faces problems like Hunger, malnutrition and nutritional deficiency disorders. Because of the burden of these conditions the disease fighting immunity is greatly lowered and thus people fall prey to various kinds of life threatening infections.

Sometimes it is not because of poverty and hunger only but it is also due to various kinds of adulterations and pollutions which make the food very unhealthy and disease causing. People are most of the time ignorant about these facts and unknowingly they consumed the food items which can be very toxic for them.

To combat the nutritional problems in India the government runs various prophylaxis programs which are discussed in length in this block. This block has three units

Block III and IV deals with nutritional assessment, surveillance and current methodologies of assessment of nutritional status, Importance of Food Standards and Hazards of Food Products.

The main responsibility and priority of the government is to eradicate the problem of hunger and malnutrition from the society completely. For this reasons government implements many nutritional surveillance programs and also sets up various programs and policies to specially help the vulnerable sections of the society.

Uttar Pradesh Rajarshi Tandon
Open University, Prayagraj

MFN-109

Advance Community Nutrition

BLOCK 1

Unit-1 Concept and Scope of Community Nutrition 7

Unit-2 Food Availability and Factors Effecting Food Availability and Its Consumption 27

Unit-3 Nutritional problem of the community and implication for Public Health 63

INTRODUCTION (BLOCK I)

Block 1 deals with the concept and scope of Community Nutrition, Food availability and its consumption. Community Nutrition deals with improving nutrition and population in both poor and industrialized countries. It includes a variety of activity such as understanding and raising awareness regarding etiology, symptoms and treatment of nutrition problems and related health disorders in the society.

It also explains the nutritional requirements and dietary guidelines for population and innumerates the programs and interventions run by the government for health and nutritional upliftment of the community.

Block I consist of three units :

Unit 1 is concept and scope of community nutrition. After going through this unit the students would be able to understand the meaning and concept of community nutrition and will also understand its scope.

In **Unit 2** the students shall go through the food availability and factors affecting food availability and its consumption. There are several factors like the amount of agricultural production, post harvest handling, marketing and distribution, the affect of population and the affect of economic factors and industrialization. In short this unit will explain to them all about food availability and how it is affected through various factors in the community.

Unit 3 is nutritional problems of the community and implications for public health. India is a country where a large section of the population still faces the problems of poverty, ignorance, hunger and malnutrition. In places where poverty is prevalent people do not have access to a proper well balanced meal even once in a day. As a result they suffer from acute malnutrition. Protein energy malnutrition and the various micronutrient deficiencies such as Vitamin A, Iron and Iodine are most prevalent. With these deficiencies people start having diseases like Kwashiorkor, Marasmus, Nutritional Blindness, Anemia and Goitre . After going through this unit the students will also know how the deficiency diseases can be prevented.

Unit – 1 Concept and Scope of Community Nutrition

Structure

1.0 Objectives
1.1 Introduction
1.2 Concept of community
    1.2.1 Meaning of community
    1.2.2 Important characteristic of Community
    1.2.3 Types of community
1.3 Meaning of Nutrition, Health and community nutrition
1.4 Meaning and concept of community nutrition
1.5 Objectives of community
1.6 Scope of community nutrition
1.7 Concept of health care
    1.7.1 Levels of health care
    1.7.2 Health care system in India
1.8 Community Nutrition – an essential component of health and health care
1.9 Check your progress Exercises
1.10 References

1.0 OBJECTIVES

After studying this unit, you will be able to understand the following:

1 Meaning and concept of community
2 Types and characteristics of community
3 Meaning of health and nutrition
4 Concept of community nutrition
5 Concept of health care
6 Health care system in India
7 Co-relation between health care and community nutrition

1.1INTRODUCTION

In the modern word because of the busy lifestyle urbanization and industrialization there is a fast change in the food consumption pattern and the lifestyle of community specially the younger generation. This has a tremendous impact on the nutrition and health profiles of the consumers. Although the consumers especially the urban population is more aware and much better informed about various issues relating to health but still because of their busy lifestyles and sometimes wrong food choices made by the consumers specially the young generation of the society. Sometimes faulty choices regarding food are made. There is a lot of information in print and digital media regarding food which often adds to the confusion in making right choices and staying clear of misinformation and misconceptions. Therefore, there is need of Dieticians, Nutritionist and other professionals with proper knowledge to ensure good nutrition and positive health of the people they serve. This need is felt even more acutely in the present time with the current health scenario prevailing all over the world. The problems of nutrition's are different from one country to another but still proper nutrition is must and most important for the good health of the community.

In this unit we will learn about community nutrition, health and impact of community nutrition on quality of life and human development. We shall also learn about the concept of health care and the three different levels at which it is available to the community. We shall understand "Health for all by 2000 A.D. and the role of primary health care in achieving the same". We shall understand the infrastructure for the delivery of health care service in the country and the role of community nutritionist.

1.2 CONCEPT OF COMMUNITY

The term community may be defined as a group or collection of groups that inhabit in a limited geographical area and whose members live together in such a way that they share the basic condition of common life.



1.2.1 MEANING OF COMMUNITY

According to the Ontario Healthy Communities Coalition, the word "community" has been used in English since the 14th century to refer to groups of people within a district who share common traits and a shared sense of identity. The concept of community he extended in the 19th century to describe the relationships of people in a larger society.

A geographic community is a community whose members share the same physical space. These are communities in the most traditional sense. Members share relationships with physical structures within geographic regions such as: B.A river or mountain. A community of interest is a small group within a geographic community. They are made up of people united by certain beliefs and goals. For example, all runners in a particular city are sometimes referred to as that city's "running community." The concept of community has also been extended to virtual communities, defined as groups of people who interact through communication media rather than face-to-face.

1.2.2 IMPORTANT CHARACTERISTIC OF COMMUNITY

Understanding the characteristics is essential for all kinds of public health practices such as program planning epidemiological studies. Community characteristics are particularly important in Public Health Emergency preparedness.

Community refers to a group of individuals and families living in a define geographical area usually comprising of the village or town or a city.

The basic characteristics of Community are as follows: -

1. **A group of People** – Community is a group of people whose interest are based on mutual dependence and co-operations. During their interactions they come together to act to satisfy basic needs of their life. A collection of people may be tiny of huge but whenever is term

community is used it always refers to a group of people. We cannot think of a community without a gathering of persons who live together, share a common life and are linked by a strong feeling of communal awareness. When several persons recite together and share similar interest and views then a community emerges. Therefore, the first prerequisites a community are individuals.

2. **A definite locality** – A community is defined by its location. A single individual can't create a community on their own. The community people live a specific geographical area i.e., a village, a town, a city, a neighborhood or a district in state.
3. **The relation of community to locality** – The community possesses a distinctive territorial characteristic that implies a common soil as well as a shred way of life. In a community, the people have a sense of 'we feeling' or 'Community feeling' or 'Community consciousness' and a strong feeling of 'belongingness' to that particular area.
4. **Common Social values, norms and other aspects of culture** – Each community has a common set of social values which form a hierarchy of organizations in a community. They may very form one society to another in culture. For instance, ownership of farm land, type of residence, religion, cash in bank, financial investment, education and position on government service, all may influence the organizational hierarchy of a community.
5. **Common set of Organization and Institution** – A community is a self-contained group exhibiting a considerable sense of self sufficiency. People in a community come together to meet their chief need through a common set of Institution and Organization.
6. **Naturality** – Communities are self-organized. It is the fruit of neither human effort nor legislation. It develops naturally as a result of numerous influences operating in unison. Individuals became member at birth because they were born into the group.
7. **Permanence** – A community is always a permanent organization. It refers to people who live in a particular area. It is not ephemeral like that of a crowd or group.
8. **Similarity** – In a number of ways members of community in a similar. As they dwell in the same neighborhood, they lead a similar lifestyle and have identical objectives. Similarities in language, culture, traditions and customs are among the many similarities seen among the members. The growth of communal sentiments is due to these similarities.
9. **A particular name** – A community has its own name by which it is known to rest of the world. Members of community are also identified by that name. For example, a residence of Odisha known as Odia.

10. **Size of Community** – On the basis of its size a community is identified. It could be tiny or large. A village is an example of little community, whereas a nation or the entire world are examples of large communities.
11. **Common interest** – while individual interest of a member of a community may differ, there may always be some common interest that unite the community people and develop a sense of belonging. A community is characterized by sharing common interest and working together to fulfill these interests and to satisfy basic needs.

Therefore, community refers to a group of mutually dependent people living in a more or less compact continuous geographical area, having a sense of belonging and sharing common values, norms and some common interest acting in a united and organized manner to satisfy their basic needs through a common set of Institution and organization.

1.2.3 TYPES OF COMMUNITY

Communities can be classified in various ways:

1. **Location-based community**: For example, rural community or urban community.
2. **Governance based community:** For example, nation, state, district.
3. **On the basis of profession:**For example,doctor community, engineer or teacher community.
4. **On the basis of family income:**low-income group, middle income group, higher income group**.**
5. **Identity-based community**: From local cliques, subcultures, ethnic groups, religions, multicultural or pluralistic civilizations to today's global community cultures. They can be included as communities of needs or communities of identities.
6. **On the basis of food habits**: for example, vegetarian, non-vegetarian, vegan etc.
7. **On the basis of religion**: Hindu community, Christian Community, sikkh and muslim community etc.
8. **On the basis of age group**: Pre-schoolers, schoolers, adolescent, adults etc.
9. **Org-based community**: They range from informally organized communities around family and network-based guilds and clubs, to more formal incorporated associations, political decision-making bodies, commercial enterprises, or small, national or international professional associations.

1.3 MEANING OF NUTRITION HEALTH AND COMMUNITY NUTRITION

Before understanding the meaning of public nutrition, it is also important to gain a good understanding of nutrition and Health.

- **Nutrition** – Nutrition may be defined as 'the science of food and its relationship to health.' It is concerned primarily with the part played by nutrients in body growth, development and maintenance. Good nutrition means 'maintaining a nutritional status that enables us to grow well and enjoy good health'.
- **Health** – The World Health Organization defines health as follows – **Health is a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity**.

This clearly means that for achieving good health people not only should be physically but also mentally and socially healthy. Its only when people behave in a sound manner and are socially acceptable, they are said to be in a positive state of health.

1.4 MEANING AND CONCEPT OF COMMUNITY NUTRITION

Community nutrition is concerned with improving nutrition and population in both poor and industrialized countries, linking with community and public health nutrition and complementary discipline. Community of public nutrition is an applied and very vast field. It includes a wide range of activities which are as follows –

- An understating and raising awareness of the nature causes and consequences of nutritional problems and related health disorders in society.
- Epidemiology, including monitoring, Surveillance and evaluation.
- Nutritional requirements and dietary guidelines for population.
- Programs and interventions – there design, planning, management and evaluation.
- Community nutrition and community-based programs.
- Public education, specially nutrition education for behavioral change.
- Timely warning and prevention and eradication of or mitigation of emergencies, including survival ration distribution.
- Advocacy and linkage with, such as population and environmental concerns.
- Public policies and programs relevant to nutrition in several sectors for examples economic development, health, agriculture and education etc.

So, community nutrition is a very vast field and has many aspects to it.

CONCEPT OF COMMUNITY NUTRITION

According to the nutritional professionals 'Nutrition is not a discipline to studied, it's a problem to be solved'. According to this definition solving nutrition problems requires multi-disciplinary co-operation. The study of nutrition starts from most basic laboratories sciences to an understanding of global, economic and political interactions among nations. The nutrition problem in developing as well as developed countries cannot be solved in the laboratory of clinic alone. The different segments of the population achieving nutritional health fall in different economic, social, cultural and behavioral segments. They also face different problems like the lack of access to food, inappropriate distributions among or within households and faulty food and health practices. The skills and knowledge needed to help address these constrains are quite different from those of the laboratory scientists or the medical practitioner. They required different kind of training which deals with the preventions and cure of the nutritional problems prevailing in the community.

In 1996, according to the letter in the American Journal of Clinical Nutrition by Mason and co-workers they suggested the name Public Nutrition to define a new field encompassing the range of factors known to influence nutrition in populations including diet and health, social, cultural, and behavioral factors and the economic and the political factors. According to them like public health public nutrition with focus on problem solving in a real word setting, making it, by definition, an applied field of study who success is measure in terms of effectiveness in improving nutritional conditions. Thus now, community or public nutrition is considered an important field of study which aims mainly at eradicating the nutrition related problem of the community and improving the nutritional and health profile of the population in all.

According to Huges and Somerset, 1997 -

"Community Nutrition is the planning and evaluation of the mix of nutrition services and activities for local communities based on needs, public health indicators and policy. It addresses local population health issues through food and nutrition related health promotion strategies."

According to Jones & Bartlett -

"Community is an area of nutrition that addresses the entire range of food and nutrition related issues to prevent disease and improving the health of individuals and families of the community"

Thus, community nutrition is a group of activities targeted at providing access to safe healthy and nutritious diet under the purview of locally available resources. The term community nutrition is often used to reflect the wide range of delivery settings and sponsoring organizations for nutrition related programs and services and cunity services directed towards individual and group in the community.

1.5 OBJECTIVES OF COMMUNITY NUTRITION

The community nutrition aims at bringing adequate changes in lifestyle and food consumption pattern in order to improve the quality of life and contribute to health promotion of the population in the community where programs and services are delivered.

Community nutrition services are a collaboration of public, consumers, community leaders, legislatures, policy makers, administrator, health and human service professionals to access and respond to community demands. Broadly community nutrition aims at the following –

- **Adequate nutrition for all** – Nutrition effects the health of people from conception till adulthood or till the person is alive. The existence and survival of living being depends on nutrition. Adequate nutrition is specially important in periods of rapid growth and development. Poor nutrition during pregnancy, infancy, childhood, adolescence, affect the outcome of pregnancy and also takes its toll on the later stages of life. India's under nutrition problem is a serious threat to child development.
- **Nutritional well-being of marginalized segment of society** – Low socio-economic conditions poor literacy rate, gender discrimination and education deprivation are some key factors contributing towards malnutrition among some population groups. With the help of community nutrition studies, we can identify these groups and provide precautionary and curative measures to them.
- **Maternal and Child welfare** - Mother and child are the most vulnerable section of the society. Proper nutrition during pregnancy lays strong foundation for future life. That's why maternal and child health has always been the focal point of community nutrition. Pre conceptual nutrition programs as folic acid/iron/Vitamin A/calcium administration etc. are the examples that show the commitment of community nutrition program towards maternal and child welfare.
- **Prevention of Lifestyle related diseases** – In modern times, diseases like obesity, diabetes, hypertension, coronary heart disease and arthritis etc are rising. The role of community nutrition is to make the people aware of the disease prevention factors.

- **To provide healthy food options** –The importance of community nutrition lies its ability to promote health through provision of healthy food items. Many individuals and communities lack access to healthy food options due to factor such as income, location and transportation/ Community nutrition programs such as farmers, markets, community garden and food banks can help address these issues and provide individuals with access to healthy food.
- **Health Equity** – Community Nutrition programs can help address health disparities by ensuring that all individuals and communities have access to healthy food options and nutrition education.
- **Cost Savings** – Community nutrition programs can also result in cost savings for individuals and communities i.e., programs that promote healthy eating habits and behaviors can reduce health care cost associated with chronic diseases such as obesity and diabetes.
- **Sustainable Food Systems** – Community nutrition programs can also promote sustainable food systems by supporting local farmers and reducing food waste. They can have a positive impact on the environment and contribute to the long-term health and well-being of individuals and communities.
- **To educate individuals and groups** –Community nutrition program can help in prevention of malnutrition and lifestyle related disorder by making the people aware of healthy eating the good lifestyle practices.

Apart from all this community nutrition surveys also provide factual evidence for the incidence of malnutrition to concern authorities or policy maker to make them realize the extent of the problem.

1.6 SCOPE OF COMMUNITY NUTRITION

Nutritional status is important because it indicates the health status and well-being of the society. It is also a marker of individual welfare. Community nutrition efforts involve a wide range of programs that provide increased access to food resources, nutrition information and education and health related care. They also include efforts to change behavior and to initiate policy.

Over the year researches have shown that for health promotion disease prevention community has to be a focal point. Local values norms and environment have significant effect on shaping an individual's attitudes and behavior. The role of community nutrition is becoming challenging and viable as it both generates and disseminates valuable health and nutrition information.

In India the problem of malnutrition is prevalent specially among the vulnerable section of the society. Community nutrition addresses the entire range of food and nutrition issues related to individual's families and special needs groups living in defined geographical areas.

Community nutrition is founded on the sciences of –

- Epidemiology – branch of medicine which deals with the incidents, distributions and possible outcomes of the diseases and other factors relating to health.
- Food
- Nutrition
- Human Behavior

Today the nutrition problems have become an object of interest for multi disciplines like public health specialists, food scientist, home scientist, bio chemist, agricultural scientist, nutritionist, journalist and extension worker and communication expert.

The major health problems in India these days

- Communicable disease problem
- Population problem
- Environmental Sanitation problem
- Medical care problem
- Nutritional problem

The two areas most commonly identified as important to public nutrition are economic and behavioral science. Economics is related to community nutrition because it applies to households. The household is production and consumption unit in which there are certain determining factors like intra household allocation of food, the value of time, the role of incomes, income sources and local prices in determining household food security.

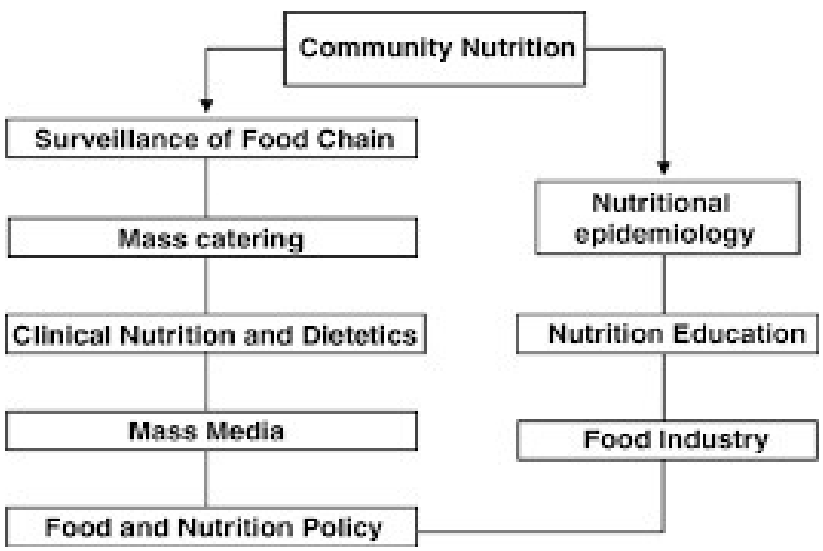
Thus, we realize that community nutrition is a very wide field as a community nutritionist and understanding of many non-nutritional determinants of nutritional outcomes is required to solve nutritional problems of population. A knowledge and understanding of programs and policies is also required.

Following are the key skills and knowledge required to work in public health and nutrition area –

1- The person working in community health and nutrition area must have the ability to collect, access and interpret pertinent information on public health and nutrition issues.
2- He should know how to successfully employ them into effective intervention and safe practices.
3- He should be able to apply the core principles of health promotion and effectively address the identified health problems and related issues.
4- He should have the ability to prepare community level planning, implementation and evaluation in two-way communication method which brings out positive result in community.
5- He should have proper communication skills in both written and oral areas which are crucial to the success of any community level nutrition planning.
6- The community nutrition workers must develop outstanding communication to adapt themselves into the atmosphere of target population group.
7- He should be able to understand the local, regional straight and central data and also the policies and strategies related documents relevant to the public health and nutrition systems.
8- Must understand economic, environment, social, cultural, political and behavioral factors that influence food supply, choice, access and consumption.
9- He must understand the purpose and application of 'Recommended Dietary Allowances for Indians, Nutrients efficacy, dietary guidelines and other important standards.

Activities under taken under in community nutrition

The community nutrition activities are as follows –



- **Growth monitoring and health assessment** – Under community nutrition assessment and monitoring of the determinants of nutrition and health is under taken. There impact on population is also assessed to identify priority issues and leverage points for interventions.
- **Imparting nutrition education** – giving nutrition education and proving health in the community where it is required most, in a cost effective and tailor made methods.
- **Collecting information** – The major activity in community nutrition is to collect and disseminate information about various community health problems.
- **Proving information**– In community nutrition programs knowledge about community health programs is given to the target groups.
- **Initiation of prevention** – Application of primary prevention principles to public health nutrition interventions is a major activity of community nutrition.
- **Skill development and training**– Community nutrition facilitates skill development and training to build public health and community nutrition capacity in health and other related sectors.
- **Planning interventions** – After the nutritional problems of the community have been identified the activity of community worker is to implement public health nutrition intervention programs including the management of Human Financial Resources.
- **Increasing awareness in people regarding policies** – The main target of community workers is to make the community aware of the policies on nutrition and health also people should be educated about the income generating programs.

Community nutrition such as school nutrition program, food banks and community gardens provide access to healthy food options and can help address the issues of various lifestyle disorders.

Community nutrition programs can also help prevent chronic diseases such as obesity, diabetes and cardiovascular diseases.

CHECK YOUR PROGRESS EXERCISE 1

1- Define the following –

a. Health ----------

---

b. Nutrition ----------

---

c. Community ----------

2- What do you understand by community nutrition? ----------

3- Explain the characteristics of a community? ----------

4- On what basis are the various communities differentiated? Explain with the help of examples? -
---

1.7 CONCEPT OF HEALTH CARE

Health care is the improvement of health by preventing, diagnosing, treating or curing disease, illness, injury and other physical and mental disorders in people. Health care is provided by medical professionals and related health care workers. Medicine, dentistry, pharmacy, obstetrics, nursing, optometry, audiology, psychology, occupational therapy, physical therapy, exercise training, and other medical professions all constitute health care. This includes primary care, secondary care, tertiary care and public health jobs.

Access to healthcare varies by country, community and individual and is influenced by social and economic conditions and healthcare policies. Health service delivery means “timely access to personal health services to achieve the best possible health outcomes.” Factors to consider in relation to access to healthcare include financial constraints (e.g., insurance coverage), geographic and logistical barriers (e.g., additional travel costs, ability to take paid time off, such as access to services), socio cultural expectations, and personal limitations (inability to communicate with health care providers, poor health literacy, low income). Health care limitations adversely affect access to health services, effectiveness of treatment, and overall outcomes (well-being, mortality).

A healthcare system is an organization established to meet the health needs of a particular population. According to the World Health Organization (WHO), a well-functioning health system must have funding mechanisms, a well-trained and well-paid workforce, reliable information on which to base decisions and policies, and a high-quality health care system. We need well-maintained medical facilities to provide medicines and technology. An efficient health system can contribute to a significant part of a country's economy, development, and industrialization. Health care has traditionally been viewed as an important factor in promoting the overall physical and mental health and well-being of people around the world. It was declared eradicated by WHO as the first disease in human history to be eradicated through deliberate medical intervention.

1.7.1 LEVELS OF HEALTH CARE

Health care is provided at three different levels in India:



1. **Primary Care level** – this is the first level of contact of an individual, the family and the community with the national health system. It is possible to deal with most of the health problems of the community effectively at this level. In India these services are provided through the following network.

   a. PRIMARY HEALTH CENTERS

   ↓

   Sub centers

   ↓

   The functionaries

   Multipurpose health workers | Village health guides | Trained birth attendants (Dais)

2. **Secondary Care level** – More complex health problems of the community are resolved at the secondary care level through the district hospitals and the community health centers. The

community health centers provide a variety of specialist facilities at the block level. The community health centers also act as the first referral level. This means that patient can be directed to the next level of health care facility without first going to the district level hospital.

3. **Tertiary Care level –** this the highest level of health care available to the community, for dealing with their most complex health problem which cannot be solved at the primary and secondary level. The institution involved in providing the required facilities and care include the medical college hospitals. These institutions have highly specialized health professionals who dispensed these services.
4. **Quaternary Care** - The term quaternary care is sometimes used as an extension of tertiary care in terms of advanced levels of medical care that are highly specialized and not universally accessible. Experimental medicine and some special diagnostic or surgical procedures are considered quaternary medicine. These services are usually provided only in a limited number of regional or national health centers.
5. **Home and community care** - Many types of medical interventions take place outside medical facilities. This includes a number of interventions on public health concerns, such as food safety surveillance, condom distribution, and needle exchange programs to prevent epidemics. It also includes professional services in residential and community settings to support self-care, home care, long-term care, assisted living, addiction treatment, and other types of health and social care services. Community rehabilitation services can support mobility and independence after amputation or loss of function. This can be a prosthesis, brace or wheelchair.
    a. As populations age in many countries, one of the priorities of health care systems is to help older people live comfortably and independently in their own homes. There are whole areas of health care designed to help older people with their daily activities at home.
    b. Transportation to see a doctor and many other activities essential to health and well-being. Despite caring for the elderly together at home, family members and caregivers may have different attitudes and values towards joint efforts and poses challenges to the design of ICT (Information and Communication Technology).
    c. Statistics show that more than 80 million Americans have taken time off from their primary occupations to care for loved ones, so many countries do not allow families to donate to care for their loved ones. We're starting to offer programs like the Personal Assistant Program for consumers that allow them to do so. their total income.

d. As childhood obesity is rapidly becoming a major problem, health services have launched programs in schools aimed at educating children about eating habits, making physical education compulsory, and instilling positive self-images in young adolescents. often introduced.

1.7.2 HEALTH CARE SYSTEM IN INDIA

Health care means the prevention, treatment and management of disease and the maintenance of mental and physical health through services provided by medical, nursing and related health professionals. According to the World Health Organization, healthcare includes all goods and services designed to promote good health. This includes “preventive, curative, and palliative interventions, whether directed at individuals or communities.” The systematic provision of such services can constitute a healthcare system. Health is defined as a state of complete physical, mental and social well-being, not just the absence of illness or disease. Health is a fundamental human right and is fully taken into account by Article 21 of the Constitution. Article 21 emphasizes that state governments protect people's health and nutrition, but central government also plays an active role in this area. In recognition of the important role played by the healthcare industry, the industry has been granted infrastructure status under Section 10 (23G) of the Income Act.

• India's healthcare sector consists of healthcare providers such as doctors, specialty clinics, nursing homes and hospitals.

• Diagnostic service centers and pathology laboratories.

• Manufacturers of medical devices.

• Contract research organizations (CROs), pharmaceutical manufacturers

THE INDIAN HEALTH CARE SYSTEM

Indian Health Care System Traditional Health Care System of India In addition to modern medicine, native or traditional health practitioners continue to practice it throughout India. Popular indigenous health traditions include Ayurveda, Siddhas, Unani, Homeopathy, Naturopathy and Yoga.

- **The Ayurvedic (Science of Life)** system addresses causes, symptoms, diagnosis and treatment based on all aspects of well-being (mental, physical and spiritual). These professionals have traditionally inherited their skills from their ancestors. However, with the advent of education, various institutions offer training in Indigenous medical practice.

- **The Siddha system** defines disease as any condition in which the normal balance of the five elements in the human being is disrupted, causing various forms of disease. The diagnostic method in the Siddha system of medicine is based on the physician's clinical insight after observation of the patient, pulse, diagnosis, and medical history.
- **Yoga** is both the science and art of living a healthy life physically, mentally, morally and spiritually. Yoga is believed to have been originated by Indian saints and sages thousands of years ago. Yoga has its origins in the Vedas and its philosophy is the art and science of living in harmony with the universe. Yogis rationalized the experience of yoga and made practical, scientifically prepared methods available to everyone.
- **Naturopathy** suggests that these methods were widespread in ancient India. There are several references in the Vedas and other ancient texts. Naturopathy believes that all illness arises from the accumulation of diseased substances in the body, and when space is given for its removal, healing or Relief is brought. She also believes that the human body has an inherent ability to repair itself and heal itself. It differs slightly from other health care systems in that it considers the holistic set of factors that contribute to disease, including: Unnatural habits of living, thinking, working, sleeping, or relaxing, and environmental factors that disrupt the normal functioning of the body.
- **The Unani system** of medicine believes that the body is composed of four basic elements: earth, air, water, and fire, and that these elements have different temperaments: cold, hot, wet, and dry. After the mixing and interaction of the four elements, a new compound with new temperaments is created: hot wet, hot dry, cold wet and cold dry. The body has simple and complex organs and receives nourishment from four fluids. Blood, sputum, yellow bile, black bile. The Unani medical system believes in health promotion, disease prevention and cure. In addition to such a medical system, there are also faith/spiritual healers, mostly present in rural India. Some spiritual leaders use one or more of traditional remedies such as Ayurveda, yoga, or naturopathy as one of their healing modalities to heal their clients. India's Modern (Allopathic) Health System India's modern (allopathic) health system consists of the public sector, the private sector and an informal network of health care providers. The size, scale and sprawl of the country have made full compliance with many well-intentioned policies and regulations difficult. Standards and guidelines exist, but compliance is minimal.

In practice, the sector operates in a largely unregulated environment with minimal control over what services can be provided, by whom, how and at what cost. As a result, there are wide disparities across countries in the access, cost, level and quality of health services provided.

1.8 COMMUNITY NUTRITION – an essential component of health and health care

We can now understand the nutrition is a very important determinant of health of an individual. Although there are other factors also which effect the health. The root cause of many health problems of the individuals and community is faulty nutrition. It could be a lack, an access or an imbalance of certain nutrients in the diet which effect the nutritional status leading to health problems. **Health for allis a universal goal of all nations and communities, so community nutrition has to be an integral part of any strategy designed to achieve this goal.**

Thus, we can conclude that community nutrition is an essential component of health and health care.

ROLE OF COMMUNITY NUTRITIONIST

Continuing changes in the healthcare environment in countries around the world present diverse and new challenges to community nutrition professionals who are closely linked to the provision of nutritional support in all healthcare activities. The shift in focus from the previous main focus of prevention and treatment has placed greater responsibility on all those involved in community health care.

Today, most illnesses are linked to lifestyle and environmental factors, but the majority of illnesses can be traced back to being caused by bacteria when the first public health movement began are included in the developed world and are less successful in public health.

A community nutritionist can perform the following tasks –

1. In the hospital setup they are responsible for food service management, nutritional care of the patient including diet counseling and imparting nutrition education to various categories of medical personal.
    a. The directorate general of health services has recommended the appointment of at least one dietician for every 100-bed hospital with progressive increase in their numbers as the hospitals bed increase.
2. There is a role for the community nutritionist in the national health setup at the centers as the nutrition advisor and research officer. At the state level they can function as the state nutrition officers.
3. Under the national ICDS scheme, 1 child development project officer (CDPO) is selected for each project. The qualifications for the post include child development / social work / home

science / nutrition or any other allied field. Also, the district cells to be created in district which are fully covered by the scheme also have the provision for a nutritionist.

4. The community nutritionist can be very helpful in all the programs of development under taken by voluntary and non-government organizations.
5. At the international level organizations like WHO, FAO and UNICEF provide opportunities for community nutritionist at the policy making, planning and implementation stages.

SUMMARY

After studying this unit, we can now understand the concept of community and we can also understand the important contributions which can be made by the community nutritionist in the field of health and health care.

1.9. CHECK YOUR PROGRESS EXERCISE 2

1- Write a brief note on level of health care in India? ----------
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2- Comment on the following –
   a. Role of Primary Health care in the field of community nutrition ----------
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      ---
   b. The Indian health care system ----------

3- How does the health care system in India help in bringing about better nutrition and health care status of the society? ----------

4- Write short note on the following –

- Meaning of Community ----------
- Important characteristics of Community----------
- Task of a community nutritionist ----------

1.10. REFERENCES

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Unit – 2 FOOD AVAILABILITY AND FACTORS EFFECTING FOOD AVAILABILITY AND ITS CONSUMPTION

Structure

2.0 Objectives
2.1 Introduction
2.2 Determination of Food availability
2.3 Per capita food availability
2.4 Factors effecting food consumptions
2.5 Biological determinants of food choices
2.6 Factors effecting food availability and its consumption
2.7 Summary
2.8 Check your progress exercise
2.9 References

2.0 OBJECTIVES

The main objectives of this unit are to make the students understand the following points –

- Determination of food availability and per capita food availability.
- The main factors which determine the food choices of an individual and community in all.
- The various factors which effect the availability of food.
- The factors that effect the consumption of food.
- How to get the maximum availability of food by avoiding the wastage and post-harvest food losses.
- How population effects the food available to the community.

2.1 INTRODUCTION

Food consumption of an individual or community in border sense is affected by many factors. Hunger being the first and foremost factors that forces us to eat food, but to have food of our choice for satisfying the physiological and nutritional needs is a different situation.

The food availability data tells us the amount of food available for human consumption by measuring the supply of food from different channels.

2.2 DETERMINATION OF FOOD AVAILABILITY

The amount of food available for human consumption is calculated as the difference between available commodity supplies and non-food use.

Total annual food supply of a commodity = available commodity supply (production + Imports + beginning stocks) – nonfood use items that can be measured. (Farm inputs + exports + stocks in the ending)

Food availability is the availability of sufficient quantity of food of appropriate quality, supplied through domestic productions or imports including food aid.

2.3 PER CAPITA FOOD AVAILABILITY

It is calculated **by dividing the total annual food supply during a given period by the total resident population in a given year.**

Total annual food supply of the commodity/that year's population = availability per person.

Proper food availability and consumption is very important for a healthy nation where people do not suffer from hunger, starvation and malnutrition. Apart from proper food availability there are many other factors which effects food consumption.

2.4 FACTORS EFFECTING FOOD CONSUMPTION

Hunger is the most important factor in our diet, but what we eat is not solely determined by physiological and nutritional needs. Other factors that influence food choices include:

- Biological determinants such as hunger, appetite and taste
- Economic determinants such as cost, revenue and availability
- Physical determinants such as access, education, skills (e.g., cooking) and time
- Social determinants such as culture, family, peers, and eating habits;
- Psychological determinants such as mood, stress and guilt
- Attitudes, beliefs and knowledge about food

The complexity of food selection is evident from the list above, but it is by no means exhaustive. Food choice factors also vary by life stage, with the strength of factors varying from person to person or group of people. Therefore, one type of intervention to change food choices may not be appropriate for all populations. Rather, interventions must be targeted to different populations, taking into account the many factors that influence food choices.

2.5 BIOLOGICAL DETERMINANTS OF FOOD CHOICE

- **Hunger** - Our physiological needs are fundamental determinants of food choices. Humans need energy and nutrients to survive and to respond to hunger and satiety (satisfaction of appetite, no hunger between two meals). The hunger appetite stimulation and food intake all are controlled by brain.

  The macronutrients carbs, protein and fat produce different levels of satiety signals. A body of evidence suggests that fat is the least satiety factor, carbohydrates have an intermediate effect, and protein has been shown to be the most satiety producing nutrient. The energy density of a meal has been shown to have a significant effect on satiety. Low-energy meals make you feel more full than high-energy meals. The high energy density of foods high in fat and sugar can also lead to 'passive overconsumption', in which extra energy is inadvertently ingested without ingesting additional amounts. The amount and portion of food eaten can be an important signal of satiety. Many people don't know the right amount and unintentionally consume too much energy.

- **Palatability-** palatability is the feeling that someone gets when eating a particular food. It depends on the following sensory properties of the food -
  - Taste
  - Smell
  - Texture
  - Appearance

  Because of this reason we don't eat food just for satiety and nourishment but also for the pleasure we get. When someone finds food palatable the appetite is automatically increased. This is more with the younger and children crowd. Sometimes increasing food variety can also increase food and energy intake.

- **Sensory aspects -** "Flavor" and "Taste" are repeatedly cited as important factor influencing eating behavior. In fact, "taste" is the sum of all sensory stimuli caused by ingesting food. This includes not only the taste itself, but also the smell, appearance and texture of the food. These sensory aspects are thought to have a particular impact on voluntary and spontaneous food choices.

  From an early age, tastes and habits influence food behavior. Sweet likes and dislikes and bitter aversions are considered innate human traits that are present from birth. Taste preferences and

food aversions develop through experience and are influenced by our attitudes, beliefs, and expectations.

ECONOMIC AND PHYSICAL DETERMINANTS OF FOOD CHOICE

- **Cost and accessibility**- There is no doubt that food cost is an important factor in dietary choices. Whether the cost is exorbitant and prohibited depends largely on a person's income and socio-economic status. Low-income people tend to have an unbalanced diet, especially eating less fruits and vegetables. However, access to more money does not automatically lead to better nutrition, but it increases food choices.

  Accessibility to stores, shops and market is another important physical factor that influences food choices and depends on resources such as transportation and geographical dimensions. Health foods tend to be more expensive when available in urban areas than in suburban supermarkets. However, increased access alone does not lead to additional purchases of fruits and vegetables, which are still considered prohibitively expensive.

  Education and Knowledge- Studies show that educational attainment can influence eating behavior in adulthood. In contrast, there is no strong association between nutritional knowledge and good eating habits. This is because knowledge about health does not directly translate into action if individuals are uncertain about how to use that knowledge. Furthermore, disseminated information on nutrition comes from a variety of sources and is seen as contradictory or mistrustful, undermining motivation for change. Therefore, it is important to convey an accurate and consistent message across various mediums on food packaging and nutrition etc through medical and health professionals.

SOCIAL DETERMINANTS OF FOOD CHOICE

- **Influence of social class** - What people eat is shaped and constrained by mainly social and cultural circumstances. Population studies show clear differences in social classes with regard to diet and nutrition. Poor diet can lead to malnutrition (micronutrient deficiency) and over nutrition (excess energy consumption leading to overweight and obesity). These are the problems faced by different sectors of society, requiring different levels of expertise and methods of intervention.

- **Cultural influences -** Cultural influences lead to differences in the usual consumption of certain foods and processing traditions, and in some cases can lead to limitations such as the exclusion of meat and dairy from the diet. However, cultural influences can vary: When moving to a new country, individuals often adopt special eating habits from the local culture.
- **Social context -** Social influence on food intake refers to the influence of one or more people on the eating behavior of others. It is directly when people are buying food or indirectly when people learn from the colleagues. When many people eat together consciously or unconsciously believes and eating pattern are transferred from one person to the other. Even when eating alone, food choices are influenced by social factors as attitudes and habits develop through interactions with others. However, quantifying social effects on food intake is difficult because people's effects on other people's eating behavior are not limited to one category and people do not necessarily get awareness by social influences.

  Social support can have beneficial effects on food choices and healthy dietary changes. For example, social support is considered to be a good predictor of fruit and vegetable consumption in adults. Social support can enhance health promotion by promoting a sense of belonging to a group and making people more capable and productive.

Family is widely recognized as important in food decisions. Research shows that food choices are formed at home. Since family and friends can be a source of encouragement to make and maintain dietary changes, it can be personally beneficial to adopt eating strategies that are acceptable to them and influence the eating habits of others.

Social setting - Although the majority of food is consumed at home, an increasing proportion is consumed outside the home, e.g., in schools, at work and in restaurants. Where food is eaten can influence food choices, especially when it comes to the types of food offered. The availability of healthy foods at home and 'outside' increases the consumption of these foods. However, access to healthy food options is limited in many institutions/schools. This is especially true for people with irregular schedules or those with special requirements, e.g. vegetarians. With the majority of employed adult men and women, the effect of work on health-related behaviors such as food choice is an important area of investigation.

Meal patterns – In every day life, people have many different occasions. The motivation to eat on each occasion is different. Most studies investigate the factors that influence habitual food choices, but it can be useful to investigate what influences food choices on different eating occasions.

The health effects of snacking have been widely debated. Evidence suggests that snacking can affect energy and nutrient intake, but not necessarily body mass index. However, people with normal weight and those who are overweight may differ in their coping strategies when snacks are freely available and also in their compensatory mechanisms at subsequent meals. In addition, the composition of snacks can be an important aspect of an individual's ability to regulate intake to meet energy needs.

Helping young people choose healthy snacks is a challenge for many healthcare professionals. At home, rather than banning unhealthy snacks, a more aggressive approach might be to introduce healthy snack options from time to time. In addition, healthy food options outside the home need to be made easier.

PSYCHOLOGICAL DETERMINANTS OF FOOD CHOICE

- **Stress** - Psychological stress is a common feature of modern life and can alter health-affecting behaviors, such as physical activity, smoking, or food choices.

  The effects of stress on food choices are complex, especially given the different types of stress that can be felt. In general, some people eat more and others eat less than usual when they are stressed.

  Proposed mechanisms for stress-induced changes in diet and food choices are dynamic (less concern for weight control), physiological (reduced appetite due to the stress-related processes) and actual differences in eating opportunities, food availability, and meal preparation. Studies also show that prolonged or frequent work stress can lead to unwanted changes in diet, increasing the likelihood of weight gain and, therefore, increasing the risk of injury and also chances of cardiovascular disease.

- **Mood -** Hippocrates was the first to suggest the healing power of food, however, it was not until middle age that food was considered a tool for altering moods and behavior. Today, it is recognized that food affects our mood and that mood has a strong influence on our food choices.

  Interestingly, it seems that the effect of food on mood is partly related to attitudes towards specific foods. The conflicting relationship with food – wanting to enjoy it but gaining weight is a struggle many people go through. Dieters, those who are very restrained, and some women report feeling guilty for not eating what they think they should be eating. Additionally, efforts to limit the consumption of certain foods can increase cravings for those specific foods, leading to so-called cravings.

Women report cravings more often than men. Depressed mood seems to affect the severity of these cravings. Reports of cravings are also more common during the premenstrual period, a time when total food intake is increased and a parallel shift in basal metabolic rate occurs.

Thus, mood and stress can influence food choice behavior and possibly both short- and long-term responses to dietary interventions.

- **Eating disorders** - Eating behavior, unlike many other biological functions, is often subject to no error cognitive control. One of the most widely practiced forms of cognitive control over food intake is diet.

Many people express a desire to lose weight or improve their physique and thus take steps to achieve an ideal body mass index. However, problems can arise when dieting and/or exercising excessively. The causes of eating disorders are often a combination of biological, psychological, familial, and socio cultural factors. The emergence of eating disorders is often associated with a distorted self-image, low self-esteem, nonspecific anxiety, obsessions, stress, and unhappiness.

Treatment for an eating disorder often requires weight stabilization and individual psychotherapy. Prevention is more difficult to define, but suggestions include avoiding child abuse, avoiding exaggerating foods and health problems; showing affection without being too controlling does not set impossible standards to reward small achievements in the present promotes independence and sociability.

EFFECTS OF CONSUMER ATTITUDES, BELIEFS, KNOWLEDGE AND OPTIMISTIC BIAS

- **Consumer attitudes and beliefs** - In the field of food safety and nutrition, our understanding of consumer attitudes has not been fully studied. A better understanding of how the public perceives their diet will help design and implement healthy eating initiatives.

The Pan-European survey of consumers' attitudes towards food, nutrition and health shows that the top five factors influencing food choice in the 15 European member states are " quality/freshness (74%), 'price' (43%), 'taste' ' (38%), 'trying to eat healthy' (32%) and 'what my family wants to eat' (29%) These are average figures obtained by combining the results of 15 European Member States, differing significantly from country to country.In the United States, the order of factors affects The following food choices have been reported: problems with taste, cost, nutrition, convenience, and weight.

In the pan-European study, women, older and more educated subjects rated "aspects of health" as particularly important. Men often choose "taste" and "habit" as the main determinant of their food choices. "Price" seems to be the most important factor for unemployed and retired people.

Interventions targeting these groups should take into account the factors that determine their perception of food choice.

Attitudes and beliefs can and will change; Our attitudes towards dietary fat have changed over the past 50 years, with a corresponding decrease in the amount of absolute fat consumed and a change in the ratio of saturated fat to unsaturated fat.

- **Optimistic bias** - Europeans are largely unaware of the need to change their diet for health reasons. 71% of respondent think their diet is already healthy enough. This high satisfaction with the current diet was reported in Australian, American and British subjects.

  Not feeling the need to change diet indicates a high optimism bias. This is a phenomenon in which people believe that they are at less risk of danger than others. This false optimism stems from the fact that people underestimate the potential of a high-fat diet relative to others, and that some consumers with low fruit and vegetable intake consider themselves “heavy consumers”.

  When people believe their diet is already healthy, expecting them to change their diet or consider nutrition and healthy eating is a very important factor in their dietary choices. It may be unreasonable to expect although these consumers are more likely to eat healthily than consumers who perceive their dietary needs to improve, they are still far from meeting generally accepted public health nutritional goals. These groups are also less likely to be further motivated by dietary recommendations.
  Thus, we can see that the above-mentioned factors can have a profound influence on food choices and the everyday meal pattern of various segments of society.

2.6 FACTORS EFFECTING FOOD AVAILABILTY AND ITS CONSUMPTION

AGRICULTURAL PRODUCTION

Agricultural production is not only the basis for improving nutrition, but also the main source of income for many people. Increasing crop production is key to ending hunger and for economic and social development.

The area of arable land has increased, but the biggest factor is the rapid increase in crop yields. In addition, diets are becoming more diverse in many countries around the world. Cereals, root vegetables and other staples once made up the majority of agricultural produce. It extends to legumes, fruits, vegetables, nuts, seeds and other foods nowadays.

Agricultural production is also becoming more international. Historically, food production was localized everywhere. Farmers produced food for their families and communities. Even if food trade became more widespread, it was largely confined to the domestic market. Today, a large amount of food is traded internationally. This will lead to more diverse diets around the world and can also be an important source of income for farmers (income from cash crops). This is especially true in low-income countries. Agriculture also has a significant impact on the environment. In the future, we must find ways to produce food that provides good nutrition for all while reducing our environmental impact.

Influencing dietary changes is a major challenge for both health professionals and the general public. Different strategies are needed to induce behavior change in groups with different priorities. Campaigns that include personalized advice that includes both practical solutions and environmental changes can be successful in promoting dietary change.

Food and nutrition security are closely linked as only nutrition-based approaches can help overcome malnutrition in an economically and socially sustainable way. Food production forms the basis of food security as it is a key factor influencing food availability. To ensure adequate food. Incorporating environmental considerations into technology development and deployment can usher in an era of evergreen revolution and sustainable food and nutrition security. Political support is essential to make this possible. This document describes various aspects of ensuring high productivity and production without ecological damage.

Swaminathan (1986) defines the concept of “food security” as “physical, economic and social access to a balanced diet, safe drinking water, environmental hygiene, primary health care and nutritional literacy”.

Swaminathan emphasizes on the following three points regarding food security -

(i) “Availability” means the physical availability of food supplies in required quantities; When food grains are used as food substitutes (suitable for situations where food grains dominate food intake), the available amount of food grains, excluding feed, seeds and waste, is available for domestic production will be derived from net imports and stock withdrawals. Physical

availability anywhere in the country depends on storage and transportation infrastructure, as well as domestic market consolidation.

(ii) Access refers to the entitlements related to people initial endowment, what they can acquire (specially in terms of physical and economic access to food).

(iii) Absorption is defined as the ability to biodegrade or biological utilize the food consumed. This has a lot to do with the availability of clean drinking water, sanitation, sanitation, basic medical care and nutritional knowledge and good practices.

However, the starting point is food production, which determines the basis of food availability. India's population is projected to reach 1.5 billion by 2030, and according to Swaminathan, the country's challenges are declining per capita arable land and irrigation water resources, as well as a biotic and biological biodiversity. The increased pressure should produce more than ever before. India currently produces about 230 million tons of grain to meet the needs of its 1.15 billion people. Livestock requirements are often ignored when calculating feed requirements. India's current situation is that it will need to double its grain production by 2050 to meet the needs of its projected population of 1.8 billion, in addition to its livestock and poultry needs.

Similar concerns were raised by the National Farmers Commission (NCF) in late 2006. In addition, the country hopes to increase its vegetable and fruit production to over 300 million tonnes by 2015. These goals can only be achieved by increasing productivity and irrigation water per hectare, as land is an increasingly scarce resource for agriculture. Factor productivity must be doubled by him to rationalize production costs and make agricultural prices globally competitive. Average farm sizes are trending downward, with almost 80% of farmers in the marginalized smallholder category. Fortunately, animal husbandry is fairer. Increased agricultural productivity for smallholder farmers, increased income for smallholders through integrated crop and livestock production systems, and multiple livelihood opportunities through agro processing and biomass utilization will help meet food production goals help reduce hunger, poverty and unemployment, which are essential.

More than 60% of population in India continue to depend on agriculture and related activities for their livelihoods. The growth of this sector is therefore an essential prerequisite for the growth of the economy as a whole. According to the Economic Survey 2012-13, the agriculture and allied sector contributed 14.5% of the Gross Domestic Product (GDP) in 2010-2011, while prices remained constant in 2004-2005. The livestock and fisheries sector accounted for 28.4% of the total production

value of agricultural and related activities in 2010-2011. Overall GDP increased by an average of 8.62% from 2004-2005 to 2010-2011, while agricultural sector GDP increased by only 3.46% over the same period. However, according to the 2001 Census, the sector still plays an important role, accounting for about 58% of the country's employment.

Agriculture plays an important role in the Indian economy. Over 58 percent of rural households depend on agriculture for their livelihoods. Agriculture makes the largest contribution to gross domestic product (GDP). Agricultural production determines the basis of food availability. According to Dr. MS Swaminathan, India's population is projected to reach 1.5 billion by 2030. The challenge for the country, therefore, is to further increase production by reducing per capita acreage and irrigation water resources, and by increasing organisms and biotic stress. India currently produces about 230 million tons of grain to meet the needs of its 1.15 billion population. As India stands today, it will need to double grain production by 2030 not only to meet the demand for livestock and poultry, but also to meet the demand of an estimated 1.8 billion people. Investments in agriculture, such as improved irrigation and drought-tolerant crops, will reduce price and income volatility. Fortified crops provide access to better diets, while high-yield grains are crucial for food security in households with poor access to food markets.

STRATEGY TO INCREASE FOOD PRODUCTION AND PRODUCTIVITY

It is clear that India will continue to be a country dominated by agriculture, especially in terms of livelihoods, for most of the 21st century. Therefore, both vision and appropriate action are required to shape our agricultural destiny. The greatest strengths of our agriculture are a large population of hardworking rural men and women, diverse climates and soil resources, abundant sunshine throughout the year, ample rainfall and water resources, long coastlines, and fertile agriculture Biodiversity. The challenge is to turn these into jobs and income. However, there are some opportunities for improvement to raise production and productivity levels and improve the livelihoods of those who depend on agriculture and related activities. The way forward for this country must be an integrated system of agriculture, livestock and fisheries.

The Green Revolution was largely confined to irrigated farmland of rice and wheat. The productivity per unit area of Indian agriculture today is much lower in India compared to other major crop producing countries. There are large yield disparities between and within provinces. China has much higher yield rates than India in all three of her major food crops grown. As noted in the Economic Survey 2012-201355,

"Increased yields are key to maintaining India's self-sufficiency in food grains". The low productivity of the element relative to fertilizer input increases production costs without the desired impact on yield. A package of practices appropriate to crops and agro ecological regions, with proper consideration of soil health, access to water, quality seeds and other inputs, is a necessary package to increase agricultural productivity

Country	Crop		
	Paddy	Wheat	Maize
Brazil	4229	NA	4086
China	6556	4762	5556
India	3370	2802	2324
Indonesia	4895	NA	4078
USA	7672	3018	9658
Japan	6488	NA	NA
Egypt	9731	6501	7977
Canada	NA	2852	9062

Source: Ref. 22. Table 7.2, Agriculture Statistics at a Glance - 2010, Directorate of Economics & Statistics, Ministry of Agriculture, Government of India.
http://eands.dacnet.nic.in/Adv_Esti_2010.htm
NA, not available

What is needed is an evergreen revolution 23 focused on rain-fed areas and suitable crops (i.e., sustainably increasing productivity without harming associated ecosystems). Given the need to respond to climate change, short- and medium-term weather forecasts and recommendations for crop and variety selection are important. Farmer-friendly technology must be disseminated. Research into dry farming techniques should be encouraged and these techniques should be made available to small holders and small farmers.

EFFECT OF POST HARVEST HANDLING AND LOSSES ON FOOD AVAILABILITY AND CONSUMPTION

Post Harvest Handling – "Post-harvest processing" in agriculture refers to the stage of crop production immediately after harvest. This includes processes such as cooling, washing, sorting and packing. As crops are harvested and ready to be removed from the ground for further processing, they begin to deteriorate in quality and quantity. Indeed, post-harvest treatments and technology will determine what the future holds for harvesting. After harvesting in the field, processing continues in the pack house. This may be a simple but providing shade and running water, or it may be a large, sophisticated and mechanized facility. In the case of mechanical harvesting, pre-washing and sorting by the harvester can also be done as part of the actual harvesting process. The basic principles of post-harvest treatment in most crops are to avoid damage (cuts, bruises and damage) and to keep the crop in good condition and desirable for human consumption.

THE POST HARVEST SYSTEM

(01)	HARVESTING handling
(02)	THRESHING
(03)	DRYING transport and distribution
(04)	STORING
(05)	PROCESSING
(06)	PRIMARY PROCESSING cleaning, classification, dehulling, pounding, grinding, packaging, soaking, winnowing, drying, sieving, whitening, milling
(07)	SECONDARY PROCESSING mixing, cooking, frying moulding, cutting, extrusion
(08)	PRODUCT EVALUATION quality control: standard recipes
(09)	PACKAGING weighing, labelling, sealing
(10)	MARKETING publicity, selling, distribution
(11)	USE recipes elaboration: traditional dishes new dishes
(12)	CONSUMER PREFERENCES product evaluation, consumer education

A post-harvest system involves a series of activities and processes that can be grouped into two growth steps.

Technical activities: Harvesting, field drying, threshing, washing, post-drying, storage, processing;
Economic activity: Transport, Marketing, Quality Control, Advice, Information and Communication, Management and Administration.

Main elements of the post-harvest system

Harvest time is determined by maturity. For cereals and legumes, a distinction should be made between ripe stalks (straw), corn with cobs, or seed pods and seeds. This affects subsequent work processes, especially storage and preservation.

Pre-harvest drying – mainly for grains and legumes. Thoroughly drying the field before harvesting ensures good preservation, but also increases the risk of loss from attack (birds, rodents, insects) and mold from weathering, and theft. Harvesting before maturity risks mold and seed rot. The time it takes for the ears and kernels to dry completely depends on the weather and atmospheric conditions. Long-term dry structures such as mangers and uncovered threshing floors and terraces expose crops to predation by wildlife, birds, rodents and small ruminants. On the other hand, if grains are not dry enough, they are more susceptible to mold and can spoil during storage. Also, over dried grain can become brittle and split after threshing, threshing, and grinding. This is especially true when grinding rice. Sieving removes crushed grains along with the shell, making them vulnerable to certain insects (such as beetles and weevils).

Transport - When transporting really ripe crops, special care must be taken to ensure that the threshed grain does not fall on the road before it reaches the threshing floor. Harvesting and initial transportation of the crop therefore depend on the location and conditions in which it is stored, especially regarding threshing.

Threshing – Threshing before the crop is sufficiently dry increases the likelihood of an incomplete process. In addition, if threshed grain is piled up too quickly or stored in damp conditions (in granaries or bags), it is more susceptible to microbial attack and has a shorter shelf life.

Storage - Effective long-term storage requires proper equipment, hygiene, and supervision. Cleanliness, temperature and humidity control are especially important in enclosed buildings

(granaries, warehouses, closed containers). Pest (insects, rodents) and mold damage can cause equipment deterioration (e.g. mites on wooden posts), leading to loss of quality, nutritional value and quantity.

Other processes – Excessive hulling and threshing can also cause grain loss, especially for rice (dehulling), which can lead to cracking and damage.
Marketing – Marketing is the final and critical element of the post-harvest system, but it takes place at various points in the produce and food chain, especially at specific stages of processing. Moreover, it cannot be separated from traffic, which is the critical link of the system.

POST-HARVEST LOSSES

"A loss is a measurable reduction in food intake that can affect quantity or quality" (Tyler and Gilman, 1979). These arise from the fact that freshly harvested produce is a living organism that breathes and changes during post-harvest handling.

Cereals and Seeds – Cereals, legumes, and oilseeds grown for human consumption in most climates and latitudes. The main grains are wheat, corn, rice, barley, sorghum, millet, oats and rye. Legumes include various types of peas, beans, catfish, and lentils. Oilseeds include soybeans, peanuts, sesame seeds, canola and sunflowers.

Post-harvest – If the harvest includes a period during which various crops are removed from the field, the post-harvest period lasts from the time the crop leaves the field until the food is prepared. For a variety of reasons, corn and rice harvests in particular can be delayed for months, mainly due to drying of straw and grain. Speak to show the relationship between harvest and post-harvest processes.

Food Waste – Food waste is any complete alteration or reduction in quantity or quality of food unfit for human consumption.

TYPE OF LOSSES

The first difference in agricultural losses is quantity versus quality. Quantitative loss is the loss of physical matter, i.e., loss of weight and volume, and can be evaluated and measured. However,

qualitative loss requires a different kind of assessment, especially as it affects the nutritional and reproductive value of the product.

This has a significant impact on the storage conditions of the food, partly on the type and size of the food, but the losses caused by various pests (insects, weeds, diseases) during the production period are taken into account.

Therefore, after discussing direct and indirect losses, we will look at weight loss, quality loss, nutrient loss, loss of seed viability and commercial loss. Remember the presence of moisture and the difference between damage and loss. Moisture Content - Biochemically, organic produce consists of dry matter and moisture. Moisture content is the amount of free water in a particular product, expressed as a fraction or percentage. For grains, for example, a moisture content of 13% is considered to allow proper storage of grains. In agriculture, moisture content or moisture percentage is commonly reported as a percentage of wet product. In other words, moisture content is the ratio of the weight of water to the total weight of dry matter and water.

Damage - Damage is the apparent deterioration of the goods, Broken or dented grain. It affects quality over quantity and can lead to significant losses in the long run. Both damage and loss must be quantified in terms of weight and cost. Direct vs. Indirect Loss – Direct loss is when food is lost through leakage (e.g. spilling from bag) or ingestion by pests (insects, rodents, birds) resulting in loss of quality for the consumer. Indirect damage will occur if it leads to a refusal to purchase.



Rural village in Siavonga district. Salvation Army food store infested by Larger Grain Borer, Zambia, FAO, 1997

Weight Loss – Weight loss is easy to observe and measure, but does not necessarily mean food loss as it is simply due to lower water levels. On the other hand, in open stands, abnormal weight gain due to moisture absorption after rainfall can cause significant damage and loss. Weight may be lost due to leakage. For example, if the bag was punctured or was not properly secured during shipping. It is often caused by prolonged infestation and ingestion by insects, rodents, birds, or improper packaging. This can be verified by taking an equal amount of clean, healthy grain, grinding two samples, and weighing both flours. A poor sample will yield less flour. This method can also be used to make sure the weight is actually correct as the weight can easily be increased by wetting the grain or adding foreign objects such as pebbles, dirt or debris.

Poor Quality – Quality criteria are wide-ranging and relate to visual characteristics, shape and size, odour and taste. Cultural factors that can influence diet and eating habits should also be considered.
Product cleanliness and safety are at the forefront of the market and correspond to what commercial law describes as "healthy, legal and fit for consumption" products. For example, when a retailer removes a handful of grain from a bag, they can immediately see if dust is being released and decide whether it is due to an insect infestation. Bad odors can also raise suspicions of rodent infestation in crops, recognizable by mouse or rat feces or hair. It may lose value.
Bad grain, straw and other plant debris, mud, pebbles, broken glass, etc. All of these items are difficult to remove, but some items pose a higher risk of contamination than others.
Soluble excreta of pests, oils, pesticides, rodent-borne pathogens, toxins from fungi and molds and also affects the quality and therefore the market value of the product.

Food Loss – Food loss is obviously due to loss of quantity, but it can also occur more subtly due to loss of quality or edibility unsuitable for human consumption. Basic foods also contain important vitamins. For example, the grain heart is rich in protein and vitamins. However, they are also preferred targets for rodents and insects. Therefore, different nutritional ingredients in products are victims of different types of parasites. While weevils feed primarily on the carbohydrate-rich interior of the seed, the endosperm, many parasites penetrate the vitamin-rich outer shell of the seed are also affected.

Loss of Seed Viability – Seeds for sowing, like other products used for propagation, are stored with the utmost care to maintain maximum germination potential. The protein-rich nuclei of grains can be prime targets for certain pests such as grains. Atmospheric conditions also play a role, as they can

weaken the yield potential of seeds. This is mainly due to fluctuations in light, temperature and humidity, leading to excessive breathing.

Business Loss – Business loss is the transformation of the different types of losses mentioned above into an economic and monetary perspective. Grocery prices are usually based on weight, but many other factors come into play. This is especially true of the qualitative factors highlighted above, including cleanliness and purity, which are increasingly in demand due to the high volume of supply on the market.

The ability of producers to take advantage of periods of rising prices due to raw material shortages is an element of good marketing management of informed and forward-looking production. This includes considering not only market-related factors, but also structural factors (such as storage facilities in sufficient condition to keep crops in stock until prices rise). We need good organization. Long-term developments such as socio-cultural changes that affect the future.
This type of market-oriented attitude relies on individual competence, but there are also some collective aspects that need to be developed. For the present, we would note that the ability to capitalize on a product depends on a number of technical and economic factors, in which the quality of the merchandise plays an increasingly important role but so also do the human qualities of the producer and hence, the training that readies him to take his place as an economic player in the life of his country.

Irreducible losses and compensation - While loss of weight during drying is normal and measurable, there are other, said "irreducible" losses, which arise basically from respiration of the product and mechanical rubbing of grain against itself, as well as the breakage inevitable with certain machines. It should therefore always be remembered that losses, whether pre-harvest or post-harvest (i.e. in production, distribution, storage or marketing) cannot be materially reduced to zero and that they have to be compensated for through extra production. The production increase rate must be progressively higher than that of losses, if such compensation is to be adequate, so that compensation for a 20 percent loss will require 25 percent more production, for a 40 percent loss, 66 percent more and for a 60 percent loss, 150 percent more.

WHY IS POST-HARVEST MANAGEMENT NECESSARY?

Agricultural products often suffer large post-harvest losses. In this case, the Philippine Department of Commerce found that the quality and quantity of cocoa bean production has some limitations, such as the need for better post-harvest fermentation and drying techniques. The goal of the post-harvest management process is to minimize these losses while adding value and improving food safety. Local governments can benefit from increased sales and year-round availability of fresh produce.

IMPORTANCE AND BENEFITS OF POST-HARVEST MANAGEMENT

Post-harvest management has many advantages. The most important prerequisites for implementing these processes in your product are:

Extends shelf life and durability

Short shelf life is the enemy of farmers and food suppliers. Not only is this costly, but it can also damage their reputation. They produce millions of tons of food waste every year. Farmers and retailers must take steps to extend shelf life of food. There are several ways to do this, including:

- Improvement of processing and handling methods
- Humidity monitoring
- Use of antibacterial agents
- Better packaging
- Low temperature maintenance

These methods of extending shelf life can help produce higher quality grains and crops, reduce waste, reduce food loss and waste, increase profit margins and improve brand reputation.

Increases the taste and appearance of food

Consumers' choice of a manufacturer's product is highly dependent on the color, flavor and texture of the harvest. Because people eat with their eyes, the size, shape, luster, and vividness of food products are important to attract consumer interest. Aroma and taste also play a large role, especially when it comes to freshness and texture, and both contribute to a positive dining experience.

A successful post-harvest management process can keep crops and other crops fresh and beautiful. Ultimately, it gives consumers an impression of quality and decides whether to buy or not.

Protect products from animals and pests

Another benefit of post-harvest management is that it allows producers to protect raw materials from animals and pests. Solutions like Grain Safe bags help prevent insect infestation that leads to dampness, humidity and weather conditions that can affect the quality of stored grain. Ultimately, this avoids significant losses during grain drying, storage and transportation.

Contribute to food security

Post-harvest management techniques can contribute to food security, primarily by reducing losses and waste. It can reduce post-harvest handling losses and increase food yields for farmers and consumers in rural and urban areas. Reducing losses can lower food prices and improve access to food.

According to Statista, the world's population is expected to reach 9.74 billion. This means that the poorest communities are experiencing the fastest growth in demand and need to feed around 22% more people. Food supplies will need to increase significantly to meet high demand in the coming decades. Post-harvest management can solve some of these problems by improving food production and distribution and reducing losses. Ultimately, it will be an important factor for future global food security.

Proper post-harvest processing techniques are very important, especially in a country like India with a rapidly growing population, as it is a key factor in agricultural production.

• Hygiene is also an important factor in reducing the likelihood of carrying pathogens through perishable foods. Residue from contaminated wash water can be contagious.

• Post-harvest handling is important to reduce loss of product quantity, quality or nutritional value.

• It also helps to maintain product quality (color, taste, aroma, aroma).

• Decreased metabolic rate, resulting in undesirable changes in color, composition, texture, taste and nutritional status.

Suppresses unwanted growth such as budding and sprouting.

• Reduces moisture loss that causes wilting, shrinkage, softness, weight loss and crispness.

• Reduce post-harvest losses of fruits, vegetables and food grains through proper packaging, transportation and storage. Each 1 percent reduction in loss saves 5 million tons of fruit and vegetables annually.

• Processing and preservation techniques ensure access to food during the off-season.

• Post-harvest technologies are needed to improve food security and enhance national food security.

• The technology will help facilitate the export of agricultural products in the form of canned goods and value-added products. Proper handling, storage and storage of food after harvesting can minimize

food waste. Decreasing food waste increases per capita food availability, and with it food availability and consumption.

INTERVENTIONS TO MINIMIZE OR AVOID LOSSES

There is a wide range of post-harvest technologies that can be adopted to improve losses throughout the process of pre-harvest, harvest, cooling, temporary storage, transport, handling and market distribution. Recommended technologies vary depending on the type of loss experienced.

However, all interventions must meet the principle of cost-effectiveness. In theory it should be possible to reduce losses substantially but in practice this may be prohibitively expensive. Especially small farms, for which it is essential to reduce losses, it is difficult to afford expensive and work intensive technologies.

The various methods used are:

1- PHYSICAL TREATMENT–

a. **Cooling methods and temperatures**: different methods of cooling are applied to produce after harvesting to extend shelf life and maintain a fresh like quality. The methods are as follows -

- **Pre cooling**– In this method foods are pre cooled and their temperature is reduced from 3 to 6 ^{o} C and they are cool enough for safe transport. Pre cooling may be done with cold air, cold water or by direct contact with eyes.
- **Air pre cooling** – Pre cooling with fruits with cold air can be done in refrigerator, storage rooms, tunnels or air coolers.
- **Icing** – Ice is commonly added to boxes of produce by placing a layer of crushed ice directly on the top of the crop.
- **Room Cooling** – this method involves placing the crop in cold storage. The room generally consist of a refrigeration unit in which cold air is passed through a fan.
- **Forced Air cooling** – the principle behind this type of pre cooling is to place the crop into a room where cold air is directly through the crop after flowing over various refrigerated metals coins or pipes.
- **Hydro Cooling** – the transmission of heat from a solid to a liquid is faster than the transmission of heat from a solid to a gas. Therefore, cooling of crops with cooled water can occur quickly and results in zero loss of weight.

- **Vacuum Cooling** – cooling in this case is achieved with the latent heat of vaporization rather than conduction. This method is particularly suitable for leaf crops such as lettuce.

b. **High temperatures**: Exposure of fruits and vegetables to high temperature during post-harvest reduces their storage or marketable life. High temperature treatment is beneficial in curing root crops, drying bulb crops and controlling diseases and pests in some fruits. Fruit ripening is also done by exposure to high temperature in combination with ethylene or another suitable gas.

1- **Storage Condition Considerations**– the marketable life of most fresh vegetables can be extended by prompt storage in an environment that maintains product quality. The desired environment can be obtained in facilities where temperature, air circulation, relative humidity and sometimes atmosphere composition can be controlled. The following storage methods are used -

- **In Situ** – this method of storing fruits and vegetables involves delayed the harvest until the crop is required. It can be used in some root crops.
- **Sand or Coir** – this storage techniques is used to store potatoes for longer periods of time which involves covering the commodity underground with sand.
- **Pits** – in this method, pits or trenches are dug at the edges of the field where the crop has been grown. Crop is kept inside the trenches which is then covered by straw and layer of soil.
- **Wind breaks** – this method is used to store onions. Wooden steaks are made into the ground in two parallel rows about one meter apart. Wires are fixed in it and the produce is kept on the wires.
- **Cellars** – these underground or partly underground room are often beneath the house. They have proper cooling and insulation. They are used to store apples, cabbages, onions and potatoes especially during winters.
- **Barns** – Barn is a farm building for sheltering, processing and storing agricultural products and animals.
- **Night Ventilation** – in hot climates the variation between day and night temperatures can be used to keep the stores cool. The storage rooms should be well insulated when the crop is placed inside. A fan is put inside the room with thermostat. This method is used to store bulk onions.
- **Controlled atmosphere** – these atmospheres are made of gas tight chambers with insulated walls, ceiling and floor. Depending on the species and varieties of fruits and vegetables various blends of oxygen, carbon dioxide and nitrogen are required. Low content oxygen atmospheres are used for fruits with long storage life.

2- **Bio – pesticides** – bio pesticides are used for non-polluting pest control. These are pest management tools that are based on beneficial microorganism and biologically based active ingredients. They are following types -

a. Microbial antagonists – naturally occurring or genetically controlled bacteria fungi, viruses and protozoa are all being used for the biological control of pestiferous insects, plant pathogens, wheat, micro-organisms as the active ingredients.
b. Plant derived products – the use of locally available plants for the control of pest and pathogens is an old technology. There are many plants which contains essential oils and vegetables oils capable of preventing infestation of stored products.

   Higher plants are the source of a wide spectrum of secondary metabolites such as alkaloids, essential oils, flavonoids, phenolics, saponins, sterols and tannins. Some of these can be used as bio pesticides.
c. Animal derived products – **Chitosan** is a polysaccharide made with shells of shrimp. It has a number of commercial and bio medical uses. It is used to fight of fungal infections.

MARKETING AND DISTRIBUTION

Agricultural marketing in India

India is an agricultural country where almost one third population depends on the agricultural sector directly or indirectly. Agriculture is the most important factor of the Indian economy. Indian agricultural contribution to the national gross domestic product (GDP) is about 25%. This the reason why emphasis has always been on commercializing agricultural production. Adequate production and even distribution of food is of highest priority for the government and is off global concern.

In earlier days the farmers sold his produce to the consumers on a cash or barter basis. In those days the village economy was self-sufficient and the marketing of agricultural products was very easy. In most of the places barter economy was prevalent which meant food for work.

Today's agricultural marketing has changed a lot. The produce has to undergo a series of exchanges or transfers from one person to another before it reaches the consumers. There are three marketing functions and steps involved in this –

- Assembling

- Preparation for consumption
- Distribution

The selling of any agricultural produce depends on many factors like the demand of the product at that time and the availability of storage etc. The product sold directly in the market or they may be stored locally for some time. It may be sold as it is gathered from the field or it may be cleaned, graded or processed by the farmer or the merchant of the village. The processing of the food products is done to please the consumers and also to conserve the quality of that product. The task of distribution system is to match the supply with the existing demand either by whole selling or retailing in various points of different markets like primary, secondary or terminal markets.

The Agricultural products in India are sold by farmers in the private sector to money lenders to whom the farmer may be indebted or village traders.

Products are sold in various ways for example –

- In the local market at a daily basis.
- At the weekly village market in the farmers village.
- In the neighboring village.
- At irregularly held markets in the nearby village of town.
- In the bigger market known as "Mandi" where food produce is sold in bulk and are purchased by the retailers.

Several central government organizations involved in agricultural marketing are as follows –

- Commission of Agricultural costs and prices
- Food Corporation of India
- Cotton Corporation of India
- Jute Corporation of India
- There are also specialized marketing bodies for rubber, tea, coffee, tobacco, spices and vegetables.

AGRICULTURAL PRICES

The food and agricultural commodity prices in India are primarily determined by domestic demand. The nature of markets facing the agricultural commodities and imperfections in these markets also influenced the price transmission and the final consumer price. In general India meets the bulks of its large food demand through domestic production.

AGRICULTURE PRICE POLICY AND MINIMUM SUPPORT PRICE

Implementation of MSP is undertaken through procurement by Central and State level agencies. The procurement of wheat and rice is undertaken by the food corporation of India under the department of food and public distribution primarily to meet the requirements of buffer stock, targeted public distribution system and other welfare schemes of the government.

THE IMPORTANCE OF SETTING UP MINIMUM SUPPORT PRICE

1- The need to provide incentive to the producer / farmer for adopting improved technology and for developing a production pattern broadly in the light of National requirements.
2- The need to ensure proper utilization of land, water and other production resources.
3- There is an effect of price policy on the rest of the economy particularly on the cost of living, level of wages, etc.

The government of India through its various organizations tries to pay the farmers / producers the best price for their produce so that they can easily meet the expenses of their day-to-day life.

THE PUBLIC DISTRIBUTION SYSTEM IN INDIA

This system is developed by government of India for proper distribution and marketing of the food grains. Public Distribution System (PDS) is an Indian Food Security Scheme established by the Government of India under the Ministry of Consumers, Nutrition and Public Distribution to distribute food and non-food items to the poor in India at subsidized prices. The main commodities sold include staple crops such as wheat, rice and sugar, and essential fuels such as kerosene, which can be found in affordable stores (also known as grocery stores) in several states around the country) network. The National Food Corporation of India procures and maintains its PDS.

The system was first enacted on January 14, 1945 during World War II and introduced in its current form in June 1947. The introduction of rationing in India dates back to the Bengal famine of the 1940s. The rationing system was revived in the wake of severe food shortages in the early 1960s, before the Green Revolution. There are two types: RPDS and TPDS. In 1992, PDS became RPDS (Reformed PDS) with a particular focus on poor families in remote, hilly, remote and inaccessible areas. In 1997 he became RPDS (Target PDS) and established a fair price shop to distribute food grains at subsidized prices.

Central and state governments share responsibility for regulating PDS. The central government is responsible for sourcing, storing, transporting, and mass-distributing food grains, while state governments are responsible for distributing grain to consumers through an established network of Fair Price Shops (FPS). State governments are also responsible for operational tasks such as allocating and identifying families below the poverty line, issuing ration cards, and supervising and monitoring the functioning of the FPS.

Public Distribution Shops, also known as Fair Price Shops (FPS), are part of the Indian public system established by the Government of India to distribute food to the poor at subsidized prices. Known locally as a grocery store or public distribution store, it mainly sells wheat, rice and sugar at below market prices, called issue prices. Other necessities are also available for sale. Ration Cards are required to purchase items. These projects are operated nationwide with joint support from the central and state governments. The goods in these stores are much cheaper, but the quality is average. Most towns, villages and cities now have grocery stores. In India, he has over 550,000 stores, making him the largest retail network in the world (according to the 2011 Census).

TARGETED PUBLIC DISTRIBUTION SYSTEM

- The Government of India has revised the nearly universal PDS and introduced a targeted public distribution system 'TPDS' in 1997 targeting specific people.
- The aim was to provide food grains to the target population below the poverty line (PPL).
- The identification of the BPL family was made through his BPL census conducted by the Government of India Rural Development Department.
- Food grains were sold to this group at half the economic price, and those above the poverty line (APL) were provided with food grains at economic prices.
- BPL families had a fixed right to eat one cereal consisting of rice and wheat/aata per month, while APL families had no fixed right.
- BPL family rights increased by over 100%
- In 2000, a supplementary food security program, Anchodaya Anna Yojuna (AAY), was launched to address the poorest of the poor.
- By order of the Supreme Court, there was a set of five criteria used to identify these families. The entitlement was set at 35 kg per month per AAY eligible family member.
- The scheme was expanded in two phases, in 2003 and in 2004, to increase coverage.

ANTYODAYA ANNA YOJANA

Antyodaya Anna Yojana (AAY) is one of the largest initiatives of the Government of India. It is a public distribution system introduced in India in 2000. The main objective of this system is to provide food security to the population and end hunger in India.

This scheme covers our country's poorest by providing food and basic necessities at subsidized prices. It was first introduced in Rajasthan. AAY was developed by N. Sri Vishnu, then Union Minister for Food and Civil Affairs.

MEANING OF ANTYODAYA ANNA YOJANA (AAY)

FOOD GRAIN COST:

All poor people receive food and other goods through the AAY program. This is done at a subsidized rate. Distribution is also through public distribution systems. In this initiative, wheat is offered at Rs.3/kg and rice at Rs.2/kg. All eligible households will receive 35 kg of rice per month. Households falling into this section can purchase 1 kg of sugar from grocery stores at a price of Rs 18.50 per kg.

RATION CARD SPECIALIZATIONS:

AAY beneficiaries are determined by the central and state governments of India. Once identity verification is complete, AAY families are issued ration cards in various colors. Families are first identified as eligible and given a unique "Antiyodaya ration card." Another name for this card is PDS (Public Distribution Card).

TARGET SECTION OF SOCIETY AND ANTYODAYA ANNA YOJANA ELIGIBILITY

AAY's primary beneficiaries are the terminally ill, widows, the disabled, people over the age of 60, and single women and men without family or community support or secure livelihoods. Landless rural workers interested in agriculture, rural residents interested in the arts, and smallholder farmers also participate in the project. Rural artisans are artisans such as potters, weavers, blacksmiths, carpenters, and slum dwellers.

Households where the head of the household is a widow or a terminally ill patient are also eligible. Terminally ill patients and widows living alone are also eligible. Tribal people living below the poverty line and people living with HIV are eligible for the program. Beneficiaries should not secure a means of subsistence or social support. Households whose annual income is less than her Rs 15,000 are also eligible for this plan.

Documents required for AAY is below:

- BPL certificate
- Income certificate
- A cancellation certificate or affidavit showing that the beneficiary has not had a ration card in the last few years.
- Antiyodaya Anna Yojana UPSC

The AAY scheme was launched in December 2000 for the poorest among the BPL families. The following groups are entitled for NAAY Card.

i. Marginal Famers
ii. Landless agricultural labors
iii. Rural artisans / craftsmen such as potters and tanners
iv. Slum dwellers
v. Persons earning their livelihood on a daily basis in the informal sectors such as porters, rikshaw pullers and cobblers etc.
vi. Destitute people
vii. Household run by widows
viii. Terminally ill persons
ix. Disabled persons
x. Persons over 60 years of age with no assured means of subsistence
xi. All primitive tribal households.

ENTITLEMENT UNDER TDPS

Eligible beneficiaries are entitled for subsidized food grains such as wheat and rice. States can provide other commodities such as sugar, Kerosene and fortified Aata under TDPS.

S.N.	Category	No. of beneficiary (families in crore)	Entitlement of food grains (kg / family)
1	AAY	2.43	35
2	BPL	4.09	35
3	APL	11.52	15 – 35
	Total	18.04	-

EFFECT OF SOCIO-CULTURAL FACTOR ON FOOD AVAILABILITY AND CONSUMPTION

People associate with their cultural or ethnic group through their eating habits. Food is often used as a means of maintaining their cultural identity. People from different cultural backgrounds eat different foods. Where the family lives and where the ancestors came from influences your food likes and dislikes.

Cultural factors have strong influenced on consumers buying behaviors. Cultural factors include the following –

- Basic values
- Needs
- Wants
- Preferences
- Perceptions
- Behaviors that are observed and learned by a consumer from near family members and other important people around them.

SOCIAL DETERMINANTS OF FOOD CHOICE

- **INFLUENCE OF SOCIAL CLASS**

  People's eating behavior and food consumption pattern is largely influenced by social class. People belonging to the upper class often over consume the energy and other nutrients. This over nutrition results in over weight and obesity. The people from lower socio-economic background and BPL families cannot consume proper nutritious diet. They suffer from under nutrition and malnutrition specially micro nutrients deficiencies.

  These problems require proper interventions where the poor can be provided with proper nutrition and others can be made aware about the nutrition requirements.

- **CULTURAL INFLUENCES**

  Individuals eating pattern is always decided by his family food pattern, traditions and the way, the community around him eats. In certain cases, there are restrictions on a number of food and on the other hand some foods are taken regularly and are consumed in large amounts.

- **SOCIAL CONTEXT**

  Social influences on food intake referred to the impact that one or more persons have on the eating behavior of others. Food choice is influenced by social factors because attitudes and habits developed through the interaction with others.

  Social support can positively influence food choices and health - promoting dietary changes. Social support from family and colleagues can have a positive impact on healthy food consumption. Family and friends have the greatest influence on individual food choices, as they can be a source of encouragement in changing and maintaining dietary changes and eating habits. Therefore, it can be said that a person's dietary habits are greatly influenced by the social class and community in which the person lives.

- **SOCIAL SETTINGS**

  Although most of the time people eat inside their homes only but in now a days time there is an increasing trend to eat outside the home also. Sometimes it is because the person has to be a work like in school, in office or anywhere at work but there are times when people eat in restaurants and hotels etc. just to have a change in taste or on some special occasions.

  If healthy food is cooked and eaten at home the person gets into the habit of eating healthy food only. These types of persons when they go out, they try and find out healthy foods is to consume. So, it is seen that social settings influence people attitude about food.

EFFECT OF ECONOMIC FACTORS ON FOOD AVAILIBILITY AND CONSUMPTIONS

Food consumption is a function of a variety of influence that include agricultural production, trade, food processing technology, religious taboos, the relative cost of foods and health concern. But a particularly powerful factor is income.

Economic factors are one of the most important determinants of food availability. Communities purchasing power and choice is reflected in health and nutrition status. Increased income has positive effect on household food intake and (if combined with nutrition status of that helps you in choosing widely) health and nutrition status of individual. Economic factors affecting food availability and consumption:

The kind of job or profession a man in clearly influences his / families choice. The physiological and social expectation are also reflected in food choices. Generally, people belonging to the lower socio-

economic strata of the society tend to consume higher amount of cereals and lesser amount of fruits vegetables, milk and milk products. This makes their diet unbalanced.

The relationship between low socio – economic status and poor health is complicated and is influenced by gender, age, culture, environment, social and community networks, individual's lifestyle factors and health behaviors.

LOW INCOME GROUPS

Low-income groups, who find it too difficult to achieve a balance healthy diet, are often referred to as experiencing food poverty or food insecurity. Food cost, accessibility to food items and awareness are the three main factors which leads to unbalanced diet. A reliance on energy – rich nutrient – poor food is consequence of lack of money to buy wholesome foods. Low-income group can also face other problems such as transportation etc. Public transport is not viable solution for many, particularly those with young children or mobility difficulties. There are other factors also like conflicting information on diet and health, not having proper cooking skills or lack of interest can inhibit buying and preparing meals from basic ingredients.

Income determined food choices and behaviors that can ultimately lead to a diet related. The origin of many of the problems faced by people on low incomes emphasizes the need for a multidisciplinary approach to targeting social needs and improving health inequalities.

Factors influencing food choice, availability and consumption are not only based upon individual preferences, but are constrained by circumstances that are social, cultural and economical. This to both under – nutrition (micronutrients deficiency) and over – nutrition (energy over consumption resulting on overweight and obesity) within the members of a community, depending on the age group, gender and level of deprivation. The disadvantaged also develop chronic disease at an earlier age compare with higher socio – economic groups, usually identified by educational and occupational levels.

EFFECT OF INDUSTRIALIZATION ON FOOD AVAILIBILITY AND CONSUMPTION

In recent decades, industrialization has changed diets and consumption habits around the world. Such changes in food consumption at global and regional levels are associated with significant health implications. Populations in rapidly changing countries are experiencing changes in their diet. This diversity in migration may be due to differences in socio demographic factors and other consumer characteristics. Alongside other factors such as urbanization, industrialization and marketing of the

food industry, trade liberalization policies over the past two decades have promoted or accelerated the 'dietary transition' associated with the rise of obesity and chronic cardiovascular disease and cancer.

Trade liberalization is also an important factor that has brought about changes in food consumption. Changes in food supply have fundamentally changed the food environment and consumer choices. The price of unhealthy foods (usually high calorie, low nutrient, saturated fat and high salt) compared to healthy foods has increased, increasing the desire and availability of unhealthy foods, and increasing consumer and food Growing asymmetries among food suppliers, increasing urbanization and lifestyle changes are all means by which trade liberalization may affect food consumption, especially among the poor.

Industrialization and trade liberalization can affect the availability of certain foods by removing barriers to foreign investment in food distribution. It may also enable foreign investment in other types of food retail. Multinational fast-food restaurants invest heavily in middle-income countries. Foreign direct investment by multinational food companies has increased the availability of processed foods in developing countries. Changes in trade policies have therefore increased the availability and consumption of meat, dairy and processed foods.

However, although trade liberalization in developing countries has made highly processed, high-calorie, low-nutrient foods and animal products more accessible and affordable, trade policies and dietary habits.

Effect of Population on food availability and consumption

Dr. Nafis Sadik is Executive Director of the United Nations Fund for Population Activities (UNFPA). After training in obstetrics and gynecology, he managed the National Family Planning Program in Pakistan before joining UNFPA, the world's largest source of multilateral support programs for population programs. Dr. Sadik has written extensively on family planning and health.

A country's ability to feed itself depends heavily on these factors:

- Agricultural land availability, water availability, and population pressures. Especially in poor countries with limited land and water space, the more people there are, the fewer resources are available to meet their basic needs. When basic needs are not met, development decreases and the economy stagnate. In some poor countries, attempts to increase food production and consumption are influenced by rapid population growth. Unequal distribution of land. Shrinking land ownership.

Increased poverty in rural areas. and widespread land degradation. Avoiding chronic food shortages requires lower fertility rates and better management of land and water resources.

- **Demographic Picture** - As recently as 1984, population growth seemed to be slowing everywhere, with the exception of parts of Africa and South Asia. At present, the situation does not look very promising as fertility reduction progress is slower than expected. The world population, currently 5.3 billion, is increasing by about 250,000 people every day. It is estimated that 1 billion people will be born in this decade. Over the next ten years, the population of developed countries will increase by 56 million and the number of people living in developing countries will exceed 900 million (United Nations Population Division, 1989; UNFPA, 1989). Broadly speaking, the biggest gains will be in the poorest countries, the societies that find it most difficult to meet the needs of new entrants and invest in their future.
- **Meet food needs** - Enough food is produced around the world to feed everyone, but that food and the technology to produce it do not always reach those in need. Food insecurity leaves nearly 1 billion people without enough to eat and more than 400 million chronically malnourished. The dramatic growth in food production in recent decades is thought to be due to the development of improved disease-resistant staple crop varieties. Increased use of chemical fertilizers and pesticides and expansion of irrigated cultivated land. Nevertheless, between 1979-1981 and 1986-1987, per capita food production declined in 51 developing countries and increased in only 43. Per capita cereal production decreased in 25 African countries. Production was also disappointing in Latin America. Seventeen countries suffered declines (UNFPA, 1990). In Asia, food production has marginally outpaced population growth, mainly due to new varieties from Asia and heavy use of pesticides. In some areas, however, losses from improper land management have offset the gains achieved. As a result, developing countries' food imports have risen dramatically to fill local deficits.
- **Food crisis equation** - The food crisis equation has three main components. First, lifestyle, income and social organization determine consumption levels. Second, the technology employed determines both the extent to which human activity damages or conserves the environment and the amount of waste associated with a given level of consumption. Poverty can hinder the adoption of better technologies to halt or slow environmental degradation. These two factors determine the impact on individuals. The third factor, inequality, has implications, for example, when most of the land is on large plots and the poor are forced to live on small farms or in marginal areas. The fourth factor, population, acts as a multiplier that determines the overall impact. Population is always part of the equation. Whatever the type of technology, levels of consumption and waste, poverty and

inequality, the larger the population, the greater the impact on the environment and thus on food production capacity. Land fragmentation affects food production and is a direct result of rapid population growth in many poor countries. Lands too small to sustain a decent living are often converted into part-time farms, with some household members (usually women and children) staying at home and tending the harvest, while others (often men) will migrate for wage work. Alternatively, land is sold to wealthier landowners, leading to a more uneven distribution of land and contributing to the creation of a large pool of landless workers. Moreover, rapid population growth can lead to inappropriate agricultural practices that exhaust and erode soils. Reduce vegetation. Excessive and inappropriate use of pesticides. and hamper water resource management. Such practices result in severe land degradation.

- **One way ahead** - In many developing countries, demographic pressures continue to demand good land and water management. Agricultural production is essential for a sustainable future in all its forms, but focusing solely on the agricultural sector without considering other important factors affecting food production is certainly not the way to address the problem. Population programs need to be integrated into broader development goals and linked to other resource issues. In order for stressed developing countries to cope with declining per capita food production and resource degradation, strategic strategies are needed to address population issues such as population growth, population distribution and rural-to-urban migration patterns. I need a plan. Wherever possible, community development strategies that integrate both essential social services and productive resources should be encouraged. Also, sustainable development strategies that address soil erosion and poverty, deforestation, declining agricultural yields and inadequate water management, and agriculture that provides loans, seeds, fertilizers and advice to poor farmers, both male and female. A dissemination program should also be implemented. Or female. Finally, we need to support research on the integration of traditional and new techniques for food production.

  Given the current population and expected trends, it is imperative to anticipate future needs. At the same time, improved resource management will make a significant contribution to increasing crop yields, preventing soil degradation in the first place, and creating sustainable livelihoods for millions of the rural poor. Managing natural resources requires a similar approach to human resource development. This means, among other things, expanding population programs and family planning services to the millions who are currently in short supply. National population programs should include comprehensive and accessible maternal and child health programs and family planning services to reduce family size and improve overall community health and well-

being. Such efforts create an opportunity to increase food production while protecting the environment and reducing the burden on the rural poor.

2.7 SUMMARY

In the above unit showed us the factors effecting the food availability and consumption. We were able to understand the various factors which effect an individual's food choice. The main influences on food availability are posed by agricultural production, growing industrialization, increasing population and the wastage of food that takes place because of post-harvest losses. Now we well understand how we can save and prevent the food available to us to increase the per capita food availability as much as possible.

2.8 CHECK YOUR PROGRESS EXERCISE

1- Give a detailed account of biological determinants of food choices? ----------
---

2- How would you calculate the following –
   a. Total food availability in a given time ?----------

      ---
   b. Per capita food availability ?----------

3- State the effect of food production on food availability? ----------
---

4- How does the increase in population effects the food availability and consumption? ----------
---

5- What do you understand by post-harvest losses? How do they effect the food availability? ----------

6- What measures can you take to prevent the post-harvest losses of food? ----------

7- Write short notes on the following – ----------

   a. Causes of post-harvest losses? ----------

   b. Use of bio pesticides to prevent post-harvest losses? ----------

8- State the effect of growing industrialization on food availability and consumption? ----------

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Unit – 3 Nutritional problem of the community and implication for Public Health

Structure

3.0 Objectives

3.1 Introduction

3.2 Incidence and causes of Protein energy and malnutrition

3.3 Sign and symptoms of Protein energy malnutrition

3.4 Marasmus

- 3.4.1 Clinical features of marasmus
- 3.4.2 Biochemical changes in marasmus

3.5 Marasmic Kwashiorkor

3.6 Treatment of Protein energy malnutrition

- 3.6.1 Dietary Modifications in Protein energy malnutrition
- 3.6.2 General Dietary guidelines in PEM
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3.7 Iron deficiency anemia

- 3.7.1 Stages and causes of Iron deficiency anemia
- 3.7.2 clinical features of Iron deficiency anemia
- 3.7.3 Treatment of Iron deficiency anemia
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3.8 Vitamin A deficiency

- 3.8.1 Prevalence of Vitamin A deficiency
- 3.8.2 Causes of Vitamin A deficiency
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- 3.8.4 Management of Vitamin A deficiency disorders
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3.9 Iodine deficiency disorder (IDD)

- 3.9.1 Prevalence of IDD
- 3.9.2 Causes of IDD
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- 3.9.4 Cretinism

3.9.5 Prevention and control of IDD
3.10 Answer to check your progress questions
3.11 References

3.0 OBJECTIVES

This unit will provide the students the understanding of the following points :

- The different types of protein, energy malnutrition.
- The causes of protein, energy malnutrition
- The signs and symptoms of protein, energy malnutrition
- The prevention and treatment of protein, energy malnutrition
- Clinical features and biochemical changes in marasmus
- Symptoms of Marasmic Kwashiorkor
- Treatment of Protein energy malnutrition

3.1 INTRODUCTION

Throughout the globe, an envisioned 26 million children underneath the age of five are stricken by extreme acute malnutrition. This range is mind blowing – most significantly, due to the fact children with severe acute malnutrition are in instances much more likely to die than properly nourished youngsters. Those deaths are the direct end result of malnutrition itself, as well as the oblique result of childhood illness like diarrhea and pneumonia that malnourished youngsters are too vulnerable to survive.

According to the World Bank report nutrition at glance at 2009 it is stated that in India “around1/3 of deaths of children are due to under nutrition” mostly from increase severity of disease. Children who are under nourished between conception and age to are at high risk of impaired cognitive development which adversely affects the countries productivity and development. The economic cause of under nutrition include direct cost such as the increased burden on the health care system and indirect costs of decreased productivity. In India an estimated 48% of children under the age of five are stunted, 43 % are underweight and 20 % percent are wastage. More than one in four infants are born with a low birth weight. This is not a problem of food inadequacy alone but it also comes with faulty child rearing practices and burden of infectious diseases.

Severe acute malnutrition can boom dramatically in emergencies. However not withstanding what we see within the headlines, the majority of instances occur in developing international location now not stricken by emergencies. Those setting are plagued as a consequence of persistent poverty, lack of education, poor hygiene, restricted right to healthy diets.

Protein energy malnutrition is identified as a major health and nutrition problem in India. It occurs mainly in children in the first year of life. Protein energy malnutrition is not a single disease but it has a wide range of clinical features. Kwashiorkor and Marasmus are the two extremes and between them there are different forms in which the clinical features are seen due to varying combinations of deficiency of protein and / or energy together with deficiencies and vitamin along with associated infections.

Mineral deficiency diseases

- Stages, causes and treatment of Iron deficiency
- Etiology symptoms and treatment of vitamin A deficiency
- Etiology symptoms and treatment of iodine deficiency disorder

3.2 INCIDENCE AND CAUSES OF PROTEIN ENERGY AND MALNUTRITION (PEM)

The prevalence of florid forms of severe Protein energy malnutrition like Kwashiorkor and Marasmus among pre-school children is less than 1 percent. National surveys indicates that about half of (48 percent) below 5-year children suffer from sub clinical under nutrition such as underweight. Most of these children are stunted and wasted which indicates that under nutrition is of long duration. According to UNICEF-WHO-WORLD BANK GROUP joint malnutrition estimates nearly half of all deaths in children under 5 are attributable to under nutrition. Nearly one in five (149.2 million) children under five years were stunted in 2020 and over 45.4 million suffered from wasting. 90 percent of worlds chronically under nourished (stunted) children are living in developing countries of Asia and Africa.

In India, 14 percent of children under five years are under weight and about 34.7 percent (i.e., 61 million children) are stunted due to chronic malnutrition.

In India, severely under-5 children are estimated to constitute around 6.4 percent. In addition, 19.8 percent are moderately malnourished according to national family health survey (NFHS-III). This means that 8.1 million children suffer from severe acute malnutrition (SAM). According to state of

food security and nutrition in the world 2019 report, 38.4 percent of children in India are stunted while 21 percent suffers from wasting. Malnutrition contributes 24 percent of the under five deaths and 30 percent of neonatal deaths in India. According to data of NFHS-V (2019-2020) from the 22 states surveyed so far, only nine showed a decline in India number of stunted children, 10 in wasted children and 6 in underweight children.

The disease protein energy malnutrition is most prevalent in those areas of the world where there is deficiency of food consumption in general. PEM is the most important public health problem in under developed countries in the world today. The factors that may lead to development of PEM are not independent but are interrelated and form a complex etiological framework.

SOCIAL AND ECONOMIC FACTORS

- The most frequent cause of PEM is poverty that results in low food availability, over-crowded and unsanitary living conditions and improper child care. In developing countries about half of the total population falls Below the poverty line (BPL).
- **Illiteracy** is another major cause that leads to poor child rearing and infant feeding practices, which leads to PEM.
- Apart from poverty the major cause of malnutrition is ignorance because of which there are taboos and misconceptions regarding foods or breast-feeding practice or other food consumption. A decline in the practice and duration of breast feeding, combined with improper weaning practice are causes of PEM.
- Migration from traditional rural setting to urban slums can contribute to or precipitate PEM.
- Due to ignorance and over population and large families are common in India. Because of having large number of people in a family the per capita food consumption is less than required and these families give rise to Kwashiorkor and Marasmus patient.

BIOLOGICAL FACTORS

Low birth weight– the beginning of PEM in children starts in rural India from the time of their birth at least around 30 percent of Indian Children are born with low birth weights (less than 2.5 kgs). The birth weight of normal child is 3-3.4 kg.

Maternal malnutrition– The main cause of low-birth-weight children is maternal malnutrition before and during pregnancy or during lactation period. Intrauterine malnutrition can lead to decrease

enzyme synthesis, less appetite and less than adequate food consumption by the child. Thus, the diets are low in protein and calories.

IGNORANCE AND POOR SOCIO-ECONOMIC STATUS

Improper child care, either as a result of lack of knowledge or lack of time could also contribute to the onset of PEM. PEM is mainly a disease of the poor and downtrodden. The mothers of these families are illiterate, work for their living and are largely influenced by the belief system of the society, are superstitious and believe in spiritual healing etc.

INADEQUATE BREAST MILK

Through prolonged breastfeeding of children is the rule in rural India, the amount of breast milk secreted in poor Indian mother is lower either than normal women and those of developed countries. In other words, the infants may not be consuming adequate breast milk leading to inadequate nutrition.

DELAYED SUPPLEMENTARY FEEDING

The mothers from lower socio-economic groups where PEM is more prevalent, delayed introduction of supplementary foods (foods in addition to breast milk) usually until the infants completes one year of age is a common practice. Thus, when breast milk is not adequate delaying supplementary feeding further aggravates the dietary inadequacy among such infants leading to PEM. Rural Indian women due to ignorance firmly believed that the children should be given supplementary foods only when they are able to pick and eat. Even after weaning (Completely stopping breast feeding) the children are not given any special diet other than the adult diet. Young infants cannot consume this diet in adequate amount due to its bulk. Early and abrupt weaning and introduction of diluted milk formulae is one of the reasons for marasmus.

INFECTION AND INFESTATION

Childhood infections (Viral/Bacterial) and parasitic infestations are always associated with PEM. These cause Anorexia (Loss of Appetite) leading to reduce food intake, interfere with nutrients absorption and utilization, and result in nutrient losses. The role of measles infections, frequent diarrhea and acute respiratory infection in the onset of PEM is very important.

ENVIRONMENTAL FACTORS

Over crowing and unsanitary living conditions may lead to frequent infections like diarrhea, dysentery, and hepatitis etc.

Agricultural pattern, flood, famine, drought, earthquake etc can lead to scarcity of food which can lead to PEM. Moreover, in India distribution of food is not adequate and storage conditions are not good. PEM can result as a consequence of mal distribution.

FREE RADICAL ATTACKS

Free radical damage the body and can contribute to the development of Kwashiorkor. The free oxygen radical which are produce during various infections are potentially toxic to the cell membrane. These free radicals are usually chelated and scavenged by protein and anti-oxidants like vitamin A, C, E and Micro minerals like Zinc and Selenium. During infections these nutrients are present in lesser concentration and so the free radical activity is very high. These free radicals can damage the liver cells and can lead to kwashiorkor.

ALFATOXIN TOXICITY

Aflatoxin a toxic chemical produced by the fungus Aspergillus flavus in grounds nuts stored in moist and humid conditions. This micotoxin causes tremendous hepato-cellular damage leading to PEM.

3.3 SIGNS AND SYMPTOMS OF PROTEIN ENERGY MALNUTRITION

Clinical features of Kwashiorkor

a. Essential sign and symptoms –

- **Growth failure** – growth in Kwashiorkor is manifested by decreased body length and low body weight inspite of retention of water in body (Oedema) and the presence of subcutaneous fat in some children. The growth retardation is primarily due to the general quantitative lack of protein.

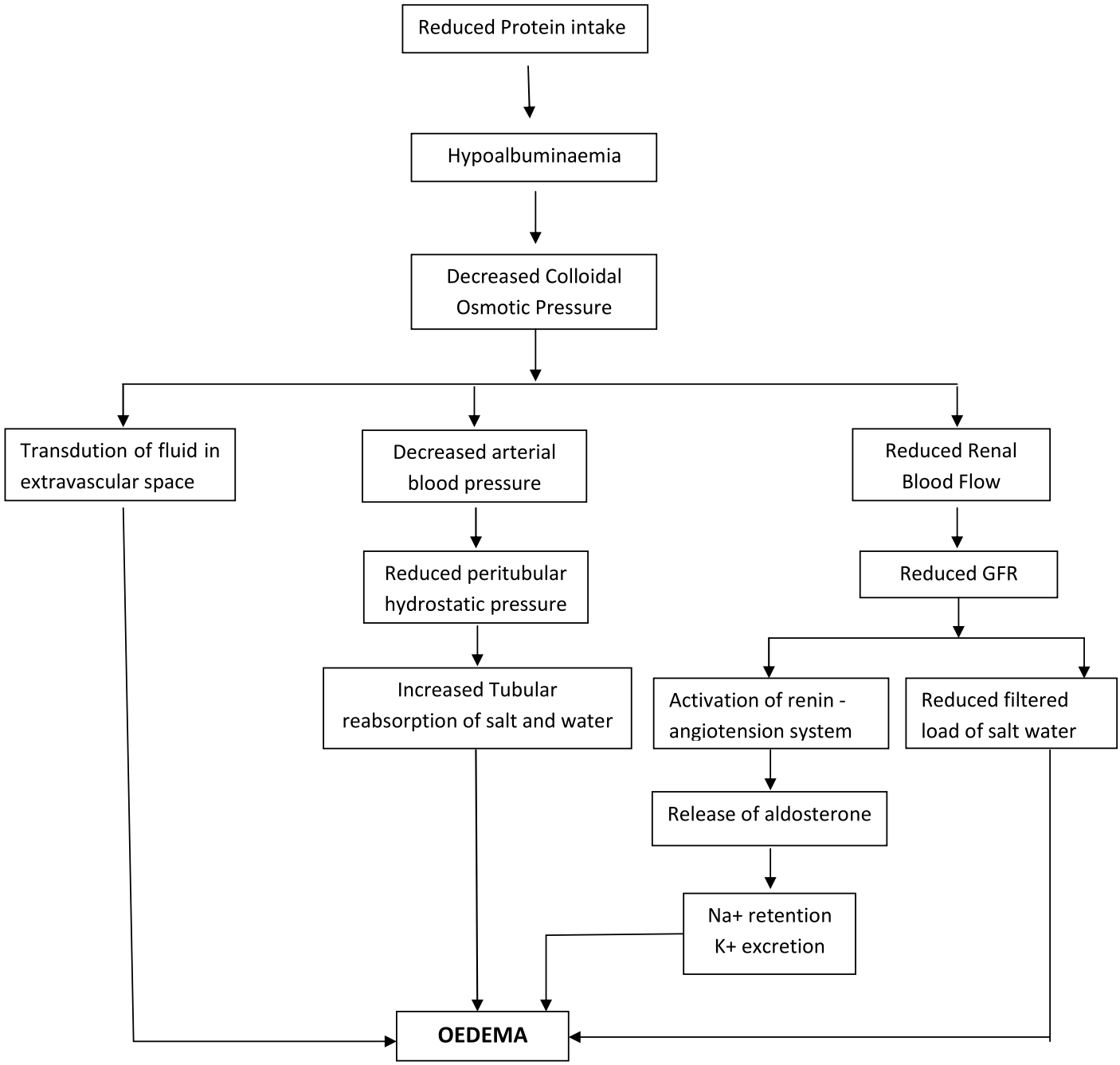
- **Mental Changes** – Kwashiorkor is characterized by the psycho motor changes like mental apathy in the form of silence, listlessness, inertness, lack of and lack of interest in surroundings etc.

- **Muscle Wasting** – this a constant feature of Kwashiorkor and there is a reduction in the circumference of the upper arm. [Oedema is seen more in four arm or leg.]

- **Oedema** – it is the most common feature of Kwashiorkor which occurs mainly in the face and the lower legs. It may also involve the hands and thigh. This is mainly due to low serum albumin and high levels of sodium and potassium in the serum. There is also some change in the normal diuretic – anti diuretic hormonal control of Urine secretion. Pitting Oedema is very common.



PATHOGENESIS OF OEDEMA IN KWASHIORKOR



b. Non- Essential sign and Symptoms –

- **Hair Changes** – Hair become thin dry and can be plugged easily without causing pain. Loss of Hair can cause patchy alopecia.

  Alternate light and dark discoloration of the hair is there which is often called the "Flag Sign".




- **Skin changes** – Scaly pigmentation of the skin is seen. In severe cases the epithelium peels of leaving behind depigmentated patches with oozing fluid which is described at **Crazy Pavement Dermatitis.** This is mark on the buttock, back of thigh and axilla.



- **Gastro intestinal Manifestation** – due to inhibition of enzyme activity the following symptoms are seen –

  Vomiting

  Anorexia

  Lactose intolerance

  Mal Absorption of nutrients

- **Liver changes**

  Hepatomegaly

  Fatty Infiltration of Liver



Stress of PEM in Kwashiorkor

↓

Dysadapted

↓

Cortisol not Increased

↓

Muscles Protein is not mobilized

↓

Decreased plasma amino acid concentration

↓

Increased Somatomedin C

↓

Increased growth Hormone

↓

Increased Plasma Fatty Acids

↓

Synthesis of lipoprotein

↓

Fatty Liver, Impaired Hepatic Functions

Pathogenesis of Fatty Liver in Kwashiorkor

- **Vitamin and Mineral deficiency** Symptom of Vitamin A deficiency are prevalent in PEM like xeropthalmia and Keratomalacia

  Angular Stomatitis and Glossitis are present due to Riboflavin deficiency.

- **Anemia** – it is mainly due to iron and folic acid deficiency the aggravating factor are Parasitic infestation which prevent the absorption of the nutrients. Anemia is usually micrositic anemia.
- **Secondary Infections** - Due to poor nutritional Status the immunity of the Kwashiorkor patient goes down and they become susceptible to secondary infections such as tuberculosis, pneumonia, measles and intestinal parasitic infestations.
- **Moon Face** – Due to oedema the face looks rounded like full moon.

BIOCHECHEMICAL CHANGES IN KWASHIORKOR

Kwashiorkor is mainly due to deficiency of protein in the diet followed by energy. There are following changes in the metabolic profile –

- Changes in serum protein – the serum protein are mainly low specially the albumin protein reduction is maximum. The serum albumin fraction ranges form 0.7 to 2.2 grams per 100 milliliter serum as compared to normal range of 3.5 to 4.0 gram/dl. The serum albumin level is the good index of the severity of the disease and an improvement in its levels shows the efficacy of the therapy. Low plasma Tranferine and Ceruloplasmin and Serum retinol binding protein also seen.
- Enzymes in the serum and digestive juices – the enzyme and digesive juices are found very low, specially serum alkaline phosphatase, choline strays, Amylase, lipase and protease.

CHANGES IN CARBOHYDRATE METABOLISM

- Kwashiorkor Children may develop hypoglycemia. Glucose tolerance may be impaired in some patients.

CHANGES IN LIPID METABOLISM

- Fatty infiltration of the liver is present, due to impaired syntheses of β-lipoprotein. This causes fatty liver.
- The level of free fatty acids in the plasma are high in all the types of PEM due to partial starvation.
- In Kwashiorkor the plasma triglyceride level and cholesterol level are low, due to decreased ability of the liver cells to mobilize lipid in the form of β-lipoprotein.

ELECTROLYTE AND WATER BALANCE

- There is deficiency of potassium as much about 40 percent. Electrolytes mainly potassium and magnesium, are depleted due to diarrhoea.
- Losses in the stools are about 20 to 30 mmol/day.
- Plasma sodium level are generally normal in both the conditions.
- Plasma potassium is often below normal. (< 2.5mmol/ltr.)

GENERAL METABOLIC CHANGES

- Low serum Urea (< 1mmol / ltr)
- Urinary Creatinine is also reduced reflecting muscles loss.
- Reduced urinary hydroxy proline level.

3.4 MARASMUS

Nutritional Maramus occurs due to both protein and energy deficiencies. The Trauma of protein energy malnutrition and the secretion of cortisol affects the child. Cortisol mobilizes protein from muscle and subcutaneous tissues to amino acid pool, which result in wasting of muscles with no edema and also without hepatomegaly. Raised Cortisol level reduces growth hormone level and so the growth of the child is stunted.

Maramus usually occurs in weaned infants below 1 year of age and pre-school children below 3 years. The incidents are highest during the first one year of life.

3.4.1 CLINICAL FEATURES OF MARASMUS

The signs and symptoms of Marasmus include the following –

a. **Essential sign and symptoms–**

- Growth Retardation – this is usually very severe. Loss of weight is much more marked than decrease in height. The child weighs below 60% of the standard weight.
- Wasting of muscles and subcutaneous fat – The subject is severely emaciated. The muscles are weak and wasted. The arms are thin and skin is loose. Subcutaneous fats is practically absent. Due to increased cortisol level muscles cells are mobilized.
- Absence of edema – although there is a slight change in serum albumin level, in marasmus Oedema is absent.

- Absence of Fatty lever- Due to better stress adaptation fatty lever is absent.

b. Non- Essential sign and Symptoms –

- Hair changes are not present.
- Classic dermatitis like Kwashiorkor is not seen.
- Gastro intestinal manifestation like diarrhea and vomiting are seen. Steatorrhea may also be seen.
- Child is hungry but at times he can be anorexic also.
- Skin is dry and atrophied.
- Sub normal body temperature is present.
- Face looks like old man or monkey face.
- Eye lesions due to Vitamin A deficiency may occur.
- Psychomotor changes are usually in the form of Irritability rather than listlessness.
- Apathy and Irritability.
- Belly shrinkage.
- Dehydration due to frequent watery diarrhea.
- Shriveled body, wrinkled skin, bonny prominence.
- Super added infections and infestation are common as in Kwashiorkor.

3.5.2 BIOCHEMICAL CHANGES IN MARASMUS

- The Bio chemical changes are less until Marasmus is on advanced degree. The reason is that the amino acids liberated from Childs own tissue may continuous synthesis of serum enzyme, elbumine and other essential metabolites.
- Anaemia may be mild to moderate. Iron deficiency anaemia is more common.
- Electrolyte disturbances are commonly present in diarrhea and vomiting.
- Blood Urea is level is usually normal.
- Blood Sugar level is slightly raised.
- Vitamin A content of serum is low.

DIFFERENCE BETWEEN KWASHIORKOR AND MARASMUS

	Features	Kwashiorkor	Marasmus
A.	**General Features**		
1	Definition	Kwashiorkor is a type of PEM due to mainly protein deficiency followed by calorie deficiency and is characterized by oedema, fatty liver, flaky hair changes etc.	Marasmus is also a type of PEM characterized by both protein and energy deficiency.
2	Age of occurrence	1 to 3 years	Any age, but infants are commonly affected
3	Pathological history	Protein deficiency more	More calorie deficiency
4	Weight Loss	Less Weight Loss	More Weight Loss
5	Muscles wasting	Less	More
6	Mental changes	More affected	Less affected
7	Hair Changes	Evident	Less
8	Skin Changes	More	Less
9	Heart	Micro cardia / normal / macro cardia	Microcardia (Usually)
10	Complications	Severe	Moderate
11	Prognosis	Poor	Varies with treatment
12	Response to treatment	Variable	Good
13	Mortality Rate	33%	20%

	Features	Kwashiorkor	Marasmus
B.	**Clinical Sign & Symptoms**		
1	Growth Retardation	+	+
2	Under Weight	+	+
3	Apathy, behavioral changes	+	+
4	Oedema	+	-
	Features	**Kwashiorkor**	**Marasmus**

B.	**Clinical Sign & Symptoms**	Sometimes found	Severe
5	Muscular wasting		
6	Dyspigmentation	Prominent	Absent
7	Dermatosis	+	-
8	Diarrhea	+	+
9	Infection	+	+
10	Moderate anaemia	+	+

	Features	**Kwashiorkor**	**Marasmus**
C.	**Biochemical changes**		
1	Hypo albuminemia	+	-
2	Potassium and Electrolyte imbalance	+	+
3	Fatty liver	+	-
4	Abnormal Fat Metabolism	+	-
5	Low Vitamin A absorption rate	+	-
6	Protein depletion	+	+
7	Low body temperature	-	+
8	Glucocorticold	Decreased	Increased
9	Serum Enzymes	Markedly less	Slightly lowered
10	Serum Triglyceride	Normal	Normal
11	Serum Cholesterol	Lowered	Normal
12	Plasma Glucose Level	Lowered	Normal
13	Blood Urea	Lowered	Normal
14	Serum free fatty acid level	Increased	Increased
15	Hydroxy Proline excretion	Decreased	Decreased
16	Ratio of EAA and Non-EAA in Serum	Decreased	Normal

(Source: textbook of community nutrition by Surya Tapadas, Academic publisher's 5th edition)

3.5 MARASMIC KWASHIORKOR

Marasmic Kwashiorkor is the third form of Protein Energy Malnutrition. Sometimes in areas where PEM is common, the malnourished children is exhibiting features of both Kwashiorkor and Marasmus. Such forms arise during transition from one form of severe PEM to another. This condition is known

as marasmic kwashiorkor. This type of PEM is the most common spectrum of PEM in India. The clinical feature of Marasmic Kwashiorkor include –

- Extreme muscle wasting.
- Loose and hanging skin folds.
- Old man or monkey face.
- Absolute weakness.
- Presence of Oedema.



NUTRITIONAL DWARFING

Chronic PEM staring quite early in life. Nutritional Dwarfing refers to a condition where chronic PEM starts in early years of life without proceeding to Kwashiorkor or Marasmus but with a marked retardation of growth resulting in nutritional dwarfing and stunting. The child adopts to prolonged insufficiency of food, showing poor linear growth and delayed pubertal development. The term bonsai children of pocket additions are now popularly used for these conditions.

Beyond height stunting can negatively affect a Childs brain development, organ development and immune function. Thus, limiting the future productiveness of the children.

UNDERWEIGHT CHILDREN

In underweight children weight for age is only 60 to 80 percent of the expected weight. The children are malnourished but do not have any features of Marasmus Kwashiorkor. Children with sub clinical PEM having reduced plasma albumin grow smaller than their genetic potential and are at the risk of

gastroenteritis, respiratory and other infections which can precipitate malnutrition. Underweight also inhibits the cognitive development and impacts fitness reputation later in life.

3.6 TREATMENT OF PROTEIN ENERGY MALNUTRITION

The treatment of PEM comprises of three essential stages which are as follows –

1- **Hospital treatment**– This treatment mainly revolves around treating life threatening conditions. The hospital treatment involves following therapeutic measures –

- Management of electrolyte and fluid imbalance

➢ **Treating dehydration** – Oral or nasogastric administration of fluids help to treat patients with mild to moderate dehydration. The oral rehydration salts (ORS) is also suggested for correcting dehydration. It is prepared by dissolving the following salts in 1 ltr. of boiled and cool drinking water. The composition of the salts as recommended by WHO is as follows –

Sodium chloride (table salt) – 3.5 gram

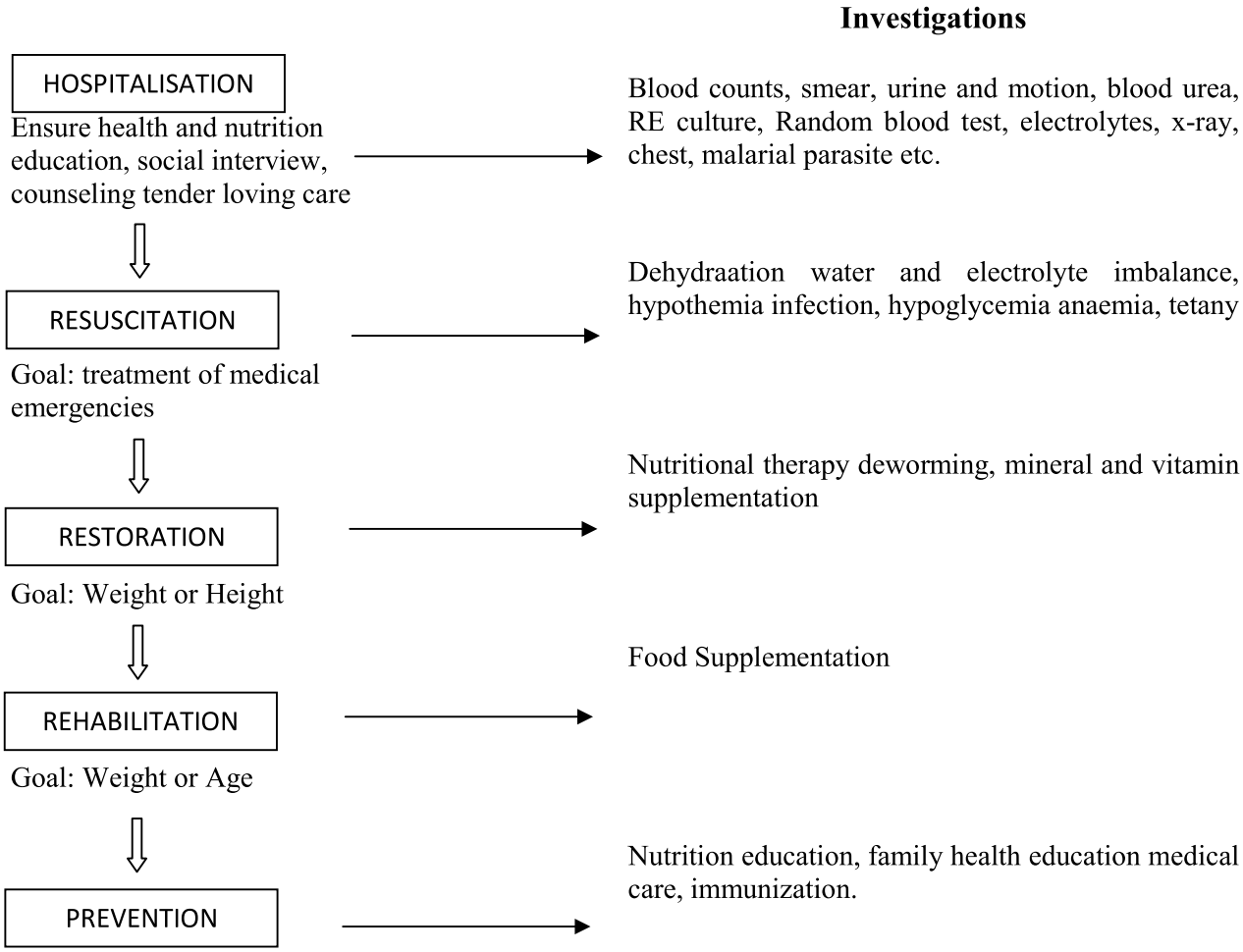
Sodium bicarbonate (baking soda) – 2.5 gram

Potassium chloride – 1.5 gram

Glucose - 20 gram

Based on the severity of dehydration 70-100 ml ORS/ kg body weight can be given at frequent intervals for a period of 4-6 hours. A clean ORS must be made up every 12-24 hours. The pre-prepared solutions should not be boiled.

STRATEGIES TO MANAGE PEM



(Source: textbook of community nutrition by Surya Tapadas, Academic publisher's 5th edition)

In case of severe dehydration, I.V fluid therapy is required to improve circulation and expand plasma volume rapidly by administering 70-100ml of fluid in the first 3-4 hours, restored to ORS for maintenance after correcting the deficit of body fluid levels. Oral potassium supplements of 1-2g/kg/day ensure faster recovery. Globally, evidence on health benefits of zinc nutrition and zinc supplementation for the growth of stunted children and children with diarrhoea has been discovered in the last decade. WHO established that zinc supplements can reduce the duration of a diarrhoea episode by 25% and are associated with a 30% reduction in stool volume.

2- TREATMENT OF INFECTIONS

Whilst the causative agent of the contamination is known or suspected, the appropriate antibiotic therapy needs to be used. Thus, for common infections which includes pneumonia, tonsillitis, malaria

penicillin is the drug of choice. Giardiasis and Ascariasis must be treated with appropriate deworming agents.

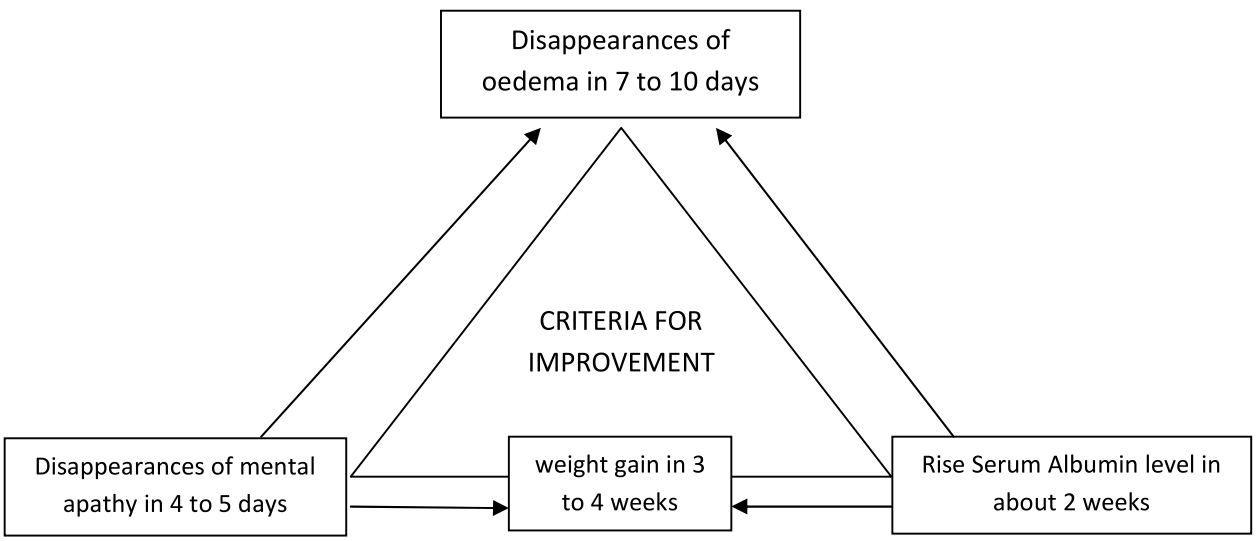
3- MANAGEMENT OF HYPOGLYCEMIA

1mg of 50% dextrose solution/ kg body weight should be given intravenously. In mild cases, milk feed and glucose in water will help.

4- ANAEMIA

Anaemia treatment should be started when the hemoglobin level is very low. Blood transfusion is recommended if hemoglobin falls below 5g/dl. 10ml of packed cells/kg body weight should be administered slowly for 3 hours.

5- CONGESTIVE CARDIA FAILURE may occur after three days of acute face usually in Kwashiorkor. Oxygen inhalation and antidiuretic therapy is useful.



Criteria for improvement for PEM child

3.6.1 DIETARY MODIFICATION IN PROTEIN ENERGY MALNUTRITION

To restore nutritional status without disrupting homeostasis. It is very well documented in the above sections that PEM is a purely nutritional disorder. Therefore, it becomes mandatory for us to know the nutritional requirements during PEM to decrease the convalescence period. Now, let us discuss the nutritional needs. Dietary management plays a vital role in prevention, treatment or recovery from PEM. The principles of dietary management include Diet rich in calories and protein. An acceptable

and easily digestible economic homemade diet is recommended which can be made with readily available ingredients. Diet usually contains skimmed milk powder, Sugar, cooked cereal and ripe banana. Fats can be introduced in the diet from second week of treatment. Vegetable – protein mixtures along with Sugar, cereals and ripe banana are very helpful. The diet should be formulated with the above-mentioned foods in such a way that the following nutritional requirement -

- **Energy** – For children above two years 150 to 200 kcal/kg body weight. For children below 2 years 200 kcal/kg body weight should be given. Malted cereals, banana, sugar and fat included in the diet helps achieve calorie intake
- **Carbohydrates** – about 50 % of the total calorie intake should be in form of carbohydrates. These carbohydrates should be easily digestible and absorbable form. For example – lactose and sucrose etc.
- **Protein** – 5 gram of protein per kilogram of the existing body weight should be given. A cereal pulse combination of 5:1 ratio helps to meet calorie as well as protein requirement. Whole milk is not tolerated if diarrhea persists, in such conditions skimmed milk can be preferred. Bengal gram is a cheap and effective source of vegetable protein. A ratio of 3:1, vegetable and animal protein should be included in the diet.
- **Fats** –35 to 40 percent of the total calories can be tolerated from fat. Inclusion of 1 to 2 tsp of saturated fat sources like butter, ghee or coconut oil makes food palatable and helps to increase calorie intake without causing gastrointestinal disturbances.
- **Vitamins** – For those with vitamin A deficiency associated with PEM. Oral dose of 50,000 IU of fat-soluble vitamin A should be administered soon, followed by 5000 units daily. Intramuscular or intravenous injections of 2 to5 mg of Vitamin K/ day for 2 to 3 days is advocated in severe PEM. Vitamin C and D should also be supplemented to prevent deficiencies.
- **Minerals** – 2.4 gram of potassium chloride and 0.5 gram of magnesium chloride can be added to the diet daily for the time period of two weeks. 300 mg of calcium lactate administered for 3 times a day enhance calcium levels. Ferrous sulphate salts improve levels of iron. Zinc and copper supplements should also be provided.
- **Fluid:** 100ml/kg/day of fluids are recommended to prevent dehydration.

Diet for a child suffering from PEM

Food Stuffs	G / caput / day	
	Diet for 1st day to 10th day	Diet for 11th day to 30th day
Milk skimmed (ml)	1000	-
Milk whole (ml)	1000	2000
Cane Sugar (g)	100	100
Dextrimaltose (g)	50	-
Ripe Banane (g)	150	150
Corn or Wheat flour (g)	25	50
Bread and Biscuits (g)	25	50-100
Vitamins	Daily requirement added to milk	Daily requirement added to milk

(Source: textbook of community nutrition by Surya Tapadas, Academic publisher's 5th edition)

SPECIAL FEEDING TECHNIQUES

1- **Intravenous Feeding** – As the fluid and electrolyte disturbance may be marked intravenous feeding can be dangerous. It is better to give all nutrients orally.

2- **Tube feeding** – Initially the child may refuse to take the feed orally due to lack of appetite and weakness, it is necessary to give the feed through nasogastric feeding for a day or two.

A formula containing 90 (g) skimmed milk, 70 gram sugar, 50 gram vegetable oil in 100 ml. Water provides approximately 1000 kilo calories and three grams protein / 100 ml. In case of animal milk intolerance milk formula should be substituted by vegetable, butter milk or cereal foods.

3.6.2 GENERAL DIETARY GUIDELINES IN PEM

- Electrolytes and fluid balance should be restored by treating Oedema and Acidosis.
- Complications like diarrhea should be corrected by intravenous feeding.
- Secondary infections like malaria, pneumonia, tuberculosis and dysentery should be treated accordingly.
- During the first 24 hrs. therapy, correction of water and potassium depletion should be given priority specially in cases of severe diarrhea. Such corrections may prevent death from heart failure.

A potassium containing electrolyte solutions none as Darrow's Solution should be administered orally the composition of the solution is (1:2:3) part by volume of 0.17 (m) lactate: normal saline: 5% glucose to which 50 ml of 50% dextrose water in added to each 500 ml solution.

- Whole blood or packed volume cells can be transfused in severe anemia.
- The anorexic and apathetic child should be given hand feeding.
- Vitamin Concentrate supplementation during the first two weeks is necessary.

Characteristics features of PEM diet
Diet Should be:
• From locally available staple foods. • Inexpensive. • Easily digestible. • Consisting of minimum of 100 ml of milk / day. • Of cereals and pulses combination in 5:1 ratio. • Equally distributed throughout the day. • Consisting of five food groups. • Of increased quantity of foods which the child is already used to. • High in calories by adding oil and banana. • Banana is also a bowel binder.

DAILY MENU FOR A CHILD SUFFERING FROM PEM

1st day to 10th day	**Time schedule**	**11th day to 30th day**
Milk (Half fat) with sugar – 1cup	Morning (6.00am)	Milk (full fat) with sugar – 1cup
Corn flour – milk pudding – 1 serving banana – 1 cup Milk with sugar – 1 cup	Breakfast (8.00 am)	Bread – 1 slice with milk Banana – 1 Cornflour milk pudding – 1 serving milk with sugar – 1 cup
Bread soaked with milk – 1 slice	Mid-morning (10.00 am)	Milk with sugar – 1 cup

Banana – 1 Milk with sugar – 1 cup		
Milk with sugar – 1 cup	After noon (4.00 pm)	Milk with sugar – 1 cup Biscuit – 2
Same as lunch	Dinner (8.00 pm)	Same as lunch
Milk with sugar – 1 cup	Bed time (10.00 pm)	Milk with sugar – 1 cup

(Source: textbook of community nutrition by Surya Tapadas, Academic publisher's 5th edition)

3.6.3 PREVENTION OF PEM

The FAO / WHO Nutrition expert committee suggested the following steps to prevent PEM:

Health Promotion:

- Measures directed to pregnant and lactating women (education, distribution of supplementary)
- Promotion of breast feeding.
- Development of low-cost weaning food sand the child should be made to eat more food as frequent interval.
- Measures to improve family diet.
- Nutrition education and promotion of correct feeding practices.
- Home economic
- Family planning and spacing of birth

Specific protection

- The child diet must contain protein and energy rich foods like milk egg and fresh fruits
- Immunization schedule should be followed

Early diagnosis and treatment

- Periodic surveillance
- Early diagnosis of any growth failure
- Early diagnosis and treatment of infection and diarrhea
- Development of programs for early rehydration of children with diarrhea
- Development of supplementary feeding programs during epidemics.
- Deworming of heavily infested children.

UNICEF inexpensive measures none to prevent PEM include GOBI Project:

Growth monitoring

Oral rehydration therapy

Breast feeding promotion

Immunization

CHECK YOUR PROGRESS

SHORT ANSWER QUESTIONS

1- Write down causes of Protein energy and malnutrition ----------
---

2- Throw light on sign and symptoms of protein energy malnutrition ----------
---

3- Write down difference between kwashiorkor and Maramus ----------
---

4- What diet would you prescribe for a child suffering from PEM ----------
---

3.7 IRON DEFICIENCY ANAEMIA

Iron Deficiency Anemia – Iron deficiency anemia is a syndrome caused mostly by malnutrition. According to WHO, it is defined as 'a condition in which hemoglobin content of blood is lower than

normal as a result of a deficiency of one or more essential nutrients, regardless of the cause of such deficiency. the most common form of nutritional anemia is iron-deficiency anemia.

DIAGNOSTIC CRITERIA FOR IRON DEFICIENCY ANAEMIA

Indicator	Cut-off point
Serum iron (µg/dl)	<60
Total iron binding capacity (µg/dl)	>300
Transferrin saturation (%)	<15
Erythrocyte protoporphyrin (µg/dl)	>100
Serum ferritin (µg/l)	<12

PREVELANCE

Recent WHO statistics indicate a worldwide anemia prevalence of about 30% with higher rates in developing countries.

In India, young children and pregnant women are most affected group with an estimated value of 69.5% and 55.3% respectively. In India, 51.40% adult non-pregnant women and 24% of adult men are found to be anemia.

We can find out prevalence of anemia by comparing WHO recommended Cut Off value of hemoglobin. below which an individual is considered anemic:

Group	Cut Off for hemoglobin (gm / 100ml)
Children (below 6 years)	11
Children (above 6 years)	12
Adolescent and non-pregnant, no lactating adult women	12
Pregnant women	11
Lactating women	12
Adult male	13

3.7.1 STAGES OF IRON DEFICIENCY

First Stage – Characterized by decreased storage of iron content without any detectable abnormalities.

Intermediate stage – In this stage iron stores are exhausted but anemia has not yet occurred. this stage is most widely prevalent stage in India.

Third Stage – In this stage overt iron deficiency when there decrease in concentration of hemoglobin due to impaired hemoglobin synthesis.

The end result of iron deficiency is Nutritional Anemia.

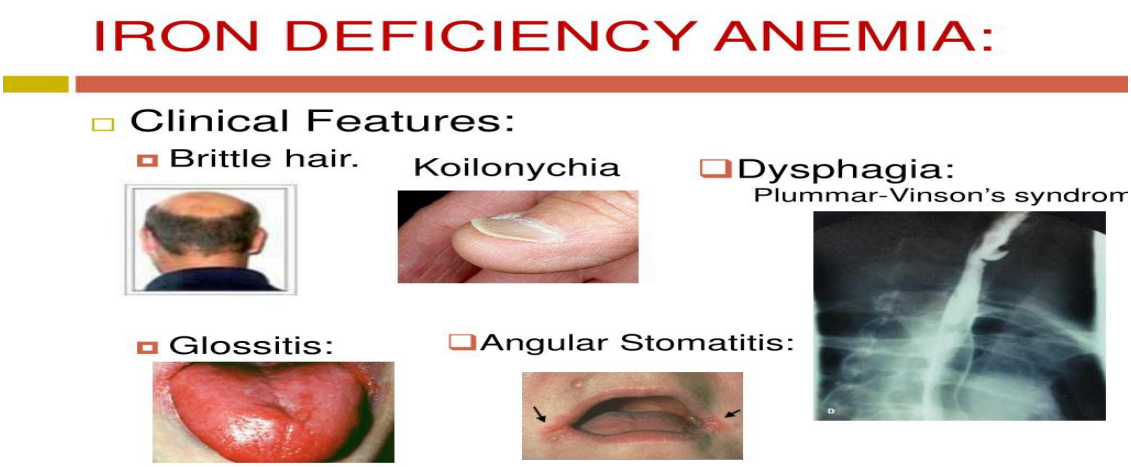
CAUSES

- Inadequate Dietary Intake.
- Poverty and ignorance.
- Poor-bioavailability of iron.
- Presence of absorption – interfering substance in the diet.

3.7.2 CLINICAL FEATURES OF IRON DEFICIENCY ANEMIA

Clinical features of iron deficiency anemia include:

- Paleness of conjunctiva.
- Paleness of Root of the mouth.
- Paleness mucosa of soft palate.
- Breathlessness even on mild exhaustion.
- In severe causes, particularly in pregnant women, swelling of feet is observed.
- Koilonychias (Spoon shaped nails)



CONSEQUENCES

The consequences of anemia are quiteserious:

Maternal and Prenatal Morality – Severe Anemia during pregnancy is associated with increased risk of maternal and prenatal morality along with foetal wastage. it is estimated that at least 80,000 women die due to anemia in every year.

Low Birth Weight – Maternal Anemia contributes to high of premature delivery, low birth, weight and mortality.

Physical work and mental performance – Normally women neglect mild form of anemia. But it has been observed that a mild reduction in level of hemoglobin can reduce work capacity and resistance of infection.

Poor Cognitive performance in Children – Anemia in infancy and childhood is associated with poor cognitive abilities and behavioral changes.

WHO RECOMMENDED GUIDELINE FOR DIAGNOSIS OF ANAEMIA

Groups	Cut-off points for haemoglobin (g/100 ml)
Children <6 years	11
Children > 6 years & adolescents	12
Non pregnant and non-lactating adult women	12
Pregnant women	11
Lactating women	12
Adult men	13

3.7.3 TREATMENT OF IRON DEFICIENCY ANEMIA

Oral iron is the preferred method of treatment of iron deficiency Anemia.

In moderate to severe anemia, 2 tablets of FERSOLATE (each equivalent to 100mg of elemental iron) are given. Due to the effect like gastric irritation, constipation, black stools, many patients discontinue the treatment. they should be advised to continue the tablets after meal. In severe anemia (HB level <5 to 7 g/ 100 ml), packed cell transfusion is recommended only after proper evaluation.

In late pregnancy, sometimes oral iron is not tolerated. In this condition parenteral therapy is preferred.

3.7.4 PREVENTION OF IRON DEFICIENCY ANEMIA

A long-term preventive strategy requires improvement in availability of iron in the diet along with behavioral change in the community while short term strategies involve only correction and prevention of iron deficiency in the diet. Thus, several approaches are necessary. Few approaches are:

Supplementation– In order to prevent nutritional anemia among mothers and children (1 to 2 years) Government of India sponsored or 'National Nutritional Anemia Prophylaxis Program' during the fourth five-year plan.

Under this program all the beneficiaries {i.e., pregnant women, lactating mother, pre school children and family planning acceptors} receives one tablet containing iron and folic acid commonly referred to as "FOLIFER" tablets daily for 100 days.

Adult beneficiaries get tablet containing 100 mg of elemental iron and 0.5 mg of folic acid. Children receives 20 mg of elemental iron and 0.1 mg of folic acid.

each beneficiaries must receive a total of 100 tablet per year.

Fortification - Fortification is the addition of iron to food – stuffs which are regularly consumed by the 'at risk' group of population. This food stuffs selected should be :

- Centrally produced
- Inexpensive
- Consumed in uniform qualities daily
- Should not affect the cooking quality of food stuff or taste or color.

Common salt satisfies all these criteria and hence it is suitable vehicle for fortification with iron. Other food items that can be fortified are wheat flour and breakfast cereals. Infant weaning foods, milk can also be fortified. Since iodized salt is already being distributed in different parts of the country. The technology of fortification of salt both by iodine and iron can be easily developed.

Dietary Diversification - It aims to ensure that the deficient population have access to food not only rich in iron but at the same time rich in vitamin C as it help the body to absorb Iron. A strategy which is self – sustaining and provide multiple nutrients at a cheaper is needed / Home gardening and Horticulture are such strategies which can be easily adopted by population to whom gardening is a

daily practice. the advantage of Horticulture approach is that, it is capable of improving household nutritional status without any external help.

Behavioral changes by communication – Illiteracy and ignorance leads to nutritional disorder. Increasing awareness regarding nutritional disorder, relationship between diet and disease, about nutritional need, is an important method of control anemia. This shows a need for change in behavior of the community specially in women. This can be obtained through various education strategies.

Strengthening the public health measures- The parasite infestation and protozoal infestation cause iron deficiency through loss of blood and destruction of RBC. The deworming, prevention and treatment help in the treatment anemia.

3.8 VITAMIN A DEFICIENCY

Vitamin A is essential for regulating number of key biological process and contributes to the normal functioning of eye sight, growth and development, maintenance of epithelial tissue integrity, immune function and reproduction.

Vitamins can not be synthesized in the body and hence it becomes essential to supply them through diet, failure of which leads to deficiency conditions. Vitamins are necessary for normal metabolic functions. Vitamins are classified as fats soluble and water soluble. Vitamin A,D,E,K are fats soluble and B complex group of vitamin and vitamin C are water soluble.

Vitamin A chemically known as retinol. Offers protection against Cancer, Cardio Vascular diseases, Cataracts and Gastric Inflammation due to its antioxidants property. The consequences of Vitamin A deficiencies are increase in mortality rate, loss of vision epithelial tissue defects, decreased immunity and decreased fertility rate. The term vitamin A deficiency disorders (VAD) describes wide spectrum of vitamin deficiency diseases.

3.8.1 PREVALANCE OF VITAMIN A DEFICIENCY

Vitamin – A deficiency is a major public health nutrition problem in the developing world. It is among the “top ten” health problems contributing to the global burden of disease and childhood mortality.

According to a global study (1995), VAD was a public health problem among 78 developing countries and VAD was reported to be widespread in periequitorial regions of the world.

In 2000, the VAD was considered to be a public health problem in 118 countries. The extent and severity of VAD are most widespread across large areas of South and South – East Asian and Saharan and Sub-Saharan countries. The highest prevalence of VAD found in Africa and highest number of affected children belong to South – East Asia.

According to a global report (2002), about 127.2 million preschool children are Vitamin A deficient and of these about 4.4 million under five children were manifested clinical xeropthalmic features.

According to WHO guidelines (2006), approximately 190 million preschool children are affected by VAD, majority of which belong to Africa and South East Asia.

VAD causes more than 250,000 children to go blind in Asia each year. Of which 52500 cases are from India each year. Although the incidence rate has significantly reduced due to continuous massive supplementation and immunization efforts taken by the government. The prevalence of Sub clinical VAD is significantly higher in all the states among pre schoolers, which is also associated with increased morbidity and mortality risk. Around 6500000 early childhood deaths from Diarrhea, measles, malaria and other infections each year can be contributed to VAD as an underline cause.

According to National Nutrition monitoring Bureau (NNMB, 1999) survey data the Indian preschool children continue to consume <50% of their RDI for vitamin – A, despite considerable socio – economic upliftment.

The prevalence of **Bitot's spots** is above WHO cut off level of 0.5% t determine public health significant in all states except Kerela and Orissa. (NIN, 2003 to 2004). The overall prevalence of night blindness among preschool children is 0.3 % and that of Bitot spot is 0.8%.

According to a National study conducted by NIN (2005-2006) the prevalence of sub clinical VAD is significantly higher among pre schoolers in all states of India.

As deficiency of Vitamin A can affect the people of all age groups it's very important to know the causes and preventive measures.

3.8.2 CAUSES OF VITAMIN A DEFICIENCY

Vitamin A deficiency is common public problems that result from a chronic low dietary intake of vitamin A due to socio economic factors that may adversely affect regular availability, access and consumption of vitamin A rich foods. The reason for Vitamin A deficiency are as follows: -

1- **Age –** Vitamin – A deficiency can occur in any age but it is prevalent mostly among preschool children. The deficiency is very rare in breast fed infants because mother's milk has got good amount of vitamin A in it. Pre schoolers are prone to VAD due to low intake of Vitamin A and also due to lowered immunity and increased susceptibility to infections and increased needs of vitamin A.

   VAD induced blindness is often associated with Protein Energy Malnutrition and is most prevalent in children under three years of age. In older children of school age, the prevalence of xeropthelemia and Bitot spot may be high due to previous low vitamin A stores in the body.

2- **Socio economic factors** – Poverty and ignorance are major contributing factors for any deficiency because the expense made towards nutritious food is minimal. Animal foods like egg, milk and lever which are rich sources of Vitamin A and assure complete absorption and utilization are expensive. Even though low cost foods like green leafy vegetable and ripe banana are good sources of Beta Carotene, due to some food fast and taboos they are avoided in the diets of children and pregnant women. Children from poor, rural and tribal areas are more vulnerable to Vitamin A deficiency. It is found that mothers of Vitamin A deficient children are generally illiterate and are ignorant about the importance of diet in disease prevention. Also the potential benefits of Vitamin A supplementation, Immunization and other basic health services like diarrhea prophylaxis are not utilised due to lack of awareness.

3- **Season –** The food production and availability of Vitamin A rich foods shows seasonal variation. This influences the vitamin A status of the community.

4- **Inadequate Dietary Intake –** Inadequate of Dietary intake of vitamin A and its precursor beta carotene is the most important contributory factor. The prevalence of Maternal malnutrition is very high in India specially in low income group due to low dietary intake of vitamin A in women. Their may be poor store of Vitamin A if the pregnant and lactating mothers are vitamin A deficient. Breast milk is a good source of Vitamin A but delayed weaning and inadequate supplementation depletes the hepatic stores of vitamin A and subsequently the child becomes vitamin A deficient during pre school age.

5- **Infections –** The common childhood infections like diarrhea, measles, respiratory tract infections and parasites infestations interfere with absorption of vitamin A leading to vitamin A deficiency.

6- **Increased excretion -** Certain other diseases like chronic infectious diseases, urinary tract infections and cancer increases vitamin A excretion causing deficiency.

7- **Parasitic Infestations –** Certain parasitic infestation like giardiasis and ascariasis interfere with absorption of vitamin A.

8- **Low purchasing capacity (Poverty) –** There is low purchasing capacity among lower socio economic groups. They are unable to meet the dietary requirements even after spending 80 to 90 % of their income on food. This is an important factor for the widespread prevalence of Vitamin a deficiency in India.

9- **Improper cooking methods –** boiling and cooking at high temperature and discarding the water in which the food stuff has been boiled reduces the retention of carotene upto a great extend. Cooking in less oil helps in retaining beta carotene better. Vitamin A is lost by oxidation.

After understanding the basic reason for Vitamin a deficiency we will now read in detail the clinical sign and symptoms to identify the VAD subjects.

3.8.3 CLINICAL FEATURES OF VITAMIN A DEFICIENCY

The deficiency system arise when the liver stores for Vitamin A have been exhausted. The symptoms of Vitamin A deficiency can be discussed under two categories –

1- Ocular symptoms (Xeropthalmia)
2- Extra Ocular manifestations

OCULAR SYMPTOMS OF VITAMIN A DEFICINECY (XEROPTHALMIA)

The clinical manifestation of vitamin A deficiency are predominantly ocular changes which are collectively known as Xeropthalmia. It is a greek word meaning Drying of the eyes.



Stages of Xeropthalmia

The world Health Organization has recommended the following classification of Xeropthalmia -

Grade of xerophthalmia	Peak age group (years)	Type of Deficiency	Risk of death
XN - Night blindness	2–6; adult women	Longstanding. Not blinding	+
X1A -Conjunctival Xerosis	3–6	Longstanding. Not blinding	+
X1B -Bitot's spot	3–6	Longstanding. Not blinding	+
X2-Corneal Xerosis	1–4	Acute deficiency. Can be blinding	++
X3A -Corneal ulcer/ <1/3 cornea	1–4	Severe acute deficiency. Blinding	+++
X3B -Corneal ulcer/keratomalacia ≥1/3	1–4	Severe acute deficiency. Blinding	++++
XS - Corneal scarring (from X3)	>2	Consequence of corneal ulceration	+/–
XF-Xerophthalmic fundus	Adults	Longstanding. Not blinding. Rare	–

Classification of Vitamin A Deficiency and the Age Groups Most Affected -WHO

Night Blindness (XN): Vitamin A is involved directly in the dark adaptation- the capacity of the eye to adapt to vision in dim light after exposure to bright light. Those deficient in vitamin A usually cannot see in dim light either at dusk or dawn as the formation of rhodopsin is hindered in vitamin A deficiency causing poor night vision. Often pregnant women experience deficiency symptoms such as night blindness that continues into the early period of lactation. Night blindness of VAD and is often in present without any signs of xerophthalmia. It is a useful screening tool and response well to treatment.

Conjunctival Xerosis (XIA): Conjunctival Xerosis is characterised by dry patches of non-wettable conjunctiva. The conjunctiva appears thick, wrinkled and pigmented (muddy colour) with a peculiar smoky appearance. This is commonly observed in children under 5 years more likely due to dietary VAD.



Bitot's spot (XIB): The process progress dirty white foamy raised dry triangular patches on the surface of the conjunctiva. They are not easily diagnosable.



Bitot's spot

Corneal Xerosis (X2): The dryness spreads from conjunctiva to cornea causing erosion of a part or the whole of corneal thickness. This is due to keratinisation on epithelial surface because of VAD. Child tends to keep the eyes closed particularly in bright light due to photophobia. If there is secondary infection there is inflammation. The lesion only heals by scarring. Corneal Xerosis if not treated properly progress to keratomalacia.

Corneal Ulcer (X3A): If there is secondary infection there is inflammation. The lesion only heals by scarring. This is known as ulceration of cornea. Initially the ulcer may be shallow and if it becomes deep it leads to perforation resulting in prolapse of contents of eyeball. Corneal ulcer if not treated properly progress to keratomalacia.



Keratomalacia (X3B): Keratomalacia consists of softening and dissolution of the cornea leading to deformation or destruction of eyeball. The corneal structure melts into a cloudy gelatinous mass dead white or dirty yellow in colour. If not treated immediately prolapse of the iris, extrusion of the lens and loss of vitreous may occur.



Keratomalacia

Corneal scarring (XS): Healing of keratomalacia results in scarring of the whole eye and frequently in total blindness.

EXTRA OCULAR MANIFESTATIONS

The extra Extra Ocular manifestations of Vitamin A deficiency includes the following –

- **Affect on Growth** – Growth is retarded in VAD due to impairment in skeletal formation.
- **Affect on reproductive system** – Keratinisation of Gonads and degeneration of germinal ephithiliam leads to sterility in males. Failure inconception, Spontaneous abortions and termination of pregnancy due to foetal death is observed in females.
- **Changes in Skin** – The affect on skin includes the following in chronic Vitamin A deficiency –
  - Xeroderma – The skin becomes dry, rough and scaly.
  - Follicular Hyper keratosis – Horny keratinized depositions around the hair follicles is seen.
  - Phrynoderma – Skin becomes scaly and resembles toad's skin.
- **Changes in nervous system** – Poor or abnormal bone growth of vertible column. Retards the growth of nervous system. Disorientation, abnormal gait, impairment of taste, smell sensation can be found.
- **Affect on Circulatory system** – In retinol deficiency the iron utilization diminishes due to low level of transferrine in blood. This can lead to micrositic anemia.
- **Immune system** – Vitamin A deficiency is associated with impaired humoral and cellular immunity and decreased activities of complement system in serum and of lysozyme in

leucocytes. The mucus membrane becomes keratinized the production of secretory IgA is reduced. These changes impaire the integrity of the membranes and their resistance to penetration by bacteria.

Diagnosis of Vitamin A deficiency

Parameters	Values
Liver Retinyl Ester	Adequate >20 mg/kg Deficient <5 mg/kg
Plasma Retinol	Normal 200-500 mcg/l Unsatisfactory 100-200 mcg/l
Plasma Retinol Binding Protein	Adults 40-90 mcg/l Pre-School Children 25-35 mcg/l
Relative Dose Response	Normal <20% Marginal Deficiency >20%

3.8.4 MANAGEMENT OF VITAMIN A DEFICIENCY DISORDER

Treatment – Vitamin A deficiency has a community health significance. So the treatment is done at a large scale. Vitamin A deficiency may affect 3 vital tissues which are eye, skin and mucosa.

Treatment of Ocular Deformities – MDVA (Massive Dose of Vitamin A Program) administers vitamin A in oil as per the following schedules –

- On diagnosis an oral dose of 2,00,000 international Unit of Oil miscible Vitamin A should be given in the age group of 1 to 6 years immediately.
- In the mild to moderate cases of Vitamin A deficiency treatment should be started with daily oral doses of 1000 µg of fat soluble Vitamin A for a period of 20 days.
- In case of night blindness and most cases of conjunctival xeroxis 30,000 International Unit Vitamin A is given for a week.
- In severe cases of Vitamin A deficiency large dose of 20,000 µg of fat soluble Vitamin A is administered for a week, followed by 10,000 µg for a further period of 20 days.
- In case of nausea and vomiting with oral treatment or persistent diarrhea, an intra muscular injection of 1,00,000 International Unit of water miscible vitamin A can be substituted for the oral doses, followed by another 2,00,000 International Unit for 1 to 4 weeks later.

WHO/UNICEF treatment schedule for Xeropthalmia

Timing of Dose	Children (0- 5 months)	Children (6-12 months)	Above 1 year of age
Immediately on Diagnosis	50000 I.U	100000 I.U	2,00,000 I.U.
The following day	50000 I.U	100000 I.U	2,00,000 I.U.
Subsequently (at least 2 weeks later)	50000 I.U	100000 I.U	2,00,000 I.U.
In Severe PEM additional monthly dose until PEM resolves	50000 I.U	100000 I.U	2,00,000 I.U.

If VAD is observed in women of reproductive age a daily dose of 10000 I.U for 2 weeks or a weekly dose of 25000 I.U of vitamin A in oil for 4 weeks is recommended.

Group	Retinol mcg/day	Beta carotene mcg/day
Man	600	4800
Women	600	4800
Pregnancy	800	6400
Lactation	950	7600
6-12 months	350	2100
1-6 years	400	3200
7-9 years	600	4800
10-17 years	600	4800

Recommended Dietary Allowances of Retinol and Beta Carotene

Red Palm Oil (1/2 teaspoon, 2g) provides 1400µg carotene, which is sufficient to meet the requirement of a child. The oil should not be deep fried as carotene substantially destroyed in that temperature.

In all cases of Vitamin A deficiency, adequate protein intake is necessary for the formation of retinol binding protein (RBP).

The patient should be treated with antibiotics to treat corneal ulcer and to combat secondary infections.

Acute corneal lesions should be considered as medical emergency and should be referred to the nearest hospital for treatment.

Formulation	Routine	Dosage
Oil based solution of retinol palmitate or acetate, as capsule or liquid (without Vitamin – E)	Oral	110 mg retinol palmitate or 66 mg retinol acetate (20000 I.U, 220 µmole)
Water miscible retinol palmitate	Intramuscular	55mg (110000 I.U, 110 µmole)

Skin problems – Retinoic acid form of Vitamin A at the dose of 0.1% should be locally administered for 1 month. It can decrease and remove hyperpigmentation of skin due to vitamin a deficiency.

To decrease mortality rate – In most severe cases vitamin A deficiency may even cause death. Adequate supply of vitamin A decreases morbidity and mortality in children due to deficiency. Their should be access to health care and immunization to decrease morbidity. Vitamin A supplement either a small dose or a large dose reduces mortality.

SOME SUGGESTED RECIPES FOR VITAMIN A DEFICIENT PATIENT

Recipe	Reasons
Boiled egg, egg custard	Rich in Vitamin A and good quality protein.
Coriander and mint chutney	Not only rich in β-carotene but also rich in other micronutrients
Carrot Halwa, Carrot Salad, Kheer, Carrot Juice	Rich in β-carotene
Papaya, Orange Juice, Mango juice	Rich in β-carotene
Palak dal, Palak Paneer, matar paneer	Rich in β-carotene and protein

3.8.5 PREVENTION OF VITAMIN A DEFICIENCY DISORDER

The prevention of VAD includes a comprehensive plan of the following factors –

1- **Dietary modifications** – A daily diet rich in green leafy vegetables and yellow and orange fruits and vegetables like mango, papaya and carrot should be given. These vegetables and fruits are rich sources of β-carotene which is a precursor of Vitamin A. Apart from this dairy products, organ meats and eggs are rich sources of retinol, which is a highly bio available form of vitamin A. Spirulina, a blue green algae provides 3,20,000mcgs of beta carotene / 100 gms. Red Palm oil is also a rich source of Vitamin A. by removing chronic dietary insufficiency vitamin A deficiency can be prevented.

2- **Horticultural intervention and Home gardening** – To get an adequate supply of beta carotene rich foods for the population. Horticultural intervention and home gardening should be promoted. The following measures can be taken –

- Ladies and Home makers should be motivated and encouraged to grow school gardens and kitchen garden.
- Cost effective home kitchen garden organizations should be practiced.
- Easily affordable and economic vegetable plantation and village level community, nursery, implantation should be promoted.
- Production of high yield genetically modified fruits and vegetables for example golden rice should be done by Krishi Vigyan shetra .
- Effective communication and linkage between agriculture, nutrition (ICDS, FNB) and maternal child health (MCH) should be promoted to ensure nutrition oriented Horticultural activities at the village level.

3- **Fortification** – All hydrogenated fats and vegetables oils are fortified with vitamin A. Toned and double tones milk can be fortified with 100000 IU vitamin A per 500 ml. Salt is fortified with vitamin A 2000 IU / grams. Other foods can be fortified with vitamin are dehydrate baby foods, midday meals food etc.

4- **Supplementation** – The National Prophylaxis program against nutrition blindness. (NPPANB) NPPANB was implemented in India in 1970. Under this program oral administration of a massive dose of 200000 I.U. of vitamin A in oil is done for pre school children every 06 months. Under the child survival and safe motherhood program since 1992, the supplementation is given under the following schedule.

- A first dose of 100000 I.U. of vitamin A is administered at 9 months along with measles vaccine.
- The subsequent dose of 200000 I.U. are given at 18 months along with DPT Booster dose.
- This is followed by three more doses 200000 I.U. each at 6 months interval (at 24, 30 and 36 months) up to the age of three years.

5- **Nutrition Education** – For prevention of VAD awareness and education of the community people to promote dietary intake of Vitamin A and beta carotene rich food are most important. Nutrition education is given to the community by Private and government sectors.

National program like Integrated Child development service (ICDS) and child survival and safe motherhood (CSSM) should promote the following activities –

- Pregnant and Lactating mothers should be encourage to consume dark green leafy vegetable, yellow and orange fruits and vegetables, eggs, milk and non vegetarian food products in their daily diets to ensure sufficient Vitamin A in the liver of new born.
- Early initiation and promotion of exclusive breast feeding should be promoted.
- After delivery feeding of colostrums should be taught and encouraged.
- The weaning should consist of dark green leafy vegetables, orange and yellow fruits, whole milk, fish and eggs.
- Nutrition education should be to the community people specially to pregnant and nursing mothers about the Vitamin A rich foods and their role.
- School children should be used as 'change agents' for communicating the importance and information of vitamin A to their community.

Prevention of Infection – Vitamin A deficiency is often associated with secondary infections like measles, diarrhea and acute respiratory tract infections. For preventions of these infections sanitary living conditions, consumption of safe drinking water and having immunity building foods with protein and vitamin rich foods should be promoted.

So for the prevention of VAD their should be complete involvement and motivation of community people should be there.

3.9 IODINE DEFICIENCY DISORDER (IDD)

Iodine is an essential micronutrient required for the mental and physical growth and development of human. Iodine deficiency has now been recognized by WHO as the most preventable cause of brain damage in the world today. Iodine deficiency is a naturally occurring ecological phenomenon that is manifested as Goitre and Cretinism in different parts of the world was known as endemic iodine deficiency.

Since a wide variety of physical and mental disorders are associated with iodine deficiency, the term "Iodine Deficiency Disorders" (IDD) in place of endemic goitre, was introduce by Hetzel in 1983.

The term **Iodine Deficiency Disorders** (IDD) refers to a spectrum of disabling conditions affecting the health of human being starting from foetal life through adulthood resulting from inadequate dietary intake of iodine.



3.9.1 PREVALANCE OF IDD

The existence of iodine deficiency Goitre is mentioned in Ancient Chinese, Greek, Roman, Indian writing. Now IDD is a major public health problem round the globe.

In mid 1990, it was estimated that more than 2 billion people from 130 countries were ‘at risk’ of IDD.

According to the estimates of WHO in 1999, about 741 millions people were affected by goitre about, 13% of the world’s total population. In 2020, more than 1.9 million individuals have inadequate iodine nutrition, of which 285 million are school age children.

In 2006,, it was estimated that there only 47 countries where IDD countries to be a public health problem compared to 54 in 2004 and 126 in 1993.

In the developed countries, the problem of IDD has been virtually eliminated through implementation of effective control measures, such as fortification of bread, salt, etc implemented since early 20th century.

IDDs contribute to the major health problem in Latin America, Africa and Asia.

In India, about 200 million people are exposed to the risk of IDD in India. Out of this, about 70 million suffers from goitre and other IDDs. In India, 54 million people are suffering from goitre, 2.2 million from cretinism and contributes 90,000 still births and neonatal deaths.

In India, the IDDs belts extend from Jammu and Kashmir in the west through Northern parts of states of Himachal Pradesh, Punjab Uttar Pradesh and Eastern Zone like West Bengal, Assam, Sikkim, Bihar, Tripura and Arunachal Pradesh. In addition, the other pockets of endemic goitre include Aravalli Hills in Rajasthan, sub-Vindhya Hills of Madhya Pradesh, Narmada Valley of Gujarat,

Eastern Ghat of Orissa, Andhra Pradesh, Western Ghats of Karnataka and Kerala and the districts of Aurangabad, Pune in Maharashtra.

The overall prevalence of total goitre among 6 to 11 years old children was about 4 percent which is below the cut-off point to indicate endemicity of IDD. the prevalence is higher is Maharashtra (11.9%) and the West Bengal (9%) according to prevalence study conducted by NIN (2003 to 2004)

CRITERIA FOR DIAGNOSIS OF IODINE STATUS

Median urinary iodine concentration (µg/dl)	Iodine status
<20	Severe iodine deficiency
20-49	Moderate iodine deficiency
50-99	Mild iodine deficiency
100-200	Ideal iodine intake
201-299	More than adequate iodine intake
>300	Excessive iodine intake

3.9.2 CAUSES OF IDD

The factors that are involved in occurrence of IDD are the followings :

Low Iodine Intake – Iodine deficiency disorders are the result of low iodine intake. It has been found that goitre is usually seen when the iodine intake is < 50 µg / day and cretinism is usually seen when the iodine is < 30 µg / day.

Environmental Factors- Iodine deficiency is an ecological problem due to low iodine in soil. The iodine deficiency is commonly found in all elevated regions subjected to heavy rainfall with run-off into rivers. High rainfall, snow and flooding increase the loss of iodine through leaching into water and loss of soil iodine which previously denuded by past glaciations.

The sea water contain iodine in access at the level of 50-60 µg / litre. Sea water evaporates Iodine to from of cloud and then condensed in the form of rain and enriches the hilly area with iodine. It is believed that environmental factor such as Trypanosome parasitic infestation can cause goitre.

Goitrogens - Goitrogens are certain chemical substances which interfere with iodine metabolism in the body. They can interfere at various stages of Thyroid hormone homeostasis such as ; up take of iodine, oxidation of iodine and conversion of thyroxine (T_4) to Triiodothyronine (T_3) by the enzymes. NADPH + H^+ oxidase, thyroid peroxidase and 5' – deiodinase respectively.

Some of the known goitrogens found in environment are thiocyanate, isothiocyanate, thio-oxazoolidone, flavonoids, disulphides, phenols, pthalates, biphenyle and lithium (used in neurological drug). These substances are known to be found in tapioca, sorghum, finger millet, okra, sweet potatoes, almonds, peaches, soya beans, bamboo shoots, lima bean, cassava, ground nuts, cabbage, mustard. cauliflower, strawberries etc.

On the basis of their level of interference, goitrogens are classified into 3 classes :

Class I – Thiocyanate, isothiocyanate and cyanogenic glycosides, which inhibit iodine uptake by the thyroid gland, are grouped in this class, found in brassica family plants mainly, such as rape seeds, mustard, cabbage, turnip, ground nuts etc.

Class II – Thiourea, thioamides and flavonoids which affects the stages of organification and coupling in the process of thyroxine synthesis.

Class III – Excess Iodine and Lithium, which interfere at the stage of proteolysis-a step necessary for utilization of thyroxine.

The goitrogen thioxazolidone is present in raw cabbage, turnip and brussel sprouts, but destroyed after cooking.

Sulphur containing goitrogens such as thioglycosides, thiocyanate are present in plants in inactive forms but when taken by animals are converted to active giotrogens.

Cabbage has a thioglycosides - progoitrin, which is converted to 5 - vinyl 2 – thiooxazolidone, which an active goitrin. The ability of the plants and animals to convert these inactive forms of goitrogens to active goitrin may vary. Cattle may consume large amount of this vegetables and may pass on goitrogens into the milk.

There is seasonal and regional variation in goitrogens thiocyanate content in foods,

The antibiotics sulphonamide and vitamin like substance para aminobenzoic acid (PABA) reduce iodine oxidation to idodine necessary in thyroid hormone synthesis.

People who live in goitrous zones should avoid goitrogenous food. People who live in non-goitrous areas can include goitrogenous foods in their diet in moderation. Goitrogenous food should not taken as staple foods.

Deficiency of Selenium – Selenium also plays a role is preventing goitre. Selenium is a part of enzyme thyroxine 5' – de- iodinase which is essential for conversion of thyroxine (T_4) to Triiodothyronine (T_3), which is the active form of the hormone. Therefore, in selenium deficiency goitre may occur.

Intrinsic factors – some of the intrinsic factors such as failure to synthesize the thyroid hormone due to inherited and congenital defects in the hormone synthesis and secretion and peripheral resistance to thyroid hormones can also result in goitre. However, the incidence of goitre due to such intrinsic factors is sporadic in nature.

THE SPECTRUM OF IDD

IDD includes a sequence of clinical features at all stages of human growth and development from foetus, infant, children, adolescent to adult human.

Deficiency of Iodine may lead to different types of disorders –

Still birth- In human, thyroid and pituitary endocrinal glands are developed by the first 12 weeks of gestation and the hypothalamus developed between 10th to 30th weeks. During intrauterine life, due to failure to convert $T_4$to T_3 failure to prepare the organism for the metamorphosis from intrauterine to extra uterine life can be seen. therefore, still birth may occur as a part of spectrum of IDD.

Goitre – Goitre is defined as non- neoplastic, non - inflammatory and non – toxic enlargement of thyroid gland.

The term 'Goitre' is used to denote the enlargement of thyroid gland associated with either normal, hypo or hyper function of thyroid gland.

The normal thyroid glands has some of iodine. In simple Goitre, this amount may be reduced to 1 mg, even though the gland is larger. The gland is unable to produce thyroxine which contains 64% iodine.

CLASSIFICATION OF GOITRE BY WHO (2001)

Grade	Sign and Symptoms
Grade 0	Not palpable or visible Goitre.
Grade 1	A mass in the neck that is consistent with an enlarged thyroid that is palpable but not visible when the neck is in normal position. It moves upward in the neck as the subject swallows. Nodular alterations can occur even when thyroid is not enlarged.
Grade 2	A swelling in the neck that is clearly visible when the neck is in a normal position and is consistent with an enlarged thyroid when the neck is palpated.

[Source : WHO / UNICEF / ICCIDD, 2001]

Thyroid gland enlarges due to deficient output of thyroid, hormone which produces hyper secretion of TSH from the pituitary and consequent enlargement of thyroid gland.

Therefore the enlargement is apparently a compensatory adaption to lack of iodine required for the synthesis of thyroid hormones.

Normal thyroid gland is not palpable or is barely palpable. According to definition by Perez and co – workers (1980), a thyroid gland whose lobes a volume greater then the terminal phalanx of thumb of the subject examined, will be considered goitrous. the normal weight of thyroid gland is about 20 to 25 g, but in goitre the enlarged glands weighs about 0.45 to 0.67 kg or more.

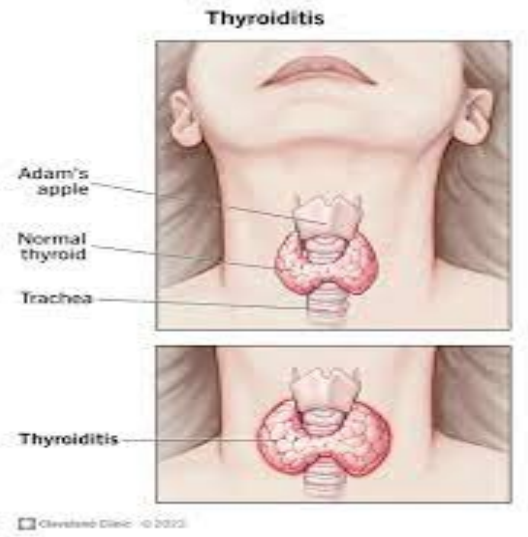
If in an area, the **total Goitre rate** among the children aged six to twelve years is equal to or more than 5%, the area is said to be endemic for goitre. [WHO / UNICEF / ICCIDD, 2001]

$$\text{Total Goitre Rate (TRR)} = \frac{\text{Number of Goitre cases of Grade 1 and Grade 2}}{\text{Total number of examined}} \times 100$$

3.9.3 TYPES OF GOITRE

Simple Goitre may be of the following types –

- **Colloid Goitre-** This is also known as endemic or benign goitre. This is mainly due to inadequate supply of iodine in diet. The alveoli are distended with colloid lined by cubical and flattened epithelial cells. Usually hypertrophy or hyperplasia is not common. Use of Iodised salt reduced this type of goitre.
- **Diffused Parenchymatous goitre** – The alvoli are not distended with colloid as in the case of colloidal goitre. the cells lining the aveoli are of columnar type. Hypertrophy and multiplication of alveolar epithelial cells are common. Lumens of some alveoli are almost obliterated.
- **Nodular or adenomatous goitre** – In nodular goitre, there is development of nodules which are localized areas of cellular proliferation within the gland. Hyperthyroidism and malignant changes occur very rarely in nodular goitre.



Development of Goitre

- **Toxic Goitre** – Enlargement of thyroid gland along with excessive secretion of thyroid hormone are the common characteristics of this type of goitre. Epithelial cells are hypertrophied and hyperplastic. Toxicosis may occur due to hyperthyroidism. Garve's disease is always associated with toxic goitre.
- **Hokkaido Goitre** – while low iodine intake causes endemic goitreor cretinism, a very high concentration may also causes hypothyroidism by inhibiting Iodine organification which is called Wolf Chaikoff effect. In Hokkaido, the Japanese people consume large amount of sea weed proving 8 to 25 mg of iodine per day or more. Iodine in large doses can interfere with the

release of T_3 and T_4. Parenchymal hyperplasia is marked and majority of patient become hyper thyroidic.

Biochemical changes in goitre : From the biochemical aspects, goitre can also be clearly stated. About half of the total iodine from the food is taken up by the gland and remaining half is excreted in urine. If dietary iodine is inadequate then plasma iodine level also falls and urinary excretion of iodine decreases.

Pituitary responses by increases secretion of TSH and so a very common biochemical feature is high level of TSH in the plasma. in mild cases the normal plasma concentrations for both T_3 and T_4 are maintained.

3.9.4 CRETINISM

Endemic cretinism is often associated with severe iodine deficiency during intrauterine life. It is prevalent in these areas where the prevalence of goitre is very high. A wide range of defects such as mental retardation, deaf – mutism and spastic paralysis of lower limbs of varying degrees are associated with this condition. Clinically cretinism can be manifested as :

Neurological Cretinism – Severe mental retardation, deaf – mutism, squint and spastic diplegia-spastic rigidity affecting the lower limbs leading to characteristics gait and brisk reflexes are the features of neurological cretinism. Stunting is not a regular feature. Iodine deficiency during pregnancy retards brain and cochlear development leading to neurological dysfunctions in new born.

Myxoedematous Cretinism - These cretins exhibit signs of hypothyroidism, such as coarse and dry skin, swallon tongue, deep hoarse voice, apathy and mental deficiency, memory ,oss, skeletal growth retardation, weak abdominal muscle, sluggish bowel function, and delayed tendon reflexes. ECG shows small voltage QRS complexes and flattening of T – Wave.

Neurological cretinism is predominantly in areas with environmental iodine deficiency, where as Myxoedematous Cretinism is seen in areas where consumption of goitrogenous foods is common e.g. tapioca eating population in Zaire are commonly affected by Myxoedematous Cretinism.

Hypothyroidism - Hypothyroidism is characterise by coarse and dry skin, husky voice, delayed tendenrefelxes, epiphysial dysgenesis as evinced by X-rays and ECG showing small voltage QRS and flattened T- waves. Serum T_4 levels will be low with normal T_3 and elevated TSH level. The BMR is reduced . This condition is generally found among adults.

Psychomotor defects – Studies have shown that the Children from Iodine deficient areas show poor scores on IQ tests and impaired school performance. They also exhibit poor motor coordination.

Impaired mental function – Population residing in iodine deficient areas usually exhibit reduced mental function, low intelligence level and high degree of apathy, reflected in lack of initiative and decision making capacities of the people.

SPECTRUM OF IODINE DEFICIENCY DISORDERS IN DIFFERENT AGE GROUPS

Stage of Life Cycle	Sign and Symptoms
Foetus	Absorption Still Birth Congenital anomalies Increased perinatal mortality Increased Infant Mortality Neurological cretinism Myxoedematous Cretinism Psychomotor defects
Neonate	Neonatal goitre Neonatal chemical hypothyroidism
Children and Adolescents	Goitre Juvenile hypothyroidism Impaired mental Functions Retarded physical development
Adults	Goitre with its complications hypothyroidism Impaired mental functions

Grading of IDD

Depending upon median urinary iodine excretion level, prevalence of total goitre rate (TGR) in the community and the severity of endemicity of IDD is graded as following :

Sl. No.	Parameter	Mild IDD	Moderate IDD	Severe IDD
1	Urinary Iodine (µg / dl)	5.0 - 9.99	2.0 – 4.99	< 2.0
2	Goitre Prevalence rate (%)	10 – 13	20 – 25	30 - 100
3	Thyroid hormones activity	adequate	impaired	Risk of marked hypothyroidism
4	Mental and Physical development	Normal	No overt case of cretinism	Mental retardation overt cretinism

3.9.5 PREVENTION AND CONTROL OF IDD

The only way to combat IDD is to provide iodine to the community. In India, the National Goitre Control Programme (NGCP) was started in 1960. Later on, in 1962, this programme is replaced by the name of National Iodine Deficiency Control Program (NIDDCP) as goitre not only the symptoms of iodine deficiency. In the year, 1992, this program was included in the Prime Minister's 20 – point Development Programme during the 7th five – year plan. Not only this programme was carried out in goitre belts but was also carried out in Gujarat, Punjab, Madhya Pradesh, Maharashtra, Arunachal Pradesh and Kerela. This programme comprises of following components :

Iodine fortification of salt and other foods – The only way to combat the problem of IDD is to fortify common foods with iodine to ensure adequate iodine intake.

Fortification of common food items such as bread, wheat flour, milk, sugar, drinking water and specifically common salt are in practice in different parts of world.

But in India, the most common vehicle for iodine fortification is through common salt.

Potassium Iodate (KIO_3) was used for the process of iodinisation, because it is comparatively more stable than potassium iodide (KI). KIO_3 was more suited for the process of iodinisation of crude moist salts.

The aim is to increase the daily intake of iodine to about 100 – 300 µg.

The amount added to the salt is related to the usual consumption of salt in the community About 10 kg of salt mixed with 1g potassium Iodide which provides 1mg of KI in 10 g daily slat intake [1mg of KI = 765 µg Iodine]

The iodine content of salt should be 30 ppm at the production level and 15 ppm at the consumer level as per specification laid by Prevention of Food Adulteration Act (PFA, 1954).

Iodised Oil supplementation – Oil fortified with iodine is available for oral or intramuscular infection.

In places, where iodized salt is not available or in case of severe cretinism iodized oil injections are suggested.

In France, iodized oil from poppy seeds oil for injection (Lipiodol) and Oral (Oriodol) administration are in use commercially.

An intramuscular injection of 1 ml of iodized oil containing 480 mg of iodine can maintain satisfactory level of iodine for 2 to 3 years, while the oral dose lasts for 1 years.

Iodination of water supply –An Iodinator consisting of canisters containing iodine crystals are connected to main pipes and fraction of water diverted through them. Iodine added directly to drinking water can correct IDD. the drinking water should contain at least 150µg of iodine / liter.

Iodine Monitoring –For Implementing the NIDDCP, requires a network oflaboratories for iodine monitoring and surveillance. The laboratories are essential for :

- Iodine excretion assessment.
- Determination of Iodine salt, soil, water and food as apart of epidemiology studies.
- Determination of iodine in Salt for quality control.

Manpower training – The health workers and other engaged in the NIDDCP should be full motivated and trained in all aspects of IDD control along with legal enforcement and public education.

Mass Communication – Mass communication is also essential for increasing awareness of people about IDD and its management through nutrition education.

Supplementation of Iodine can also be given in bread and other commonly used foods, Sea Foods, eggs can be suggested for people who are at risk.

Presently, UNICEF has joined hands with our Central Government to carry out NIDDCP and non – iodized salt is nowbanned from many states.

SUMMARY

After studying the above content we can now understand the following concepts very clearly –

- The various nutritional problems prevalent in the community and their implications for public health.
- Common nutritional problem in India and their causes.
- Sign , symptoms, treatment and prevention of protein energy malnutrition
- Causes, symptoms and treatment of micronutrient deficiencies (vitamin A, Iron and Iodine)

3.10. CHECK YOUR PROGRESS EXERCISE - 2

1- Write a detailed note on causes and prevention of vitamin A deficiency diseases? ----------
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2- Throw light on stages of development of vitamin A deficiency diseases? ----------
---

3- Comment on causes and prevention of iron deficiency anemia? ----------
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4- Write a detailed essay on causes symptoms and types of iodine deficiency disorder? ----------
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5- Write short notes on the following –
   - Rich source of vitamin A ----------

- Factors effecting absorption of iron----------

- Cretinism----------

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Advance Community Nutrition

BLOCK 2

Unit-4 Schemes and Programs to Combat Nutritional Problems in India **117**

Unit-5 Hazards to Community Health and Nutritional Status **146**

Unit-6 National Nutrition Policy **175**

INTRODUCTION (BLOCK II)

Block II deals with Nutrition Policy, hazards to community health and Nutritional Status.

In our country a large group of population faces problems like Hunger, malnutrition and nutritional deficiency disorders. Because of the burden of these conditions the disease fighting immunity is greatly lowered and thus people fall pray to various kinds of life threatening infections.

Sometimes it is not because of poverty and hunger only but it is also due to various kinds of adulterations and pollutions which make the food very unhealthy and disease causing. People are most of the time ignorant about these facts and unknowingly they consumed the food items which can be very toxic for them.

To combat the nutritional problems in India the government runs various prophylaxis program which are discussed in length in this block. This block has three units

Unit 4 discusses the various schemes and program to combat nutritional problems in India like vitamin A and Iron prophylaxis program, the Goitre control program, the Mid-day meal program and the integrated child development services etc.

Unit 5 tells us the hazards to community health and nutritional status and their preventions. In this unit we study the adulteration in different food items and their methods of detection, pollution of water and affect of industrial sewage and pesticide residues in food. After going through it we will also be aware about the prevention strategies and precautions that we can take to avoid these hazards.

In **Unit 6** we will understand the nutrition policy in India and its plan of action. The nutrition policy is formulated by the Indian Government to combat their problems of hunger and malnutrition in India as much as possible. After going through this unit we will also know the policy instruments being implemented by the Indian Government.

Unit – 4 Schemes and Programs to Combat Nutritional Problems in India

Structure

4.0 Objectives

4.1 Introduction

4.2 Nutrition deficiency Control Programs

- 4.2.1 Vitamin A Prophylaxis program
- 4.2.2 National Nutritional Anaemia Prophylaxis program
- 4.2.3 Iodine deficiency disorders program

4.3 Supplementary Feeding Programs

- 4.3.1 Mid Day Meal program
- 4.3.2 Special Nutrition program

4.4 Integrated Child Development services

- 4.4.1 Early Childhood care and Development
- 4.4.2 Care and Nutrition Counseling
- 4.4.3 Health Services
- 4.4.4 Community Mobilization, awareness, Advocacy & Information Education and Communication (IEC)

4.5 Summary

4.6 Check Your Progress

4.7 References

4.0 OBJECTIVES

After studying this unit the students will be able to understand the following points :

- The various programs run by the government to combat malnutrition
- The objectives and functioning of vitamin A prophylaxis program for prevention of nutritional blindness.
- The objectives and components of National Anaemia Prophylaxis program.
- The objectives, components and functioning of Iodine deficiency disorders prophylaxis program.

- The components, functioning, beneficiaries and importance of mid day meal scheme.
- The detailed structure, components, functioning and benefits of Integrated child development scheme.

4.1 INTRODUCTION

Malnutrition is the one of the worst public health problems in a country. It decreases the working capacity of the people which prevents the nation to become self sufficient. Malnutrition is a burning problem in India also but the government of India has made constant efforts to combat against this problem by adopting several intervention programmes. The programmes can be discussed under the following heads –

1- Nutrient Deficiency Control Programme (Prophylaxis programme)
2- Integrated Child Development Services Scheme (ICDS)
3- Supplementary Feeding Programmes (Mid – day Meal Scheme, Special Nutrition Programme and Applied Nutrition Programmes)
4- Food Security Programmes (FSP)

4.2 NUTRITION DEFICINECY CONTROL PROGRAMMES (Prophylaxis Program)

The National Nutrient Deficiency Control or Prophylaxis Programmes adopted by the government of India are discussed below –

1- National Prophylaxis Programme for prevention of blindness due to Vitamin A deficiency.
2- National Nutritional Anaemia Prophylaxis programme
3- National Goitre Control Programme or Iodine Deficiency Diseases Control Programme.

We shall now discuss each of these Prophylaxis Programmes in detail.

4.2.1 NATIONAL PROPHYLAXIS PROGRAM AGAINST PREVENTION OF NUTRITION BLINDNESS DUE TO VITAMIN A DEFICIENCY (NPPNB DUE TO VAD)

The national program for prophylaxis against blindness due to vitamin A deficiency was launched in 1970. This program was started as an urgent measure to combat the unacceptably high magnitude of Xerophthalmic blindness in the country seen in 1950 and 1960. The program was started as a 100% centrally sponsored program. This program includes children in the age group of 6 months to 5 years,

who are given a massive oral dose of 200000 I.U of vitamin A in oil every six months. In 2006, the age group of eligible children was revised as 9 months to 5 years of age (oral prophylactic dose). This prophylactic mega dose administration of vitamin A is primarily advocated because of the claim of 23% reduction in childhood mortality and not mainly for blindness prevention.

The vitamin A is readily absorbed and stored in the liver from where it is gradually released for utilization by the tissues. The program is implemented by the department of Health and Family welfare and is an integral part of the maternal and child health programs.

Objectives – The objectives of the prophylaxis program are as follows –

- To make and effective reduction in the incidence of the problem
- Prevention of blindness due to vitamin A deficiency

Beneficiaries

- Children in the age group of 6 months -5 years, particularly from rural, tribal and urban slum areas.

Program Components - The main components and activities of the program are as follows –

- The prophylactic doses of vitamin A are provided as per the following doses schedule –
    - 100000 IU at 9 months with measles immunization
    - 200000 IU at 16-18 months, with DPT booster
    - 200000 IU every 6 months, up to the age of 5 years.
    - a total of 9 mega doses are to be given from 9 months of age up to 5 years.

- **To create awareness about the importance of prevention of vitamin A deficiency –** Various awareness promotion program are organized among the women attending antenatal clinics, immunization sessions and the women and children registered under ICDS program.
- **Treatment of vitamin A deficient children -**
    - All children with xerophthalmia are to be treated at health facilities.
    - All children having measles, to be given 1 dose of Vitamin A if they have not received it in the previous month.
    - All cases of severe malnutrition to be given one additional dose of Vitamin A.

- **To promote consumption of Vitamin A rich foods –**
    - Local production and consumption of Plant foods which are rich sources of carotenoids such as green leafy vegetables, pumpkin, carrots, papaya, Mango and oranges etc. should be increased and promoted.
    - All pregnant and lactating women and children under 5 years of age should be encouraged to increase regular dietary intake of vitamin A rich foods.
    - Early initiation of breast feeding and feeding of colostrums should be encourage.
    - In the weaning diet along with cereals, pulses and milk & milk products. Vitamin A rich foods should also be included.
    - When economically feasible addition of egg, liver and other non vegetarian food products should be encourage.

4.2.2 NATIONAL NUTRITIONAL ANEMIA PROPHYLAXIS PROGRAM

Nutritional anemia is one of the major health problem in India. To control this widely prevalent problem, the National Nutritional Anemia Prophylaxis program (NNAPP) was launched in India by the Government of India in 1970.

The most vulnerable section for our country are pregnant women, nursing mothers and women of age group of 15 to 45 years.

According to survey by WHO, 50% of the children, 50% of the pregnant and nursing mothers and 30% adult males are found to be anemic. Anemia reduces the capacity of doing work, lowers the productivity and adversely affect the general health.

Objectives –

- To assess the baseline prevalence of nutritional anemia in mothers and young children through estimation of haemoglobin levels.
- To put those mothers and children with low the Haemoglobin levels (less than 10g/dl and 8g/dl respectively) on anti-anaemia treatment.
- To put the mothers with Haemoglobin level more than 10g/dl and children with Haemoglobin more than 8g/dl on the prophylaxis programme.
- To continuously monitor the quality of the tablets, distribution and consumption of the supplements, and to periodically assess the Hb levels of the beneficiaries.
- To motivate and educate the mothers about the advantages of consuming these tablets.

Beneficiaries -

- Women of age group of 15 to 45 years.
- Pregnant women, Lactating mother.
- Children under 12 years.
- Women using IUD (Intrauterine device) for family planning.

Program components and Strategies –

Short term strategy – Under this program tablet containing iron and folic acid (IFA or Folifer) tablet is distributed to expectant and nursing mothers, IUD users and pre school children. The IFA tablets each containing 100 mg of elemental iron and 500 micro grams folic acid are given to women during the last 100 days of pregnancy and for 100 days during lactation.

In case of pre school children (1 to 5 years) 20 mg of elemental iron 100 µg folic acid day are distributed in a year.

The male multipurpose worker (MMWs) and other health functionaries working in PHC distribute these tablets. For young children who cannot swallow the tablet, iron and folic acid containing syrup (2ml) is given. For safety reasons the liquid formulation are dispensed in bottles which are designed in such a way that only 1 ml can be dispensed each time.

Dispersible tablets have an advantage over liquid formulation in programmatic conditions. These have been used affectively in other parts of the world and in large scale in Indian studies.

Intermediate term strategy – Iron deficiency anemia is wide spread in different segment of population. In view of that fortification of food with iron is permitted as a preventive strategy. In India fortification of common salt is developed and it is developed and demonstrated to be affective through field trials by National Institute of Nutrition to prevent Iron deficiency Anemia. 5 g of ferrous sulphate heptahydrate ($FeSO_4.7H_2O$) per kg is added.

Long term strategy – Promoting the consumption of Iron rich foods like green leafy vegetables, cereals, whole millets with ragi, bajra, pulses and jaggery etc. Consumption of vitamin C rich foods increases the iron absorption.

4.2.3 NATIONAL GOITRE CONTROL PROGRAM OR IODINE DEFICIECNY DISEASE CONTROL PROGRAM

The National IDD control programme implemented in 1992 by Dept. of Health, Govt. of India has aimed at ensuring production and supply of iodized salt at low cost to all goitre endemic areas. The essential components of this NIDDCP includes iodine fortification, monitoring and surveillance, manpower training and mass communication.

Objectives – the major objectives of the program are –

- To identify goiter endemic regions.
- To provide iodized salt to endemic areas.
- To access the impact of the program over a period of time.

Prevalence of IDD – At global level the estimated prevalence of IDD is about 1000 million of which 220 million suffer from goitre, 6 million suffer from cretinism and about 20 million suffer from mild neurological disorder.

In India over 16 million people are at risk, 54 million have goitre, 2.2 million have cretinism and 6.6 million have mild neurological disorder.

Programme components – The essential components of IDD control programme (1962) to prevent IDD are as follows : -

- **Iodine fortification**: The main vehicles for fortification of iodine are salt, sugar, wheat flour, bread, milk and water.
- **Iodised Salt**: Salt fortified with potassium iodate at the level of not less than 30ppm at the time of production and not less than 15ppm while consumption has been determined as a measure to control IDD. Iodised salt is an effective, low cost, long term and sustainable solution to reach a large scale at risk group as there is low potential for excessive intake and no change in customers‘ acceptability.
- **Double Fortified Salt:** Due to the co-existence of IDD and iron deficiency anaemia, National Institute of Nutrition has come with a measure of dual fortification of common salt with two micronutrients iodine and iron together. The stability and bioavailability remains unaltered proving this to be a successful preventive measures for overcoming iodine and iron deficiency disorders simultaneously.
- **Iodised Oil:** Intramuscular injection of 1ml of iodised poppy seed oil (lipiodol) providing 480mg of iodine can provide protection from IDD for 2-3 years while oral dose (oriodol) can give protection for 1 year approximately. Iodised oil will be most effective in preventing new cases of cretinism and mental retardation. Iodised oil with safflower oil has been produced

successfully by NIN, and is to be into the market soon. The drawback in iodised oil implementation compared to iodized salt is that this is very expensive and requires extensive man power to take the programme to public.

- **Iodized Water:** Control of IDD through iodized water would be an even more simple measure. 150mcg/l of iodine levels in water would help correct IDD.
- **Iodine monitoring and surveillance** – Countries Implementing Control Programme requires a network of laboratory for iodine monitoring and surveillance. These laboratories are essential for :
  - Iodine excretion and determination.
  - Determination of iodine in water, soil and foods
  - Determination of iodine in salt for quality control.
- **Manpower training** – It is important for control of success. The health workers and others involved in the programme should be fully trained in all aspects of goitre including legal enforcement and public education.
- **Mass communication** – The mass communication is a powerful tool for nutrition education. It should be fully used in goitre control programme.

Currently this programme is successfully implemented in this country. At present 70% of the population is consuming iodized salt. The states lagging behind are salt producing states of Gujarat, Rajasthan and Tamil Nadu.

ANSWERS TO CHECK YOUR PROGRESS EXERCISE 1

1- Name the various programs run by the Indian government for irradication of malnutrition? -----
---

2- Write a detailed note on importance and components of vitamin A prophylaxis program? -------
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3- Throw light on the anaemia prophylaxis program? ----------
---

4- Write down objectives, components and functioning of Iodine Deficiency Disorders Control Program? ----------

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5- Write short notes on the following –

- Importance of Vitamin A prophylaxis program for iradication of nutritional blindness? -

---

- Beneficiaries and importance of Anaemia Prophylaxis program? ----------

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4.3 SUPPLEMENTARY FEEDING PROGRAMMES

Dietary supplement programs play an important role in preventing and combating malnutrition. The goal of these nutritional supplement programs is to improve the nutritional status of vulnerable groups in society through the distribution of nutritional supplements. The Indian government has introduced various short-term measures regarding nutritional supplementation. The lunch program is an important part of the supplement program.

4.3.1 MID DAY MEAL PROGRAM (MDMP)

The Middle Meal Program is also known as School Meal or School Lunch Program. The Midday Meal is the world's largest program, feeding nearly 12 million children in 12.65 Lakhs schools and other education centers nationwide.

मध्याह्न भोजन योजना
Mid-day Meal Scheme

MDM School feeding was first introduced in 1925 for disadvantaged children in Madras Municipal Corporation. Then, a few years later, on 15 August 1995, the Central Government of India launched the National Nutrition Assistance Program for Primary Education (NP-NSPE) to promote school enrollment, retention, attendance and improvement the nutritional level of children. As a key support under the program was the free delivery of 100 grams of grain per child per school per day. They also provide grain transport subsidies up to Rs. 50/dt. By 2002, the system had been implemented in all states by order of the Supreme Court of India. The name of the program was changed to PM-POSHAN (Pradhan Mantri Poshan Shakti Nirman) Program in September 2021 by the ministry responsible for the program, the Ministry of Education. The central government also announced that by 2022, 24,000 students who attend pre-primary education in state and state-supported schools will be able to participate in the scheme.



The program provides free weekday lunches to children in public school primary and secondary schools and state-sponsored Anganwadi, Madarsa and Maktab. Mid day Meal Program is the largest

program of its kind in the world with more than 1.27 million schools and centres and 120 millions children participating in it.

Objectives - The purpose of the lunch service is to:

- Improve the nutritional status of Grades I-VIII children in state, community, and government sponsored schools.
- Encourage poor children from disadvantaged backgrounds to attend school more regularly so they can focus on classroom activities.
- Provide nutritional support to primary school children in drought-affected areas.

Beneficiaries - Children in the age group from 6 to 14 years old.

Program Components – The main component of the program is nutritional support. The central support consists of –

- 100 g cereal (wheat or rice)/child/school/day for primary school children and 150 g cereals / child/school/day for high school children for 200 school days per year, in cooked form.
- Food Grain Transport Subsidies are granted in 11 special category states at PDS rates common in those states, up to Rs. 75/dt.

Food and Nutritional contribution of the programme - Dietary guidelines for the minimum and calorie content of meals per day for children are as follows:

Entitlement norm per child per day under MDM		
Item	**Primary (class one to five)**	**Upper primary (class six to eight)**
Calories	450	700
Protein (in grams)	12	20
Rice / wheat (in grams)	100	150
Dal (in grams)	20	30
Vegetables (in grams)	50	75
Oil and fat (in grams)	5	7.5

For micronutrient tablets of vitamin A, iron, folic acid and for deworming anti parasitic tablets are given. Students are entitled to receive amounts provided by the National Rural Health Mission School Health Program.

The detailed nutritional contribution of the food items provided are :

Food Items	Primary School Children			Upper Primary School Children		
	Requirement under MDM (g)	**Energy content (kcal)**	**Protein (g)**	**Requirement under MDM (g)**	**Energy content (kcal)**	**Protein (g)**
Food grains (Rice / wheat)	100	340	8	150	510	14
Pulses	20	70	5	30	105	6.6
Vegetables	50	25	-	75	37	-
Fats & Oil	5	45	-	7.5	68	-
Salt and Condiments	As per need	As per need	As per need	As per need	As per need	As per need
Total Contribution		480 Kcal	13g		720 kcal	20.6g

Supplement Costs – As of 1st April 2019, the cooking cost for Primary School is Rs 4.48 per child per day and Rs 6.71 per child per day for Middle and High School.

The central government provides 75% of the total cooking costs and the state government provides the remaining 25%.

Program Organization and Implementation- This program is administered by the Ministry of Education, Government of India –

- This program is run by Panchayat and Nagarpalikas.
- Meals are normally served on school grounds.
- School teachers are responsible for preparing and distributing meals, maintaining food inventories, health charts and attendance records related to the program.
- Helpers are assigned to assist teachers in preparing meals.

4.3.2 SPECIAL NUTRITION PROGRAM – This program was established in 1971 by the Ministry of Social Welfare of India. It Provides approximately 300kcal and 10g of protein for preschoolers and approximately 500kcal and 25g of protein for pregnant and nursing mothers, 6 days a week. The program is operated under the Minimum Requirements Program. The program has been addressed in rural areas, especially in tribal and urban slum low socio-economic subgroup areas.

Objectives – The main objectives of the program are –

• Improve nutritional status of women, pre-school children, pregnant and lactating mothers in urban slums, tribal areas and drought-affected rural areas.

• Provision of supplementary food for vulnerable children, pregnant women and breastfeeding mothers.

Program Components –

• The program operated under the Minimum Requirements Program. The program has been addressed in rural areas, especially in areas of lower socio-economic groups in tribes and urban slums.

• The program provides nutritional supplementation of approximately 300kcal and 10g of protein for preschool children and approximately 500kcal and 25g of protein for pregnant and lactating mothers six days a week.

Foods supplemented by SNPs include:

• Fresh milk from local sources.

• Homemade or bakery made bread.

• Other nutritional supplements such as balahar, corn, soya milk, wheat flour, skimmed milk powder etc are also given.

• Supplementation with multivitamin tablets containing vitamin A, vitamin C, folic acid, and iron tablets are provided.

Nutritional Contributions of the Supplement		
Beneficiaries	Nutritional Contribution	
	Energy (Kcal)	Protein (g)
Infants (6 to 12 months)	200	8-10
Children (< 1-6 years)	300	10
Pregnant women (1st trimester) and nursing mothers	500	25

In addition to supplementary food, the program also included regular health checks of beneficiaries. The program also implemented a vaccination program to improve the overall appearance of the

children, regular hemoglobin assessments for iron status, and weight measurements of beneficiaries at regular intervals.

4.4 INTEGRATED CHILD DEVELOPMENT SERVICES

The ICDS program is one of the largest and most unique early childhood development programs in the world. It was established on 2nd October 1975 as part of the Fifth Five Year Plan and in accordance with the National Policy for Children.

Objectives of the Scheme – Objectives of the Scheme are broadly classified as follows: -

- Institutionalize basic services and strengthen structures at all levels
    - Implementation of ICDS in mission mode to prevent malnutrition
    - Strengthening ICDS-AWC as the first village post for health, nutrition and early education
    - Focus on children under 3 years old
    - Focus on early childhood care and learning environments
    - Shift from spending to child-related outcomes
    - Promoting decentralization and community-based, locally responsive parenting approaches
- Enhance capacities at all levels:
    - Vertical integration of training of all officers to enhance field-related joint actions and teamwork to achieve desired outcomes and goals
    - Establishment of national training resource centers at central and state levels District Manual – Integrated Child Development Program (ICDS) 2
- Ensure appropriate inter-sectoral response at all levels:
    - Ensure grassroots convergence by strengthening partnerships with PRI, communities and civil society to improve child development services
    - Coordinating and networking with all governmental and non-governmental organizations serving children
- Raise public awareness and participation :
    - Strengthening maternal and child health, nutrition and health education
    - Raise public awareness at all levels of children's vulnerabilities
    - Informing beneficiary groups and the public about the availability of core services
    - Promoting social mobilization and voluntary action
- Create database and knowledge base for Child development services:

- Strengthen the ICDS management information system (MIS)
- Use information and communication technology (ICT) to strengthen the information infrastructure and share and disseminate information
- Conduct research and documentation

Beneficiaries :

- Children below six years.
- Expectant and Nursing mothers
- Adolescent girls
- Women in the age group 15 to 45 years.

Programme components / package of Services – ICDS offers a comprehensive and cost-effective package of integrated services to address the multifaceted and interrelated needs of children. Providing a package of services based on the consideration that the overall impact would be much greater if the various services were developed in an integrated manner, as the effectiveness of each service depends on the support from related services. The concept is the main one.

The four main components of the scheme are as follows –

ICDS Scheme

1- Early childhood care education and development (ECCED)
2- Care and Nutrition Counseling
3- Health Services
4- Community mobilization awareness, advocacy & IEC

4.4.1 EARLY CHILDHOOD CARE, EDUCATION AND DEVELOPMENT (ECCED)

The services and interventions summarized in the Early Childhood Care Education and Development (ECCED) component are listed in the table below, along with the activities performed and the responsible officers.

Service and Target Beneficiaries	Interventions and Activities	Functionaries Responsible
ECCE/Non- formal education activities The beneficiaries of this service are: • 0-6 year Children • Parents / Care givers	**Interventions: -** • Paying home visits to guide the parents • Early detection of malnourished children • Checkup of the child on monthly basis for growth and development. • Providing non formal education. **Activities:** • Teaching the children in play way method • Activities for overall development of a child. • Teaching the parents and mothers for training children through play way method. • Regular Monitoring of Children for growth and development. • Promoting the participation of parents and mothers in the activities of the school.	• Anganwadi Worker (AWW) • Second AWW cum Child Care & Nutrition Counselor • Supervisor is required to attend at least 2 EECE meetings per month
Supplementary Nutrition The beneficiaries of this service are: - • Children from 6 months to 6 Yrs • Pregnant and Lactating Mothers	**Interventions: -** • Providing snacks and meals as per norms. **Activities: -** • Providing supplementary nutrition for minimum 300 days in an year. • Making sure to fill the gap between recommended dietary allowances (RDA) and the average daily in take of beneficiaries.	• AWW • Second AWW • Anganwadi Helper (AWH) • Self Help Groups (SHGs) and Others

(Integrated Child development Scheme (ICDS) manual for district level functionaries, 2017)

4.4.2 CARE AND NUTRTION COUNSELLING

The services and interventions that are grouped into the Component of Care and Nutrition Counseling are detailed in the table below along with activities to be carried out and the functionaries responsible to carry out these activities.

Service and Target Beneficiaries	Interventions and Activities	Functionaries Responsible
Infant & Young Child feeding (IYCF) Promotion & Counselling Beneficiaries of this service are: • pregnant and lactating mothers • Mothers of children under the age of 3	**Interventions:** • IYCF practice includes breastfeeding and appropriate complementary feeding for the first six months. • Qualified individualized advice through home visits; **Activities:** • Counseling women on food intake • breastfeeding counseling aimed at providing children with nutritious diets; • For optimal breastfeeding practices in conjunction with growth monitoring • Complementary foods • Home visits and aftercare	• AWW • Second AWW cum nutrition Counsellor • Supervisors • Accredited Social Health Activist (ASHA) • Auxiliary Nurse Midwife (ANM)
Mother Care counseling Beneficiaries of this service are: • pregnant and lactating mothers	**Interventions:** • Early registration of pregnancy • Counseling on diet, rest and IFA compliance during home visits • Monitoring weight gain • Check for pallor, edema, or signs of danger • Important home advice, breastfeeding support and spacing	• ASHA • ANM • Medical Officer (MO) • Second AWW cum nutrition counselor

	advice for newborn care **Activities:** • Nutrition advice for all women aged 15-45 • Counseling and communication on women's behavior change (BCC) regarding: ➢ Basic health care, nutrition, maternity care, healthy eating habits ➢ Childcare, infant feeding, access to health services ➢ Family planning and environmental hygiene • Breastfeeding support includes support at initiation of breastfeeding with qualified advice	
Education on care, nutrition, health and hygiene Beneficiaries of this service are: • pregnant and nursing mothers and other caregivers; • Communities and families	**Intervention:** • Monthly health and nutrition training • Education on improved care practices – nutrition, health and hygiene, psychosocial • Knowledge exchange on pregnancy, lactation and adolescent care; • Promoting local cuisine and family nutrition • Proper food demonstration • Celebrations such as Nutrition Week, Breastfeeding Week and ICDS Day	• Anganwadi Worker • Second AWW cum nutrition counsellor • Supervisor

	Activities: • Children aged 0-3 are weighed monthly and children aged 0-6 weighed quarterly. • Maintain an age-appropriate weight gain chart for every child from 0 to her 6 years old. According to WHO standards for child growth. • Identify growth retardation and provide appropriate counseling to caregivers on optimal infant nutrition and health. • Provide each mother with a joint maternal and child protection chart to track nutritional status, immunization schedules and developmental milestones for both the child and the pregnant and lactating mother.	
Community-based care and management of underweight infants Beneficiaries of this service are: • Moderately and severely underweight children and their mothers • caregiver	**Intervention:** • 100% weighing of all eligible children and identification of underweight children • Referral to NRC/MTC for children needing medical assistance. • 12 days nutrition counseling and care sessions for children in need (Sneha Shivirs), 18 days home care and aftercare during home visits **Activities:** • At Sneha Shivirs, AWC mothers and caregivers of underweight babies receive 12 days of hands-on training	• AWWs • AWH • Supervisors • Mother's Group • PRIs/ SHGs/ MO • Additional Anganwadi Worker • Nutrition Counsellor ASHA and ANM as facilitators

	in her care practices, followed by 18 days of hands-on training at home. • Follow-up of the child's weight gain during her 18-day home practice by home visits.	

(Integrated Child development Scheme (ICDS) manual for district level functionaries, 2017)

4.4.3 HEALTH SERVICES

The services and interventions that are grouped into the Component of Health Services are detailed in the table below along with activities to be carried out and the functionaries responsible to carry out these activities.

Service and Target Beneficiaries	Interventions and Activities	Functionaries Responsible
Immunization and Micronutrient Supplementation The beneficiaries of this service are: • Children - 0-3 years and 3-6 years • Pregnant and Lactating Mothers	**Interventions:** • Regular fixed monthly Village Health and Nutrition Days. • Primary Immunization • Boosters • TT for Pregnant women • Vitamin A supplementation (9 months – 5 Years) • IFA supplementation (infants after 6 months of age) • Deworming as per guidelines & Counseling **Activities:** • Ensure immunization of pregnant women and infants. • Children to be given Vitamin A and Booster Doses as per the national immunization schedule	• ANM/MO • ASHA • AWWs as facilitators

	• AWW to assist health functionaries for complete coverage. • Organizing and conducting fixed day immunization sessions, known as "Village Health Nutrition Days (VHND)" at the Anganwadi Centre.	
Health Check-up The beneficiaries of this service are: • Children - 0-3 years and 3-6 years • Pregnant and Lactating Mothers	**Interventions:** • Antenatal Care (ANC)/ Post Natal Care (PNC)/Janani Suraksha Yojna (JSY) • Support for Integrated Management of Neonatal & Childhood Illness / Janani Shishu Suraksha Karyakram (JSSK) • Identification of severely underweight children requiring medical attention & support of community. **Activities:** • Carry out regular health check-ups, recording weight, immunization, support to community based management of malnutrition, treatment of diarrhea, deworming and distribution of iron and folic acid and medicines for minor illness • Anganwadi Centre (AWC) to control common ailments like fever, cold, cough, worm infestation etc. including medicines and basic equipment for first aid	• ANM • MO • ASHA • AWWs
Referral Services	**Interventions:** • Referral of severely underweight to	• ANM • MO

The beneficiaries of this service are: • Children - 0-3 years and 3-6 years • Pregnant and Lactating Mothers	health facility / NRCs • Referral for complications during pregnancy • Referral of sick new - born and sick children **Activities:** • During health check-ups and growth monitoring sessions refer sick and malnourished children as well as pregnant and lactating mothers in need of prompt medical attention, to the Health facilities	• ASHA • AWWs

(Integrated Child development Scheme (ICDS) manual for district level functionaries, 2017)

4.4.4 COMMUNITY MOBILIZATION, AWARENESS, ADVOCACY & INFORMATION EDUCATION AND COMMUNIATION (IEC)

Service and Target Beneficiaries	Interventions and Activities	Functionaries Responsible
EC, Campaigns and Drives etc. The beneficiaries of this service are: • Families & Community	**Interventions:** • Information dissemination & awareness generation on entitlements, behaviors & practices • Sharing of nutritional status of children at Gram Sabhas meetings • Linkage with Village Health Sanitation and nutrition Committee (VHSNC), Action Groups and Community. **Activities:** • Sensitization and engagement of Panchayat Raj Institutions/Self Help	• AWW • Second AWW • Supervisors • Food and Nutrition Board (FNB) • Dist. & Block Resource Centre's • ICDS Management

	Groups/Mothers Committees on Nutrition & Child Development • Social mobilization campaign in partnership with Song and Drama Division in tribal areas, rural areas • Use of mainstream media channels like TV, Radio, print media, newsletter etc. for propagating good practices of child & women health • Identifying local troupes to generate awareness about components of ICDS Scheme • Interpersonal Communication through home visits, the mothers-in-law, mother and other care givers are also sensitized to ensure appropriate care and feeding practices at home. • Voluntary Action for promoting ICDS schemes are invited for undertaking home visits and counseling.	

(Source – Integrated Child development Services, manual for district level functionaries, 2017)

Special points of ICDS Services –

1- **Supplementary Nutrition** – The supplementary nutrition given to children below 6 year of age and pregnant and nursing mothers from low income families. The provision of supplementary nutrition includes supplementary feeding and distribution of nutrient supplements.

- **Supplementary feeding** – At the ICDS centre's food is provided with an aim to meet the gap of nearly 1/3 of Calories and half of the protein requirement for a day of children below six years as well as of adolescent girls, pregnant women and nursing mothers.

  Supplementary food is provided for 300 days in an year which means 6 days per week or 25 days per month. Supplementary food given to severely malnourished children is twice the quantity (double ration) as given to moderately malnourished children. Supplementary foods should include the following –

- Mixture of cereals (Wheat, rice, maize, jowar, bajra, ragi)
- Pulses (Soyabean, Gram, Chana, Moong, Arhar, Masoor etc)
- Green leafy vegetables and fruits
- Oil and Oil seeds (Ground nut, mustard, sesame, coconut or soyabean oil)
- Sugar or Jaggery

Hygiene and cleanliness should be maintained during cooking and distribution of supplementary hot cooked meals.

ICDs Supplementary Food Recommendation		
Beneficiaries	Nutritional Contribution	
	Energy (Kcal)	Protein (g)
Children (0-3 years) (3-6 years)	500	12 to 15
Severely malnourished children (6-72 months)	800	20 to 25
Pregnant women and nursing mothers and adolescent girls	600	18 to 20

ICDs Meal cost Allocated to beneficiaries	
Beneficiaries	Cost of Supplementary meal
Child (7-72 months)	Rs. 8 per child per day
Child (7-72 months) severely malnourished	Rs. 12 per child per day
Pregnant women and nursing mothers	Rs. 9.50 per beneficiary per day

Micronutrient Supplement Distributions –

- Vitamin A supplementation –

Age	Dose of Vitamin A
Children (6-11 months)	1 dose of 1,00,000 I.U of Vitamin A orally
Children (1-5 years)	1 dose of 2,00,000 I.U of Vitamin A orally every six months

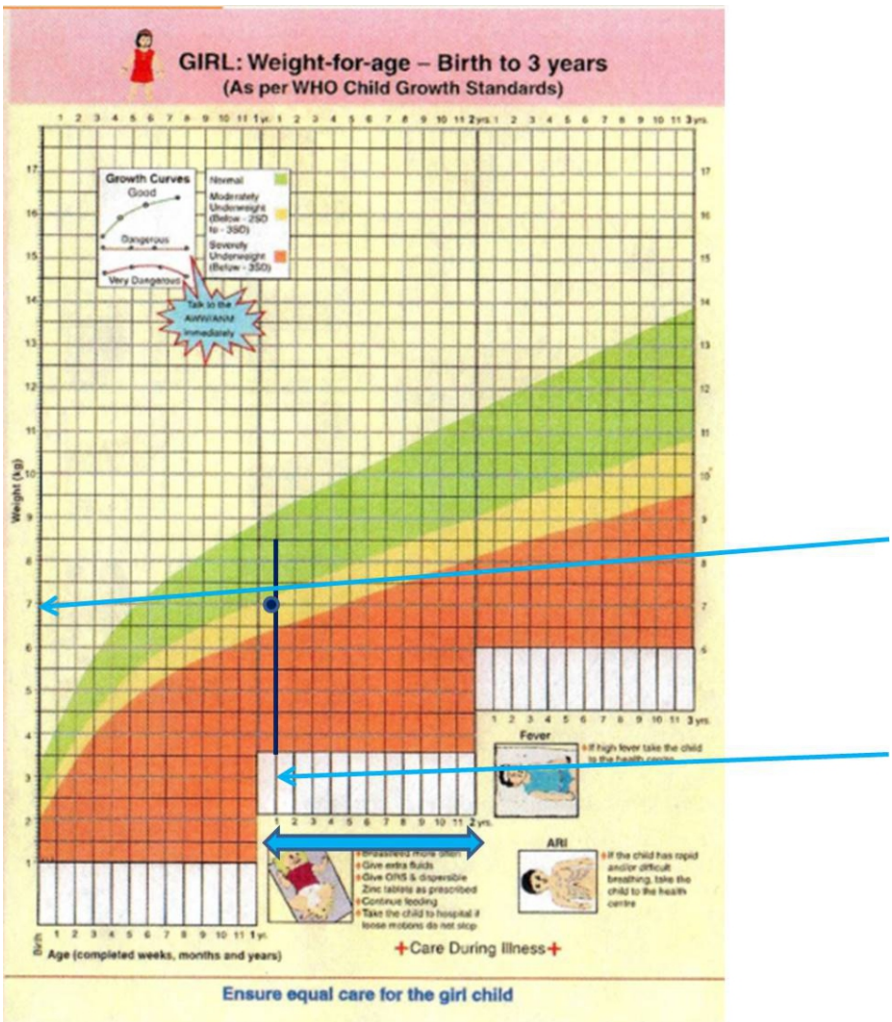
- **Iron and Folic Acid Supplementation** – All pregnant women and children (1-5 years) are given iron and folic acid (IFA) tablets to prevent anaemia as per the following recommended dose irrespective of their hemoglobin status.

Beneficiary	Dose	Quantity
Pregnant women	1 big tablet (each tablet	1 tablet per day for 100

	containing 100 mg of elemental iron and 0.5 mg folic acid)	days (in third trimester of pregnancy)
Children (1-5 years)	1 small tablet (each tablet containing 20 mg of elemental iron and 0.1 mg folic acid)	1 tablet per day for 100 days every year

(Source – Integrated Child Development Scheme, Manual for district level functionaries, 2017)

- **Growth Monitoring** – The growth monitoring is a tool for preventing malnutrition and for early detection of growth faltering. Body weight is an easily measurable parameter and can be interpreted by the AWW using new **WHO growth Chart** (2008) to assess the child health and nutritional status.



The new WHO Growth Standard Chart helps to measure –

1- Change in current estimates

2- Increase In total of normal weight children.

3- Increase in severely underweight children.

4- Increase in Underweight Children (mild, moderate & severe) in age group of 0-6 months.

Using this chart the mothers can be educated regarding –

- Child's growth
- Dietary requirements
- Proper diet and cooking methods
- Proper feeding procedures (Quantity and frequency of feeding)

Health checkups – Regular health checkups are provided for expectant and nursing mothers and for children below 6 years of age. The pregnant mothers are also given iron and folic acids tablets. Along with health checkups other services provided are –

- Recording of weight
- Immunization
- Required management of under weight and malnutrition
- De-worming
- Treatment of diarrhea
- Distribution of simple medicines

Immunization – Children below 6 years of age should be immunized against the six diseases which are preventable i.e. Diphtheria, Pertussis, Tetanus, Poliomyelitis, Tuberculosis and Measles. These diseases are the major cost for child morbidity, mortality, disability and malnutrition. Pregnant women are also given Tetanus vaccine.

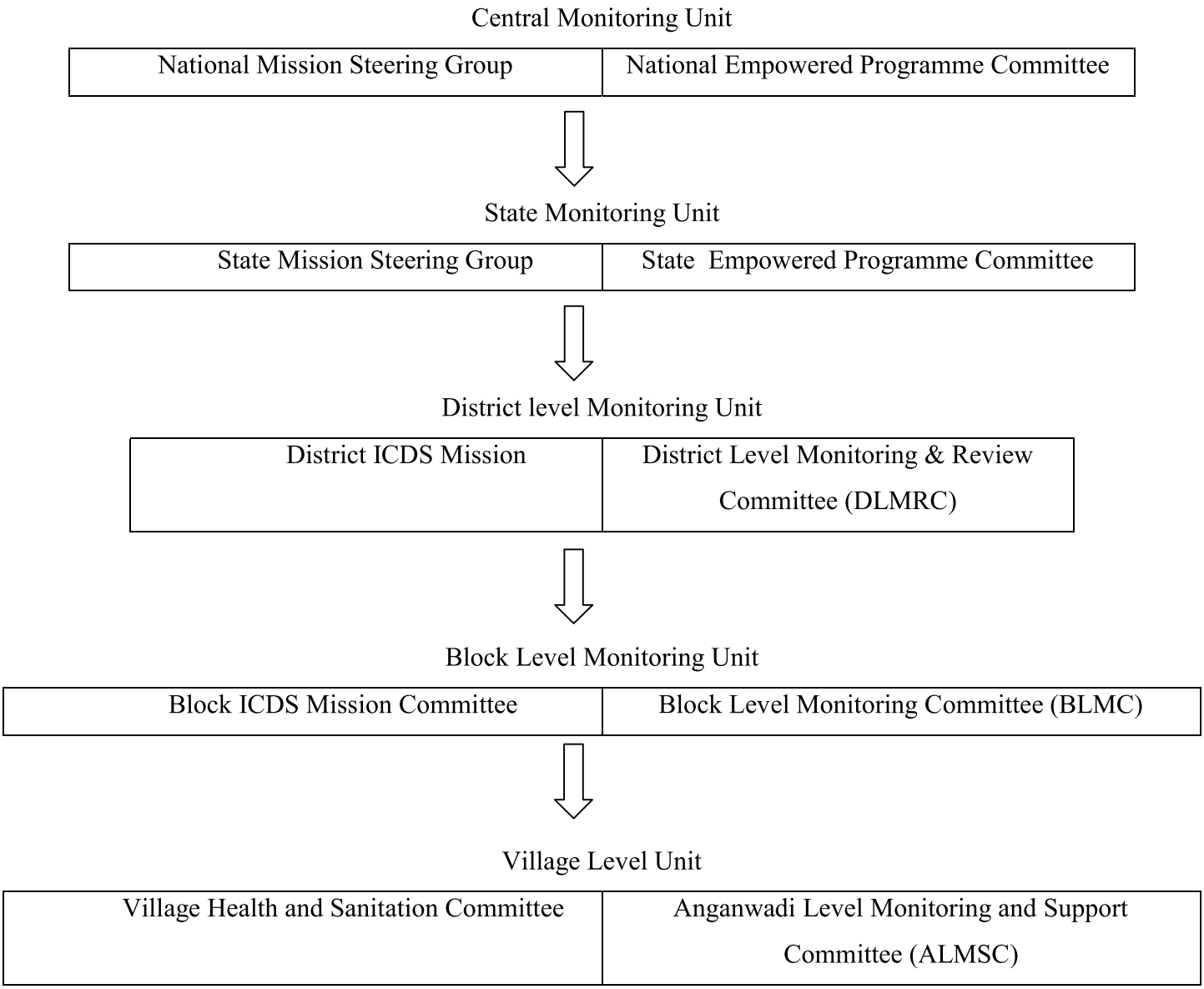
Referral services – During the checkup and immunization sessions if any child is found to be malnourished or sick prompt medical attention is provided. The children are referred to primary health centre or sub centre. The anganwadi workers are also trained to detect disease and disability among children. They makes a list of all such cases and refer them to the medical officer of the primary health centre.

Other Schemes by ICDS – In present time, the following schemes are being run under ICDS schemes

Schemes	Beneficiaries	Programme component
Rajeev Gandhi Scheme for Empowerment of Adolescent	Adolescent girls (11 to 18 years)	ICDS provides services to improve nutrition and health

Girls (SABLA)		status by providing supplementary nutrition (600 kcal and 18g protein) at the rate of Rs. 5 per beneficiary per day for 300 days in a year for 11 to 14 years to all girls in the age group of 15 to 18 years. In addition health education and life skills education are also given to make them self sufficient.
Kishori Shakti Yojna (KSY)	Adolescent girls (11 to 18 years)	ICDS Provides services to improve the nutritional health and developmental status of adolescent girls. Awareness promoted regarding health hygiene and family care. Literacy, numerical skills and vocational skills are also provided.
Nutrition Programme for Adolescent Girls (NPAG)	Adolescent girls (11 to 19 years weighing less than 35 kg)	6 kg of free food grain is provided per beneficiary per month. In addition, nutrition, health education is also given to beneficiaries and their families.

Administrative and Organizational setup –



Monitoring functions at district levels -

- The work progression, supervision and monitoring of the scheme is carried out with the help of different academic Institutions such as Community Medicine Department of the Medical Colleges, Home Science College and School of social work etc.
- With the help of the above institutions, data from each district is collected and analyzed. The data analysis and project implementation progress is monitored in monthly Progress Report (MPR) and Annual Progress Report (APR) which are submitted to the monitoring and Evaluation Unit of the Ministry of Women and Child Development.

District Level Monitoring Functions - At the district level, monitoring is carried out at 3 different levels in District:

- District Magistrate / Collector and/or District Welfare Officer led monitoring
- Block level monitoring by CDPO
- Cluster level by the Supervisor
- Apart from Administrative monitoring, Community based monitoring mechanism are encouraged to bring in transparency and accountability in delivery of services.
- Time lines for submission of reports maintained on the integrated portal.

Thus ICDS is the major programme channel for addressing child rights related to survival, protection, participation and development. It is considered as an unique and integrated prgramme having the following special features –

- Integrated Package of Services
- Maximum beneficiaries coverage
- Coordination mechanism
- Convergence of services
- Inter-sectoral approach
- Training setup
- Overall development of children
- Community empowerment
- Community participation
- Child right conservation
- Gender equality

4.5 SUMMARY

After studying the above unit we have understood the various nutritional programs run by the government to irradicate malnutrition. These programs on one hand help in the adequate growth and development of children and on the other hand they help in bringing up better nutritional status of the society. They help the vulnerable groups of the society like pregnant and lactating women and growing children. With the help of these programs there can be better health nutrition education and overall development of the children.

4.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISE 2

1- Write a detailed note on supplementary feeding programs? ----------
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2- Write down objectives components, beneficiaries and functioning of Mid Day Meal Program? ----------

3- Write a detailed note on Integrated Child development Services? ----------

4- Write short note on the following –

- Growth Charts ----------
- Immunization ----------
- Referral services by ICDS----------
- Types of Meals provided in Mid Day Meal Scheme ----------

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Unit – 5 Hazards to Community Health and Nutritional Status

Structure

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5.0 OBJECTIVES

The objectives of this following unit are as follow –

- To know the various sources of water and the causes of water pollution.
- To know the various types of pesticides and the possible ways by which the mixing of these pesticides in human food can be avoided.
- To know the harms which the industrial sewage does when it is mixed in food items.
- To find out possible ways to minimize the effect of industrial sewage.

- To understand the types of adulterants and also the various tests by which adulteration can be identified.
- To understand the functions and roles of FSSAI.

5.1 INTRODUCTION

Health and nutritional status of an individual can be explained as "condition of the body as influenced by the diet, the level of nutrient in the body and the ability of those levels to maintain normal metabolic integrity."

Apart from diet and nutrition there are many other factors in the environment that effects the nutritional status of people. In present times some non-nutritional factors pose great hazards and threat to human health. The most important of these factors are as follows –

1- Pollution of water
2- Industrial offense sewage
3- Pesticides residues in foods
4- Adulteration in food items

It is very important for us to make sure that every person tries to stay away from these hazards as much as possible. In the following unit we shall discuss in detail about the types of hazards which the community is facing these days, there causes and possible prevention.

5.2 POLLUTION OF WATER

Water is important for a person's life. It is required by all human beings without water they would be no life and so clean water from reliable sources is important for growth, development and well-being for people. If safe drinking water is not available for consumption it results in ill health.

Water is required directly for drinking, cooking, washing etc and indirectly for irrigation, construction work, power generation and waste disposal etc.

Water used for human consumption should be fresh, clean, safe and wholesome. Such water is called **potable water**. It can be defined as water which is free form pathogenic agents, harmful chemical substances, odour and unpleasant taste and suspended particles.

Water is called non - potable when it contains the following harmful things –

- Industrial waste

- Domestic waste
- Infective or parasitic agents
- Harmful and poisonous chemical substances
- Suspended particles
- Unpleasant odours and taste

Non potable water should be treated and bacteriologically and chemically tested before consumption.

5.2.1 SOURCES OF WATER

We get water from rain, land surface or from underground source. This water is recycled by nature and in the process of recycling it comes in contact with the various contaminants from the atmosphere, soil and industrial waste etc. This shows that the water from nature is generally unsterile and should be checked and treated before consuming it. We get water from the following sources –

1- **Ground water** – Ground water is cheapest and most easily available source of water. The soil acts as a filter and remove many contaminants from surface water. As water goes deeper, it becomes cleaner.

Advantages of Ground water –

- This water is mostly free from pathogenic microorganism and so usually requires no treatment.
- Even in the dry season we can get water from deep wells.

Disadvantages of Ground water –

- The ground water usually has high mineral content specially the presence of calcium and magnesium makes it hard.
- Pumping is required to get the water form water source.

Types of ground water sources – Types of ground water include the following –

- **Springs** – ground water that finds its way from the surface is called Spring.
- **Wells** – wells are of two types –
    - **Shallow wells** – shallow wells are not very deep and so they can get contaminated from drains and manure etc.
    - **Deep wells** – Deep wells are not easily contaminated but they should not be left open.

- **Tube wells** – they wield water which is bacteriologically safe. They are made up of a galvanized iron pipe which is sunk into the water bearing area and fitted with the strainer at the bottom and a hand pump at the top.

2- **Rain –** rain water is generally clean, bright, sparkling and chemically very soft. However it can get impurities which could enter through the atmosphere like dust, soot and gases like carbon dioxide and ammonia.

3- **Water from Land Surface –**Most of the water that we consume comes from the land surface which originates from land water. The sources of land surface water are as follows –

- **Impounded Reservoirs –** they are also called artificial lakes. They are used to store large quantities of surface water. For example dams are built across rivers and streams to create such reservoirs.
- **Rivers and streams –** In modern times water from rivers and steamers is mostly polluted and it unfit for human consumption. It should be treated before use. Specially during monsoons river water may contain dissolved or suspended purities and may have high bacterial count. Impurities from sewage water, industrial waste and drainage from agricultural areas are generally present.
- **Sea water –** sea water contains large amount of dissolve salts mainly 2.5% sodium chloride. It cannot be used for drinking unless it is demineralized.

5.2.2 CONTAMINATION OF WATER

Water bodies can be polluted from the following sources –

1- **Domestic Sewage** – It is the primary source of pathogens and putrescible organic substances. Discharge of untreated raw sewage from households and can contaminate water.

2- **Toxic Waste** – waste is considered toxic if it is –

- Poisonous
- Radio active
- Explosive
- Carcinogenic
- Mutagenic (causing damage to chromosomes)
- Teritogenic (causing birth defects)

Sources of toxic chemicals include improperly disposed waste water from industrial plants and chemical process facilities (lead, mercury and chromium).

3- **Pesticides** – when pesticides are used on agricultural area and suburban lawns and water is run of from that area the pesticides gets mix up in water. Pesticides like Chlordane, Dieldrin and Heptachlor are highly toxic to humans.

4- **Solid waste** – If solid waste like garbage, rubbish, electronic waste, trash, construction and demolition waste are improperly disposed, they become a major source of water pollution. Many solid waste such as plastic and electronic waste breakdown and leach harmful chemicals into water making them a source of toxic water pollution.

5- **Sediments** – sediment or silt resulting from soil erosion of construction activity can be carried into water bodies by surface run off.

6- **Thermal pollution** – Heat is also a water pollutant because it decreases the capacity of water to hold dissolved oxygen in solution. This situation is harmful for fish and water eco system. The rise in water temperature is mainly because of global warming.

7- **Petroleum oil Pollution** – It occurs when oil form roads and parking slots is carried in surface run off into water bodies. Oil slicks eventually move towards shore harming equatic life and damaging recreation areas.

8- **Microbiological contaminant** - Microbiological contamination of drinking water is very rampant. The WHO clean water standards require that 98% of the water samples from any one area to be completely free from coliform bacteria. By this measure most (70%) of India's surface water is polluted. In 1990, Government of India survey report showed coliform level to be serious problem at many urban location on the Ganges and on section of other rivers.

Water borne infections prevalent in India are: cholera, gastroenteritis, diarrheal disease, enteric fever, viral hepatitis and guinea worm infestation.

9- **Chemical contaminants -** The possibility of chemical contaminations is tremendous in areas where drinking water is drawn from varied sources like rivers, lakes, ponds, streams, open well, tube well and hand pump, etc. the chemical contaminants so far indentified in the country are : fluoride, arsenic, iron, nitrates and phenols. Out of these, arsenic and fluorides are causing health problems in the population. These ill-health effects are irreversible in nature and prevention seems to be the only solution.

10- **Arsenic in Drinking water** – Large amounts of arsenic in the geological crust can result in water that has a very high amount of this mineral. At present, this problem has been reported from West Bengal, The source of arsenic in the geological crust is iron pyrites.

11- **Iron** – The problem of excess iron in drinking water is prevalent in 15 states and the Union Territory of Pondicherry. Excess iron in water causes corrosion of water pipes and other

installations, specially tube wells. From the health point of view it encourages the growth of bacteria and impairs the digestive process. It also creates an aesthetic problem because of its taste and odour. One can control this problem either by supplying water from alternative sources within the permissible limit of 1.00 ppm or by treatment of water.

12- **Fluoride** – Fluoride poisoning can cause health problems affecting teeth, bones, muscles, the gastrointestinal system and variety of soft tissues in the body. The disease caused by high intake of fluorine, mainly through drinking water is called **fluorosis** which is non reversible in nature. The disease occurs both in young children and older people. In young children the disease affects only the teeth, which is called **dental fluorosis**. In older people the situation is most serious where bones, muscles and soft tissues get affected and the condition is called **skeletal fluorosis**. In the advance stage of clinical manifestations, there is **acute crippling** which adds to social problems.



Dental Fluorosis



Skeletol Fluorosis



Acute Crippling

5.2.3 HAZARDS OF WATER POLLUTION

- Phosphorus and nitrate from fertilizers and detergents contaminates surface waters where they act as nutrient. They promote the growth of oxygen consuming algae which reduces the dissolved oxygen level of water killing fish and other aquatic organism.
- Organic pollutants that get mixed in water through domestic commercial and industrial practices like petroleum refineries, paper mills, breweris, tanneries and slaughter houses etc contaminate the water. This provides nutrition for microorganism there by reducing the dissolved oxygen level of the aquatic system and killing the aquatic organisms.
- The pesticides travel through food chains. When they reach humans they accumulate in the fatty tissues and affect the nervous system.
- The thermal pollution of the water reduces the dissolved oxygen level of the aquatic system making it incapable of supporting life.
- Radioactive pollutants from mining and nuclear power plants enter humans through food and water and get accumulated in the blood, thyroid gland, liver, bones and muscles.
- Fluoride containing pollutants cause fluorosis, which results in neuromuscular, respiratory, gastro intestinal and dental problems.
- Industrial wastes result in the addition of poisonous chemicals such as are arsenic, mercury, cadmium and led etc. which kill aquatic organism and may reach human body through contaminated foods.

Water borne diseases – they can be caused by infective agents that are present in water. For example

- **Bacteria** – Cholera, typhoid, paratyphoid, bacillary dysentery, infantile diarrhea and gastro enteritis.
- **Viruses** – viral hepatitis and poliomyelitis
- **Protozoa** – amoebiasis, giardiasis
- **Helminthic infective organisms** – for example Ova off roundworm, whipworm and threadworm.

5.2.4 WATER QUALITIES STANDARDS AS PER WHO (1971)

The WHO following five water qualities standards –

1- Microbial pollutants – Standards for bacterial quality of treated water are –

- No sample should contain more than 10 coliform organisms in 100ml of water.

- No sample should contain E. coli in 100 ml of water.
- Coliform organism should not be detectable in 100ml of any two consecutive samples of water.
- Throughout any year 95% of the samples should not contain any coliform organisms in 100 ml of water.

2- Toxic substances –

- Arsenic not more than 0.05 mg per litre.
- Cadmium not more than 0.005 mg per litre.
- Led not more than 0.05mg per litre.
- Mercury not more than 0.001mg per litre.
- Selenium is not more than 0.01 mg per litre.

3- Radio active substances – Pollution of water by radio active substances is on the rise and WHO has set standards for acceptable limits.

4- Other characteristics affecting acceptability – there should be no discoloration, unacceptable odour and taste or dissolve salts affecting pH in water. All these should be within desirable limits set by the WHO.

5- Fluoride levels – it should vary between 0.5 to 0.8 mg per litre.

Classification of water

Sl no.	Coliform count /100 ml of water	Grade / Class	Remarks
1	0-1	Class 1	Highly satisfactory
2	1-2	Class 2	Satisfactory
3	3-10	Class 3	Doubtful
4	More than 10	Class 4	Unsatisfactory

Health Hazards of water pollution

- Radioactive pollutants (from mining and refining of uranium thorium and nuclear power plants) enter humans through food and water and get accumulated in the blood, thyroid gland, liver, bones and muscles.
- Poisonous chemicals such as arsenic, mercury, cadmium, lead etc. gets added in water through industrial wastage causing killing of aquatic organisms and they may also reach human body through contaminated food.

- Non – bio degradable pesticide specially organs chlorines travel through food chains. When they reach humans they accumulate in the fatty tissues and affect the nervous system.
- Fluoride causes fluorosis which results in neuromuscular, respiratory, gastro intestinal and dental problems.
- Domestic commercial and industrial effluents (Petroleum refineries, Paper mills, breweries and slaughter houses. Contaminate the water with organic pollutants. They reduce the dissolve oxygen level of the aquatic system there by killing the aquatic organisms.

5.2.5 PURIFICATION OF WATER

Basic steps in purification of water –

- **Storage and sedimentation** – water is stored in large reservoirs for about two weeks. In this time suspended impurities settle down.
- **Filteration**– it is carried out by either of two methods –

a. Slow sand or biological filters – In this process water slowly passes over sand grains and gravel covered with a slime layer of algae and bacteria. These microorganisms purify the water.

b. Rapid sand or mechanical filters – In these types of filters alum or aluminium sulphate is added to haston flocculation. This precipitated out the impurities which are filtered of through a bed of sand.

- Chlorination – Chlorine kills the remaining pathogenic organisms and makes the water pure. A minimum level of 0.2 ppm to 0.5 ppm residual chlorine is recommended for drinking water.

Chemicals found in drinking water and their harmful effects on human health.

Sl no.	Chemical	Harmful effects
1	Led	Led can accumulate in the body effecting central nervous system. Children and pregnant women are most at risk.
2	Fluoride	Access fluoride can cause fluorosis.
3	Nitrates	Sometimes drinking water may get contaminated with nitrates. If It reaches to infants through formula milk it restricts the amount of oxygen that reaches the brain causing blue baby syndrome. It can also cause digestive tracts cancers.
4	Petrochemicals	Petrochemicals like benzene can cause cancers even at low exposer levels.

5	Chlorinated solvants	Can cause reproductive disorders and some cancers.
6	Arsenic	Can cause lever and nervous system damage, vascular diseases and skin cancer.
7	Pesticides	Sometimes organophosphates and carbonates present in pesticides affect and damage the central nervous system and can cause cancer. The chlorides present in them can cause reproductive and endocrinal damage.

5.3 INDUSTRIAL OFFENSE SEWAGE

Industrial sewage primarily affects human health and it comes through industrial effluent and debries. Although the development of industries and development revolution has given employment to a large number of people and it has also cause many positive changes in every aspects of human life but at the same time because of industries there have been many negative changes in the environment which have affected human health in many ways.

Industrial sewage is the waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process. For examples – chemicals, solvents, paints, sludge, sand paper, traces of metals, industrial by products or even radio-active waste constitutes the industrial offense sewage.

The sewage is a complex mixture of chemicals which may include high concentration of ammonium, nitrate, phosphorus and due to high dissolved solids may be of high alkalinity.

The negative effects of industrial revolution –

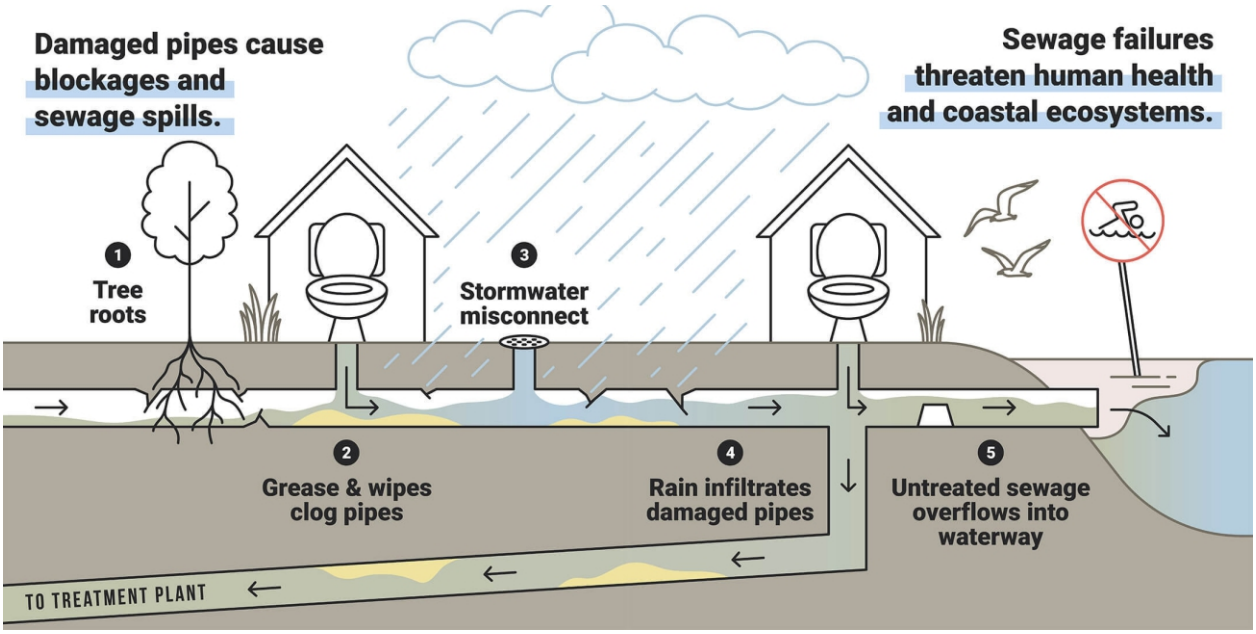
1- It has caused depletion of natural resources.
2- It causes carbon emissions which negatively effects the respiratory system.
3- It causes lot of environmental pollution.

The humans can get exposed to industrial sewage contamination through the following routes

1- Oral – Humans can gets exposed by drinking contaminated water of eating contaminated sea food. The shell fish eat the bacteria and when eaten raw and partially cooked these shell fish can make people sick. Different types of chemical solvants used in industry can cause lever damage.

2- Dermal – it is through getting in touch with contaminated water directly (as in bathing) or indirectly (open cut or skin rashes). Gastro intestinal disorder have been linked to sewage pollution with virus implicated as the cause.

3- Aerosol – Sometimes if air has high concentration of sewage contamination it can reach inside human body through inhaling water droplets and breathing.



5.3.1 HEALTH HAZARDS OF INDUSTRIAL OFFENSE SEWAGE

All types of industrial waste be it toxic waste, chemical waste or municipal waste all are extremely harmful for our health. All types of sewage carry pathogenic organisms that can transit disease to humans and animals. The following health hazards can be due to industrial waste –

1- Organic matter and nutrients causes an increase in aerobics algae and deplects oxygen from the water. This suffocates the fish and other aquatic organism.

2- Industrial waste contains many toxic compounds that damage the health of aquatic animals and those who eat them. It causes immune suppression reproductive failure or acute poisoning.

3- Heavy metals can accumulate in lakes and river they are toxic to marine and such as fish and shell fish and to the humans who eat them. Heavy metals can also slow development, result in birth defects and some are even carcinogenic.

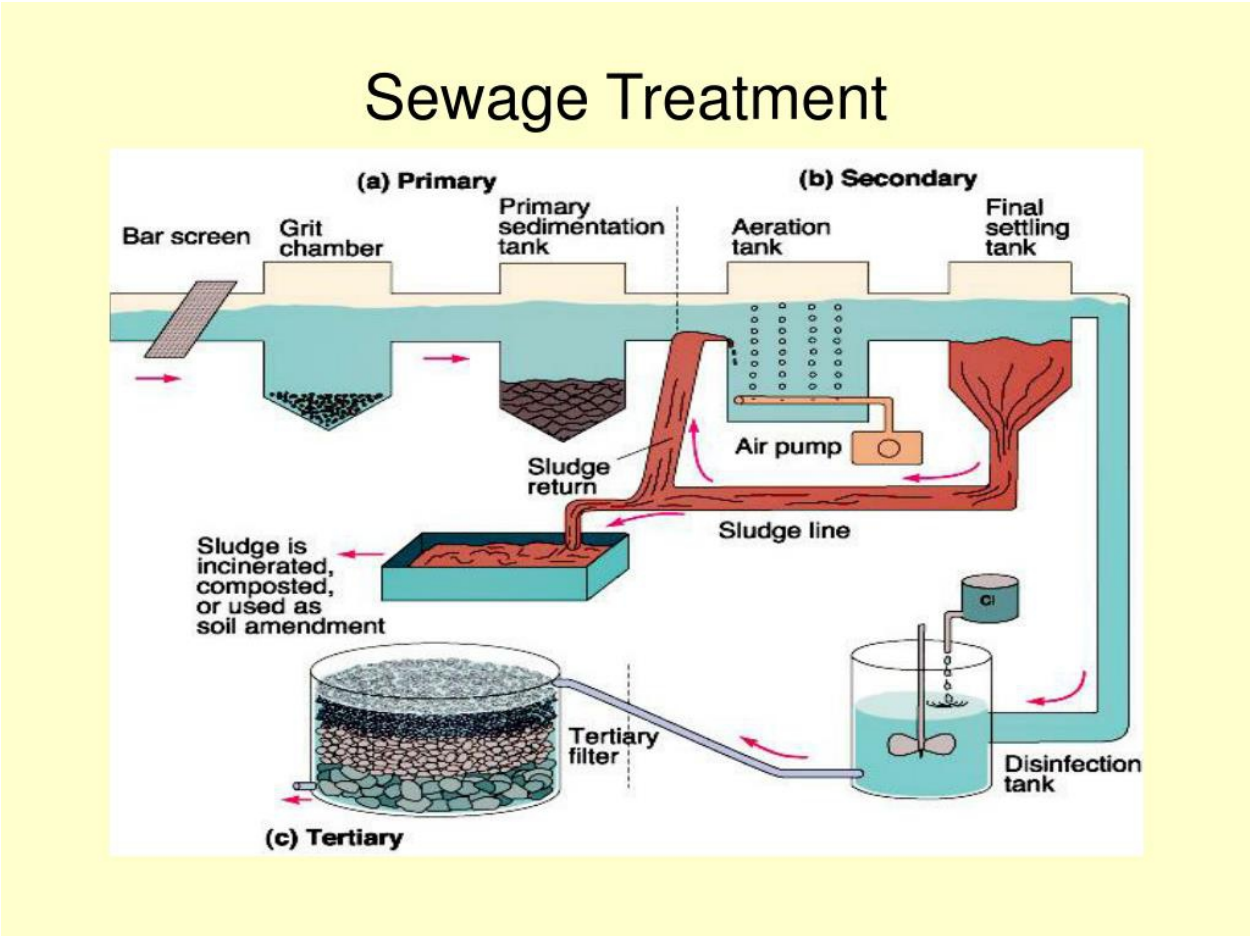
4- Microbial pollutants from sewage often result in infectious diseases that affect aquatic life and human beings through drinking water. Microbial water pollution is a major problem in a

developing world diseases such as – cholera and typhoid fever are the primary cause of infant mortality.

5- Suspended particles in fresh water reduces the quality if drinking water for humans and the aquatic environment for marine life. These particles can often reduce the amount of sun light penetrating the water thus disrupting the growth of photosynthetic plant and micro organism.

5.3.2 TREATMENT OF SEWAGE

The process of removing the contaminant from sewage to produce liquid and solid (sludge) suitable for discharge to the environment or for reuse is called sewage treatment. Aseptic tank or other waste water treatment system such as bio filters can be used to treat sewage close to where it is created. In some cases the treated sewage sludge is called **bio solids** and can be used as a fertilizer.



5.4 PESTICIDES RESIDUES IN FOOD

Pesticides are chemicals used in agriculture to protect crops against insects, fungi, weeds and others pests. Farmer used pesticides to protect their crops from harmful insects, bugs and pests that eat and damage crop. Pesticides may be of the following types –

- Fungicides
- Herbicides
- Insecticides
- Some chemicals pesticides are – Glyphosate, Asiphate, Deet, Metal dehyde, boric acid, diazinon, DDT and melathion etc.

Some pesticides are used to protect public health in controlling the vectors of tropical diseases such as mosquitoes but pesticide are harmful and toxic to human beings. Animals and birds, whether pets or stray, should not be allowed to enter an area where food is prepared, stored or served. Cats, Dogs, crows, sparrows and pigeons may present problem for the catering establishment.

Domestic animals are carries of ticks and mites and enteric pathogens like staphylococcus aureus and salmonellae. Like humans staphylococci are found the skin and nose of dogs and cats. Their presence is indicated by their droppings and sign of rubbish strewn around garbage bins.

Birds carry mites and many harmful microorganisms. They peck at food and damage packages. The presence of birds droppings and loose feathers in or near food is obnoxious.

They can be controlled by

- Installing screens on window, doors and ventilations.
- Discouraging the entry of animals in the premises
- Discouraging the practise of feeding leftover to animals in the premises
- Proper storage and disposal of garbage.

PESTICIDES

These include insecticides and rodenticides. They are substances which have certain pharmacological effects on insects and rodents either as poison or as repellents. Pesticides that are reliable, easily available, have a prolonged residual effect and are not highly toxic to human and preferred. Pesticides can be categorized on the basis of the nature of the substances, their effect on pests, and methods of applications.

5.4.1 TYPES AND NATURE OF PESTICIDES

1- Inorganic pesticides – they are natural chemical substances, for example, sulphur dust, arsenic, hydrogen cynanide and paris greens.
2- Organic Pesticides – These are mainly plant extracts. They are least harmful to humans and are also least effective against insects, for example, pyrethroids. They have a quick "knock down" action but little residual effect, hence repeated applications are necessary.
3- Synthetic pesticides – as the name implies, these are man made chemicals, are highly dangerous and should be stored away from food preparation areas. they include chlorinated hydrocarbons like lindane, Dichloro Diethyl Trichloroethane (DDT) and chloropyriphos, organo-phosphates like malathion, phosphine and diazinon and carbamates like carbandazim, aldicarb and carbaryl.

THEIR EFFECT ON PESTS

1- Stomach Poison – these are applied to plants and ingested by insects while they feed on these plants, for example, arsenic, fluorides.
2- Contact Poison – these are applied directly to pests. They penetrate and damage the insects body wall, for example, DDT, BHC (benzone hexachloride) and Indiara.
3- Residual poison – these are applied to surfaces. Insects touching them pickup a lethal dose, for example, DDT and BHC.
4- Synthentic poisons – these are applied to plants and animals. These poisons are absorbed and translocated to all parts of the organism, so that insects feeding on them acquire a lethal dose.
5- Repellents – These keep insects and other pests away from a given area, due to the odour they emanate, for example Dimenthyl phthalate (DMP), Dibutyl Phthalate (DBP) and Tulsi leaves.
6- Fumigants – These poisons are inhaled by pests and cause death, for example, hydrocyanic acid gas and sulphur dioxide.

METHODS OF APPLICATION

1- Sprays, for example, lindane, pyrethrum
2- Pellets, for example, boric acid and naphthalene balls.
3- Chalk coated or impregnated with insecticidal powder or dust.
4- Dusts, for example, BHC, DDT.
5- Meals, for example, zinc phosphide, warfarin.
6- Vapours, for example, lindane, DDVP (dichlorvos) hydrocyanic acid.

7- Lacquers, for example, insecticides mixed with lacquers, paints varnishes, these are effective for at least one year.
8- Liquids, for example, kerosene, minerals and tar oils.
9- Aerosols – they contain liquefied gas, for example freon, under pressure, which when released after the valve of the dispenser is opened, lets off the insecticidal solutions mixed with it, for example, pyrethrins, DDT.

HEALTH EFFECTS OF PESTICIDES RESIDUES ON HUMAN HEALTH

Pesticides are potentially toxic to humans. They may induce adverse health effects including cancer, effects on reproduction, immune or nervous systems. Before they can be authorize for used pesticides should be tested for all possible health effects and the results should be analyze by experts to assess any risk to humans.

Pesticides can cause short term adverse health effects called acute effects or they can cause chronic adverse effects which occurs months or years after exposure.

1- Acute (immediate health effects) – the immediate health effects from pesticides are as follows –
    - Irritation of the nose and throat
    - Burning, stinging and itching on the skin
    - Rashes and blisters on the skin
    - Nausea
    - Dizziness
    - Diarrhea
    - People with asthama may have very severe reactions to some pesticides particularly pyrithrin, pyrethroid, organophosphate and carbamate pesticides.
2- Chronic (Long term health effects) – the long term health can be as follows –
    - Cancer and tumers of various organs
    - Brain and nervous system damage
    - Birth defects
    - Infertility and other reproductive problems
    - Damage to the liver, kidneys, lungs and other body organs.
    - Serious effects of pesticides include blood cancers, lymphoma and cancers of the brain,breasts, prostate, testis and ovaries.

- Birth defects, still birth, spontaneous abortion, sterility and infertility.
- Endocrine disturbances

HEALTH EFFECTS OF CERTAIN CLASSES OF PESTICIDES

Types of Pesticides	Organs effected	Symptoms
Organophosphates and carbamates	Brain and nervous system and gastrointestinal system	Headache, nausea, dizziness, vomiting, chest pain, diarrhea and muscle pain and confusion. In severe cases patient can have convulgens, difficulty breathing, involuntary urination. Koma and death.
Soil fumigants	Skin, eyes and lungs	Extreme irritation in eyes and lungs. In severe cases pre mature birth in pregnant ladies take place prolonged use can cause cancer.
Pyrethroids	All organs specially reproductive organs	They can cause cancer and reproductive harm. Some pesticides also cause gastric damage. According to central disease control and prevention pyrethroid exposure is linked to heart disease.

PRECAUTIONS TO BE TAKEN WHILE HANDLING PESTICIDES

All pesticides are toxic to humans. Food service workers need to be adequately instructed regarding the hazards involved and should be trained to avoid them.

There are some of the precautions needed:

1- Using gloves and masks while handling these chemicals is essential.
2- Wash hands thoroughly after use.
3- Never use sprays when food is openly displayed
4- Storage of insecticides away from food articles. Holding these poisons in a separate area with their proper labels is important to avoid accidental poisoning. Also they are to be kept away from heat and open flames.
5- Knowledge of the type of pesticides banned and the specific residual limits permissible in food commodities as laid down by the Government of India is essential.
6- First hand knowledge of antidotes to various poisons is necessary for food service workers.

PESTICIDES BANNED BY THE GOVERNMENT OF INDIA

1- Aldrin
2- Chlordane
3- Heptachlor
4- Dibromo – chloropropane
5- Toxaphene
6- PCP
7- PMA
8- Pentachlorone – nitrobenzene
9- Methyl parathion
10- Nitrofen
11- Paraqualdementhyle – sulfate
12- Nicotine sulphate
13- Tetradifon

Use of DDT in agriculture and BHC on vegetables, fruits and oilseed crops and in preservation of grains have also been banned because their safety is doubtful.

5.4.2 GREEN PEST MANAGEMENT

GPM is a pest control strategy using organic or plant based material or material of natural origin. it is an extension of integrated pest management and is looked upon as an eco-friendly pest management system. Sometimes non organic substances are also used in GPM if they are non toxic and do not have a polluting effect on the environment, for example, insects bait stations that have synthetic active ingredients may be termed green. This is because the process of applying the product is also important in GPM.

GPM is a proactive mode of controlling pests unlike conventional pests control that focuses on use of pesticides. Exclusion of pests, environmental changes and physical trapping are some of the non- pesticides measures used. GPM is considered to be the most advanced form of IMP and includes continuous training of technician on common pests, inspection or identification of pests, latest development in pests control measures, understanding its habit and biology, diagnosing and correcting pest friendly conditions, effective use of new products and sealants, paper inspections of the building and rectifying inlets.

GPM strategies work with a long term visions and finding more permanent solutions to pest

control while minimizing the use of toxic pesticides and educating the public that green products are not necessarily very costly, but are beneficial in the long run.

5.5 FOOD ADULTERATION

Food is a basic need of life. The food we eat is absorbed by our body and helps carry out metabolic processes and sustain life. Food is essential for growth and various life activities. Our daily diet includes many vegetables, fruits, legumes and grains, all of which we enjoy raw or processed into delicacies. However, nowadays, we sometimes see very thin milk mixed with water, white, yellow and black pebbles in raw legumes, and small white pebbles in rice. Mixing such elements with food is adulteration.

As we struggle with overpopulation, environmental hazards, and depletion of natural resources, one of the man-made hazards is food adulteration. Food is adulterated when it is contaminated by outside influences or its natural composition or quality is altered. Food contamination has a serious impact on our health. Despite various government actions, raising awareness about the dangers of food adulteration is common practice in many countries. The food industry employs a variety of methods to contaminate food using various chemicals and synthetics. This article contains the following descriptions of food adulteration, its types and methods.

5.5.1 WHAT IS FOOD ADULTERATION?

Adulteration is a criminal offense. Food isconsidered adulterated when food does not meet legal standards set by the government. Food adulteration occurs when substances that compromised quality are intentionally or unintentionally added to food. Therefore, food adulteration can be defined as the contamination or adulteration of food or food ingredients by the addition of harmful substances.

WHAT IS AN ADULTERANT?

Substances that deteriorate the quality of food when added to it are called foreign substances. It is a substance found in other foods that affects the natural quality of the food. Contaminants may be of any form and amount. Foreign material contamination is usually harmful and can reduce product effectiveness. Adulteration may not be very harmful, but it greatly reduces the nutritional value of food. Some contaminants are classified as carcinogenic or lethal with long-term exposure. Different types of adulterants are used to mix into different foods.

When is food considered to contain foreign matter?

There are several conditions to determine whether food has been adulterated. These points are summarized below.

- Substances are added that impair the quality of the food or make it unsafe.
- Cheap or inferior substances are used as substitutes for all or some of the ingredients. Food ingredients are partially or completely removed, affecting food quality.
- The food is mixed with contaminants. Or the colors are changed to look better.
- Anything that reduces food quality is added or removed.

Examples of food contamination

Below are some examples of food contamination.

- Mixing of legumes with sand and pebble particles.
- Mixing of milk and water.
- Mixing of oils with chemical derivatives or cheap oils.
- Packing of low-quality food with fresh, superior-quality food products.

These are examples of food contamination.

Why is food adulteration done?

You may have noticed that the practice of adding water to milk has been practiced for many years in order to increase milk yield and get more benefit from less milk. Food contamination by food manufacturers and industry also occurs for a variety of reasons.

- Food adulteration is part of a business strategy to make more money through cheaper means.
- This is done to make the food attractive and also to imitate another, more popular food.
- Sometimes food adulteration is done unintentionally due to lack of awareness and knowledge.
- Contamination increases the weight of your food, which in a cheaper way increases the profit and sales.
- Population growth is also having a major impact on food contamination.
- Inefficiency of government management efforts also is a major reason for food adulteration.

5.5.2 TYPES OF FOOD CONTAMINATION

There are four different types of food adulteration.

- Intentional contamination: - When adding substances similar to the ingredients of food to food in order to gain more weight and gain more benefit. Examples: Mixture of pebbles, stones, marble, sand, mud, earth, chalk dust, polluted water, etc.
- Unintentional or incidental contamination - Poor food handling can lead to contamination. Pesticide residues on crops, larva development and presence of rodent droppings, etc. can make the food contaminated.

  Raw foods can also be contaminated with harmful microorganisms. For example meat, fish, milk and vegetables.

Pathogenic organisms	Food commonly involved	Effect and diseases
BACTERIAL		
Bacillus Cereus	Cereal Products	Nausea, vomiting and abdominal pain.
Clostridium botulinum toxins	Defectively processed meat and fish	Botulism (muscular paralysis, death due to respiratory failure)
Clostridium perfringens	Defectively processed and pre cooked meat	Nausea, vomiting abdominal pain and diarrhoea.
Salmonela	Defectively processed meat fish and egg products, raw vegetables grown on sewage	Salmonellosis (vomiting abdominal pain, diarrhea and fever)
Shigella Sonnei	Foods kept exposed or sold in unhygienic surroundings.	Bacillary dysentery
Staphylococcus Aureus	Foods kept exposed or sold in unhygienic surroundings.	Increased salaivation vomiting abdominal pain, diarrhea
Staphylococcus Pyrogenes	Foods kept exposed or sold in unhygienic surroundings.	Scarlet fever, septic sore throat
FUNGAL		
Aspergillus Flavus	Corn and ground nut	Liver damage and cancer
Claviceps purpurea (ergot)	Rye and pearl millet infested with ergot	Ergotism (burning sensation in extremities) peripheral gangrene
Fusarium Sporotrichiodies	Cereals and millets infected with fusarium	Liver damage

Penicillium islandicium	Rice	Liver damage
PARASITIC		
Trichinella spiralis	Pork and Pork products	Nausea, vomiting, diarrhea, colic and muscular pain (trichionosis)
Ascaris Lumbricoidis	Raw vegetables grown on sewage farms	Ascariasis
Entamoeba histolytica	Raw vegetables grown on sewage farms	Amoebic Dysentery
Ancylostoma Duodenale (hookworm)	Raw vegetables grown on sewage farms	Epigastric pain, loss of blood anaemia.

(Source : Swaminathan M, 1987, Food Science Chemistry and Experimental Foods, the Banglore printing and publishing company limited)

- Metal contamination: - Metal contamination occurs when metallic substances such as lead or mercury are added to food, either accidentally or intentionally.

TOXIC EFFECTS OF SOME CHEMICALS

Name	Food Commonly involved	Toxic effects
Arsenic	Fruits sprayed by led arsenate, drinking water	Dizziness, chills, cramps and paralysis leading to death.
Barium	Food contaminated by rat poison (barium carbonate)	Violent peristalsis, muscular twitching and convulsions
Cadmium	Fruit juices and soft drinks that come in contact with cadmium plated vessels, crabs, oysters and kidneys	Excessive Salivation, liver, kidney damage, prostrate cancer, multiple fractures
Cobalt	Water, beer	Cardiac failure
Copper	Acid foods in contact with tarnished copper ware	Vomiting, diarrhea and abdominal pain
Led	Some processed food, led water pipes	Paralysis, brain damage, incurable anemia
Mercury	Mercury fungicide treated seed grains or mercury	Paralysis, brain damage and blindness

	contaminated fish	
Tin	Canned Foods	Colic, vomiting, photophobia
Zinc	Food stored in galvanized iron ware	Dizziness and vomiting
Pesticides	All types of Foods	Acute or chronic poisoning causing damage to liver, kidney, brain and nerves leading to death.
Antibiotics	Meat from animals fed with antibiotics	Drug resistance, hardening of arteries and heart disease.

(Source: Swaminathan M, 1987, Food Science Chemistry and Experimental Foods, the Banglore printing and publishing company limited)

- Packaging hazards: - Also, the packaging material that packs the food can mix with the ingredients of the food, which can lead to packaging risks.

Methods of Food Adulteration

There are several methods of food contamination as follows -

- Mixing - A mixture of sand, dust, clay, mud, pebbles and food debris.
- Alternative: - Some of the healthy ingredients are replaced with cheap and inferior ingredients, which can change the nutritional value of food and cause health problems.
- Use of spoiled food: - In this method, decomposed food is mixed into healthy food. Food that conceals any kind of damage or inferiority is also considered adulterated. Intentional mixing of healthy foods with foods of questionable quality results in contamination of the final product.
- Toxic Additives: - Food adulteration also includes adding harmful substances to food in order to generate higher profits and increase sales. For example, the addition of dyes, colorings, or harmful and prohibited preservatives.
- Wrong branding: - Changes in information given to consumers such as production dates, expiry dates, ingredient lists or misleading ingredient derivatives.
- Artificial aging: - Adding chemicals to fruits and vegetables to hasten the ripening process is also considered food adulteration. For example, mangoes are ripened with carbide to meet commercial supply and demand.

Effects of food Adulteration

Food contamination has a great impact on our health. Long-term consumption of this type of food, adulterated or not, is very harmful to the body. Consuming such foods increases toxicity in the body. If the nutritional value of food contaminated with foreign substances is reduced, the food has no nutritional value for the body. Addition of chemical contaminants or dyes often proves fatal. Because they are harmful to health and carcinogenic. Some adulterated foods can directly affect internal organs, causing heart, kidney, liver, and many other organ damage or malfunction.

How to detect food Adulteration

Food contamination has many negative effects on our health. Long-term consumption of contaminated food can be fatal. Using organic foods is becoming more and more trendy these days as they provide us with the complete nutrition that certain foods are supposed to provide. It contains no harmful chemicals and is not polished with wax or other toxins. However, due to lower productivity, organic food is not always available and is more expensive than conventional products. Therefore, it is important to recognize if food is adulterated.

How to prevent food Adulteration

There are some ways to prevent food contamination are as below –

- At the industry level, stopping food adulteration requires strict and stringent legislation as well as government intervention and controls.
- Always be careful not to buy black or dark colored foods to avoid consuming food with foreign substances.
- Stop eating processed foods.
- Wash or soak fruits and vegetables well before eating. Canned foods should be checked for leaks and swelling before purchase.
- In the Indian market, FSSAI is the Government License Number for Food Safety. Therefore, always check the FSSAI food packaging, ingredient list, production date and expiration date.

5.5.3 DETECTION OF ADULTERATION IN FOOD PRODUCTS

Intentional adulterant and methods of detection

Name of the food article	Adulterant	Methods for detection of adulterants
Cereals and pulses		
Food grains	Hidden insect infestation	Take a filter paper impregnated with ninhydrin (1% in alcohol). Put some grains on it and then fold the filter paper and crush the grains with hammer. Spots of bluish purple color indicate the presence of hidden insects infestation.
Bajra	Infested with ergot	Long irregular black grain indicates ergot in 2% salt solution ergot floats.
Bengal gram flour	Yellow maize flour	When rubbed with fingers roughness indicates presence of maze flour.
Rava	Iron fillings	By moving a magnet through it iron filling can be separated
Rice	Marble or other stone	Place of small quantity of rice on the palm of the hand and gradually immersed the same in water. The stone chips will sink.
Wheat flour	Maida	When dough is prepared from adulterated wheat flour more water has to be used and chapattis made up of this flour will taste different.
Dals	Kesari dal	At 50ml of dilute hydrochloric acid to dal and keep on simmering water for about 15 min. development of pink color indicates the presence of kesari dal. On visual examination the wedge like shape can be seen in kesari dal.
	Clay, stones, gravels, led chromade, metanil yellow	Shake 5grm of dal with 5ml water and add a few drops of hydrochloric acid. A pink color shows presence of color.
Milk and Milk Products		
Milk	Water	The lactometer reading should not be 1.0 to 8
	Starch	Add tincture of iodine. Development of blue color shows the presence of starch.
Milk, Curd	Cane sugar	Add 0.1 gm of resorcinol and 1ml of concentrated HCL to 10ml of the sample and boil. A rose red color indicates the presence of cane sugar.

Khoya	Starch	Add tincture of iodine indication of blue color shows the presence of starch.
Spices (Whole and Powdered)		
Black pepper	Dried seeds of papaya fruit	Papaya seeds are shrunken, oval in shape and greenish brown or brownish black in color. They also have a different flavor.
Chilly powder	Brick powder, soap stone	Any grittiness that may be felt or settling of the sediment at the bottom of glass confirms the presence of brick powder or sand. Smooth white residue at the bottom indicates the presence of soap stone.
	Artificial color	Water soluble artificial dye can be detected by sprinkling a small quantity of chilly or turmeric powder on the surface of water contained in a glass tumbler. The soluble dye will immediately start descending in color streaks.
Cloves	Volatile oil extracted cloves	Exhausted cloves can be identified by their small size and shrunken appearance.
Common Salt	White powdered stone, Chalk	Stir a spoonful of simple salt in a glass of water. The presence of chalk will make the solution white and other insoluble impurities settle down.
Coriander powder	Common Salt	To 5ml of sample add a few drops of silver nitrate. White precipitate indicates adulteration.
Turmeric Powder	Metanil yellow	Take a teaspoon full of turmeric powder in a test tube. Add a few drops of concentrated hydrochloric acid. Instant appearance of violet color which disappears on dilution of water. If the color persist presence of metanil yellow is indicated.
Cumin Seeds	Grass seeds colored with charcoal dust	Rub the cumin seeds on palm. If palm turn black adulteration is indicated.
Beverages		
Tea leaves	Exhausted tea or black or Bengal Gram dal husk with color or any artificial color	a. Tea leaves sprinkled on wet filter paper would immediately release added color. b. Spread a little slaked lime on white porcelain tile or glass plate. Sprinkle a little tea dust on the lime will show the

		presence of coal tar dye. In the case of genuine tea, there will be only a slight greenish yellow color due to chlorophyll which appears after sometime.
Coffee	Chicory	Gently sprinkle the coffee powder sample on the surface of water in a glass. The coffee floats over the water but chicory begins to sink down within a few seconds. The falling chicory powder particles leave behind them a trail of color due to large amount of caramel they contain.
Soft Drinks	Mineral acid other than phosphoric acid	Soak a strip of filter paper in a 0.1% solution of metanil yellow and then dry. Dip one end paper into the soft drink. Wetted portion turn violet if mineral acid is present.
Fats and Oils		
Ghee or Butter	Vanaspati	Take about one teaspoon of melted ghee or butter with equal quantity concentrated hydrochloric acid in a test tube and add to it a pinch of cane sugar. Shake well for one minute and test it after 5 minutes. Appearance of crimson color in lower (acidic) layer shows the presence of vanaspati. The test is specific for seasame oil which is compulsorily added to vanaspati. Some of coal tar dyes also gives a positive test.
Mustard Seeds	Argemone seeds	Examine under magnifying glass. The argemone seeds are more blacken and rough. There surfaces are irregular and rough whereas mustard seeds have a smooth surface.
Sugar	Chalk powder	Dissolve in a glass of water chalk will settle down at the bottom.

FOOD LAWS TO ENFORCE ADULTERATION, FSSAI

FSSAI has been created for laying down science based standards for articles of food and to regulate there manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption. The FSSAI was established in 2008 under the aegis of the ministry of health and family welfare.

The food authority guides and regulates all persons engaged in manufacturing, processing, import, transportation, storage, distribution and retail of food, on issues of food safety and nutrition. The chair person and chief executive officer of FSSAI are appointed by the central government. The head office of the authority is located at FDA Bhawan, Kotla road , New delhi.

5.6 INTRODUCTION AND ROLE OF FSSAI

The main role of authority is to regulate and monitor the manufacture processing, distributions, sale and import of food to ensure safe and wholesome food to the consumers. The act lays down the following main functions for discharge by the authority –

1- FSSAI prescribes the standards and guidelines with respect to food. It also prescribes specified appropriate systems for enforcement.
2- FSSAI specifies limits for the following –
    - Additives
    - Contaminants
    - Pesticides
    - Veterinary drug residues
    - Heavy metals
    - Processing aids
    - Mycotoxins
    - Antibiotics
    - Pharmacological active substances
    - Irradiated foods
3- FSSAI lays down food labeling standards including claims on health and nutrition.
4- FSSAI directs the methods of sampling and analysis.
5- FSSAI lays down the procedure and the enforcement of quality control In relation to nay imported article of food into India.
6- It creates an information network across the country to spread rapid, reliable and objective information about food safety.
7- It trains the person who are involved in food business.
8- FSSAI promotes general awareness about food safety and food standards.

SUMMARY

In the above unit we have understood all about the various hazards that pose a great problem for the people of community on one hand pollution of water effects every population group and on the other hand food adulteration and effect of pesticides can cause serious and sometime fatal health problems. It is very important for the community to prevent the admixture and effects of these hazards as much as possible.

5.7. CHECK YOUR PROGRESS EXERCISE 1

1. Write down various types of hazards for community health and nutritional status? ----------
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   ---
2. Write a detailed note on pollution of water? ----------

   ---
3. Write short note on the following –
   A. sources of water ----------

   B. Contamination of water ----------

      ---
4. Throw light on steps of water purification? ----------

   ---
5. What do understand by Industrial offense sewage? How it can be prevented? ----------
   ---

   ---
6. State the various types of pesticides and their harmful effect on human health? ----------
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7. What do you mean by food adulteration? Write down various types of adulterants? ----------

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8. Write down test for detection of adulteration in the following food items –
    - Turmeric----------

    - Chilly powder ----------

    - Coffee powder ----------

    - Desi ghee----------

    - Various types of dals ----------

5.8 REFERENCES

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Unit – 6 NATIONAL NUTRITION POLICY

Structure

6.0 Objectives

6.1 Introduction

6.2 India's Nutritional Status

6.3 The Major Nutritional Problem of India

6.4 The need for National Nutritional Policy

6.5 Aims and Objectives of National Nutritional Policy

6.6 National Nutrition Policy Instrument

6.7 Administration and Monitoring

6.8 Check your progress

6.9 Reference

6.0 OBJECTIVES

In the earlier units we have seen that malnutrition is a grave and and endless problem of our country specially the vulnerable groups of the society face these problems even more. After going through this unit the students shall be able to address the following key points –

1- The nutrition Status of India
2- The major nutritional Problems of our country
3- The interlinked between poverty and malnutrition
4- The need for a national nutrition policy
5- The nutrition policy instruments
6- The Administration and monitoring of the National Nutrition Policy programmes at central and state level.

6.1 INTRODUCTION

Pervasive poverty leading to chronic and persistent hunger is the greatest scourge of today's developing countries. About 50% of people in India live below the poverty line, and even if they spend 80% of their income on food, they cannot eat a balanced diet. The physical manifestation of these recurring tragedies is the state of malnutrition, which manifests itself in large segments of the poor, especially women and children. Malnutrition is a condition resulting from inadequate intake of food and other essential nutrients, resulting in impaired growth and health of the body. Proper nutrition is important for staying healthy disease free and achieving an adequate level of physical activity. Malnutrition reduces adult employability and productivity and increases child mortality and morbidity. Such productivity declines lead to decreased earning power, leading to further poverty. The vicious cycle of increasing poverty and hunger as a result of malnutrition continues.

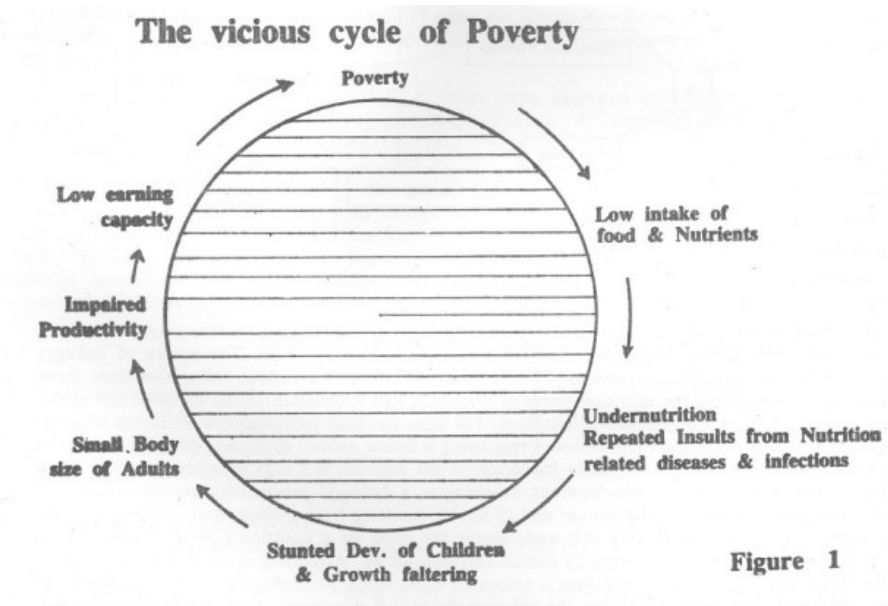


Figure 1

Malnutrition and infections are interlinked Malnourished people often get various infections. Infectious diseases increase the need for food that people cannot afford due to poverty. This leads to increased weakness, decreased immunity, and increased susceptibility to infections. Malnutrition and infectious diseases are also linked, leading to a vicious cycle of disease and poverty. Good nutrition of the population is therefore very important for the development and well-being of the country.

6.2 INDIA'SNUTRITIONALSTATUS:

A. **Overall position regarding in take:-**

1.**Calorie and protein in take:**

There is research showing that total calorie consumption at the household level is increasing. From 1957 to 1979, total protein intake in urban areas exceeded ICMR recommendations for all income groups. Even in rural areas, total consumption by all population groups was above recommended levels between 1975 and 1989. In fact, trends over time show that the average caloric intake of the lowest-income group trended significantly higher during 1970.

But as far as consumption of protein and protective foods like fats and oils are concerned there has not been a steady increase. Dietary patterns have also not changed much despite increase calorie consumption. The large calorie intake is mainly because of high intake of cereals. When there are natural disasters like famine and draught the landless agricultural labor families are worst affected.

2- **Micro nutrients intake**

In urban areas the mean intake levels of iron are according to ICMR recommended levels for all groups but in some areas adolescent girls and pregnant women are affected by Iron deficiency anemia.

B. **The Disaggregated Picture**

Although the National Nutrition Monitoring Service's report on average household food consumption levels does not show a significant reduction in intake of foods other than vitamin "A," these averages are in fact true. According to a study by the National Nutrition Monitoring Service, about 34% of households are well below average on food, even in terms of monthly household income. Although the population has fallen below the poverty line since 1960 (from 56.8% in 1987-88 to 29.2% for him), India's staggering 250 million people are malnourished to varying degrees. Suffering from The Green Revolution and other effective government programs in national food security have eradicated famine, extreme hunger and hunger. What remains is varying degrees of chronic and endemic famine, combined with the prevailing pattern of food distribution within households, which has led to serious nutritional problems for women and children, especially in rural households poses a serious threat.

So the final picture is that the nutrition situation in India is not good as a large section of people still suffers from hunger, starvation and malnutrition.

6.3 THE MAJOR NUTRITIONAL PROBLEMS OF INDIA

The Major Nutritional Problems of India can be classified as follows:

1. **Problems due to under nutrition –**

a. Protein Energy Malnutrition (PEM): Protein-energy malnutrition is the most common malnutrition among preschool children in India. The majority of them suffer from varying degrees

of malnutrition. About 43.8% of children suffer from moderate her PEM and 8.7% suffer from severe extreme malnutrition. As reported in various research reports, the prevalence of child malnutrition increased from 5.9% to 9.9% between 1975 and 1990, while the proportion of normal children (both boys and girls) increased from 5.9% to 9.9%. , indicating that moderately malnourished children decreased from 47.5% to 43.8%. .The proportion of severely malnourished children decreased from 15% to 8.7%. The urban slum child population had the lowest proportion of normal weight children and the highest proportion of severely malnourished children. The increase in the proportion of normal children was notable in all states except Orissa.

TABLE—4

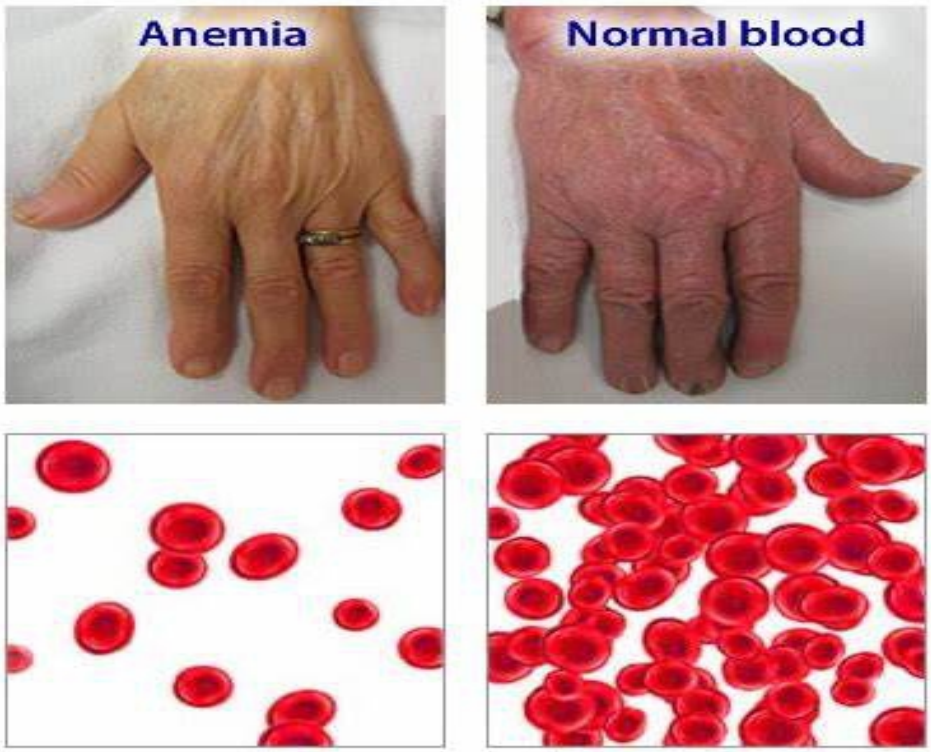
PERCENT DISTRIBUTION OF CHILDREN (1-5 YEARS) ACCORDING TO NUTRITIONAL GRADES*

State	Period	n	Normal	Mild	Moderate	Severe
Kerala	1975—79	737	7.5	35.7	46.5	10.3
	1988—90	882	17.7	47.4	32.9	2.0
Tamil Nadu	1975—79	1183	6.2	34.2	47.0	12.6
	1988—90	3337	8.0	42.0	45.8	4.2
Karnataka	1975—79	1065	4.6	31.1	50.0	14.3
	1988—90	2035	4.8	38.1	48.8	8.3
Andhra Pradesh	1975—79	809	6.1	32.4	46.1	15.4
	1988—90	2838	8.7	39.5	44.3	7.5
Maharashtra	1975—79	760	3.2	25.4	49.5	21.9
	1988—90	1666	6.7	38.0	47.5	7.8
Gujarat	1975—79	718	3.8	28.1	54.3	13.8
	1988—90	1262	7.3	33.9	45.8	13.0
Madhya Pradesh	1975—79	585	8.4	30.3	45.1	16.2
	1988—90	237	17.7	27.4	38.9	16.0
Orissa	1970—79	571	7.5	35.9	41.7	14.9
	1988—90	1175	8.1	34.6	46.6	10.7
Pooled	1975—79	6428	5.9	31.6	47.5	15.0
	1988—90	13432	9.9	37.6	43.8	8.7

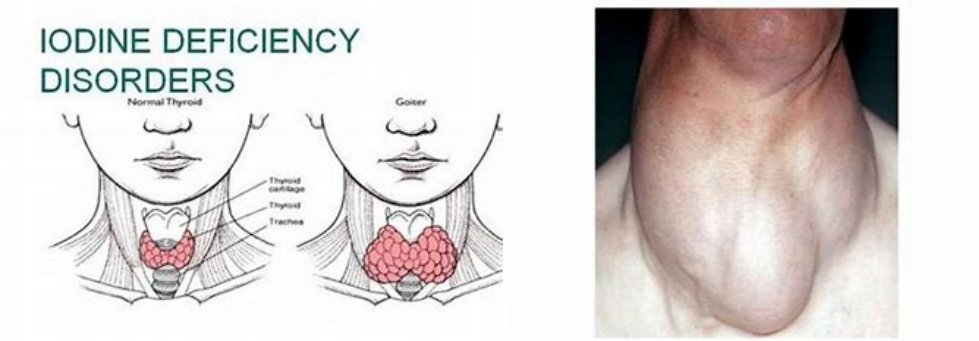
*Based on NCHS standards

Source : National Nutrition Monitoring Bureau Report of Repeat Surveys (1988—90) published by National Institute of Nutrition. Indian Council of Medical research, Hyderabad.

b. **Iron Deficiency and Nutritional Anemia:** Nutritional anemia in preschool children, adolescent girls and pregnant and lactating mothers is one of the biggest preventable health problems in India. Various studies by the National Institute of Nutrition estimate that about 56% of preschool children in the third trimester and almost 50% of pregnant mothers suffer from iron deficiency. A grain-based diet that is primarily an iron source. Low iron intake, combined with hookworm infestations and infections, exacerbates the problem. A NMMB report (1989-90) found that the slight decline in mean total iron intake between 1979 and 1990 was offset. Karnataka, Maharashtra, Gujarat and Madhya Pradesh were the only states whose intake exceeded his RDI in 1989 and 1990.



c. **Iodine Deficiency Disorder**: In India, about 40 million people suffer from goiter, and an estimated 145 million live in goiter-endemic areas. The prevalence of goiter in these endemic areas ranges from 1.5% in Assam to 68.6% in Mizoram. It is also estimated that 2.2 million children are affected by cretinism and approximately 6.6 million suffer from mild intellectual disability and varying degrees of motor impairment. Iodine deficiency is also estimated to be responsible for about 90,000 bird stagnation and neonatal deaths each year.



d. Vitamin 'A' Deficiency: More than 7 million children in India are affected by malnutrition each year. This is primarily due to a deficiency of vitamin "A" combined with protein-energy malnutrition. The most severe vitamin A deficiency leads to decreased vision, and it is estimated that about 60,000 children go blind each year. Vitamin A deficiency is assessed by xeroconjunctiva and Vito's spots. An NNMB study showed no signs of vitamin A deficiency in

infants, but the prevalence increased with age. In addition, higher prevalence was observed among school-age children of all income groups. In urban areas, it was highest among slum children (7.8%), followed by industrial workers (6.3%), middle-income groups (4.7%) and low-income groups (4.1%). According to NNMB, average intakes did not match recommended levels in any state.

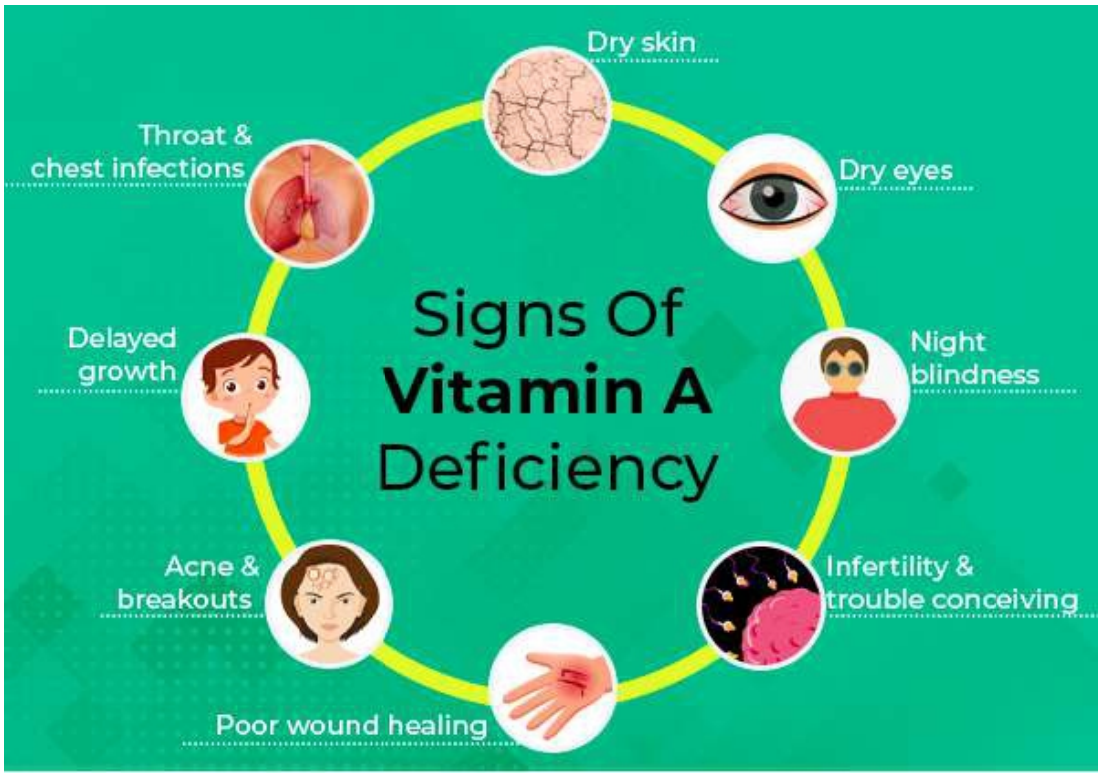


Table 5 : **Incidence of Bitot's spot among children in rural Areas (percentage)**

Year	pre-school children (1—5 years)	School going children (5—14 years)
1975	0.6	1.7
1976	1.4	4.1
1977-78	1.4	4.2
1979	0.9	1.3
1980	1.5	3.1
1981	2.7	5.1
1982	1.8	3.1

Figures indicated are the median values of the prevalence levels in the surveyed states.

Sources : Rao, N. Pralahad and Gowrinath, S.J. Diet and Nutrition Profile in Ten States of India over a Decade in the implementation of a National Nutrition Policy in India, October 28—30, 1985, Srinagar.

e. **Prevalence of Low Birth Weight Children** : India has a very high proportion of low birth weight babies. Infant nutritional status is closely related to maternal nutritional status during pregnancy

and infancy. In India, 30% of babies born are underweight (weighing less than 2500g). According to ICMR studies, mean birth weight range from 2 to 2.5 kg. The prevalence of low birth weight infants ranged from 26% to 57% in urban slums and 35% to 41% in rural areas. Low birth weight has been found to be associated with several factors, including maternal age, maternal weight, weight gain during pregnancy, gestational interval, hemoglobin <8%, and maternal illiteracy. Keeping in view the fact that birth weight is the most important determinant of child survival and that the maternal nutritional status is the most decisive factor in preventing low birth weight. The National Health Policy has set a goal of bringing down the incidence of low birth weight by 10 per cent and the present maternal mortality rate from existing rate of 4 per 1000 to 2 per 1000 live births.

Women are in all three critical stages. During infancy, childhood, adolescence and reproductive life, the risk of malnutrition and disease is increased. Child mortality figures show that female children are more likely to die than male children. This may indicate social prejudices that lead to ignoring female babies.

Table—6: Child Mortality rate (0—4 yrs.) by sex and rural urban residence

Years	Rural			Urban			Combined		
	Male	Female	Pers.	Male	Female	pers.	Male	Female	Pers.
1971	53.2	59.3	56.2	31.1	33.3	32.2	53.2	59.3	51.9
1981	43.1	48.0	45.5	20.0	20.9	20.4	39.2	43.3	41.2
1982	42.2	45.7	43.9	21.2	20.5	20.9	31.9	40.5	39.1
1983	40.5	43.1	41.8	21.1	21.7	21.4	36.5	38.7	37.6
1984	44.2	48.2	46.2	22.6	23.8	23.2	39.5	43.0	41.2
1985	41.4	45.3	43.3	19.4	22.1	20.7	36.6	40.4	38.4
1986	36.6	43.3	40.8	20.3	21.5	20.9	34.7	38.6	36.6

Source:- India, Office of the Registrar General, Vital Statistics Division, Sample Registration System, 1971, 1981—1986.

2. **Seasonal Dimensions of Nutrition –** In the Indian context, high-yield modern agriculture coexists with rain-fed subsistence agriculture. In most of India, the rainy season is the worst month for landless rural residents. Then weeding, plowing, and other tasks demand the most energy from them. For the poor, household goods are a dreaded threat, and market prices are skyrocketing. Water-borne illnesses are very common during several months of the year. These conditions will resolve or worsen by the end of October or even November. These are months of rural debt and forced market participation by small landless farmers. All these issues make eating very difficult during this time. The seasonality of employment in subsistence farming is influenced by the

difficulty of high energy demands during peak working hours and household-level variability, through food availability showing differences in food intake between men, women and children. affect nutrition. Fall below the survival limit during the deposit period.

3. **Natural Calamities and the landless** – The rural landless poor are the most vulnerable to drought, floods and famine. In pandemics and famines, the most affected groups are landless agricultural workers, followed by artisans, artisans and non-farm workers.

4. **Market distortion and disinformation** – One feature not mentioned is that famine does not cost much when food availability actually decreases. They are caused by the sudden loss of purchasing power of these marginal groups (such as landless workers) who are inevitably dependent on the market. Lessons from around the world prove that it is not acute food shortages that are at stake, but the widespread beliefs about food shortage psychosis and crop failures. This causes price increases leading to severe malnutrition situations.

5. **Urbanization** – Malnutrition in urban areas is a big problem. A study by NNMB shows that urban slum dwellers in India are almost as poorly nourished as the rural poor. The diet lacks food and nutrients. Urban slum dwellers and children in the urban informal sector are the most nutritionally vulnerable of all groups. Income insecurity and the lack of informal food systems within society push many of these families to the brink of survival. A result of a growing urban culture that encourages the diversion of a large portion of family spending to luxury goods and entertainment. Poor sanitary conditions, acute respiratory infections and epidemics characterize these urban settlements.

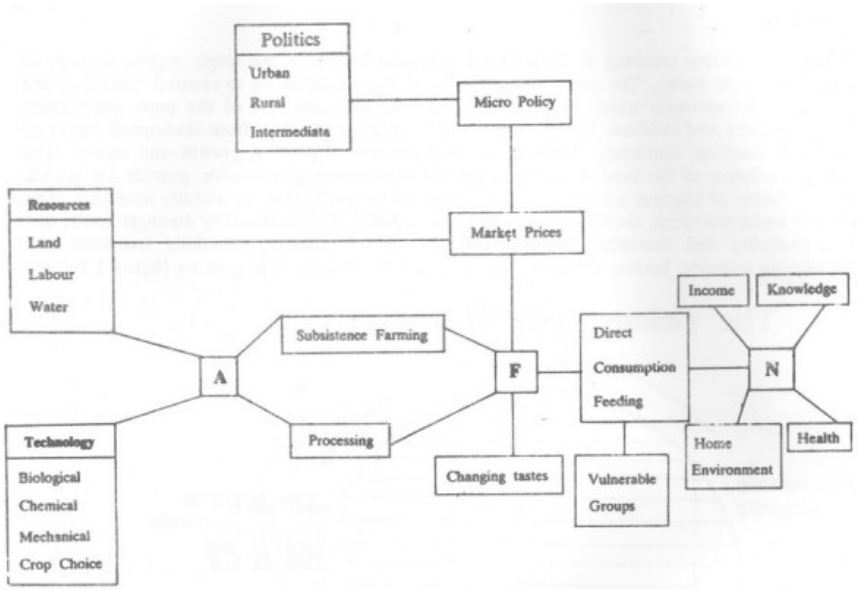
6. **Special Nutritional Problems of People living in hill, Industrial Workers, Migrant Workers and other special categories** – There are a number of regional and occupational nutritional issues that are unique to particular social groups. Nutritional imbalances among hill tribes engaged in very strenuous work, specific nutritional problems for some categories of industrial workers and migrant workers are such specific groups.

7. **Problems of over nutrition, over weight and Obesity for a small section of urban population** – The growing size of India's middle class over diet, obesity, diabetes, hypertension, cardiovascular disease and other health risks is a concern for many, especially in urban areas.

6.4 NEED FOR A NUTRITION POLICY

The need for a national food policy is implied both for good nutrition in the country and for eliminating various difficulties caused by malnutrition. The general problem of under nutrition has to

be seen as a part of larger set of processes that produces and consumes agricultural commodities on farms, transforms them into food in the marketing sector and sells the food to customers to satisfy additional nutritional aesthetic and social needs.



A common problem of malnutrition is the larger set of processes that produce and consume agricultural products on farms, transform them into food products in marketing departments, and sell food products to customers to meet nutritional, aesthetic and social needs. Within this set there are three sub sets of issues within the brought sectors of agriculture, food and nutrition. The third sub sets of nutrition is the result of the other two sub sets.

Policy interventions are necessary and paramount to affect the functioning of these subsets and thereby improve the nutritional status of societies. The nature of connectivity will determine the fate of such interventions. . The diagram above shows the various connections between these three subsystems that determine the nutritional status of a society, highlighting the complex and multifaceted nature of nutrition problems.

The National Nutrition Policy is formulated and implemented by the Ministry of Women and Child Development, Government of India. It was approved by the Government of India in April 1993 and introduced into both Houses of Parliament in August 1993. The policy aims to eradicate malnutrition. The policy also advocates a "comprehensive, integrated, multi-sectoral strategy to address the multifaceted problem of under nutrition and achieve optimal nutritional status for people."

The National Nutrition Action Plan (NPAN) was issued in 1995 to implement national nutrition policy containing specific strategies for the prevention and management of micronutrient deficiencies.

6.5 AIMS AND OBJECTIVES OF NATIONAL NUTRITION POLICY

AIMS

The policy is based on the belief that reducing malnutrition and improving the nutritional status of people will contribute significantly to human resource development and the country's overall economic and social development. The main purposes of NNP are:

- Raise awareness of the urgent need to reduce malnutrition in the country.
- Emphasize the need for cross-sectoral coordination to achieve nutrition goals.
- Coordinate relevant departments to recognize nutrition as a result of sectoral activities.
- Identify short-, medium-, and long-term strategies for achieving nutrition goals through direct policy change or direct institutional or structural change.

OBJECTIVES

Objectives of National Nutritional Policy are given below -

1- To reduce the incidence of severe (8.7%) and moderate (43.8%) malnutrition by half

2- All adolescent girls from poor families to be covered through the ICDS in all CD blocks of the country and 50% of urban slums

3- To increase per capita availability of 215 kg. for that to achieve production target of 230 MT.

4- The NNP serves as a legally binding document to substantially reduce level of malnutrition specially of vulnerable groups and to main stream nutrition in national socio economic development plans.

5- To connect with the implementation of the national growth and poverty eradication strategy.

6- Atleast 100 days of employment created for each rural landless family, employment opportunities in urban slums dwellers and urban poor.

7- Distribution of iodized salt to cover all endemic areas.

8- Nutritional blindness to be completely eradicated.

9- To expand the nutrition intervention net through ICDS, so as to cover all vulnerable children in the age group of 0 to 6 years.

6.6 NATIONAL NUTRITION POLICY INSTRUMENTS

Recognizing the fact that nutrition is a multi-sectoral problem and needs to be addressed at many levels, nutrition policy tools should focus on nutrition interventions specifically targeted at vulnerable groups in society and through various development policy tools.

Direct interventions (short-term strategies) and indirect policy instruments through long-term institutional and structural changes were advocated.

NNP aims to address this problem by utilizing direct (short term) and Indirect (long term) interventions.

Direct Short termintervention: The short term majors focused on the following strategies:

i. Ensuring proper nutrition of target groups (vulnerable groups) -

Nutrition interventions for vulnerable groups in society focus on nutrition and health of vulnerable groups and implemented many nutrition programme to improve the health status of these target group like children, adolescent, pregnant and nursing mothers.

ii. Expanding the safety net for children -

Expanding the nutrition intervention network through Integrated Child Development Services (ICDS) to cover all at-risk children in the age group 0-6.

Proper implementation of universal immunization, oral rehydration and ICDS services have been expended to cover all vulnerable children in the age group 0-6 years. 46 nutritionally at risk children by extending ICDS blocks of the country.

iii. Growth monitoring in 0-3 years age groups –

NNP aims at improving growth monitoring with closer maternal involvement, especially in 0 to 3 year old group. Growth monitoring aims identification of malnourished and provision of nutritional management for the children. This includes the provision of adequate nutrition for the children, health education of mothers, empowerment of the mother to manage nutritional needs of her children effectively.

iv. Nutrition of adolescent girls to enable them to attain safe motherhood -

NNP Reaches out to adolescent girls and prepares them to be safe mothers through ICDS. Their nutritional status is guaranteed to improve and they receive continuing education in home skills and are covered by non-formal education, especially nutrition and health education.

v. Nutrition of pregnant women to decrease incidence of low birth weight –

NNP ensure better coverage for expectant mothers. This coverage includes nutritional support from the first trimester through the first year of pregnancy. Fortification of essential foods for example salt with iodine and / or iron.

vi. Food Fortification –

NNP does fortification of essential food items with appropriate nutrients to avoid deficiency disorders like iodine deficiency, iron deficiency etc.

vii. Provision of low cost nutritious food –

Majority of the Indian population belongs to low socioeconomic groups and they cannot afford the expensive food products. There is a need to provide low cost nutritious food product for the people to maintain and improve the health of the individual family and the community by developing indigenous systems with locally available foods.

viii. Management of micronutrient deficiencies in vulnerable groups – vitamin A, iron, folic acid and iodine deficiencies in children, pregnant women and nursing mothers.

a. **Indirect Policy interventions (long term) :** The long term strategies for achieving the national goals through indirect institutional and structural changes include :

i. Ensuring food security – 215 kg of food grains should be available per person per year. This requires production of 250 MT of food grains.

ii. Improving dietary habits – The dietary pattern of the people should be improved by promoting the production and increasing the per capita availability of nutritionally rich foods at affordable cost. Production of pulses, oil seeds and other foods crops should be increase. The production of protective food crops such as vegetable, fruits, milk, meat, fish and poultry should also be increased. should encourage the production of nutritious foods and increase his per capita availability of these foods.

iii. Effective Income Transfer Policy – This will help the rural and urban poor by refocusing and restructuring anti-poverty programs such as the Integrated Rural Development Programme, and job creation programs such as Jawahar Rojgar Yojna. It is intended to improve the qualification package. By ensuring a fair food distribution through the purchasing power of the lowest economic class of the population and the expansion of the public distribution system (PDS).

iv. Improving the purchasing power –

One of the main causes of under nutrition is low purchasing power of the poor. So to increase the purchasing power government should generate jobs for the poor.

v. Poverty alleviation programmes –

Like integrated rural development programs and employment generation schemes should be encouraged.

vi. Informal sectors job –

90% of India's labor force remains trapped in low productivity jobs in the informal centers. So promising job opportunities should be offers skilled and non skilled workers.

vii. Prevention of food adulteration –

Government responsibility is to ensure that food will not cause harm to the consumers when it is prepared or eaten according to its intended use.

viii. Implementation of Land Reform –

Implementing land reform measures so that the vulnerability of the landless poor can be reduce. NNP works for increasing agricultural productivity and infusing an element of equality of local institutions.

ix. Health and family wellfare –

Women poor reproductive health in India is affected by a variety of socio cultural and biological factors. Thus efforts to improve women's education, raise enrollment and attendance rates of girls in school and reduce the dropout rate on one hand and enhance women's income on the other hand are fundamental in the long run for improvement in women and family health.

x. Nutritional surveillance –

It should include the following –

- Anthropometric assessment to identify target groups
- Assessment to monitor progress
- To assess overall program effects.
- Nutritional surveillance is necessary to understand the nutritional status of the people.

xi. Communication –

The department food and nutrition should take measures to communicate the public regarding the nutritional deficiency disorders, its preventions and information regarding the nutritional programs through affective majors of information, education and communication.

xii. Community Participation –

For the effectiveness of the services provided for the public the government should create awareness among the public so as to gain their participation.

xiii. Equal remuneration for women –

The government of India should take measures to empower women by providing equal remuneration with that of men.

xiv. Provides basic nutrition and health knowledge with a specific focus on healthy eating practices for infants

xv. Strengthen and upgrade enforcement mechanisms to prevent food tampering.

xvi. Nutritional monitoring

xvii. Communication through established media for effective implementation of nutrition policies

xviii. Ensuring effective minimum wage administration

xix. Increase community participation – by involving the community through panchayat and other beneficiary committees, or by actually involving women, especially women, to share the knowledge and awareness of society about nutrition and health in gardens and healthy eating can be enhanced through nutrition education programs that practice This will also create effective demand for all nutrition-related services at the community level.

xx. Nutrition Education Programme –

NNP ensures the education and literacy improvement

xxi. Improving the status of women –

Women should be empowered by providing basic education, employment opportunities and providing good health care services.

The policy states that the above measures should be managed through cross-sectoral coordination and activities.

6.7 ADMINISTRATION AND MONITORING

1- NATIONAL NUTRITIONAL POLICY IMPLEMENTATION

The implementation strategy involves the following –

- Setting up inter sectoral coordination mechanism at centre, state and district levels.
- Advocacy and sensitization of policy makers and programme managers.
- Intensifying micro nutrient malnutrition control activities
- Reaching nutrition information to people
- Establishing nutrition monitoring and mapping at State, District and community level.
- Developing district wise disaggregated data on nutrition.

The national nutritional policy has to be implemented at various levels. The following are the key points for its implementation –

a) At the central level the measures return above have to be administered by several ministries / department of the government of India.

b) The various government and non-governmental organization also have to follow the instructions.

c) There should a close collaboration between the food policy, the agricultural policy, the health policy, the education policy, the rural development Programme and the nutrition policy as they all help each other to achieve the target.

d) Special working groups shall be constituted in the departments of agriculture, rural development, health education, food and women and child development to implement nutrition policy wherever necessary.

e) An Inter-ministerial Coordination Committee will function in the ministry of human resource development under department of women and child development to see the proper implementation of National Nutritional Policy.

f) The National Nutrition Council will be formed in the Planning Commission, with Prime Minister as the president. Members will include concerned union ministers, a few state ministers and representatives of non-governmental organization and whose members include relevant Union Ministers, several rotating Ministers of State, experts, representatives of non-governmental organizations and grassroots leaders, especially women. Furthermore, the effective implementation

of the NNP is highly dependent on the formation of Union National/Territorial Governments and National Food Councils.

2- MONITORING OF NUTRITION SITUATION

A nutritional surveillance set up will be constituted to analyze the nutrition situation of countries population specially children and mothers. The following bodies will be responsible for this –

- National Institute of Nutrition
- National Nutrition Monitoring Bureau
- National Institute of Health and Family welfare
- Central Health Education Bureau
- Home Science Colleges
- Medical Colleges
- Non-Government Organizations

A mechanism will be made to utilize the services of medical graduates and graduates of food and nutrition science to manage the national nutrition programmes. They will be trained every year.

A nationwide monitoring system will be made to get reliable and comparable data from all parts of the country. The national nutrition monitoring bureau and national institute of nutrition will be accountable to the department of women and child development for the nutrition surveillance report. This will ensure a reliable data base in the country not only to assess the impact of ongoing nutrition and development programs but also to ensure prompt and proper action wherever necessary.

3- ROLE OF STATE GOVERNMENT

To achieve the goals said by the government of India regarding National Nutritional Policy the effective role of state government is very important. The central government has given the following set of instructions for the state government –

- There should be an apex state level nutrition council which will be chaired by the chief minister the other members will be the concerned minister of the state government, representatives of the leading NGO's working in the state and experts and representatives of related professional bodies.
- For the effective implementation of the National Nutrition Policy in the state there should be an inter-departmental coordinating committee to function under the chief secretary, which will coordinate, oversee and monitor the nutrition situation.

- Special working groups will be set in the departments of agriculture, rural development, health, education, women and child development and this group will responsible for the overall implementation and setting of the schemes.

4- MOBILIZING THE RESOURCES

To bear the cost of various nutrition interventions it is important to mobilize resources within the community for sustainability of these interventions. The following bodies have to take up this challenge –

- State government
- Local Bodies including municipal and Panchayat bodies
- Non-government Organizations
- Cooperatives
- Professional Organizations and Pressure groups

It is important to build community support and participation for the effective implementation and success of these schemes.

The state government may consider constituting similar bodies that is state coordination committees and state nutrition councils at the district level also.

6.8 CHECK YOUR PROGRESS EXERCISE 1

1- Give a detailed account of National Nutrition Policy of India ? ----------
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2- What are the various nutritional problems faced by the Indian Communities ?----------
---

3- In your opinion why the National Nutrition Policy should be implemented in India ? ----------
---

4- Throw light on the National Nutrition Policy Instruments? ----------
---

5- Write a detailed note on Administration and Monitoring of National Nutrition Policy? ----------
---

6- Write short note on the following –

- Long term interventions of the NNP ?----------

- Importance of NNP in combating malnutrition? ----------

6.9 REFERENCES

- National Nutrition Policy document by Government of India department of Women and child development, ministry of Human resource development, New Delhi.
  Community Nutrition in India, by Dr. Prabha Bisht, Star Publications Agra.

Uttar Pradesh Rajarshi Tandon
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Advance Community Nutrition

BLOCK 3

Unit-7 Nutritional Assessment **195**

Unit-8 Current Methodologies of Assessment **220**

Unit-9 Food and Nutrition Surveillance Systems **280**

INTRODUCTION (BLOCK III)

Block III deals with nutritional assessment and surveillance and current methodologies of assessment of nutritional status.

The main responsibility and priority of the government is to eradicate the problem of hunger and malnutrition from the society completely. For this reasons government implements many nutritional surveillance programs and also sets up various programs and policies to specially help the vulnerable sections of the society.

This block has three units

Unit 7 is all about nutrition assessment. If we want to eradicate malnutrition and improve the quality of life of a particular segment of the population, we must know how to do the nutrition assessment. So that we exactly know about the nutritional problems of that section. This unit will also tell us the nutritional assessment of hospitalized patients.

In **Unit 8** we will study about the current methodologies of assessment of nutritional status. These methods are collectively known as the ABCD method, which stands for Anthropometric measurements, biochemical assessments, clinical methods and dietary surveys. In this unit we will also study about the other functional indicators which tell us about a person's nutrition status.

Unit 9 this unit will tell us all about the basic concept of nutritional surveillance and how to set up a surveillance system. In later part we shall study about the monitoring and evaluation of these programs.

Unit – 7 NUTRITIONAL ASSESSMENT

Structure

7.0 Objectives
7.1 Introduction
7.2 Meaning of Nutritional Status
7.3 Meaning of Nutritional Assessment
7.3.1 Nutritional Assessment Goals
7.4 Food and Nutrition issues in the community
7.4.1 Food Security and food insecurity
7.5 Nutritional status of individual and community
7.6 Community health and factors effecting community health
7.7 Diet and Nutritional status
7.8 Importance of Nutritional assessment and screening for healthy and hospitalized patient
7.9 Diagnosis of Malnutrition
7.10 Methods of screening
7.10.1 Community : Malnutrition Universal screening tool (MUST)
7.10.2 Hospitals Nutritional Risk Screening (NRS)
7.10.3 Elderly Mini Nutritional Assessment (MNA)
7.11 The SOAP Note
7.12 Check your progress Exercise
7.13 References

7.0 OBJECTIVES

The main objectives of this unit is to make the student understand the following key points:

- The meaning of health, nutrition and nutritional status
- The key concepts of food security and food insecurity
- The meaning of assessment of nutritional status
- The importance of assessment of nutritional status of a community.
- The importance of nutritional assessment of hospitalized patient.

- The methods of screening of community, hospitalized patient and elderly people.
- The SOAP process of documentation of data.

7.1 INTRODUCTION -

Before delving into the different ways to assess nutritional status, we must first understand the importance of nutritional status.

7.2 MEANING OF NUTRITIONAL STATUS -

Nutritional status is the state of the body. It is entirely dependent on food intake and utilization. A person's nutritional status can be good or bad. A well-fed person has the following characteristics:

1. Is physically and mentally healthy.
2. Possesses good immunity against infections and diseases
3. His diet is balanced and the diet provides all the nutrients it needs to meet his body's needs
4. He has shiny hair, smooth skin, clear eyes, a well-developed physique, and lean flesh.
5. He has a wary look on his face.
6. His weight matches his height.
7. He is alert normal and he sleeps well
8. He has Strong stamina.
9. Good nutrition helps people live longer and enjoy life to the fullest.

7.3 MEANING OF NUTRITIONAL ASSESSMENT

Assessing the nutritional status of communities is one of the first steps in developing public health strategies to combat under nutrition. Nutritional assessment is the systematic process of determining the nutritional and health status of an individual or group of individuals. Nutritional status assessment can be defined as “the interpretation of nutritional status to determine whether an individual or community is healthy or malnourished”. This means that the method of determining the nutritional status of an individual or community is called nutritional status assessment.

The British Dietetic Association defines nutritional assessment as the systematic process of gathering and interpreting information to make decisions about the nature and causes of diet-related health problems affecting individuals or communities.

7.3.1 NUTRITION ASSESSMENT GOALS

Goals and targets for nutritional status are:

- The main objective of nutrition assessment is to determine the nature, extent and prevalence of malnutrition in different regions.
- To identify groups of vulnerable and most vulnerable communities
- To identify the causes of malnutrition in individuals and communities.
- To Identify and analyze environmental factors that directly or indirectly contribute to malnutrition.
- Discover facts and key actions to improve community health and nutrition.
- Assist governments in developing various strategies to combat malnutrition.
- Assist agencies in determining funding needs for each program.
- Completion of material and human resources required for government policies and programs.
- Evaluation of existing nutrition programs and policies.
- Minimize healthcare costs and improve individual and national economic productivity.

7.4 FOOD AND NUTRITION ISSUES IN THE COMMUNITY

A community can be any group, such as the population of a city or country, or residents of a nursing home. Community Nutrition is a community outlining of programs and services that provide appropriate nutritional patterns and promote healthy lifestyles to improve quality of life and promote better health for people. Community nutrition includes nutrition surveys, epidemiological nutrition studies, and the development, implementation, and evaluation of nutrition recommendations and goals.

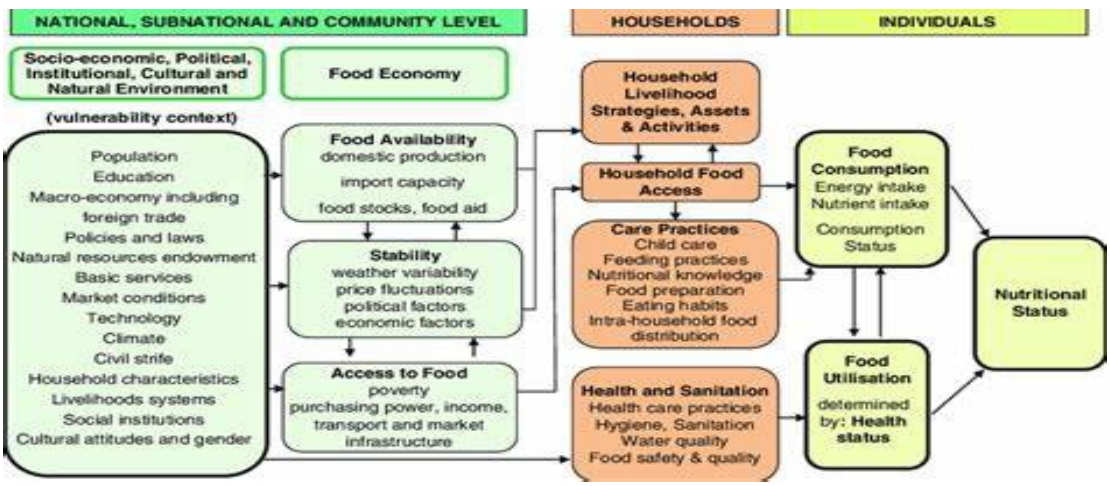
7.4.1 FOOD SECURITY AND FOOD INSECURITY

Food security is an important criterion to consider when discussing food and nutrition issues in communities. The 1996 World Food Summit defined food security as “access to adequate, safe and nutritious food for all people to meet their daily needs and dietary preferences for an active and healthy life. when it is physically, socially and economically available at all times.”

Food security plays a critical role in improving the nutritional status of communities by ensuring food for all those suffering from persistent hunger and malnutrition, as well as for vulnerable groups. Food security, in other words, means that all people have access to food at all times and are able to lead

vibrant and active lives. The National Food Security Act of 2013 ensures affordable food and nutritional security so people can live in dignity. Food security has interrelated dimensions. Availability, Accessibility, Use, Stability and Vulnerability.

- Food availability refers to domestic food production, imported food, and food supplies available in government granaries.
- Access to food means that food is within reach for all. Food accessibility is related to affordability. That means people have enough money to buy enough safe and nutritious food to meet their dietary needs. This depends on resources such as work and knowledge in addition to purchasing power.
- Access to food refers to access to food, proper use of water and good hygiene. Food preferences, food cultures, taboos and nutritional awareness at both individual and community levels influence the effective use of food.
- Food inspection. Extreme weather, economic instability and civil war affect food security and other related determinants.
- Food hazards are parameters related to vulnerable individuals or health conditions. This group has high nutritional needs and food security needs to be ensured to avoid lethal situations.



(*Source: FAO FIVIMS 2010- *FAO/FIVIMS Framework: Linkages between the Overall Development Context, the Food Economy, Households and Individual Measures of Wellbeing)

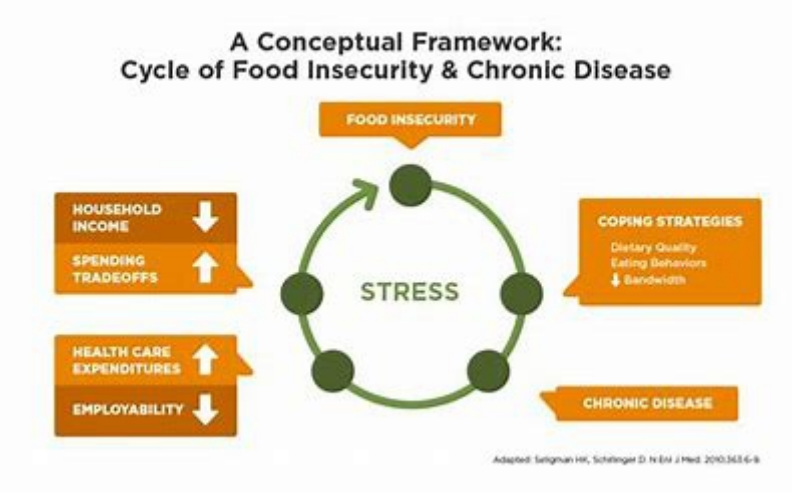
This frame work clearly depicts the components related to food security and food insecurity. Moreover, it is also noteworthy to understand that utilization of food translates food security to nutrition security. The nutrition security is defined as a balance between biological requirement in energy and nutrients and the quantity and quality of foods consumed. According to Food and

Agriculture Organisation Nutrition Security is physical, economic, environmental and social access to balanced diet and clean drinking water for every child, woman and man‖. The physical, economic, social and environmental determinants which have an impact on the food and nutritional security being

- Lack of nutritional knowledge and awareness
- Gender inequality
- Denial to safe water
- Inadequate sanitary environment
- Natural calamities
- Urbanisation
- Low per capita income
- Low Wages
- Unemployment and underemployment
- Inequalities in land distribution
- Low land utilization
- Agricultural instabilities
- Population growth
- Poverty
- Political instability
- Social discrimination

In spite of all these hurdles, it is imperative to sustain household food security, for improving nutritional status of the community.The lacunae in any of the determinants lead to food insecurity. Shortages in food production or food availability through import / export lead to food insecurity due to rising prices or disruption of distribution channels. At the household level, poor access to food is largely due to poverty, and poor households do not have sufficient resources to meet their food needs, leading to food insecurity.

Food insecurity leads to many social unrests. In addition, poor job performance, declining cognitive skills, poor academic performance, reduced income resulting from inadequate and undernourished nutrition, stress and chronic disease conditions significantly reduce individual and community productivity. Food security and good nutrition are positive outcomes in themselves and contribute significantly to economic development.



(Source: Seligman and Schilinger New England Jnl. of Medicine, 2010)

Food insecurity can be chronic or temporary. Chronic food insecurity is a situation in which households are constantly unable to obtain enough food. Temporary food insecurity is when households do not have access to food at a particular time. They arise from livestock and crop production failures, job losses, import difficulties, man-made and natural disasters, and other adverse conditions.

- Initiatives to Improve Food Security

National, regional and local availability of food depends primarily on production, stockholding and imports and exports of food materials. To overcome any kind of food insecurity, the Indian Government has built buffer stocks, set up Public distribution systems (PDS), in which the food procured by Food Corporation of India is distributed through government regulated ration shops among poorer section of the society either at free of cost or at a price very much lower than the market price. Thereby, making sure that the food is secured to all at all levels to maintain the nutritional status of a community through effective food distribution strategies.

Also, an effective food control system improves the nutritional status of the population through manifolds viz:

- Ensuring that nutrient composition of foods is retained during the food chain i.e. production, storage, handling, processing, packaging, and preparation.
- Preventing and controlling biological and chemical contamination of foods.
- Promoting hygienic practices throughout the food industry by establishing appropriate codes and standards and training of food handling personnel.

- Reducing food losses caused by spoilage, contamination or improper storage or distribution.
- Promoting a safe and honestly presented food supply by requiring composition and nutrient information on food labels.
- Educating consumers about foods that are injurious to health, or unfit for human consumption, or are nutritionally or economically degraded.

Apart from improving the nutritional status, an effective food control system encourages the orderly development of a nation's food industries, creates greater outlets for the farmers produce, stimulates increased foreign exchange earnings through export of foods that comply with acceptable standards, and avoids losses that occur when substandard foods are traded.

All of these effects help create jobs, increase incomes and ultimately improve nutritional status as consumer diets become more varied and nutritious. Strengthening food control systems and increasing consumer awareness of food handling practices and appropriate food choices are essential to ensuring adequate nutrition.

7.5 NUTRITIONAL STATUS OF AN INDIVIDUAL AND COMMUNITY

The definition of nutritional status was already explained below -

WHO defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Optimal health and a balanced diet are the rights of every individual. The goal of optimal nutrition can be achieved through a balanced diet through which normal physical and mental development is achieved. Nutritionists also emphasize that personal health needs to move from optimal health to overall health. "Bionutrition" aims to ensure overall wellness by covering all health contingencies and organically building internal reserves to combat chronic disease. Bionutrition provides preventative and curative treatment by consuming the right nutrients in the right proportions.

Malnutrition - results from a deficiency or excess of one or more essential nutrients. A broad term that includes both undernutrition and overnutrition, imbalances and specific deficiencies. Nutritional status is a condition caused by an inadequate or unbalanced diet that does not contain all the nutrients necessary for good nutrition.

Inadequate nutrition - is primarily due to inadequate energy, protein and micronutrients to meet the basic needs of the body for maintenance, growth and development, and in some cases, nutrient deficiencies. It may also be due to poor metabolism leading to proper absorption and utilization.

The effects of malnutrition are growth retardation, high morbidity and mortality among young children, retarded physical growth and reduced cognitive development, reduced productivity and reduced vitality leading to a shorter lifespan. High maternal mortality, stillbirth and low birth weight are also associated with malnutrition.

In contrast, overeating can be defined as a condition in which a person consumes nutrients in excess of what is required by the RDA.The health consequences of overeating include obesity, diabetes mellitus, hypertension, cardiovascular disease, kidney disease, liver and a high incidence of metabolic disorders and non-communicable diseases such as gastrointestinal disease.

Imbalance is a pathological condition caused by a mismatch between essential nutrients, with or without absolute nutrient deficiency.

A **specific deficiency** results from a relative or absolute deficiency of a single nutrient.

Table 1 Malnutrition – Causes and Factors

Causes of malnutrition	Factors Influencing malnutrition
Decreased availability of food due to ➢ Increase in demand due to population increase ➢ Low production ➢ Exhaustion of stocks	Lowered food intake
Ignorance	Wrong infant feeding practices, inability to make correct choice of food resulting in over/under nutrition
Economic conditions	Lowered purchasing power causing under nutrition/higher purchasing power causing over nutrition
Vulnerable groups	Inability to meet the increased nutrient needs during periods of rapid physical growth, e.g. in young children, adolescents, pregnant woman and lactating mothers; Nutrient demands

	also increases during illnesses.
Poor personal hygiene and environmental sanitation	Increased susceptibility to infections and thereby illnesses

7.6 COMMUNITY HEALTH AND FACTORS AFFECTING COMMUNITY HEALTH

The broad range of primary, preventive and curative health services needed and provided at the individual and community levels is an important consideration in maintaining the health and economy of nations. Key dynamics that determine community nutritional status include:

- **Geographical and physical conditions:** The availability of natural resources, type of land, temperature, rainfall, mode of transportation, and industry location all have a significant impact on the nutritional status of a community.
- **Agricultural practices:** The type and quantity of crops grown, nutritional parameters of produce, and post-harvest practices all affect the health of communities.
- **Demographic framework:** It is well known and established that each individual's status reflects their community. Population characteristics such as family size, family type, sex ratio, young-to-older ratio, and urban-rural population index reflect the nutritional status of the community.
- **Cultural conventions:** Maternal and child health practices, attitudes towards family planning, illness and treatment practices reflect the health status of the community.
- **Socio-economic background:** Family income, land tenure, livestock and community resources, and women's literacy all have a significant impact on community health.
- **Health string:** Morbidity and mortality by age and cause, access to health centers, governmental and non-governmental health promotion initiatives, medical advances, availability of medical and emergency medical staff, hygiene and environmental hygiene, and gestational intervals are all , a factor that helps assess the nutritional status of the community.
- **Diet practice:** Breastfeeding and weaning practices, cooking and nutrition knowledge also influence the nutritional status of the community.

Facts about good Nutrition practices to improve overall nutritional status –

- Nutrition education should start in schools and communities.

- Develop and enhance science-based food preparation skills for all ages.
- Promoting sanitary environmental practices.
- Individual Nutrition advice is an important strategy.
- Community nutritionists should raise awareness of healthy, physically active lifestyles.

7.7 DIET AND NUTRITIONAL STATUS

Food also plays a major role in human survival and social representation. There are several aspects that regulate food choices and attitudes toward food that can be termed diet-related behaviors or eating habits. Factors that influence feeding behavior include:

- **Physical factors**: Physical factors access to food, education and nutritional knowledge, cooking techniques, and time available for cooking and eating determine eating habits and determine nutritional status.
- **Psychological factors:** Emotions play an important role in determining feeding behavior. Positive emotions such as happiness cause hunger and increase food intake, while negative emotions such as stress have complex effects, causing some to eat more and some to eat less. These psychological factors and eating disorders play important roles in determining food intake and nutritional status.
- **Biological factors:** Hunger and appetite, including appearance, taste, taste and palatability, influence the sensory organs and directly affect attitudes towards available food. Delicious food served daily improves nutrient intake, creates healthier communities, and vice versa.
- **Social factors:** Peer effects, cultural influences, and family taboos are seen as important social factors that influence food choices and, in turn, nutritional status. For example, the male members of the family are served preferentially and only the leftovers are shared among the female members of the family, resulting in poor nutritional status for the female members.
- **Economic factors:** The affordability of nutritious food is determined by food income and expenditure. Non-vegetarian foods, legumes and fruits are considered expensive and therefore avoided by low-income people as they can lead to malnutrition.

7.8 IMPORTANCE OF NUTRIENT ASSESSMENT AND SCREENING FOR HEALTHY PERSON'S AND HOSPITALIZE PATIENTS

Nutrition is a basic requirement of life. It plays an important role in promoting health and preventing disease. Many factors can lead to change and malnutrition. Malnutrition is a condition resulting from,

or caused by a combination of, malnutrition or over nutrition and varying degrees of inflammatory activity, resulting in abnormal body composition and decreased function. Recognizing and correcting malnutrition is important for both health and disease. Throughout an individual's lifetime, proper nutrition is associated with several chronic diseases that have a significant impact on morbidity, mortality, and quality of life. Proper nutrition is fundamental to healthy living and aging for individuals and communities. Nutrients play a very important role in supporting healthy aging and preventing non-communicable diseases. It is very important to understand the importance of maintaining state. When communities adopt healthy, well-nourished and balanced diets, the prevalence of malnutrition and non-communicable diseases is reduced, resulting in lower healthcare costs worldwide. Malnutrition can be avoided in communities by taking the following measures -

- By improving the nutritional status of all people
- Provide ongoing nutrition education through simple and inexpensive interventions.
- Providing special nutritional and dietary supplements to vulnerable groups in society.
- Fortification of foods with micronutrients for the general population.
- Address the multiple risk factors underlying malnutrition, including physical, social and medical factors.

As such, diet and nutrition should be considered along with other socioeconomic issues as an integral part of any solution to achieve adequate nutritional intake and support optimal health and healthy aging.

In hospitals, patients who are mildly undernourished or who suffer from under nutrition or over nutrition are common in clinical practice. The prevalence of malnutrition in hospitalized adults is 50-30%. Malnutrition is an important part of co-morbidities and should be viewed as an additional condition. In hospitals, many patients are already malnourished before they reach the hospital. Those most at risk of malnutrition are the elderly, low-income, or socially isolated people who are hospitalized or living in nursing homes. People with chronic illnesses and those recovering from serious illnesses and conditions can also become malnourished. In particular, diseases and conditions that affect the ability to eat predispose patients to malnutrition.
A large survey showed that 4/5 patients did not eat enough to meet their energy and protein needs. This could be for the following reasons-

- Pelvic disease can directly affect parenting i.e. for esophageal strictures.

- Any illness can affect a patient's metabolism, increasing nutritional requirements or decreasing food intake.
- Malnutrition can also occur in hospitals due to improper catering and poor quality food.
- The patient may not like the food served.
- Fasting periods before many tests and interventions lead to even more inadequate food intake.

The consequences of under nutrition in hospitalization patient

Poor patient nutrition can result in –

• Increased complications.

• Long-term hospitalization

• High mortality

• Higher treatment costs

• Decreased efficacy or tolerability of some important treatments such as antibiotic therapy, chemotherapy, radiation therapy, or surgery.

Malnutrition is a significant burden for patients and healthcare workers and must be actively managed. If malnutrition is diagnosed, it should be treated according to an individual treatment plan. The best results are achieved when care is delivered by a multidisciplinary support team.

To improve the overall outcome of nutritional treatment, patients with overt malnutrition and those at highest risk of or developing nutritional deficiencies during hospitalization should be selected. An ideal treatment plan should begin with screening of all patients on admission and proceed to detailed or nutritional assessment of those identified as at high risk.

Appropriate nutritional interventions should be provided for malnourished or high-risk patients.

7.9 DIAGNOSIS OF MALNUTRITION

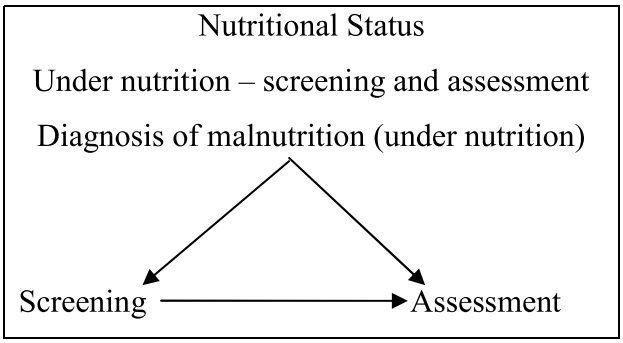
There are several ways to diagnose malnutrition, but the two most common ways to diagnose malnutrition are:

1- Calculation of the patient's body mass index - the body mass index is calculated and, accordingly, the degree of malnutrition is determined.

2- Nutrition Screening and Assessment - Screening and assessment tools have been developed to facilitate early detection of malnutrition in all patients.

3- It is important to document the nutritional status of all enrolled patients. After grading the screening procedure with stars, we will further evaluate patients who were screened and found to be at risk.

Nutrition screening is a tool for quickly and easily assessing patients at risk for malnutrition.



Screening should be a simple and rapid process that can be performed by nursing and medical staff. It should be accurate and sensitive enough to detect almost all patients at nutritional risk. Methods of nutritional screening should be validated in clinical studies.

Screening should be performed within her first 24-48 hours of first contact and periodically thereafter. Patients identified as at risk should undergo nutritional screening. Dietary assessment is a more in-depth process and should be performed on patients identified as at risk during the screening process. A nutritional assessment is also the basis for a formal diagnosis of malnutrition.

7.10 METHODS FOR SCREENING

Several validated screening tools are available and recommended by the European Society for Nutrition and Metabolism (ESPEN).

- Screening tools address some basic questions.
- Recent weight loss.
- Current Body Mass Index.
- Recent food intake.
- Severity of illness.

ESPEN publishes guidelines for nutritional screening in older adults in communities, hospitals, and institutions. The usefulness of recommended screening methods is based on predictive validity, practical validity, reliability and practicality.

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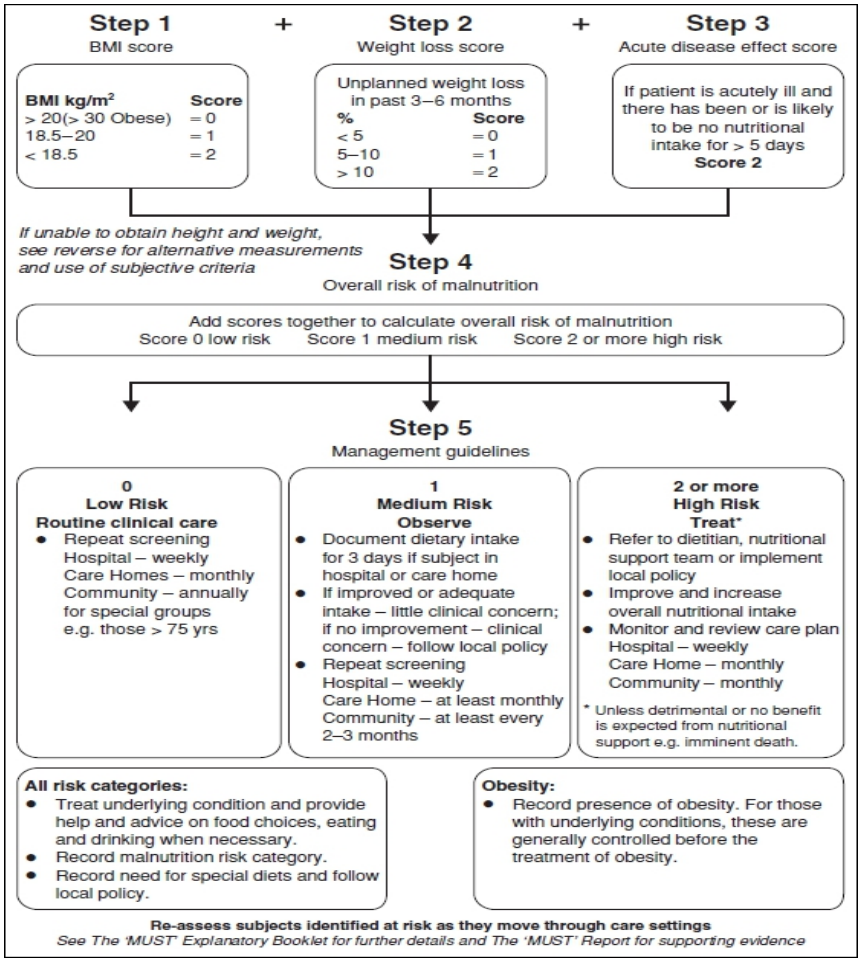
7.10.1 COMMUNITY: MALNUTRITION UNIVERSAL SCREENING TOOL (MUST)

For general community screening, MUST is a useful tool for rapid assessment of levels of malnutrition. The main drawback is that recent food intake is not taken into account and calculation of weight loss rate and his BMI is causing problems in some units.



(Kondrup J et al, ESPEN guidelines for nutrition screening 2002, Clinical Nutrition 2003 22. 415-421)

7.10.2 HOSPITAL: NUTRITIONAL RISK SCREENING (NRS)

NRS-2002 is a simple and well-validated screening tool. The NRS-2002 begins with questions on his four items above for the "initial" screening. In case of significant deviation from normal, if you answered 'yes' to one of the questions, a 'final' screen will follow. Final screening includes documentation of impaired nutritional status and severity of illness. Each parameter can be assigned a score from 0 to 3. Through the validation process, a final score of 3 or higher was determined to indicate that the patient would benefit from the nutritional support plan.

Table 2 Nutritional Risk Screening (NRS 2002); Initial screening questions

Initial screening, I		Yes	No
1	Is BMI < 20.5?		
2	Has the patient lost weight within the last 3 months?		

3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill? (e.g. in intensive therapy)		
Yes: If the answer is 'Yes' to any question, the final screening is performed. **No:** If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient is (e.g.) scheduled for a major operation, a preventative nutritional care plan is considered to try to avoid the associated risk.			

Table 3 Nutritional Risk Screening (NRS 2002); Final screening

Final screening II			
Impaired nutritional status		**Severity of disease** (≈ increase in requirements)	
Absent **Score 0**	Normal nutritional status	Absent **Score 0**	Normal nutritional requirements
Mild **Score 1**	Wt loss >5% in 3 months or Food intake below 50-75% of normal requirement in preceding week	Mild **Score 1**	Hip fracture Chronic patients, in particular with acute complications: cirrhosis, COPD Chronic hemodialysis, diabetes, oncology
Moderate **Score 2**	Wt loss >5% in 2 months or BMI 18.5 - 20.5 + impaired general condition or Food intake 25-50% of normal requirement in	Moderate **Score 2**	Major abdominal surgery Stroke Severe pneumonia, hematologic malignancy

	preceding week		
Severe **Score 3**	Wt loss >5% in 1 months (>15% in 3 months) or BMI < 18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week	Severe **Score 3**	Head injury Bone marrow transplantation Intensive care patients (APACHE>10)
Score: +		**Score:**	**=Total score:**
Age score:	if ≥ 70 years: add 1 to total score above		**= age-adjusted total**
Score ≥ 3: the patient is nutritionally at-risk and a nutritional care plan is initiated. Score < 3: weekly re-screening of the patient. If the patient is (e.g.) scheduled for a major operation, a preventative nutritional care plan is considered to try to avoid the associated risk.			

7.10.3 ELDERLY: MINI NUTRITIONAL ASSESSMENT (MNA)

Two specific well-validated instruments of hers are available for patients 65 years and older (15, 16). Full MNA (15) and shortened form (MNA-SF) (16). MNA is a combined screening and assessment tool. A complete MNA consists of her two parts:

1- screening

whether the patient is at risk

2 ratings

Table 4 Mini Nutritional Assessment (MNA); Screening

A	**Has food intake declined over the past 3 months due to loss of appetite digestive problems, chewing or swallowing difficulties?** 0 = severe loss of appetite 1 = moderate loss of appetite 2 = no loss of appetite
B	**Weight loss during last months?** 0 = weight loss greater than 3 kg 1 = does not know 2 = weight loss between 1 and 3 kg 3 = no weight loss
C	**Mobility?** 0 = bed or chair bound 1 = able to get out of bed/chair but does not go out 2 = goes out
D	**Has suffered physical stress or acute disease in the past 3 months?** 0 = yes 2 = no
E	**Neuropsychological problems?** 0 = severe dementia or depression 1 = mild dementia 2 = no psychological problems
F	**Body Mass Index (BMI) [weight in kg]/[height in m]^2?** 0 = BMI less than 19 1 = BMI 19 to less than 21 2 = BMI 21 to less than 23 3 = BMI 23 or greater

Screening score (subtotal max. 14 points)

12 points or greater	**Normal - not at risk**	**-> no need to complement assessment**
11 points or below	**Possible malnutrition**	**-> continue assessment**

Table 5 Mini Nutritional Assessment (MNA); Assessment

G	**Lives independently (not in a nursing home or hospital)?** 0 = no 1 = yes
H	**Takes more than 3 prescription drugs per day?** 0 = no 1 = yes
I	**Pressure sores or skin ulcers?** 0 = no 1 = yes
J	**How many full meals does the patient eat daily?** 0 = 1 meals 1 = 2 meals 2 = 3 meals
K	**Selected consumption markers for protein intake?** At least one serving of dairy products (milk, cheese, yoghurt) per day yes? no? Two or more serving of legumes or egg per week yes? no? Meat, fish or poultry everyday yes? no? 0.0 = if 0 or 1 yes 0.5 = if 2 yes 1.0 = if 3 yes
L	**Consumes two or more servings or fruits or vegetables per day?** 0 = no 1 = yes
M	**How much fluid (water, juice, coffee, tea, milk...) is consumed per day?** 0.0 = less than 3 cups 0.5 = 3 to 5 cups 1.0 = more than 5 cups
N	**Mode of feeding?** 0 = unable to eat without assistance

	1 = self - fed with some difficulty 2 = self - fed without any problems
O	**Self-view of nutritional status?** 0 = view self as being malnourished 1 = is uncertain of nutritional status 2 = views self as having no nutritional problem
P	**In comparison with other people of the same age, how do they consider their health status?** 0.0 = not as good 0.5 = does not know 1.0 = as good 2.0 = better
Q	**Mid - arm circumference (MAC) in cm?** 0.0 = MAC less than 21 0.5 = MAC 21 to 22 1.0 = MAC 22 or greater
R	**Calf circumference (CC) in cm?** 0 = CC less than 31 1 = CC 31 or greater

(Dupertuis YM, Kossovsky MP, Kyle UG, et al, Food intake in 1707 hospitalized patients, a prospective, comprehensive survey, clinical nutrition 2003,22(2):115-23)

Assessment score (max. 16 points)

Screening score (max. 14 points)

Total assessment (max. 30 points)

Malnutrition Indicator Score

17 to 23.5 points -> at risk of malnutrition

Less than 17 points -> malnourished

The initial long version of the mini-nutritional assessment (MNA) was followed by a simpler one. The MNA-SF is derived from the original MNA and includes only 6 items. Recently it was revised and the

calf circumference was added if the BMI cannot be calculated. The short form of the MNA has turned out to be as good as the long version, and it is more rapidly done. If the score is 11 or less the patients is regarded as at risk for malnutrition and the full MNA has to be done.

Table 6 Mini Nutritional Assessment Short Form (MNA-SF)

A. Has food intake declined over the past 3 months, due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe loss of appetite
1 = moderate loss of appetite
2 = no loss of appetite
B. Weight loss during last 3 months?
0 = weight loss greater than 3 kg
1 = does not know
2 = weight loss between 1 and 3 kg
3 = no weight loss
C. Mobility
0 = bed- or chair-bound
1 = able to get out of bed / chair but does not go out
2 = goes out
D. Has suffered psychological distress or acute disease in the past 3 months?
0 = yes
2 = no
E. Neuropsychological problems?
0 = severe dementia or depression

1 = mild dementia
2 = no psychological problems
F1. BMI
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater
IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2. DO NOT ANSWER QUESTION F2 IS QUESTION F1 IS ALREADY COMPLETED
F2. Calf circumference
0 = CC less than 31cm
1 = CC 31cm or greater

Screening score (max 14 points)

12 - 14 points: **normal nutritional status**

8 - 11 points: **at risk of malnutrition**

0 - 7 points: **malnourished**

NUTRIC-SCORE FOR RISK SCREENING IN THE ICU

For ICU patients a scoring system was developed to identify patients who will benefit from nutritional therapy. Initially several variables were included in this score: Age, baseline APACHE II, baseline SOFA score, number of co morbidities, days from hospital admission to ICU admission, Body Mass Index (BMI) < 20, estimated % oral intake in the week prior, weight loss in the last 3 months and serum interleukin-6 (IL-6), procalcitonin (PCT), and C-reactive protein (CRP) levels. This score was adapted and now includes 6 domains. It has been shown that the score can also be used effectively without measurement of IL-6.

Table 7 Nutric scoring system

Variables in Nutric score	Nutric scoring system Range	Nutric scoring system Points
Age	**< 50**	**0**
	50 - < 75	**1**
	> 75	**2**
APACHE II	**< 15**	**0**
	15 -20	**1**
	20 - 28	**2**
	> 28	**3**
SOFA	**< 6**	**0**
	6 - < 10	**1**
	> 10	**2**
Co-morbidities	**0 - 1**	**0**
	2 +	**1**
Days from hospital to ICU	**0 - < 1**	**0**
	1 +	**1**
IL-6	**0 - < 400**	**0**
	400 +	**1**

Patients with a high Nutric-score at admission to the intensive care have a higher mortality risk. The NUTRIC scoring system was externally validated and may be useful in identifying critically ill patients most likely to benefit from optimal amounts of macronutrients when considering mortality as an outcome.

7.11 THE SOAP NOTE

After doing the nutritional assessment of the hospitalization patient it is very important to keep the acquired data safely, so that it can be assessed by the medical professionals to make a nutritional care plan for the patient. These entries can be filled up in the medical records by a process called the SOAP note. The content of the soap note are as follows:

Subjective data – the information which is obtained from the patient or the patient's family is compiled in the form of a data for later use.

Objective data – the data which is gathered from the results of various test, analysis, diagnostic procedures and observation by health care team.

Assessment – the subjective and objective data of patient's are assessed by the medical professionals to exactly know the patients nutritional and health status.

Plan – After assessment specific plans are made for individuals' patients. The plans have the following points –

- specific treatment plans,
- nutritional care plans,
- modified diet,
- nutritional counseling goals etc.

At the end the clinical dietician documents the actual nutritional care to be provided. This has the following points –

1- Type of diet to be given
2- Adjustments for intolerance of the diet
3- Diet instructions.

7.12 CHECK YOUR PROGRESS EXERCISE

1- Define health nutrition and nutritional status? ----------
---

2- Write down importance of assessing nutritional status of a community----------
---

3- Write down various methods of screening for assessment of nutritional status? ----------
---

4- Write short note on the following –
   - Mini Nutritional Assessment (MNA) ----------

   - Nutritional Risk Screening (NRS) ----------

5- Throw light documentation of data through SOAP method?----------
---

6- Write a detailed note on Malnutrition Universal Screening Tool (MUST)?----------
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7.13 REFERENCES

- Prabha Bisht, 2017, Community Nutrition in India, Star Publication, Agra
- Swaminathan M, Essentials of food and Nutrition, Bangalore publishing Limited, Bangalore.

Unit – 8 CURRENT METHODOLOGIES OF ASSESSMENT OF NUTRITIONAL STATUS

Structure

8.0 Objectives

8.1 Introduction

8.2 Methods of nutritional assessment

- 8.2.1 Classifications of Methods of Nutritional Assessment

8.3 Direct Assessment methods – ABCD Analysis

- 8.3.1 Nutritional Anthropometry
- 8.3.2 Bio Chemical Assessment
- 8.3.3 Clinical Assessment
- 8.3.4 Diet Survey

8.4 Biophysical Methods

8.5 Functional Assessment

- 8.5.1 Test for grip strength
- 8.5.2 Test for Respiratory Fitness
- 8.5.3 Harvard Step Test
- 8.5.4 Squatting Test

8.6 Methods of Indirect Assessment of Nutritional Status

- 8.6.1 Vital Statics
- 8.6.2 Infant Mortality Rate
- 8.6.3 Perinatal Mortality Rate

8.7 PRA (Participatory Rural Appraisal)

8.8 Check your progress excercise

8.9 References

8.0 OBJECTIVES

The major objectives of such an assessment is to determine the following points –

- To determine the type of nutritional deficiency (What)
- To determine the magnitude or the numbers affected (How many)
- To determine the distribution of malnutrition in different geographical areas (Where)
- To identify the at-risk groups (who)
- To determine the contributory factors (why)

The above said points indicate that the goal of the nutritional assessment of communities is to discover facts about nutritional situation and determine actions to improve nutrition and health. To get the exact magnitude type, prevalence, and reasons of malnutrition it is essential to plan appropriate intervention strategies. That is why in the formulation of public health strategy to combat malnutrition assessment of nutritional status of community is the first step.

So, the principle aim of the Nutritional assessment of a community are –

- To map out the magnitude and geographical distribution of malnutrition as a public health problem.
- To discover and analyze the ecological factors that are directly or indirectly responsible for malnutrition.
- To suggest appropriate corrective measures not only for the control and eradication of malnutrition, but also for the subsequent nutritional upliftment of the society.

8.1 INTRODUCTION

Nutritional status is the state of the body with respect to food intake and utilization. Human nutritional status is defined by George Christakes (1973) as ``the state of human health affected by nutrient intake and utilization as determined from the interrelationship of information from physical, biochemical and dietary studies".

A person's nutritional status can be good or bad. Good nutrition means a balanced diet that provides all the nutrients to meet your body’s need. Such a person is said to be optimally nourished. Good nutrition is reflected in shiny hair, smooth skin, active facial expressions, clear eyes, well-developed physique, and lean flesh. His weight should be appropriate for his height and his reaction should be normal.

Good nutrition is also reflected in endurance and disease resistance. It can extend a person's life. In short, well-fed people live their lives to the fullest.

In the last unit we studiedthat the strategy to determine the extent and severity of nutritional problems is called nutritional assessment or assessment of nutritional status. We must first understand what we mean by the term nutrition status.

Nutritional status, refers to the state of health of an individual which is affected by the intake and utilization of nutrients. Thus the process of nutritional assessment is done to assess the severity and magnitude of nutritional problems prevalent in communities due to faulty intake or utilization of nutrients.

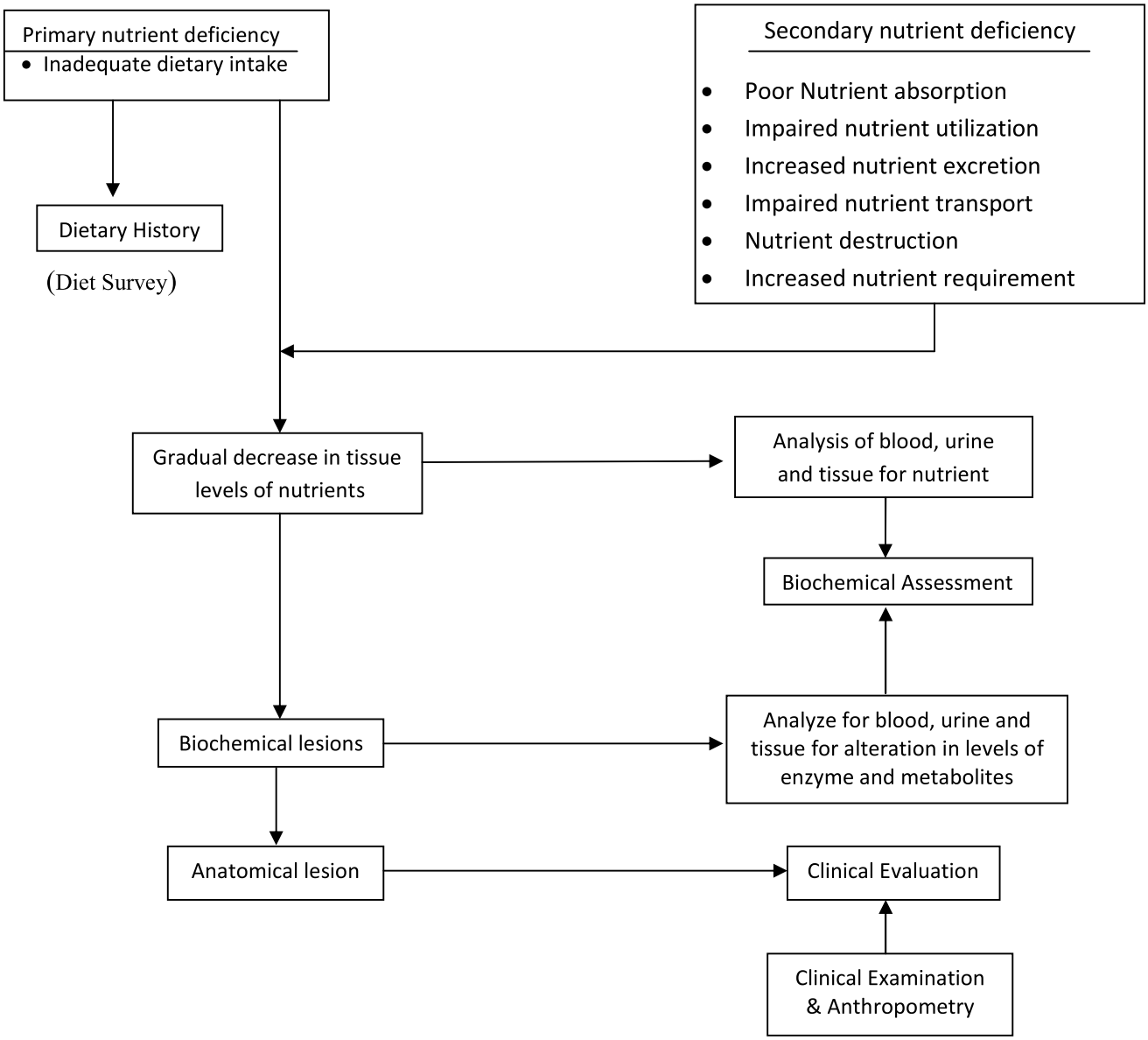
8.2 METHODS OF NUTRITIONAL ASSESSMENT

Various methods of nutritional assessment help us to determine the severity, prevalence and causes of malnutrition but it is equally important to know how the disease progresses. The primary cause of any nutritional deficiency is inadequate supply of nutrients. The cause of this may be poverty, non - availability of foods or lack of nutritional knowledge.

The dietary inadequacy leads to the following changes in the affected person’s body.

- Changes in muscles mass.
- Muscle wasting
- Progressive anatomical changes in some organs of the body.
- When Inadequacy further continues, there are sub clinical changes also which can be recognized by bio chemical, bio physical or functional assessment.

Before discussing the methods of assessment let us review the sequence of development of nutritional deficiency that starts from dietary inadequacy to when the signs and symptoms of nutritional deficit becomes evident. A clear understanding of the stages of deficiency is crucial in order to select the techniques needed to assess the nutritional status.



Development and Assessment of nutritional deficiency

(Source: Text book of community nutrition by Suryatapa Das, 5th edition academic publishers)

8.2.1 CLASSIFICATION OF METHODS OF NUTRITIONAL ASSESSMENT

The methods of nutritional assessment are of following two types –

Direct Methods	Indirect Methods
Anthropometry	Vital health statistics
Bio chemical and laboratory assessment	Ecological factors assessment
Clinical examination	
Diet survey	

8.3 DIRECT ASSESSMENT METHODS - THE ABCD ANALYSIS

Direct assessment methods are precise methods in which an individuals nutritional status is accurately assessed and measured. It is usually done for smaller population so that it is possible to assess each and every individual seperately. In this type of Assessment methods certain indicators are measured on a specific sample of the community. Direct assessment can be conducted by several methods of which the most important methods include anthropometry, bio chemical assessment, clinical studies and diet survey. They are collectively called **ABCD analysis.**

8.3.1 NUTRITIONAL ANTHROPOMETRY

The word Anthropometry comes from two words Anthropo means "human" and metry means "measurement". Nutritional Anthropometry is a tool concerned with the measurements of the variation of physical dimensions, and the gross compositions of the human body at different age levels and degrees of nutrition.

Human body reflects changes in morphological variations due to inappropriate food intake or malnutrition. Information on this aspect is important and has practical applications

APPLICATION OF ANTHROPOMETRY

- Assessment of extent of under nutrition in vulnerable groups of the population.
- Anthropometry measurement are reliable tools for assessment of subclinical forms of malnutrition.
- Anthropometry measurement helps in Monitoring of individual children at regular intervals to find out whether there is any faultering in growth during the intervals and to help in early detection and initiating prompt remedial measures.
- Identification of children who are at risk of under nutrition, to target and prioritize nutrition action programs under nutrition.
- Anthropometry measurement is useful in mid-term appraisal or terminal evaluation of the ongoing intervention programs to assess whether these programs have achieved the objectives or not.
- It is useful in assessing an individual response to nutritional rehabilitation.

- Anthropometry can be utilized as a tool for nutritional surveillance and for collection of secondary data on indicators which may directly or indirectly affect the nutritional status.
- To appraise the impact of seasonal variations of food supplies or nutritional status of the community.

By going through the above-mentioned points, we understand the importance of nutritional anthropometric measurements.

Common Anthropometry Measurements

Although a large number of tests under Anthropometry are available, the simplest, quickest and easiest methods will give maximum information concerning the actual problems under investigations. The most commonly used measurements used in a routine nutritional assessment are the following –

- **Body mass** as judged by body weight.
- **Linear dimension** such as height
- **Reserves of energy protein and body composition as judged by the principle soft tissue. Sub-cutaneous fat and muscle circumference.**
- **Muscles development by mid upper arm circumference (MUAC)**

Circumference of head and chest are also included in some surveys covering children under five. For assessment of adipose tissues, waist and hip circumference are also used along with fat fold thickness measurements.

Body weight – body weight is the most commonly used and the simplest reproducible Anthropometry measurement to assess the nutritional status of the individuals specially children.

Significance of Body weight –

- Body weight indicates the body mass and is a composite of all body constituents like water, mineral fat, protein and bone.
- The serialmeasurement of body weight in growing children give a better index for growth monitoring.
- It is applicable not only by health personal, but often by less educated parents for whom it is useful as source of health education.

- The evaluation of the significance of the weight measurement must take into account length, frame size, proportion of fat, muscle and bones and the presence of pathological weight due to odema or any other ill health condition.
- Rapid loss of body weight in children should be considered as an indicator of potential malnutrition.

Equipment's and techniques of Body weight measurement – the choice of suitable weighing scale is vital to obtain accurate measurement of body weight. It should have the following qualities –

- Should be sturdy
- Inexpensive
- Easily transportable
- It should be accurate within the limits required for example 0.1 kg.

Two types of weighing machines based on two different principles are available –

- Beam or lever balance weighing scale – they are also known as salter weighing scales. They are light and portable and can be hung from a roof or tree, placing a child in the sling and then the weight is recorded by the measurer. Beam balances are extensively used in ICDS projects.



- The spring balance used in the bathroom type weighing scales are not recommended as it easily become stretched and inaccurate from frequent use.



The following points should be kept in mind while measuring the weight -

As far as possible weight should be taken with minimum clothing, without shoes and without holding any support.

In case of infants the weight can be taken with an elder person preferably mother carrying the infant / child and subtracting the weight of elder to get the correct weight of infant child.

The zero error of the weighing scale should be checked before taking measurement and should be corrected as and when required.

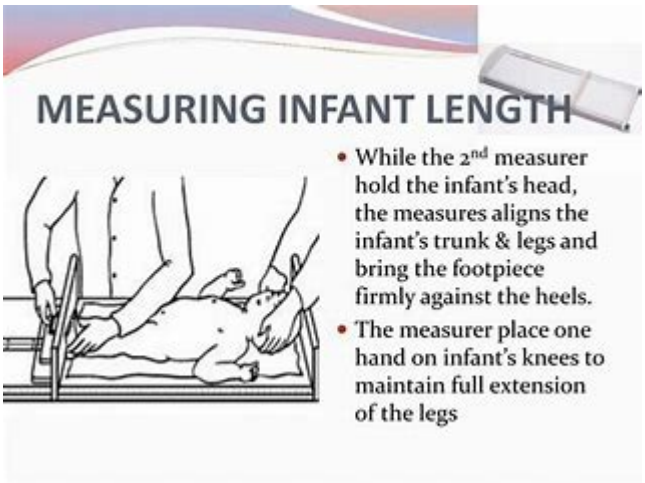
The mean of three successive measurement will give the final body weight of the subject.

Height – The height and length of the individual is greatly influenced by hereditary and environmental factors. The maximum growth potential of an individual is determined by hereditary factors. Whereas the environmental factors like nutrition and illness (morbidity) determine the extent up to which the genetic potential is expressed. Height is considered an index of chronic or long duration malnutrition. Inadequate dietary intake and / or recurrent infections reduce nutritional bio availability resulting in growth retardation. During periods of severe nutritional deprivation, linear growth rate slows down, leading to stunting in a individual.

Height is very reliable parameter that reflects the total increase in size of an individual up to the moment it is determined.

Equipment's and techniques ofheight measurement –

Infantometre – in case of infant and early pre-school children **recumbent length** (crown – heel length) is measured with the help of infantometre.





The infant is laid on the board which is a flat surface. The head is positioned firmly against the fixed head board, with eyes looking vertically. The knees are extended and the legs need to be held straight and firmed with the feet touching the sliding board. The upright sliding food piece is move to obtain firm contact with heels and the length reads to the nearest 0.1 cm.

Anthropometer or standiometer – Within this a vertical measuring rod is used to measure the height of older children and adults. The subject should stand on a flat floor by the scale with feet parallel and with the heels buttock, shoulder and back of head touching the upright. The moving head piece of the anthropometre should be lowered to rest flat on the top of the head And the reading should be taken. The measuring scale should be two meter high and capable of measuring to an accuracy of 0.5 cm.



Head Circumferences – Measuring the head circumference is a standard procedure in pediatrics to detect the pathological conditions accompanied by a large head with hydrocephalus or to small skull with microcephalus.

Head circumference is related mainly to size of brain, which increases quiet rapidly during infancy. It normally reflects age rather than health or nutrition. The head circumference increases rapidly during first year of life but it may be affected in second year of life due to protein energy malnutrition.

In nutritional anthropometry the chest / head circumference ratio is of value in detecting PEM in early childhood. The head circumference may also be used as a rough additional guide in age assessment.

Equipment and techniques of Head Circumferences – Measurement of head circumference is done with a narrow (below 1cm wide), flexible, non-stretch measuring tape (made of fiber glass) by placing it firmly round the frontal bone just superior to the **supra orbital ridges**, passing it round to head at the same level on each sight, and laying it over the maximum occipital prominence at the back of the head. Measurement should be made to the nearest 0.1cm.

Chest Circumference – The chest circumference in normally nourished children grows faster then head during the 2nd and 3rd year of life. As a result, the chest circumference over takes head circumference by about 1 year of age. As a result, between 6 month and 5 years the ratio of chest / head circumference of less than 1 may be due to failure to develop or to wasting of muscle and fat of the chest wall and can be used as a community indicator of PEM of early childhood. In such circumstances due to poor growth of chest, the head circumference may remain to be higher than the chest even at the age of 2.5 to 3 years.

Equipment and techniques of Chest Circumferences – A narrow flexible and non-stretchable fibre glass tape is used. The chest circumference is taken at the nipple level preferably in mid inspiration. Measurement should be made to the nearest 0.1 cm.

HEAD AND CHEST CIRCUMFERENCES MEASUREMENT IN FIRST FIVE YEARS OF LIFE

Age (month)	Head circumferences (cm)	Chest Circumferences (cm)
at birth	35.0	35.0
03	40.4	40.0
06	43.4	44.0
12	46.0	47.0
18	47.4	48.0
24	49.0	50.0
36	50.0	52.0
48	50.5	53.0
60	50.8	55.3

[source: Growth and Development of Children, Fourth Ed, by E.H. Watson and G.H. Lowrey-1962. Year book Medical Publishers inc.]

Mid Upper Arms Circumference (MUAC) - Poor muscle development or muscle wasting are important indicators of all forms of protein energy malnutrition in early childhood. Mid Upper Arm circumference and calf circumference are recognized to indicate the status of muscle development but

of the two MUAC is considered more practical as it is simpler and easily accessible in any age and gender.

Between 1 to 5 years of age the arm circumference remains fairly constant. Hence this can be used as tool not only to assess malnutrition but also to determine the mortality risk in children. It co-relates with weight, weight for height and clinical signs of PEM.

Equipment and techniques of Mid Upper Arms Circumference (MUAC) – The MUAC is taken in the left hand along the midpoint between the tip of the acromion of the scapula and the tip of the olecranon of the ulna bone of the forearm, with the arm bent at the elbow at a right angle and marked with a marker. The arm should hang freely and be measured with a flexible, non-stretching fiberglass tape measure. Measurements below 12.5 cm indicate severe PEM, 12.5 cm to 13.5 cm indicate moderate PEM, and above 13.5 cm the child is considered well-fed. The value should be 27-30 cm for adult females and 30-33 cm for adult males. This measurement is taken using Shaquille tape, quack sticks, or bangles.

Subcutaneous Body Fat Measurement – The main store of energy reserves is subcutaneous fat. The main reservoir for energy storage is subcutaneous fat. There is a strong relationship between obesity and caloric reserves, muscle mass and protein status, and it can be used as a tool to assess overall nutritional status at specific life stages.

Equipment and techniques of Subcutaneous Body Fat Measurement - Skinfold calipers are an efficient way to measure skinfold thickness wherever you need it: shoulder blades, chest, triceps, biceps, abdomen, thighs, and humerus. considered to be a tool. , and USA-MRNL calipers. Una calipers are used in India. A standard contact clamping surface of 20.40 mm and an accuracy of 0.1 mm are considered in the selection. The device should apply a constant pressure of 10 g/sq. mm across the subcutaneous fat thickness. A measured fat fold consists of a double layer of skin and fat. A fat fold parallel to the long axis is pinched between the thumb and forefinger of the left hand, without passing through the underlying muscle, and measured with a caliper.

The Techniques of Measurement at Various Body Sites

Site	Measurement
Sub Scapular	A diagonal fold is natural cleavage line just inferior to inferior angle of scapula with calliper applied 1 cm below
Suprailiac	An oblique fold is grasped behind to midaxillary line and above the iliac crest.

Triceps	Midpoint between acromion of scapula and olecranon of ulna is measured and vertical fold 1cm above line on posterior aspect of arm.
Biceps	Vertical skin fold is lifted over the belly of biceps brachii at the line marked for triceps, calliper is applied 1cm below finger.
Thigh	A point is located in the anterior midline of thigh between hip and knee joints.
Chest	The skin fold will run diagonally between shoulder and apposite hip.
Abdomen	A vertical point adjacent to the umbilicus is measured

Interpretation of Anthropometric Measurements -

- **Assessment of Children –** the elementary measurement consisting of height, weight, skin fold thickness, head, chest, and mid upper arm circumference can be expressed in numerous ways in relation to reference data and the outcome related to the nutritional status. The anthropometric data can be expressed in a number of ways in relation to reference data –
  - by the use of mean and standard deviation values
  - By calculating percentages of the median value of standards / references which is assigned as 100% and
  - By comparing with percentile of the reference data where median value is the 50th percentile.

1- **Determination of Nutritional status using weight and height** – with the help of the following tables we can understand how to categorized the children into different grades of nutritional status using the anthropometric measurements in comparison with the reference values as indicated by National Centre for health statistics (NCHS). The type and duration of malnutrition can be well identified by using these classifications:

A. STANDARD DEVIATION CLASSIFICATION – the WHO recommends the used of SD Classification (WHO 1983) to categorized the children into different grades of nutritional status. The pre school children can be classified into underweight (weight for age), stunting (Height for age) and wasting (Weight for height) . it can be calculated using NCHS / WHO – MGRS reference values as provided below -

SD Classification	Weight for age	Height for age	Weight for height
> Median – 2 SD	Normal	Normal	Normal
< Median – 2 SD to < Median – 3 SD	Moderate underweight	Moderate Stunting	Moderate wasting
< Median – 3 SD	Severe underweight	Severe Stunting	Severe wasting

B. **GOMEZ CLASSIFICATION –**

% Weight of age of NCHS standard status	Grade of Nutritional Status
> 90	Normal
75 – 89.9	Grade I under Nutrition
60 - 74.9	Grade II under Nutrition
< 60	Grade III under Nutrition

C. **INDIAN ACEDEMIC OF PEDIATRICS (IAP) CLASSIFICATION –**

% Weight of age of NCHS standard status	Grade of Nutritional Status
> 80	Normal
70 – 79.9	Grade I under Nutrition
60 – 69.9	Grade II under Nutrition
50 – 59.9	Grade III under Nutrition
< 50	Grade IV under Nutrition

D. **WATERLOW MALNUTRITION CLASSIFICATION**

Types/ Degree of malnutrition	Cut of level as % of NCHS* Median

	Indicator	
	% Wt/Age	% Wt/Ht
Normal	> 90	>80
Short duration malnutrition	> 90	< 80 wasted
Long duration malnutrition (Nutritional dwarf)	< 90	<80 stunted
Current and long duration malnutrition	< 90	<80 stunted and wasted

E. **Classification of Jelliffe**: In 1965, Jelliffe developed age-assessment weights to determine the degree of malnutrition. 90-80% of the elderly expected weight he is grade 1 malnourished, 80-70%, 70-60%, and 60% are 2nd-, 3rd-, or 4th-degree malnutrition .

2. Determination of nutritional status using MUAC– the arm circumference increased rapidly in children from birth to 1 year. It increases from 9.5 cm to 16 cm. The MUAC varies very little between age of one upto five years. It remains constant fairly at about 16 to 17 cm among well-nourished normal children. During this period the infentile fat is replaced by muscles. A value of 16.5 cm is the reference cut of point used as a standard. The MUAC classification for grades of malnutrition is as follows:

MUAC (cm)	Category
> 13.5	Normal
12.5	Possible mildly malnourished
< 12.5	Severely malnourished, requires immediate attention

3. Assessment of PEM in children – With the help of the following table we can understand the different parameters in Anthropometric measurements and how they help to differentiate normal children and children with protein energy and malnutrition.

Anthropometric Measurement (parameter)	Description of the parameter	Inference	
		Normal	PEM
1. Rao and Singh Index	$\frac{\text{wt. in kg}}{(\text{ht in cm})^2} \times 100$	> 0.15	Moderate: 0.13 – 0.15 Severe:< 0.13

2. Weight / age welcome classification	% of weight for age of NCHS standards	> 80 %	80-60% Kwashiorkor (Oedema) < 60 % Marasmus (without Oedema)
3. Mid Upper Arm Circumferences		> 13.5 cm	mid:<13.5 cm Moderate: 12.5cm – 13.5 cm Severe:<12.5 cm
4. Bangle Test	this is done by slipping a bangle with an inner diameter of 4.0 cm upto forearm. it is less sensitive as the elbow circumferences, representthe thickness of the bone	does not pass upto elbow	passes / crosses the elbow
5. Shakir's tape	This is a plastic tape with colored zones green, yellow and red representing more than 13.5 cm, 12.5 to 13.5 cm and < 12.5 cm respectively to measure MUAC	fall in the green zone	within yellow zone: moderate Within red zone: severe
6. skin fold thickness	Taken as triceps	> 10 mm	> 6 mm
7. Kanawati MUAC Index	$\frac{\text{MUAC}}{\text{head circumferences}}$	> 0.32	mild: 0.28 – 0.32 Moderate: 0.25 – 0.38 severe :< 0.25
8. Chest / Head circumferences	$\frac{\text{Chest circumferences (cm)}}{\text{Head circumferences}}$	> 1.0	> 1.0

	(cm)		
9. MAC / Height ratio	MAC (cm) / Height (cm)	0.32 – 0.33	> 0.29 (severe
10. The Quack Stick	It is the short name for quacker arm circumference stick. It is a rod with 2 sets of markings, One indicating height , and the other MUAC for corresponding height. The height is measured and the stick is placed behind the standing child.	Height,then the expected for measured arm circumference	Height > than the expected for measured MUAC

(Source: Text book of community nutrition by Suryatapa Das, 5th edition academic publishers)

4. Assessment of Adults – After the linear growth ceases around 21 years, weight for height indicates muscles fat mass in the adult body. The ration of weight in Kg / height ^{2} m is referred to as body mass index or quetelet index. It provides a reasonable indication of nutritional status of adults. The BMI is co-related with adiposity. The following table shows the WHO classification of BMI.

WHO CLASSIFICATION OF WEIGHT STATUS	
WEIGHT STATUS	**BODY MASS INDEX (BMI), kg/m^2**
Underweight	<18.5
Normal range	18.5 – 24.9
Overweight	25.0 – 29.9
Obese	≥ 30
Obese class I	30.0 – 34.9
Obese class II	35.0 – 39.9
Obese class III	≥ 40

On the basis of available data in Asia, the WHO expert committee (2004) concluded that the Asian Indian have a higher percentage of body fat. According to the committee the BMI category of Asian Indian can be classified as follows –

BMI (Kg / m^2)	Nutritional status of Asian Indians
< 18.5	Chronic energy deficiency
18.5 – 23.0	Normal
23.0 – 27.0	Over Weight
> 27.0	Obesity

BMI is calculated as –

$$\text{BMI} = \frac{\text{body weight in kg}}{(\text{Height in meter})^2}$$

Waste and Hip ratio - The waist-to-hip ratio shows the distribution of fat in the human body and is an indicator of central obesity. A waist-to-hip ratio greater than 1.0 in men and greater than 0.8 in women indicates an increased risk of android obesity and atherosclerosis.

Broca's Index –

Broca's Index = (Ht in cms - 100) = ideal body weight (kg)

The Broca's Index is a simple, easy-to-use index for assessing the nutritional status of adults. The Broca Index correlates not only with weight and height, but also with BMI. The table shows the best combination of measurements found to be useful in measuring the growth and health of infants, preschool and school age children, adolescents, and adults.

Best Set of Anthropometric Measurements/ Indices for Assessing Nutritional Status

Details	Measurements / Indices
Newborns	Weight, height, weight for height (%) or weight / $height^2$
Infants	Weight, height, weight for height (%) or weight / $height^2$,head and chest circumference
Pre-school children	Weight, height, weight for height (%) or weight / $height^2$ arm and calf

	circumference
School age children and adolescents	Weight, height, weight for height (%) or weight / height^2
Adults	Weight for height (%) weight / height^2, Weight/ height, Weight / height^{3}or Broka 's index

(Source: Visweswara Rao, K.1999, Biostatistics.)

Weight for height is superior to weight for age for screening short-term malnutrition with high specificity. Weight for age is a better way to monitor malnutrition over time because of the usual random errors in age data. Water low's classification is recommended for those interested in assessing the nature and duration of malnutrition.

Merits –

- Anthropometry is easy to perform without technical knowledge
- Results are easy and immediate to interpret.
- This is the most cost-effective method.
- Faster and less time consuming.
- This method can also be implemented in remote villages where facilities are not available.
- No side effects.
- Non-invasive and allows for better collaboration with the community.

Demerits –

- Results may be inaccurate if the equipment used is not properly calibrated.
- This may not be the most definitive method and may require alternative support methods.
- Standards are in constant need of revision.

You cannot use the same percentile for height and weight. This limitation is inherent in existing standards. We therefore became familiar with nutritional anthropometry as one of the direct methods for assessing the nutritional status of children and adults. We proceed to the next direct method of assessing biochemical indicators.

8.3.2 BIOCHEMICAL ASSESSMENT

Biochemical and laboratory assessment methods are more objective precise and sensitive methods for evaluation of nutritional status than any other methods.

It may help in diagnosis of Primary Malnutrition (resulting from inadequate food intake) and is valuable in guiding to take necessary actions in secondary malnutrition (resulting from conditions of increased need or losses of substrate).

Characteristics of an ideal biochemical test –

- Should be sensitive
- Should be easily accessible
- Should be specific
- Easy to carry out
- Preferably be non-invasive
- Should be inexpensive

During the development of any deficiency disease bio chemical changes can be expected to occur prior to clinical manifestation. Therefore bio chemical test is conducted to identify sub clinical malnutrition or onset of clinical manifestation of a disease. The biochemical test can be conducted on easily accessible body fluids such as blood and urine and they can help to diagnosdisease at the sub clinical stage.

Laboratory tests for nutritional assessment include: -

- Measuring individual nutrient concentrations in body fluids.
- To frequently detect abnormal levels of metabolites in urine after loading
- When vitamins are known to be cofactors (riboflavin deficiency), the activity of vitamin-dependent enzymes can be measured to help detect malnutrition at the preclinical stage.

Although nutritional surveys cannot capture all biochemical parameters, it is recommended to collect the following values to assess nutritional status:

- Serum albumin level.
- Iron, folic acid, and vitamins B_6 and B_{12} to aid in blood formation.
- Fat-soluble vitamins A and D in the blood.
- Blood and urine glucose levels to determine diabetes.
- Blood lipid profile including cholesterol and triglycerides indicative of heart disease.

BIOCHEMICAL TESTS APPLICABLE TO NUTRITION SURVEY

Nutritional Deficiency	First Category	Second Category
	(Those which have been most extensively used in post nutrition survey and have a demonstrated usefulness)	(These tests are complicated and are based on sample that are difficult to collect)
Protein	• Amino acid imbalance test • Hydroxyproline excretion test • Urinary area • Urinary Creatinine per unit of time	Serum protein fraction by electrophoresis
Vitamin – A	Serum Vitamin A Serum Carotene	-
Vitamin - D	Serum alkaline phosphatase (in young children)	Serum inorganic phosphorus
Ascorbic Acid	Serum ascorbic acid	white blood cells ascorbic acid Urinary ascorbic acid Load test
Thiamine	Urinary thiamine	Load test blood Pyruvate Blood lactate Red Blood cell Hemolysate Transketolase
Riboflavin	Urinary riboflavin	Red Blood Cell Riboflavin load test
Niacin	Urinary N – methylnicotinamide	Load test urinary pyridone
Iron	Hemoglobin Hematocrit Thin blood film	Serum iron percentage saturation oftransferrin

Folic Acid & Vitamin – B_{12}	Hemoglobin Thin blood film	Serum folate (L. casel) Serum Vitamin – B_{12} (E. gracilis)
Iodine	-	Urinary iodine, Test for thyroid function

(Source: Text book of community nutrition by Suryatapa Das, 5th edition academic publishers)

If the nutritional history is unknown or if malnutrition occurs, biochemical testing can be performed to detect minor deficiencies in individuals before clinical signs of disease develop and appropriate corrective action can be taken.

Biochemical test for nutritional deficiencies – We shall now look at the different biochemical test used for detecting nutritional deficiencies.

1- **Test for Protein energy malnutrition**– the following test are performed to assess protein and nutritional status.

- **Serum Protein -** when the child starts having protein energymalnutrition the first indication is the lowering of serum total proteins and serum albumin. The normal albumin levels are 3.5 to 5.5 g/dl. During PEM the levels may go down to 2.0 to 2.5 g/dl. Serum transferrin levels <0.4mg/ml suggests severe malnutrition.
- **Serum amino acid ratio** – the ratio of non-essential / essential amino acids is severely affected at an early stage of PEM specially in Kwashiorkor. This ratio is not affected in Marasmus.

$$\textit{SerumAminoAcidRatio} = \frac{\text{Glycine+Serine+Glutamine+Taurine}}{\text{Leucine+Isoleucine+Valine+Methinonine}}$$

Normal mean value	-	15
Subclinical malnutrition	-	2 to 4
Frank kwashiorkor mean value	-	5

Urinary Hydroxyproline Index

$$\text{HydroxyprolineIndex} = \frac{\text{αmicromoleshydroxyproline /ml}}{\text{αmicromolescreatinine/ ml/ kgbodyweight}}$$

- **Urinary Creatinine Height Index** The measurement provides an approximate idea of the musculature of the child and it is of value in assessing the recovery of malnourished children as well as in the detection of marginal nutrition.

$$= \frac{\text{mg creatinine /24 hour excreted by the malnourished child}}{\text{mg creatinine /24 hour excreted by a normal child of the same height}} \text{ Urinary Creatinine Height Index} \times 100$$

Normal and recovery from PEM - 0.1

Kwashiorkor and marasmic kwashiorkor - 0.24 to 0.75

Marasmus - 0.33 to 0.85

Children who eat low protein diet show low ratios of urinary urea to creatinine.

2- Biochemical test for Vitamin A deficiency – the values of serum retinol are generally used as the simplest and most practical methods of assessment of vitamin A status in community.

SERUM RETINOL LEVELS FOR DIAGNOSIS OF VITAMIN – A DEFICIENCY

Serum retinol level (mg/dl)	Vitamin – A status
< 20	Deficient (High Risk)
20-30	Low (moderate risk)
> 30	Acceptable (low risk)

3- Test for anemia– the following two methods are used for assessment of Iron deficiency anemia.

- Measurement of hemoglobin level
- Estimation of iron stores by serum ferritin level.

WHO RECOMMENDED GUIDELINE FOR DIAGNOSIS OF ANEMIA

Groups	Cut-off points for hemoglobin (g/100ml)
Children <6 years	11
Children > 6 years & adolescents	12
Non pregnant and non-lactating adult women	12
Pregnant Women	11
Lactating Women	12
Adult Men	13

DIAGNOSTIC CRITERIA FOR IRON DEFICIENCY ANAEMIA

Indicator	Cut-off point
Serum iron (ug/dl)	<60
Total iron binding capacity (ug/dl)	>300
Transferrin saturation (%)	<15
Erythrocyte protoporphyrin (ug/dl)	>100
Serum ferritin (ug/l)	<12

4- Test for Iodine deficiency – the levels of Urinary iodine indicate the iodine status of a community

CRITERIA FOR DIAGNOSIS OF IODINE STATUS

Median Urinary Iodine concentration (ug/dl)	Iodine Status
<20	Severe Iodine Deficiency
20-49	Moderate Iodine Deficiency
50-99	Mild Iodine Deficiency
100-200	Ideal Iodine Deficiency
201-299	More than adequate iodine intake
>300	Excessive Iodine intake

5- Test for Vitamin D deficiency – Serum 25 hydroxy – cholecalciferol level is measured for the assessment of vitamin D status.

DIAGNOSIS CRITERIA FOR VITAMIN – D DEFICIENCY

Serum 25 hydroxy cholecalciferol Level (ng/ml)	Vitamin – D status
< 5	(severely low) high risk
5-10	low level
> 10	acceptable

6- Biochemical tests for assessing deficiency of other nutrients –

OTHER NUTRIENTS

Nutrient	Diagnostic tests	Deficiency criterion

Riboflavin	1- Urinary Riboflavin 2- Erythrocyte Glutathione Reductase tests	< 80 mg / g of creatinine > 1.7 (high risk)
Niacin	Ratio of N' – methyle-2 pyridone-5-carboxylamine and N'-methyl-nicotinamide	< 1
Folic Acid	Serum folate RBC folate	< 3ng / ml 140 ng / ml
Vitamin – B_{12}	Serum B_{12}	80 pg / ml
Zinc	plasma zinc	< 84 mg / dl

Different parameters assessed by Biochemical methods and their normal and deficient values.

Nutrients	**Principal method**	**Normal**	**Deficiency**
Vitamin A	Serum Vitamin A Relative Dose Response Test (450-1000µg retinol) 100µg/kg dehydroretinol; Dehydroretinol: Vitamin A	30 µg /dl - -	<20 µg/gl>20%RDR >0.06
Vitamin D	S.25,hydroxy cholecalciferol	>10ng/ml	<5 ng/ml
Vitamin E	Serum vitamin E/total lipid ratio	>0.8	-
Vitamin K	Protein induced by vitamin K absence PIVKAS	Absent	Accumulate
Thiamine	Urinary thiamine Erythrocyte Transketolase test (ETK-AC) Activated coefficient	100µg/24hr 65 µg/ of creatinine <1.15	- >1.25
Riboflavin	Erythrocyte glutathione reductase (EGR –AC)	<1.2	>1.4
Niacin	N-Methyl 1-2 pyridone -5 carboxylamide (2 pyridone) and N1 - methyl nicotinamide ratio	1-4	<1.0
VitaminB6	Urinary excretion B_6 Erythrocyte asparatate amino tranferase (EAspAT-AC)	<1.7 – 2.0	<20µg/g creatinine -
Folic acid	Serum folate RBC folate Formimino glutamic acid FIGLU	>6.0 ng/ml >160ng/ml <20mg FIGLU in 8 hours after histidine load of 0.26 g/kg body weight	<3.0ng/ml <140ng/ml >100mg
$VitaminB_{12}$	Serum B12	200-900pg/ml	80pg/ml
Ascorbic acid	P. Ascorbic acid levels Leucocyte ascorbic acid	>0.3 mg/dl >15mg/dl	<0.2mg/dl <8 mg/dl

Iron	Serum ferritin levels Serum iron Serum transferrin Haemoglobin	- - - >13g/dl (Men)>12g/dl (Women)	12 µg/l <40 µg/dl <0.16 - -
Iodine	Urinary excretion of Iodine	>50mg/g creatinine	-
Zinc	Plasma Zinc	84-104 µg/dl	-
Copper	Serum Copper	75-125 µg/dl	-

(Source: Textbook of Human Nutrition, BamjiMehtab, 2009)

Limitations of biochemical assessment –

- Time consuming and expensive.
- Cannot be applied community-wide. high population
- You need experienced and well-trained professionals to perform the tests.
- Most tests only show current nutritional status.
- Sampling is dangerous because it is an invasive method. We need standardized reference values for specific nutrients and standardized specific tests.

Having dealt with biochemical assessment, we now deal with biophysical or radiological assessment of nutritional status.

8.3.3 CLINICAL ASSESSMENT

Physical signs and symptoms of malnutrition are important aids in detecting nutritional deficiencies. Clinical examinations assess the health of population and communities based on examination for changes believed to be related to inadequate nutrition. These sign can be seen or felt in superficial epithelial tissues, specially the skin, eyes, hair and buccal mucosa or in organs near the surface of the body such as the parotid and thyroid glands.

The WHO classification of signs associated with malnutrition helps to identify particular nutritional deficiency when the survey requires rapid screening. They have been classified into 3 groups as tabulated below:

Group I: Signs that are considered to be of value in nutritional assessment. These are often associated with nutritional deficiency. Signs of malnutrition may be mixed and may be due to the deficiency of two or more micronutrients.

Group II: Signs that require further investigation. They may be related to chronic malnutrition, where health and environmental problems such as poverty and illiteracy are co existent.

Group III: These include physical signs that have no relation to malnutrition, although they may be similar to physical signs found in malnourished persons. These may be checked properly by a physician or other health worker trained in nutritional diagnosis.

This WHO classification helps to identify particular nutritional deficiency where the survey is limited and aimed at rapid clinical screening of the community. The clinical assessment should be done by well trained personnals and the physical signs should be recorded precizely and the interpretation of results should be based on standardized definition of a particular sign.

CLASSIFIED LIST OF SIGNS USED IN NUTRITIONAL ASSESSMENT

	Group I **Signs known to be of value in nutritional assessment**	**Group II** **Signs that need further investigation**	**Group III** **Some signs not related to nutrition**
Muscular and skeletol system	Muscle wasting craniotabes frontal and parietal bossing epiphyseal enlargement (tender or painless) beading of ribs, persistently open anterior fontanelle, knock-knees or bow legs, diffuse or local skeletal deformities, deformities of thorax (selected), musculoskeletal hemorrhage	winged scapulae	Funnel Chest
Internal System : a. Gastro-intestinal b. Nervous c. Cardio Vascular	Hepatomegaly • Psychomotor Change • Mental retardation • sensory loss • Motor weakness • Loss of position sense • Loss of Vibratory sense • Loss of knee and ankle jerks • Calf tenderness • Cardiac enlargement • Tachycardia	Condition of Ocular Fundus Blood Pressure Changes	splenomegaly

(Source : WHO expert committee on medical assessment of nutritional status, 1963)

Merits of Clinical Assessment –

- Relatively inexpensive method.
- No field devices or lab required.
- The easiest and most practical way.
- Provides valuable information to public health workers.

Limitation of Clinical Assessment –

- A physical examination may reveal sign of certain nutritional deficiencies which are not detected by dietary of laboratory methods.
- Properly trained personnel are required.
- Non-specific signs can be falsely associated with nutritional deficiencies.
- Early signs and symptoms are vague and often include weakness, lethargy, and irritability.
- The procedure is non-invasive and the symptoms are observed externally. So sometimes it may give non specific result.

NUTRITIONAL DEFICIENCY DISORDERS AND THEIR DIAGNOSTIC SIGNS AND SYMPTOMS

Nutritional Disorders	Sign and Symptoms
Kwashiorkor	• Oedema • Under weight (< 80% of normal weight for age) • Apathy and Irritability • Moon Face • Hair and Skin changes
Marasmus	• Extreme Muscle wasting (emaciation) • Loose and hanging skin folds • Old man's or monkey face
Marasmic Kwashiorkor	• Extreme muscle wasting • Loose and hanging skin folds • Old man's or monkey facies • Absolute weakness

	• Oedema
Vitamin – A deficiency	Changes in the eyes such as • Conjunctival Xerosis • Xeropthalmia • Bitot's spot • Night blindness Skin changes – rough skin (phrynoderma)
Iron deficiency anemia	• Paleness of conjunctiva • Paleness of tongue • paleness of mucosa of soft palate • Low hemoglobin • swelling of feet • spoon shaped nails (koilonychias)
Iodine deficiency iodine	thyroid enlargement • spontaneous absorption • congenital abnormalities • Cretinism / myxoedema
Riboflavin deficiency	• Angular stomatitis • glossitis • cheilosis
Niacin deficiency	Dermatosis • diarhhoea • dementia
Vitamin – C deficiency	• Spongy bleeding gums • hyperkeratonic changes around thigh and buttocks • Iron deficiency anaemia
Vitamin – D deficiency	Rickets and osteomalacia – beading of ribs, pigeon chest, protruding chest bones, knock knees or bow legs
Essential fatty acid deficiency	lesion in skin – generally sun on back of

	elbows, around knees and sides

(Source : Text book of community nutrition by Suryatapa Das, 5th edition academic publishers)

8.3.4 DIET SURVEY

Community nutrition plays an important role in determining health and nutritional status. As explained in the previous chapter, there are several factors that determine the food choices made by people belonging to a community.

Scope and purpose –

- Preliminary surveys provide a systematic survey of community food supplies and food consumption patterns.
- Serves as an aid in the interpretation of anthropometric, biochemical, biophysical, and clinical findings.
- Diet survey is an important part of nutritional assessment, but is cannot be used alone to make a diagnosis of nutritional health.
- The methods used in their instance must be appropriate for the purpose intended.
- Diet assessment is also an important aspect of survey of nutritional status of population group.
- Rapid cost effective screening may be conducted by trained para professional to identify persons 'at risk' in a community. A comprehensive assessment requires much more time, is more expensive and should be in a clinic / hospital setting and should be reserved for the patients who are 'at risk' and who require intensive nutritional rehabilitation.

Types of Diet Survey – Dietary research can be done in two different approaches -

Qualitative approach - refers to the study of a qualitative approach to food, including the types of food consumed, opinions and attitudes towards food, cultural influences on food, and food practices under specific physiological conditions. Qualitative approaches stress on quality aspects of food which are as follows –

- Kinds of foods that are eaten by people
- Opinion and attitude towards the food items
- Any cultural aspect attached to specific food or beverages.
- Food practices during health and disease .
- Food practices during special physiological conditions like pregnancy, lactation, infancy and old age.

Quantitative approaches - quantitative approaches attempt to quantify foods and beverages in terms of consumption and obtain their relative nutritional value. provides a measure of the adequacy or inadequacy of food consumed. For example how much food is eaten by the people. In quantitative enquiry how much food and beverages are exactly consumed are estimated in terms of grams or litres and their nutritive value are calculated. Comparison of nutrient in take with the RDA provides a measure of adequacy or inadequacy or excess in take of food / nutrient consumption.

Methods of Diet Survey – A number of diet survey method is available. The various methods are as follows –

1- **Food Weighment methods** – In this method, raw or cooked food is physically weighed on an accurate scale. The ideal way to get a true picture of a nutrition is to take surveys for seven consecutive days.

Each day, food is weighed in the morning and evening before the actual cooking begins. Weigh only the edible portion of raw food. Consumption of meals by guests and additional food consumed by family members such as food brought in in cooked form and accepted by friends and relatives must be detailed. Surveys should not be conducted on fast days and festival holidays. The age, sex and physiological status of all family members consuming food should be recorded. Foods are converted into nutrients using food composition tables. Nutrient intake can therefore be expressed per unit consumed (CU) or per her. The calorie required for one consumption unit is 2400Kcal.

COEFFICIENT FOR COMPUTING CALORIE REQUIREMENT FOR DIFFERENT GROUPS

Group	Consumption Unit
Adult Male (Sedentary Worker)	1.0
Adult Male (Moderate worker)	1.2
Adult male (Heavy Worker)	1.6
Adult female (sedentary worker)	0.8
Adult female (moderate worker)	0.9
Adult female (Heavy worker)	1.2
Adolescent – 12 to 21	1.0
Children 9 to 12 year	0.8
Children 7 to 9 years	0.7
Children 5 to 7 years	0.6

Children 3 to 5 years	0.5
Children 1 to 3 years	0.4

(Source : Gopalan, C., Rama Sastri, B.V. and Balasubramanian, S.C. (1999) Nutritive Value of Indian Foods, National Institute of Nutrition, ICMR, Hyderabad)

$$\text{Intake of food/CU/day (g/ml)} = \frac{\text{Raw amount of each food (g/ml)}}{\text{Total C.U} \times \text{No. of days of Survey}}$$

If a household consists of an adult sedentary male, moderate working adult female, an adolescent boy, a 3 year old girl, then the total Consumption Unit of the family = (1.0+0.9+1.0+0.5=3.4)

If the family has cooked and consumed 1500gms of raw rice for a day, the approximate intake of rice per C.U per day = 1500/3.4=441 gms.

Advantage –

- Relatively accurate method for weighing food directly.
- It is simple method.

Disadvantage –

- It is time consuming and requires the cooperation of kitchen staff during the research period.
- The factors used to calculate intake apply only to calories and cannot be calculated for other nutrients such as protein, vitamins and minerals.
- It is not possible to estimate the exact consumption of any particular age or physiological group like pre schooler, pregnant and lactating women within the family.
- All the cooked food may not be eaten on the same day.
- Surveyors must remain on the survey site.

2- **Twenty four hours recall method** – This method is used to collect food intake data from individuals in large-scale dietary surveys. Dietary data are obtained via verbal questionnaires from respondents. In this method the respondents are asked to recapitulate What was eaten, how much food was eaten, how was the food prepared, when was it eaten and other details related to food in take. The housewives or the member of the household who cooks and serves food to the family is generally contacted. This method uses a standardized set of cups adapted to local conditions. Information on the total amount cooked for each preparation is provided on the standardized cup.

The amount of each food consumed by a particular person in the family e.g. Preschoolers, adolescent girls, and pregnant or breastfeeding women will be judged by cups. Cups are primarily

used to help respondents remember how much they prepared and gave to each member. A single family's intake of cooked food is converted to the raw amount of each food, which can be calculated using the following formula:

$$\textbf{Individual raw intake} = \frac{\text{total raw amount for each food item (g) x individual cooked in take (vol)}}{\text{Total cooked amount of the preparation (vol)}}$$

Advantage –

- Inexpensive, quick to administer, and provide detailed information about specific foods.
- This method is based on short term memory. So it is more likely to get accurate data then estimate of average intake over a long period of time.
- Respondents save time and effort by not having to keep food records.
- Respondents cooperate well.
- Used in conjunction with the food frequency cross-check method.

Disadvantage -

- Lack of reliable indicators of food intake.
- Irregular eating habits make it difficult to remember.
- Estimated serving sizes may vary.
- Recall date may differ from normal intake.
- Respondents may withhold or change food information.

3- **Diet History method** - Dietary histories are useful for obtaining qualitative information about long-term dietary habits. This method was developed by his B.S.Burke and consists of four steps.

step 1: Collecting general information about the subject's nutritional and health status.

Step 2: 24-hour recall is used to obtain information on general dietary habits.

Step 3: Cross-check the information provided in step 2.

Step 4: 3 day record on the subject is collected.

The subjects are asked for information on the past dietary habbits which may be as follows –

- The number and type of meals they normally eat.
- The frequency and extent of using various food groups such as green and yellow vegetable, milk or milk products, meat, eggs and cereals.
- There food likes and dislikes.
- Food allergies.

- Seasonal variation in intake.

The success of this method depends on the cooperation of the subject and the effectiveness of the interviewer.

Advantage:

- Infant weaning and breastfeeding practices and related cultural constraints prevalent in communities can also be examined using this method.
- It may also be possible to collect information on the approximate amount of food consumed at home, such as 30 kg of rice per month or 0.5 liters of milk per day.
- This method has been used to study people's eating patterns, eating habits, food preferences, and/or avoidance in physiopathological conditions such as pregnancy, lactation, and disease.

Disadvantage:

- It requires more time and money.
- You need well-trained interviewers.
- Data may be unreliable.
- Estimates of food intake using this method are generally higher than using weighing records.

4- **Food intake record / Food diary method** – This method requires maintaining a dietary record with the weight of food consumed by the individual/family depending on the number of days surveyed. In general, 3 or 7 days of logging is recommended. The 7-day recording is called the feeding cycle. The person's record food eaten, time of intake, place where eaten (Home/Outside) and frequency of each food item taken etc. portion sizes are estimated using food models and standard measuring instruments or food items that are actually made

Advantage –

- Accuracy is established because food and drink consumed can be recorded instantly.
- Find detailed food intake, lifestyle, and factors that influence food intake.
- The cause of food allergies is easy to identify.
- Track factors related to an unbalanced diet.

Disadvantage –

- Respondents must be literate.

- Accurately estimating portion sizes requires knowledge and skill.

5- **Expenditure pattern method / written questionnaire -** In this method, money spent on both food and non-food items is assessed using a specially designed questionnaire. The reference period is either the previous month or the previous week.

Advantage:

- This method is obviously less cumbersome as there is no need to actually weigh the food.
- In practiced hands, both the weighted and effort pattern methods give comparable results.

Disadvantage -

- The reference period is usually long.
- Information about food purchased by households does not necessarily reflect actual average consumption.

6- **Food inventory method** – Food inventory methods, also called institutional nutrition surveys, are used in institutions such as dormitories, armies, barracks, orphanages, and nursing homes, where homogeneous groups of people eat from a common kitchen. This method takes into account the amount of food served to the kitchen and the number of people attending the meal, according to records kept by the director. Use one week as a reference period. The average intake per person per day can be calculated as:

$$\text{Average in take / person / day} = \frac{\text{(Stock at the beginning of the week – Stock at the end of the week)}}{\text{Total number of inmates partaking the meal x Number of days of survey (7)}}$$

Advantage:

- A large number of samples can be covered in a short time.
- You can check the consumption of meals in the facility.

Disadvantage :

This method is only possible if the community is well educated and subject to a monetary economy where food is usually purchased at the market.

7- **Food frequency checklist** – The next dietary survey method is the meal frequency checklist. The checklist is used to find out how often and individual eats a specific type of food. Food frequency consist of asking individuals (by interview or checklist) . How often (daily, monthly, weekly)

specific foods are eaten. This methods realize of the principle that an average long term diet pattern is more important rather than food intake survey on few specific days.

A food frequency checklist consist of two components –

- A food list
- Frequency response section

  A food frequency questionnaire consist list of approximately 100 or fewer individual food or food groups that are important contributor to a population‘s nutrient and energy needs. Usually, these foods are grouped into categories on the basis of nutritive value or bodily functions.

Advantage –

- Using the 24-hour recall method, the food frequency checklist allows the rater to double the accuracy of the information he receives.
- Relatively cheap and quick to conduct for large population surveys. A preferred method for studying the relationship between diet and disease at the macro- and micronutrient level.

Disadvantage - The number of foods is limited to 100, so the foods selected should be representative of common foods consumed by subjects.

8- **Chemical analysis / duplicate sample method –** Subjects weigh and record food at the time of ingestion, weigh and store replicates of food, and send to the laboratory for nutritional analysis.

Advantage –

- This is the most accurate dietary survey method.
- This is a direct method of nutrient analysis, no food consumption charts or other tools required.
- This method is often used in metabolic balance studies.

Disadvantage –

- A very expensive method.
- Requires intensive monitoring.
- Good lab support is essential.

9- **Dietary score** - The next method of dietary research to investigate is nutritional assessment. It assigns arbitrary ratings to foods based on their nutritional content. Human consumption of each food item is estimated by the frequency method. for example. Foods are classified according to their primary source of a particular nutrient. For protein, eggs are 3, fish are 2, and legumes are 1. Then calculate the frequency, total score and percentage of food intake. The value of this qualitative method increases when combined with other quantitative nutritional assessment methods.

Advantage –

- This is a very simple method.

Disadvantage –

- Time consuming.
- Knowledge of the rating system is required.

Problems in Diet Survey - Even when dietary studies are well planned, several issues can arise related to how the data are collected, analyzed, and interpreted. Problems that field researchers such as nutritionists / social scientists encounter during the process include –

- Memory gap.
- Longer reporting periods and more errors.
- No response due to lack of subject cooperation.
- Errors due to rough local measures (inventory method)
- Inaccurate weighing of food (weighing method)
- Seasonality and incorrect reporting period selection.
- Response errors due to deviations from normal eating patterns during the study period.
- Lack of knowledge about the use of food ingredient lists.
- Remote or inaccessible learning areas.
- Lack of rapport with respondents.
- Long study period.
- Poor timing of surveys.
- Lack of trained staff.
- Lack of equipment support.

Delays in data processing and interpretation of results due to lack of technical skills. To overcome the above issues, the following points should be considered:

- A pilot study is required.
- Adequate means of communication and transportation to the study area must be ensured.
- Pre-study orientation to subjects promotes good relationships.
- Diet and nutrition survey sample sizes should be a ratio of 1:4 or 1:5, depending on the purpose of the study.
- Initial knowledge of the situation on the ground is useful for developing questionnaires, checklists, and guidelines.
- If necessary, an interim evaluation should be conducted.

CHECK YOUR PROGRESS EXERCISE 1

1- Throw light on the classification of methods of nutritional status? ----------
---

2- What do you understand by ABCD analysis? ----------

3- What is the importance of Anthropometric measurement? ----------
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4- Write a detailed note on biochemical nutritional assessment? ----------
---

5- Write in detail the importance of Clinical Assessment? ----------
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6- How would you ensure the presence of protein enery malnutrition in a child? ----------
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7- Write short notes on the following –

- 24 hrs recall method? ----------

- Food frequency analysis ----------

- Importance of diet survey ----------

8.4 BIOPHYSICAL METHODS

Biophysical or radiological studies are used in certain studies that require additional information on changes in bone or muscle performance. The method is based on biophysical principles, and methods such as radiological examination, physical function assessment, and cytological methods are commonly used for this purpose. These methods have been used to study bone changes in rickets, osteomalacia, osteoporosis and scurvy. If laboratory tests show certain malnutrition, the following x-rays can be done:

- In rickets, there are dense, healed, concave lines on the distal ends of the long bones, usually the radius and ulna.
- In infant scurvy, long bones appear as ground glass with reduced density.
- In beriberi there is an increase in the size of the heart visible on x-rays.
- Bone changes also occur in advanced fluorosis.
- An endocardiometer used to graph heart sounds and measure nutritional status.
- Cytological examination of stained epithelial tissue swabs taken from the oral mucosa show altered nutritional status. These tests can help detect vitamin A deficiency, dehydration, or fever.

FUNCTIONAL INDICES OF NUTRITIONAL STATUS

System	Nutrients
Structural integrity	
Erythrocyte fragility	Vitamin-E, Se
Capillary fragility	Vitamin – C
Tensile strength	Cu

Host defence	
Leucosyte Chemotaxis	Protein / Energy, Zn
Leucocyte phagocytic capacity	Protein / Energy, Fe
Leucocyte bactericidal capacity	Protein / Energy, Fe, Se
T Cell blastogenesis	Protein / Energy, Zn
Delayed cutaneous hypersensitivity	Protein / Energy, Zn
Haemostasis	
Prothrombin time	Vitamin – K
Reproduction	
Sperm count	Energy, Zn
Nerve function	
Nerve conduction	Protein / energy, Vitamin – B_1, B_{12}
Dark Adaption	Vitamin – A, Zn
EEG	Protein / Energy
Work Capacity	
Heart rate	Protein / Energy, Fe
Vasopressor response	Vitamin - C

(Source :Solomoner, N.W. and Allen, L.H. (1983). Nutrition Review, 41(2) 30-50)

Advantages - Results are more accurate and can be used as ancillary data for other methods.

Disadvantages –

- The equipment required is expensive.
- Technical knowledge is required to interpret the data.
- Difficulties in transporting equipment to remote areas and inland villages
- The laborious biophysical method has proven attractive because of the progress and accuracy of the results.

8.5 FUNCTIONAL ASSESSMENT

Functional assessment is used to assess changes in function associated with nutritional deficiencies. This method is use to assess the nutritional adequacy of cells, tissues, organs, and anatomical systems

to perform their biological functions. Functional indicators of nutritional status include cognitive performance, disease response, fertility, physical activity, on job, social, and behavioral performance.

Functional indicators that have many potential advantages over static indicators with respect to the adequacy of nutritional status information are described below.

- **The submaximal treadmill test**, which assesses cardiac output, work output, and respiratory capacity, may serve as an adjunct to biochemical and anthropometric measurements in assessing nutritional status.
- **Infant fertility and birth weight** reflect population-level nutritional status.
- **Lactation performance** is another functional indicator of individual nutrition. Milk yield, fat, and total milk energy are reduced in undernourished women.
- **Social performance**: An individual's ability to interact with peers and the environment serves as an index for assessing functional nutritional status. Prenatally malnourished infants exhibit several behavioral deficits that may adversely affect the development of social skills, such as decreased activity and reduced interaction with caregivers.

Other functional indicators for assessment of nutritional status

8.5.1 TEST FOR GRIP STRENGTH - Grip strength is a measure of muscle strength, or the maximum force/tension produced by the muscles of the forearm.It can be used as a screening tool to measure upper body strength and overall strength. It is most useful for taking multiple measurements over time to track performance. Research shows that midlife grip strength predicts disability in old age and helps assess a patient's overall health. The equipment’s needed for this tests are hand dynamometer and a standard grip strength chart.

Grip strength declines with age, eventually affecting daily life. Simple things like opening a glass, carrying groceries, or turning a doorknob are made more or less difficult by the strength of your hands.

It is also a reliable indicator of many health conditions associated with aging –

- A 2018 prospective study found that handgrip strength was associated with cardiac structure and function, with a pattern indicating less cardiac hypertrophy and remodeling. These properties are known to be associated with a reduced risk of cardiovascular events.
- In elderly patients with hip fractures, early assessment of grip strength may provide important prognostic information regarding the patient's future functional development.

- A 2017 scoping review found that using hand grip strength to monitor cognitive changes is important, and that decreased grip strength over time may serve as a predictor of age-related cognitive decline. have been reported. Similarly, a 2016 review found that grip strength has predictive validity in reducing cognition, mobility, functional status, and mortality in community-dwelling older populations.
- It has been recommended to perform grip strength measurements in geriatric wards as part of routine inpatient assessments (K Ibrahim et al. 2018 study). This is because decreased grip strength in hospitalized elderly patients is associated with poor patient prognosisand longer length of stay in the hospital and mortality. Many older patients are at risk of poorer medical outcomes due to poor grip strength and have found benefit from dietary and exercise interventions.
- A cross-sectional study (2020) showed a low correlation between handgrip strength and standard leg strength measures (hip, knee and ankle extensors/flexors) and functional ability in older women.

Method of use - The American Society of Hand Surgeons and the American Association of Hand Therapists recommend the Jamar Dynamometer for grip strength assessment. These are expensive items and many inexpensive dynamometers are available on the online market place which are perfect for physiotherapy and clinic use.





- The client sits with the shoulders straight, the elbows bent at 90 degrees to his chest, and the forearms and wrists neutral. The therapist places the dynamometer in the client's hand while gently supporting the base of the dynamometer and instructs the client to press as hard as possible. Gripping force should be applied gently and not in abrupt, jerky movements.

Before performing a strength test, check should be done for the presence of healing tissue that could be damaged by this test. So that other outcome measure can be used.

8.5.2 TEST FOR RESPIRATORY FITNESS – In the last 45 years tests of respiratory function have moved from the research laboratories of university departments into the world of everyday practice. This is appropriate as the tests greatly improve diagnostic skills and disease management.

There are many different respiratory function tests, each with strengths and weaknesses. Importantly, a report of respiratory function is only as good as the extent of patient co-operation, the training and skill of the technical staff, the equipment used and the experience of the reporter.

Respiratory function tests are an objective measure of abnormal physiology and a means of following a patient's progress (see box). Considerable reliance is placed on respiratory function testing in the assessment of work-related respiratory illness. The tests rarely provide a single clinical diagnosis and must always be interpreted within the full clinical context. They also require co-operation (sometimes maximal performance) from the patient, and this may limit their usefulness in certain situations.

For the purposes of testing, the respiratory process can be simplified into its major components. Breathing (i.e. ventilation) results when a given respiratory drive interacts with a certain respiratory load. This process requires work and results in gas exchange. Inadequacies in gas exchange should lead to attempts at correction by a readjustment of drive. Direct testing of respiratory drive is not easy. Defects in respiratory drive are usually inferred from monitoring the effect of an abnormal load on ventilation.

Lung function tests are most useful in the following situations
• the analysis of breathlessness of obscure origin or when the complaint appears out of proportion to the objective clinical evidence • the quantitation of respiratory impairment (e.g. fitness for surgery, employment or travel)following progress or deterioration, either spontaneous or in response to therapy, (e.g. asthma, fibrosing alveolitis, respiratory failure) • assessment for medicolegal purposes

Simple measurements of respiratory load increases in the respiratory load to breathing are very common. Resistive load increases in conditions such as asthma, obstructive bronchitis, cystic fibrosis and emphysema and impair airflow. Elastic load increases in condition such as interstitial fibrosis, muscle paralysis and obesity impair lung inflation. The quantitation of respiratory load involves determining the vital capacity and the speed of maximal expiratory flow.

The peak flow meter is widely promoted as a simple lung function monitor. Serial measurements in conditions such as asthma provide valuable information about disease progress. However, peak expiratory flow (the earliest portion of forced expiration) is very effort-dependent. Also, peak flow measurements give no information about elastic load abnormalities.

Load assessment is best done with spirometry. This provides a written record of slow (VC) and/or forced vital capacity (FVC), forced expired volume in one second (FEV1) and maximum mid-expiratory flow (MMEF). Most modern electronic spirometers plot volume against flow rate and permit inspiratory as well as expiratory manoeuvres. The machine makes the calculations and corrections and prints out the measured indices.

Expiratory spirometric patterns can be classified as:

Normal	Vital capacity within the statistical normal range for height, age and gender. A normal proportion of the VC can be forcibly expelled within a second (i.e. FEV1 /VC is 70-80%).
Obstructive	FEV1 /VC is below normal. Vital capacity may also be below normal.
Restrictive	Vital capacity below the statistical normal range. FEV1 /VC is higher than normal and may be 100%.
Mixed obstructive and restrictive	Vital capacity below normal and FEV1 /VC below 70%.

In severe obstruction, the vital capacity may be very reduced. Deciding if a restrictive or obstructive process predominates, may need the measurement of static lung volumes (functional residual capacity or residual volume) to assess the degree of hyperinflation. In practice, this distinction can usually be made clinically and static lung volume measurement is only occasionally important.

Diseases predominantly involving the very small airways (bronchiolitis, interval asthma) produce recognisably distinctive spirometric abnormalities. Indices of small airway function include the MMEF and the expiratory flow during the last phase of expiration. On an expiratory flow-volume curve, small airway abnormality is shown as a concavity in the descending limb and a reduction in the measured flow at some point in the expired vital capacity - often the flow at 75% vital capacity. These simple tests of small airway function are only useful if there is not concomitant larger airway obstruction.

Forced inspiratory volume measurements, when contrasted with equivalent expiratory volumes, can detect the presence of upper, extrathoracic airway obstruction such as retrosternal goitre or vocal cord paralysis. This form of obstruction is less during expiratory manoeuvres so that the ratios of FIV1 /FEV1, MMIF/MMEF and flows at 75% vital capacity on an inspiratory and expiratory flow-volume curve become less than unity.

Asthma

Asthma is a common cause of airflow limitation. The reversibility of the airways obstruction is usually assessed by spirometry before and after a bronchodilator aerosol. An increase of 10% or more in either vital capacity or FEV1 is taken to indicate significant reversibility, although, of course, not necessarily the maximum reversibility achievable.

When the suspicion of asthma is not confirmed by spirometry, a challenge procedure can be used to assess abnormal bronchial reactivity. This may involve the patient exercising or inhaling histamine, methacholine, hypertonic saline or cold air. Each challenge has its own protocol and risks, and these challenges are best performed in a well-supervised laboratory. Bronchial hyper reactivity is not synonymous with asthma. Although the vast majority of patients with ongoing asthma will have brisk reactivity, most people with a past history of asthma will have intermediate reactivity and some asymptomatic people with no past history will have a degree of bronchial reactivity. Bronchial reactivity is often expressed as the percentage concentration or dose of an agent that produces an acute fall of 20% in FEV1 (PC20 or PD20). Laboratories performing these challenges will usually have established their `normal reactivity' values.

Simple measurements of gas exchange normal gas exchange requires adequate alveolar ventilation, normal ventilation/blood flow relationships and adequate alveolar-capillary membrane surface area. There are tests of varying sophistication which specifically examine each of these functions.

Alveolar ventilation this is not easy to measure directly, as it is not a simple function of the volume of expired air passing the mouth each minute (i.e. the minute ventilation). The size of the dead space (alveolar dead space, connecting tubing volume and tracheobronchial tree) is often uncertain. This uncertainty, combined with the influence of the breathing pattern, means that minute ventilation may be a very misleading estimate of alveolar ventilation. To overcome this difficulty, the arterial carbon dioxide tension is used as an inversely proportional index of `effective' alveolar ventilation. Hence, a normal arterial carbon dioxide tension is taken to indicate satisfactory alveolar ventilation. Elevated or reduced carbon dioxide tensions reflect alveolar hypoventilation or hyperventilation respectively.

Ventilation/blood flow relationships these are most simply assessed by considering the lungs as a gas exchanger. Its efficiency is rated by the size of the difference between the amounts of oxygen and carbon dioxide in the blood and in the air. If the lungs are working efficiently the differences in composition will be small. Non-uniformity of ventilation/blood flow ratios will result in abnormally wide differences - the alveolar-arterial PO_2 and arterial-alveolar PCO_2 gradients will be abnormal. The oxygen tension gradient is normally less than 10% of the inspired oxygen tension. This simple index can be calculated using the alveolar gas equation

Alveolar-capillary surface area

This is assessed by one of several techniques measuring the uptake of carbon monoxide, a gas with affinity for blood and which is easily analysed. Although sometimes designated as tests of diffusion, these techniques are much more influenced by effective alveolar-capillary area and therefore are now more commonly termed gas transfer tests. Although many factors influence the result, these tests are usually abnormal in diffuse interstitial inflammatory and fibrotic processes and in emphysema. They are useful in the subclassification of restrictive conditions (those with and without gas transfer impairment) and in determining the probable extent of emphysema in patients with chronic airflow obstruction. They are commonly used in following patients' response to therapy in such conditions as sarcoidosis and fibrosing alveolitis.



Simple exercise testing

Tests performed during exercise provide information about overall fitness and the appropriateness of cardio respiratory responses. They can be elaborate procedures following cardiac output, pulmonary haemodynamics, gas exchange and anaerobic metabolism measurements at varying grades of exercise, but this type of study has little place in everyday practice. Observations made during a six-minute walk test can provide useful objective information provided the subject is induced to co-operate fully. The actual distance walked, the degree of breathlessness experienced and the change in blood oxygen level

(assessed by portable oximetry) are data which can be obtained simply. These data are required before some authorities will agree to provide portable domiciliary oxygen. The extent of exercise limitation due to mechanical load excess agrees reasonably well with the degree of impairment on spirometry.

When to use respiratory function tests

The most common reason for studying pulmonary function is in the analysis of breathlessness. The application of simple tests of load (spirometry 3), gas exchange (arterial blood gas analysis 5) and gas transfer will usually allow conclusions as to whether or not the complaint is reasonably based.

In hospital practice, the gas exchanging aspects of pulmonary function become important in the assessment and management of acute respiratory failure. Respiratory function tests are also widely used to assess fitness for surgery, fitness to undertake certain occupations or to assess the degree of impairment in work-related lung conditions.

8.5.3 HARVARD STEP TEST – The Harvard Step Test is used to measure a client's aerobic fitness. It tests the cardiovascular system and reflects the body's overall ability to cope with and recover from increased physical strain.

This test is easy to perform and requires minimal equipment. The participant walks at a rate of 30 steps per minute for 5 minutes or until he is exhausted. There are many other variations of the step test .

It was developed to be originally used by military personnel for fitness testing, but later used by civilian individuals also. The step test can be performed in children, adolescents, adultsand athletes.

Equipment required: step or platform (Male 20 Inches /50.8 cm, Female : 16 Inches / 40 cm), stopwatch, metronome or cadence tape.

Before the test

- Explaining the test procedure & signing consent form
- Recording anthropometric data
- Individual should be resting/sitting down for 3-5 min
- Resting Heart Rate is measured



Methods of Test - The client steps up and down at a rate of 30 steps per minute (1 second up, 1 second down) for 5 minutes or until exhausted. Fatigue is defined when the client cannot maintain his stepping rate for continuous 15 seconds.

Subjects are seated immediately after completing the test and total heart rate is counted 1-1.5 minutes after completion, 2-2.5 minutes after completion, and finally 3-3.5 minutes after completion. The heart rate is counted by feeling your pulse on the wrist.

Fitness index assessment

A person's Fitness Index score is determined by the following formula:

Fitness Index = (100 x test time (seconds)) divided by (2 x total recovery period heart rate).

For example B. If the total test time is 300 seconds (if the client completes all 5 minutes) and his heart rate is 1-1.5 minutes 90, 2-2.5 minutes 80, 3-3.5 minutes 70, then the Fitness Index score is: will be (100 x 300) / (240 x 2) = 62.5.

Rating	Fitness Index
> 96	Excellent
83-96	Good
68-82	Average
54-67	Low Average
< 54	Poor

8.5.4 SQUATTING TEST – The squat test is an active postural maneuver that applies one of the most intense orthostatic loads. In healthy subjects, with adequate baroreflex homeostasis, changes in blood pressure and heart rate are transient and do not cause symptoms. However, in various pathologies, both the increase in blood pressure when squatting and the decrease in blood pressure when standing are more significant and persistent, and can lead to discomfort and adverse events. It has been used in studies of patients prone to tetralogy of Fallot, heart transplantation, autonomic dysautonomia including diabetic cardiovascular autonomic neuropathy, and vasovagal syncope. Careful analysis of changes in blood pressure and heart rate during standing-to-squatting and squatting-to-standing transitions allows early detection of changes in vagal and sympathetic nerve function. In particular, squatting has been proposed as a therapeutic tool to combat hypotension in patients suffering from dizziness due to autonomic imbalance and orthostatic hypotension, or in patients exhibiting presyncope symptoms. Immediately after training.

The purpose of this review is to analyze hemodynamic patterns during squat attempts in different pathological situations and to describe possible negative and positive hemodynamic changes associated with this posture. There was particular interest in using the squat test to assess cardiovascular autonomic neuropathy associated with diabetes.



8.6 METHODS OF INDIRECT ASSESSMENT OF NUTRITIONAL STATUS

Indirect assessment methods are chosen where direct assessment methods are not applicable, especially for assessing the nutritional status of very large populations. They are useful for retrospective studies and the results obtained can help enrich other methods of nutritional research.As we know, the commonly used indirect methods are biostatistics and an assessment of ecological factors. Learn more about each method.

8.6.1 VITAL STATISTICS - The term vital statistics refers to the data and analytical methods used to describe the following community life events –

- Births
- Illness
- Marriages
- Migration
- Morbidity and
- Mortality

All these are influenced by the nutritional status.

The parameters used in Vital Statistics are:

- **Morbidity measurement** - Morbidity refers to the types and types of illnesses that we face, face, or experience that affect our daily activities. The following scales are used to quantify prevalence:

$$\textbf{Incidence Rate} = \frac{\text{Total number of new cases of specified disease per year}}{\text{Mid year Population}} \times K$$

$$\textbf{Prevalence rate} = \frac{\text{Total number of old cases existing at a point of time}}{\text{Total population at that point of time}} \times k$$

Where K can be 100 or 1000 or 10000 or 100000

- **Mortality measurement**

8.6.2 - (A)INFANT MORTALITY RATE (IMR):

This is the number of babies who die within the first year of life per 1000 live births. As infant feeding improves, the IMR decreases. In most wealthy countries, this percentage is between 10 and 20. In India, it is 80 per 1,000 live births.

$$\text{IMR} = \frac{\text{No. of deaths under one year of age in a year}}{\text{No. of live births in a year}} \times 1000$$

8.6.3 (B) PERINATAL MORTALITY RATE (PNMR): This is the number of infant deaths and stillbirths per 1000 total live births. This rate provides an indication of maternal nutrition through many other factors, including the genetic make-up of both mother and child, levels of exposure to infections, and available standards of medical care.

$$\text{PNMR} = \frac{\text{Late foetal deaths after 28 weeks or more gestation} + \text{Deaths under one week}}{\text{Mid-year population of the same age group in the same year}} \times 1000$$

Infant mortality rate (TMR): - The infant mortality rate is the number of deaths between the ages of 1 and 4 years per 1,000 live births. The severity of the symptoms and effects of malnutrition in young children is well known.

Then, among the indirect methods, we follow the evaluation of ecological factors, including several parameters. Each one can be recorded in detail.

Assessment of Ecological Factors

Ecology plays an important role in maintaining the nutritional status. Ecological factors relevant to the etiology and prevention of malnutrition include:

a) **Conditioning of infection:** Nutrition and infection are a vicious circle. The commonly associated infections with malnutrition are -

- Bacteria: Tuberculosis, whooping cough, diarrhea,
- Viral: Measles
- Parasitic: Malaria, Ascariasis
- Protozoal: amoebiasis

b) **Cultural influence**: Diet, eating habits, food attitudes, meal patterns and local reasons on causation prevention and cure of diseases. All have a significant impact on nutritional status.

c) **Socio-economic factors:**

Suitable socio-economic factors to assess nutritional status are demographic factors, literacy rate, housing and sanitation facilities, water supply, sanitation, occupation, income and food costs.

d) **Health and Education Services:**

The following information from health and education services can help you indirectly assess nutritional status.

- Information about the number of hospitals
- No. of beds and record keeping in the hospital
- No. of maternal, child and geriatric admissions
- Diagnosis of prognosis
- Methods of treatment
- Food and nutritional rehabilitation centers available, and services provided.
- Number of schools and number of students in them.
- Attendance rate of school.
- Use of mass media. availability and uses

All these methods indirectly help to assess the nutritional status.

At the end it can be concluded that indirect asessment methods are also available, but are less reliable than direct methods. Dietary intake survey results vary widely in complexity, depending on the type and number of staff involved, the time available, the purpose of the survey, and the quality of information requested from respondents. From this, we can conclude that direct methods of nutritional assessment can be mainly used and indirect methods can contribute to increasing the validity of the assessment.

MINI NUTRITIONAL ASSESSMENT (MNA)

We have studied about mini nutritional assessment in the previous unit.

8.7 PARTICIPATORY RURAL APPRAISAL (PRA)

PRA representa a group of approaches and methods that will encourage the community of a village to actively participate in raising and analyzing their knowledge of their life conditions in order to create a correct action plan.

Praticipatory Rural Appraisal approach is an approach to facilitate the understanding of the problem among the rural and their recongintion. It is an approach used by non governmental organizations and other agencies involved in international development.

Importance of Praticipatory Rural Appraisal

Following are some of the advantages of PRA which makes it importance for a program –

1- **Target groups real priorities and problems are identified -**

In PRA the target people that is people belonging to the local community are asked about the problem which they are facing. The outsiders do not try to find any solutions of these problems rather they find out an work with local prople on the problems.

2- **Delegations of responsibilities**

The technique of PRA encourages local people two manage and take responsibility towards all the developmental activities. This way the local people get a sense of ownership and enthusiasm and their efficiency to achieve the goals increases.

3- **Motivation of local development workers**

When the local development workers or the people working with non government organizations gwt to work in PRA activities. They get motivated. They also work more efficiently towards the developmental activities because they have better understanding, commitment and awareness about the local probems.

4- **Use of local resources**

In PRA activities local people encouraged to take part. These people design the activities by keeping in mind the availability of local resources. This makes complete use of existing local resources like manpower, time, materials and others.

5- **Sustainable developmental activities**

In PRA activities local people plan and carry out activities themselves. They execute the activities which are technically, environmentally, socially and financially appropriate to local conditions and thus the development is more sustainable.

6- **Bring desirable behaviourable changes**

Local people make use of visual basis like resource map. The local people encouraged to offer their views which are appreciated and included in their activities.

7- **Use of indigenous knowledge**

Local people have an indigenous knowledge system which they acquired through work experience to solve problem in their own specific situations. In PRA techniques this knowledge is shared and used for development.

METHODS OF PRA

Several PRA tools are available for data collection. These are used for relationship building as well as data collection at the village level.

A. Social Map

It is the most popular method in PRA. It depics the local habitation pattern, the nature of housing and social infrastructure. It also throws light on roads drainage systems, schools and drinking water facilities etc.

Difference between social map and regular map

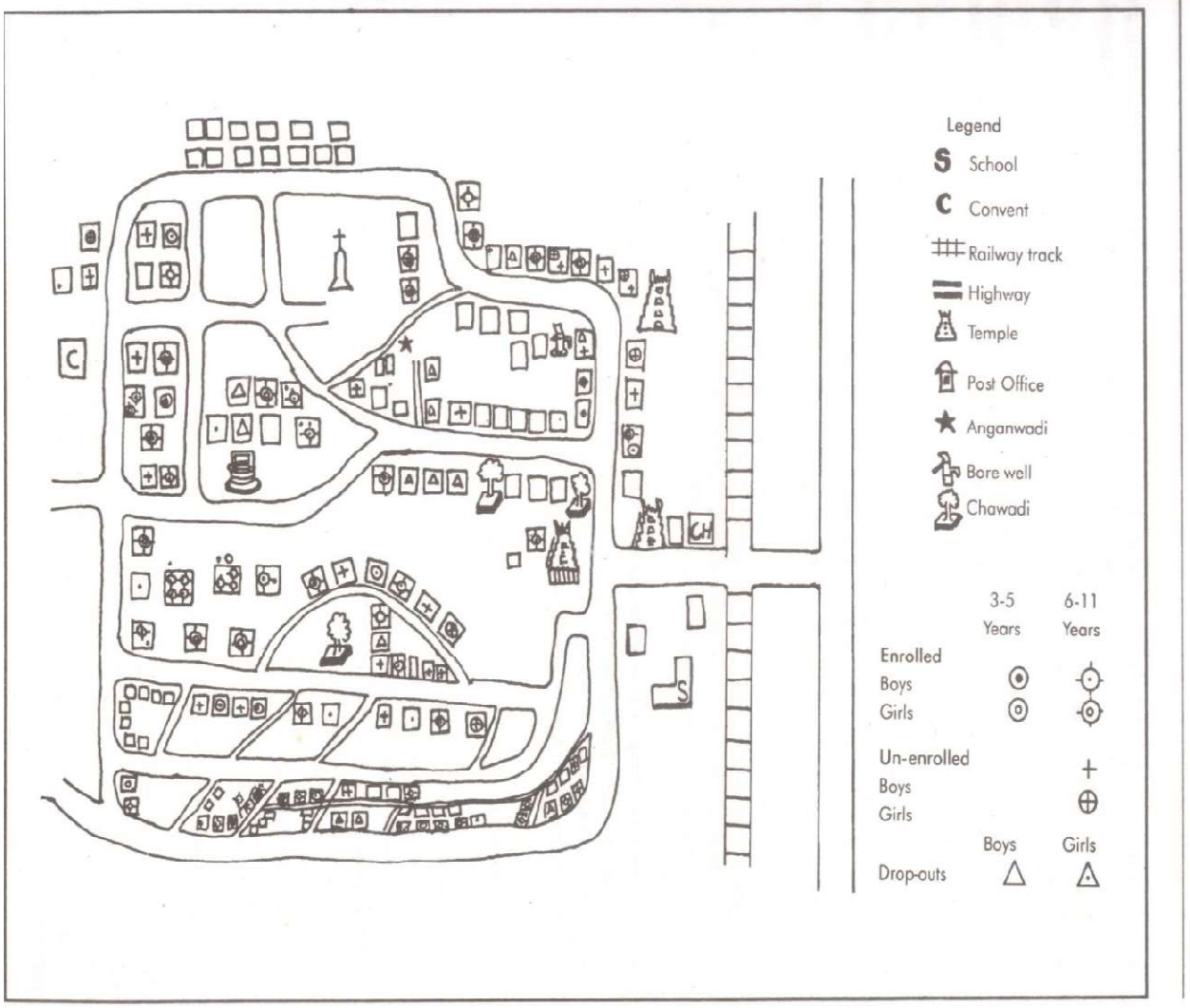
1- The social map is made by the local people and not by experts.
2- The social map is not drawn on scale.
3- The social map reflects only what the local people believe to be relevant and important for them.
4- Social map reflects the perceptions of the local people regarding social dimensions with their reality with the high degree of authenticity.
5- A social is different from a resource map also because resource map depics the natural resources like land, water sources, flora and fauna etc.

Application

A major feature of social maps is that they are very useful for comprehensively understanding different aspects of social reality, such as social stratification, demographics, habitation patterns, and social infrastructure. Various uses for social maps include:

- Develop a comprehensive understanding of the physical and social aspects of village life.
- Gather demographics and other necessary information about your household
- Provide high-altitude discussion forums to decipher various aspects of social life
- Acts as a monitoring and assessment tool.

Figure 2.1 Social Map of Chetlamallapuram Village



Social Map

B. Resource Map:

Resource maps are he one of the most commonly used PRA techniques alongside social maps. Social maps focus on residential areas, public facilities, roads, temples, etc., while resource maps focus on local natural resources, representing land, hills, rivers, fields, vegetation, etc. A resource map can also cover residential areas. In some cases, the distinction between resources and social cards can be blurred.

The PRA Resource Map is not to scale. This is done by locals, not professionals. Locals are considered to be the most knowledgeable about the area in which they have lived since ancient times. Therefore, resource maps produced by local people can be considered accurate and reliable. However, it's

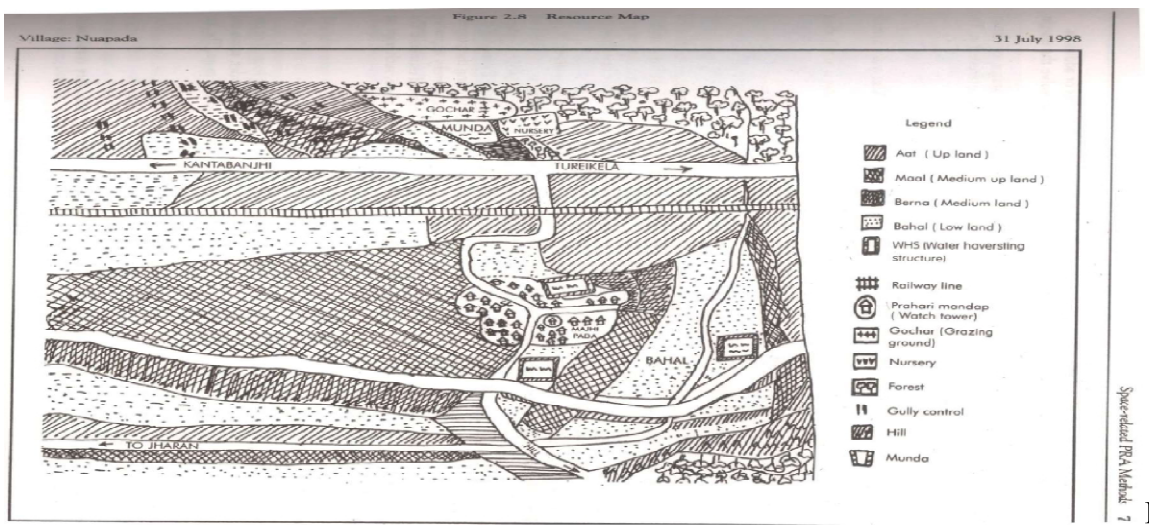
important to remember that these are people's perceptions, not exact measurements to scale. A resource map therefore reflects how people see their place in terms of natural resources.

Application

Resource Maps are used to represent various aspects related to the management of a location's natural resources, including:

- Topography , Terrain, Slope
- Forests, vegetation and tree species
- Soil type, fertility, erosion and depth
- Land and land use, command areas, holdings, boundaries and property;
- Water, bodies of water, irrigation sources, rivers and drainage
- Watershed development, various soil and water conservation measures, bare land, etc.
- Agricultural development, cropping patterns, productivity, etc.

Resource maps have proven particularly useful as they provide a spatial structure that focuses discussion and analysis.



Resource Map

C. Transect Walk:

Transect is another PRA technique for exploring the spatial dimension of people's reality. It is widely used in natural resource management. It provides cross-sections representation of different

agroecological zones and specific characteristics such as topography, land types, land use, tenure, access, soil types, soil fertility, vegetation, crops, problems, opportunities and solutions.

Natural resources continue to be the focus of each sector, but this does not mean that there is no place to show the social dimension. Different social aspects are displayed depending on the exercise goals. The determinants of caste and ethnicity, access and control, and gender aspects of settlements are well documented. Transects are different from resource maps, even though they overlap in area. A resource map provides a bird's eye view of a location with an emphasis on natural resources. Transects, on the other hand, represent cross-sections of different agroecological zones, allowing the zones to be assessed comparatively using different parameters. This is typically done after the resource map and is useful for triangulation. It also helps advance the process of identifying and planning natural resource development issues in the region.

Application

Transects are used for a variety of purposes, including:

- Assessment of natural resources with respect to current issues and opportunities
- Consideration of issues raised in other of his PRA exercises, particularly social mapping, natural resource mapping, etc.
- Plan different interventions and check the relevance of planned interventions
- Monitoring and evaluation of interventions and projects.

D. Timeline:

Timelines are an important PRA technique often used to examine the dimension of time from a historical perspective. The chronology records the chronology of events as remembered by the locals. It is presented as a continuous accumulation of past events. The important thing here is that it is not history itself, but past events that people themselves recognize and remember.

Application

The timeline method is useful when:

- Learn from the community what the community considers to be significant past events.
- Gain a historical perspective on current issues from the community.

- To stimulate discussion about changes related to topics of interest. B. Education, Health, Food Security, Gender Relations, Economic Conditions, etc.
- Developing relationships with villagers, such as discussing the village's past, which is a good, non-threatening and enjoyable starting point.

Figure 3.1 Time Line

llage: 49 Bannur April 19

1905	• Construction of irrigation tank
	• Main crops were jowar, horse gram and a coarse cereal locally known as Korra
1931	• Drought—20 families migrated
1940	• Private school building constructed
1945	• 10 irrigation wells excavated. Led to changes in crops cultivated later.
1950	• Church built
1954	• First 'sarpanch' (chief of the local self government at the village level) was elected
1960	• Drought
1969	• Gravel road laid
1977	• Electricity connection to the village
1983	• Government school buildings—one Telugu and one Urdu medium constructed
1985	• Two drinking water tanks built
1991	• Bus service started to the village
1992	• Savings and credit programme started
1995	• First woman elected as 'sarpanch'
1996	• Sanction of governement housing colony for the weaker section
1997	• Intervention of BIRDS—a voluntary organisation in the village
	• First television set in the village

Participants: Fakruddin (male, 70 years), Sarojamma (female, 50 years), Subbamma (female about 90 years), Tirapalu (male, 55 years) and others
Facilitator: Anil Kumar

E. **Seasonal Map**:

Seasonal charts are also known as seasonal calendars, seasonal activity profiles, and seasonal analysis. Seasonal charts are one of the most common PRA techniques used for time analysis over annual cycles, with months or seasons as the basic unit of analysis. This reflects the local population's perception of seasonal variations in various items. However, seasonal charts are not statistically based, but can be triangulated using secondary or primary data to validate the information generated.

Seasons are an integral part of people's lives and have a significant impact on the lives of locals, especially in rural areas. Seasonal charts are used to see what happens throughout the year and when.

By quantifying the scale of various activities, the usefulness and richness of the activities are further enhanced.

Application

Seasonal charts help identify periods of high workload, periods of relative easing, credit crunch, disease, food security, wage availability, and more. It helps in carrying out various activitie and planning programs. This is used to identify times of stress and plan when intervention is most needed. Seasonal charts allow you to identify and analyze survival patterns throughout the year. A great advantage of seasonal analysis is that it presents a set of factors and their magnitudes, and helps us understand how these factors are related and influence each other. These relationships can be very revealing.

Figure 3.15 Seasonal Diagram: Agriculture and Education

Village: Aukpa-Adoka, Nigeria June 1999

Criteria \ Months	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
Happiness 5=high 1=low	3	5	5	4	2 • Drinking water	4	5 • Children day and matches	2 • No money • Farming	1 • No food • Work load	5 • Yam • Vacation	4	5
Proposed Change								Vacation	Vacation			
School expense TN = Text & note book C = Extra classes F = Free P = Pocket expenses B = Bire (pen) E = Excursion	P 200 B 20	P 200 B 20	C100 F 200 P 200 B 20	E 100 P 200 B 20	P 200 B 20	C 100 F 400 P 200 B 20	E 100 P 200 B 20	P 200 B 20	P 200 B 20	P 100 B 20	TN 2600 C 100 F 400 P 200 B 20	E 100 P 200 B 20
Students' attendance (Present / Absent)												
Diseases children suffer from				Measles / Running	Typhoid / stomach		Sore throat / Headache		Sore throat	Malaria		
Activities children engage in	Farming, harvesting hunting, football			Harvesting honey, clearing farmland, trading in yam, hunting, fishing			Prepare yam heaps, planting, trading in yam, hunting, fishing, football			Planting of tomatoes, pigeon pea, beni seed; football		

Participants: Ocheme Ameeh, Timothy S. Akor and others
Facilitators: Somesh Kumar, Paul and Andrew

150 Methods for Community Participation

SUMMARY

After studying this unit the students on one hand will understand the meaning and importance of Assessment of Nutritional status and on the other hand they would get an insight of the various methodologies used for Assessment of Nutritional status. They would also understand the meaning importance and methods of participatory rural appraisal techniques.

This unit deals in detail with the different methods of assessment which are collectively called the ABCD analysis.

CHECK YOUR PROGRESS EXERCISE – 2

1- Write down importance of functional assessment? ----------

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2- Throw light on Grip Strength Test? ----------

3- What do you understand by squatting Test? ----------

4- How the health of a person can be assessed by Respiratory Fitness Test? ----------

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5- What do your understand by PRA methods? What are its importance. ----------

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6- What are the indirect methods of assessment of nutritional status? ----------

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7- What are the various methods of Praticipatory Rural Appraisal? ----------

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8- Write short note on the following

- Seasonal map ----------

- Difference between social map and regular map----------

9- Write a detail note on functional assessment? ----------

8.9. REFERENCES

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UNIT 9 FOOD AND NUTRITION SURVEILLANCE SYSTEMS

Structure

9.0 Objectives

9.1 Introduction

9.2 Nutritional Monitoring

9.2.1 Objectives of Nutritional Monitoring

9.2.2 Components of Nutritional Monitoring

9.3 Nutritional Surveillance

9.3.1 Comparison between Nutritional Monitoring and Nutritional Surveillance

9.3.2 Objectives of Nutritional Surveillance

9.3.3 Nutritional Surveillance Process - The Triple A cycle

9.3.4 Methodology of Nutritional Surveillance System

9.3.5 Methods of carrying out Nutritional Surveillance

9.4 Food and Nutrition Surveillance System Indicators

9.4.1 Types of Indicators

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9.4.3 Selection of Nutritional Indicators

9.4.4 Criteria for selecting indicators – the SMART Concept

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9.5 Food and nutrition surveillance Implementation Steps

9.6 How to strengthen a Surveillance System

9.7 Characteristics of a good nutrition Surveillance System

9.8 Principles of Transforming a weak surveillance system into a strong one.

9.9 Check your Progress

9.10. References

9.0 OBJECTIVES

The immediate objectives of a food and nutrition surveillance system are:

- to describe the nutritional status of the population, with particular reference to defined subgroups who are identified as being at risk; this will permit description of the character and magnitude of the nutrition problem and possible changes in these features;
- to provide information that contributes to the analysis of causes and associated factors and therefore permits a selection of preventive measures, which may or may not be nutritional;
- to promote decisions by governments concerning priorities and the disposal of resources to meet the needs of both "normal development" and emergencies;
- to enable predictions on the basis of current trends in order to indicate the probable evolution of nutritional problems. Considered in conjunction with existing and potential measures and resources, these will assist in the formulation of policies;
- to monitor nutritional programmes and to evaluate their effectiveness.

9.1 INTRODUCTION

The food and nutrition surveillance system is a mechanism to transfer food and nutrition data through food preparation, modification and application of the food and nutrition policy of a country.

9.2 NUTRITION MONITORING

Adequate and proper nutrition is very important for a good health of population. It is because of a complex set of factors cutting across a number of economic sectors. A well-organized national nutrition monitoring and surveillance system is necessary for the formulation of a realistic national nutrition policy and to plan a comprehensive food and nutrition related action programmes.

The term monitoring and surveillance are often used synonymously in nutritional assessment but we shall understand the difference between the two terms.

Monitoring refers to the collection analysis and feedback of quantitatively précised measures from a relatively large representative samples of a population at the national and state level. It is essential for the purpose of finding out time trends and an understanding differences in the diet of the population sub group, their nutritional status and nutrition related health and disease risk.

The WHO defines nutritional monitoring as follows:

"It is the measurement of changes that take place overtime in the nutritional status of a population or a specific group of individuals."

9.2.1 OBJECTIVES OF NUTRITIONAL MONITORING

- To assess the nutritional status of representative group of communities on a continuous basis in order to study the changes in the nutritional status if any.
- To evaluate the various intervention programs to determine the achievement of the goals.
- To identify current information gaps and new information that needs to be consistent with the demographic and epidemiological changes that may take place in the population.

A well planned and integrated national monitoring system should cover the following content areas:

- Food and nutrient consumption at household and individual levels.
- Nutritional status by anthropometry and clinical nutritional deficiency conditions.
- Nutrition related risks of selected chronic diseases.
- Food security particularly at household levels.
- Identification of vulnerable sub groups of the population which are at higher risk of nutrition related health problems.
- Food Safety.

All the above information should be focused on selected high risk, sub population group like Below Poverty Line (BPL) Population, population in chronically drought prone areas and tribal population.

9.2.2 COMPONENTS OF NUTRITIONAL MONITORING

The nutrition monitoring system is based on following two components -

1- **Population group** – for conducting the nutritional monitoring process, it is important to first decide the target groups of population specially the vulnerable groups of developing countries. After assessing the current nutritional status of different age groups the monitoring of nutritional status of vulnerable groups specially mother and child are highly prioritized. The monitoring of nutritional status of pre schooler's and school going children is also done but the main aim of nutritional monitoring should be on the whole population for getting the true picture of the community through monitoring.

2- **Key indicators used in monitoring** – An effective nutritional monitoring system should provide information on the following points –

- Prevalence of nutritional disorders either by direct measurement and observation or by self reported diseases prevalent in different groups.
- Information about the personal attribute of people of the community.
- Nutrition behavior of the community.
- Information on utilization of health and nutrition services.
- Information regarding various aspects of nutritional status e.g. under weight, wasting and stunting in addition to clinical assessment should be included.
- Laboratory supported hemoglobin estimation at least once in five years should also be included to detect anaemia among all the groups of population particularly among pregnant women and young children.
- To assess the intra-family food distribution dietary intake by all the individuals should be recorded.
- Data on various aspects on implementation of intervention program should also be included. The data collected should be accurate and should representate of whole communities.

9.3 NUTRITION SURVEILLANCE

Nutritional surveillance means watching over nutrition in order to make decisions, which we lead to improvement of nutritional status of a population.

WHO defines nutritional surveillance as follows, “it is continuous and systematic process of collection, analysis and interpretation of information to assess nutritional status and to initiate appropriate early actions to promote optimal nutrition action.”

Therefore nutrition monitoring is an integral part of nutrition surveillance and it refers to “repeated measurement of nutritional status of population at regular intervals or a specific group of individuals over a period of time.” But surveillance is concerned with data levels for initiating actions in response to events occurring during specific programme implementation in the population.

9.3.1 COMPARISON BETWEEN NUTRITION MONITORING & SURVEILLANCE

Nutrition Monitoring	Nutrition Surveillance
Measurement tool to keep a watch on the nutritional status of community to assess the	Nutritional surveillance means watching over the nutrition in order to make decisions which

changes in nutrition status of people over a period of time.	will lead to improvement of nutritional status of population.
It is an integral part of nutritional surveillance.	Nutritional surveillance is not a complete procedure and includes monitoring plus taking appropriate interventions.
The data collected through monitoring are more precise quantitatively.	The measures / data collected for surveillance purposes are often less precise compared to measures collected in monitoring systems.
The timely feedback of information to influence nutritional policy is the key feature of successful monitoring.	The timely feedback to plan, target and carryout needed programmatic activities and corrections in terms to achieve set objectives / goals is the key feature of surveillance.

9.3.2 OBJECTIVES OF NUTRITIONAL SURVEILLANCE

The immediate goals of the food and nutrition surveillance system are to:

- To describe the nutritional status of the population, particularly in relation to defined subgroup identified as vulnerable. This makes it possible to explain the nature and extent of nutritional problems and possible changes in future.
- To Provide information that contributes to cause-and-connection analysis.
- Monitor nutrition programs and assess their effectiveness.
- To monitor nutritional programs and assess their effectiveness and also evaluate the various interventions program in operations to determine the achievements of the program or to make sure weather the goals of the program have been met or not.
- Facilitate Government Decisions on Priority and Disposal Resources that meet both 'normal development' and urgent needs.

In emergencies, goals specifically focus on:

- Warning system. It is used as a means of highlighting the ongoing crisis.
- Determination of appropriate reaction strategies. This may also include non-food products as food aid to address the underlying causes of malnutrition.

Table I Aims of a food and nutrition surveillance system

Purpose	Time-frame	Type of information required	Leading sectors
Warning system of nutritional emergency	Short term	Food availability Early effects on nutritional status	Agriculture Meteorology Livestock Food Health
Trends of malnutrition over a number of years	Medium to long term	Change in nutritional status Trends in economy and agriculture	Health Economic Agriculture
Trends in nutritional effects of affluence	Medium to long term	Change in nutritional status Morbidity and mortality from specific diet-related diseases	Health Food

provoke a reaction- Nutrition monitoring system provides trend analysis that notices the magnitude of the change. This may initiate a detailed evaluation. It can lead to reactions.

alignment - Nutrition information helps target areas which are more vulnerable or are at risk or areas which are in need for greater help.

Identification of malnourished children - Some forms of surveillance can identify Children with severe malnutrition.

9.3.3 THE NUTRITION SURVEILLANCE PROCESS – "TRIPLE A CYCLE"

Nutritional surveillance process includes A**ssessment, Analysis and Actions** to promote better health and nutrition. These three processes are termed as triple "A cycle". **Nutrition surveillance process – 'Triple A cycle'** – the nutrition surveillance process includes the following three points –

- Assessment
- Analysis
- Actions to promote better health and nutrition

The first step – ASSESSMENT

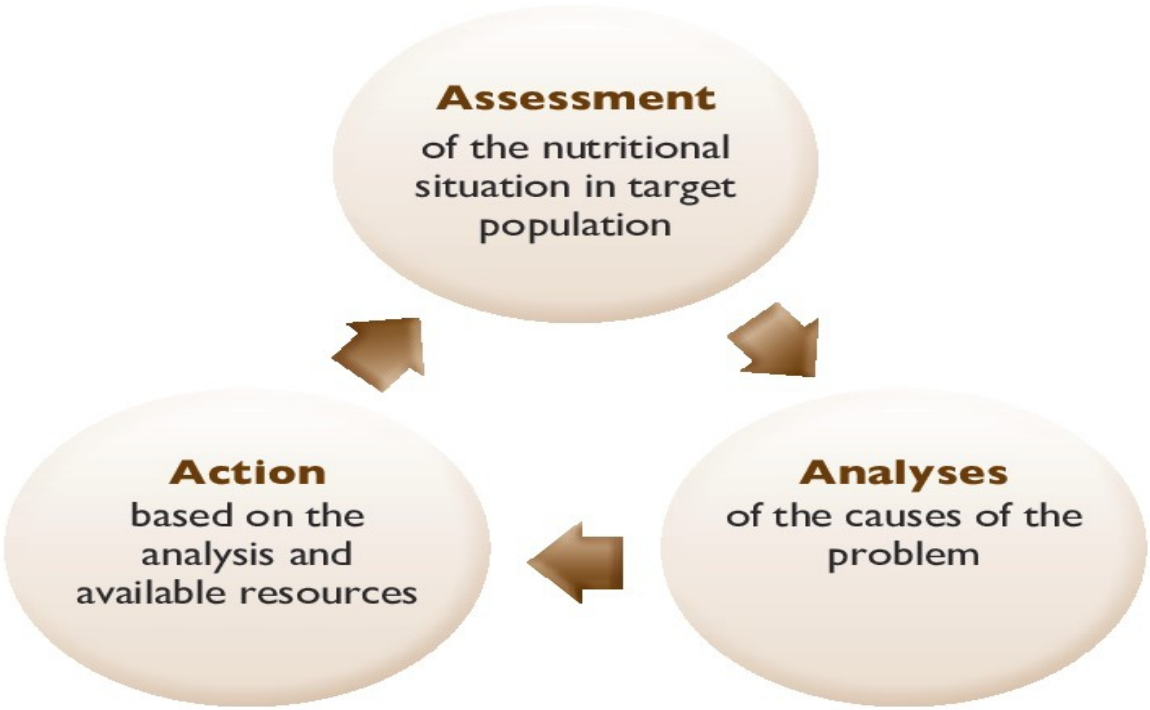
In this step the nutritional status of individuals is done.

The second step – ANALYSIS

In this step the causes of the deterioration in nutritional status are found. For example the reason of poor nutritional status in an area among pre school children may be due to delayed complementary feeding, inadequate dietary intake, frequent attacks to infections and non utilization of services provided by Government etc.

The third step – ACTIONS TO PROMOTE BETTER HEALTH AND NUTRITION

In this step the health and nutrition workers carefully inquire the reasons behind the deterioration and nutritional status at local and household levels and then introduce suitable actions. The action may be proper nutrition education of mother or awareness creation or feeding nutrient dense foods to infants or controlling infectious diseases by health services.



Triple-A cycle diagram addressing nutrition-related problems

9.3.4 METHADOLOGY OF NUTRITION SURVEILLANCE SYSTEM

The methodology consist of the following key points –

- **Indicators for data collections** – the nutritional surveillance system in the country depends on information collected from the periphery and processed at the centers.

  Information which can be collected from the periphery might come from various areas like health, food, agriculture, socio-economic and other areas. Information are collected by using certain indicators from these areas. The indicators for nutritional surveillance are based on certain measurements or observations that have direct or indirect relation to health and nutritional status of the population. Since malnutrition is a multi factorial problem indicators for nutritional surveillance are selected form different aspects. The indicators are generally health indicator and socio-economic / non health indicators types.

a. **Health indicators –**
    - Vital statistics
    - Anthropometric measurements
    - Clinical Assessment (signs and symptoms)
    - Biochemical indicators

b. **Non health and socio-economic factors**
    - Monthly income of the family
    - Percentage of monthly income spent on food
    - Literacy status of father and mother
    - Family size
    - Land holding
    - Crisis of staple food items at different seasons such as during rainfall or drought months.
    - Birth intervals
    - Availability of safe water etc.

However any indicator selected for nutritional surveillance system should have the following properties –

- Should be easy
- Inexpensive
- It should be easily collected through the existing health and other system of the country.
- Must be sensitive enough to reflect the nutrition situation of the country.
- Should be least time consuming.
- Should be feasible for collection.

ASSESSMENT OF THE NUTRITIONAL SITUATION IN THE TARGET POPULATION

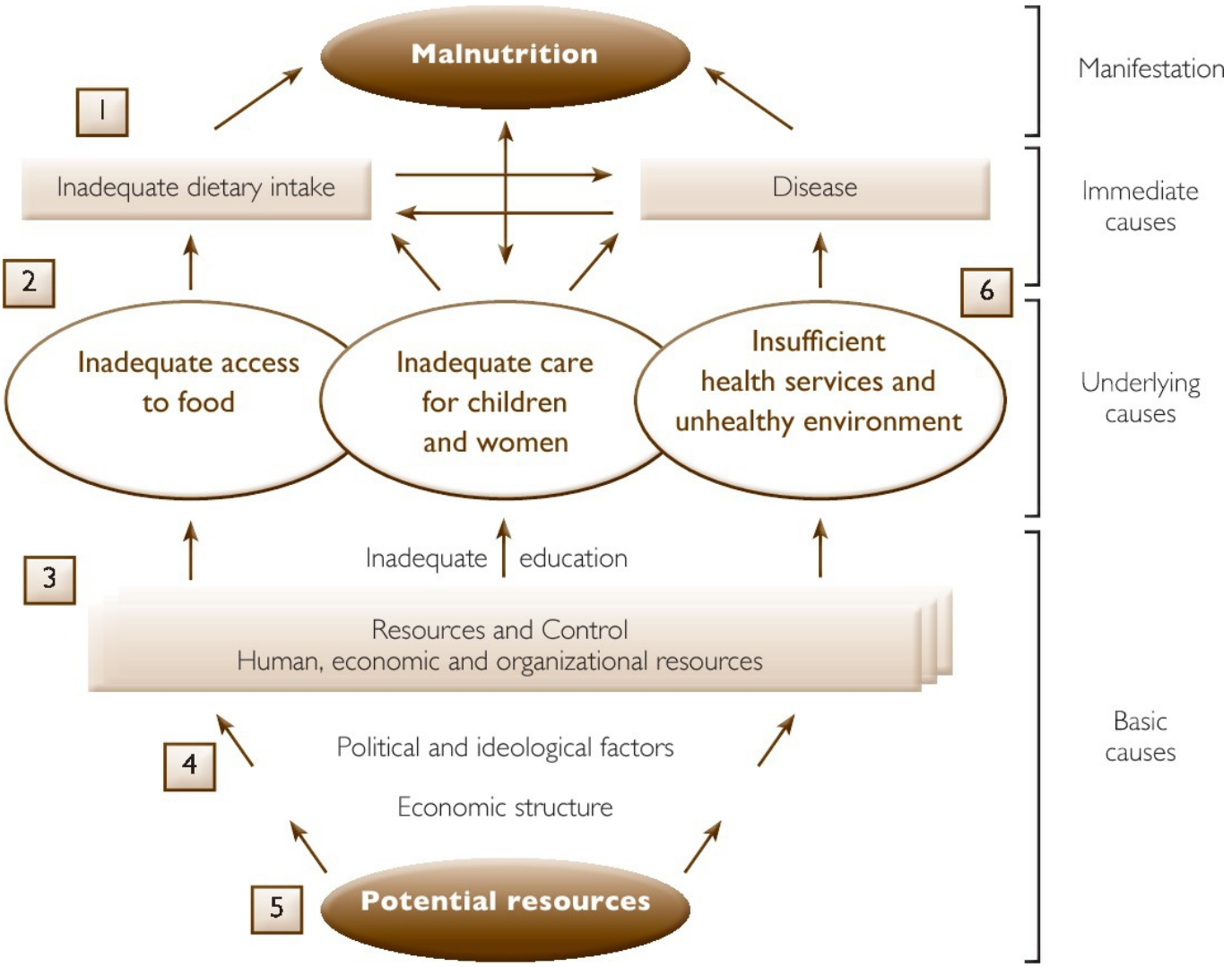
For the assessment of the nutritional situation the major determinants of nutritional status have to be determined –

MAJOR DETERMINANTS OF NUTRITIONAL STATUS

The nutritional status of a population is affected by many variables, including: food production and availability, purchasing power, dietary habits and intake, disease patterns and other relevant factors. These factors can be causally arranged sequence or model.

Malnutrition can be caused by not eating the right amount or type of food or by a particular health condition. It can be caused by illness Digestive tract, such as indigestion and malabsorption after ingesting food . Other causes of malnutrition include increased energy and increase nutrient needs due to illness or nutrient losses due to illness like diarrhea and bleeding, etc.

With the above information, factor-focused models can be developed showing effects of various factors on nutritional status, including interactions with malnutrition infectious diseases, sanitation or water supply.



1. Nutritional status depends on dietary intake of food and nutrients, and disease
2. Family or individual food intake or food consumption depends on food available to the Family and family awareness regarding nutrition.

3. Food availability depends on: (a) the relationship between food prices and market returns; work; (b) food harvesting in subsistence households; (c) both prices – Wage Rates and Mixed Market and Subsistence Household Production
4. The relationship between food prices and income is greatly influenced by imports and food aid.
5. Regional food production is influenced by many interrelated factors both within and outside the region Country (such as weather).
6. Food utilization depends on the physiological state of the human body, which is influenced by environment, access to clean water, and morbidity. Morbidity status results from inadequacies in the environment, water and sanitation situations.

9.3.5 METHOD OF CARRYING OUT NUTRITIONAL SURVEILLANCE

Normal situation

The following general method is recommended for setting up food and nutrition monitoring systems under normal conditions.

Large-scale food and nutrition research

The surveillance system should create an inventory of all major public health, diet and nutrition surveys. This could serve as a basis by breaking down the data at the sub region, district and village level. In particular, general surveys such as population health surveys, national nutrition surveys, or national food security surveys should be considered. Be sure to include your chosen nutritional indicators.

Repeat small surveys

A duplicate small survey is a population-based survey that uses standard methods to collect quantitative and qualitative data. They assess the type, severity, extent and causes of malnutrition in a representative sample of the population (children and/or adults). Its purpose is to help policy makers and managers develop strategies and prioritize areas at risk and specific types of interventions. Replicate surveys include national surveys conducted periodically at the national level and smaller surveys conducted at the local level to collect nutritional information in a timely manner.

Sentinel Site Monitoring

Sentinel Site Monitoring monitors a limited number of sites to identify general health trends in the population. Sites can be specific populations or villages that cover vulnerable populations. Trends are

monitored using a variety of indicators including nutritional status, morbidity, nutritional problems, coping strategies and food security. Data can be collected and analyzed centrally (central-based Sentinel site monitoring) or by trained members of the community (community-based Sentinel site monitoring).

Census data

Nutritional assessments are conducted occasionally at school. The aim is to identify at-risk children with poor health, malnutrition and low socioeconomic status. Results can be used to support policy-making in targeted school feeding programs and food-based strategies. The need to monitor obesity in school-age children is becoming increasingly important. School census data, supported by information on specific food consumption patterns, marketing of healthy foods, and information on physical activity levels, are crucial in understanding the major causes of obesity.

Growth monitoring

Growth monitoring is the continuous monitoring of a child's growth. The aim is to identify growth retardation or failure on an individual level and contribute to the timely resolution of the problem. Growth is usually measured as weight for age once a month. However, new WHO growth curves (weight/height or length) are now recommended. Growth monitoring can be performed by medical professionals at maternal and child health clinics (clinic-based growth monitoring) or by trained community members in the village (community-based growth monitoring).

Emergency Situation

Emergencies quickly require data and information about vulnerable people and groups. Therefore, the Joint United Nations Nutrition Cluster Survey recommended the following -

Sentinel Site Monitoring is especially useful for early warning purposes and can quickly identify trends. These trends may serve as a catalyst for conducting nutritional surveys to more accurately determine the extent of malnutrition.

In an emergency, we can get additional data sources from:

• Rapid nutritional assessment.

• Rapid screening based on average upper arm circumference.

There is no single prescribed method for emergency nutrition monitoring systems. Different sources of nutritional information are often used depending on the circumstances and what is appropriate, available and feasible. Best methods use representative data from a population.

Challenges

The most important aspect of food and nutrition management systems is ensuring an effective link between information and action. But reliability of data, timeliness of reporting, efficient behavioral management and sustainability are all challenges. Another challenge is the interpretation of the results or findings. Similar levels of acute malnutrition have different implications depending on the context. If the underlying causes of malnutrition are not understood, appropriate responses may not be possible. One of the biggest challenges is ensuring effective system continuity. One of the main reasons surveillance systems have failed in the past is the failure of national and local governments to allocate the necessary resources to maintain surveillance systems.

When establishing nutrition monitoring systems, it is important to plan for long-term sustainability, especially in areas where the crisis is likely to persist. Ideally, if a system proves to be effective and sensitive in monitoring changes over time, it should not be difficult to justify long-term allocation of resources. Having an accurate early warning mechanism to initiate a response is far more cost-effective than supporting a full-scale humanitarian response to a food emergency.

Institutionalization

Institutionalization can also be an issue, such as adapting the system and linking it with existing early warning and health information systems. The risk of many information systems is that they rely on a variety of information sources across multiple government departments, such as health, agriculture, and education. This means that certain ministries are not responsible for managing the system and it can spiral out of control over time.

Connecting information into action

Linking information to action is very important. Collecting data that is not actionable is pointless. Surveillance systems should therefore be designed to maximize the potential for response when necessary. This should consider the system's ideal institutional location, information dissemination channels, and the environment in which the analysis will be presented. Involving decision makers in the design and development of analytical frameworks for using information makes the system more reliable and more likely to respond when needed.

USE AND USER OF MONITORING INFORMATION

There are many factors that lead to malnutrition. For example, socioeconomic status, potential users of nutrition monitoring information can be found in different areas (Table 2). Although it is unrealistic to expect diet to play a leading role in decisions about overall resource allocation, diet monitoring can help analyze diet outcome strategies, suggest alternative diet strategies, and ultimately can be used to objectively assess their impact. There is an advocacy role for long-term nutritional monitoring that supports other similar methods that seek to identify the root causes of malnutrition. However, surveillance probably has the greatest potential to drive changes in pro-nutrition policies on specific selected issues.

Table2Stakeholdersoffoodandnutritionsurveillancedata

Stakeholder	Purpose
Government	*Nutrition*: national food and nutrition guidelines, nutrient reference values, nutrition goals and targets, nutrition strategies (e.g. Healthy Eating–Healthy Action), purchasing services *Health:* health strategies (e.g. chronic is ease, in equalities, population subgroups), purchasing services, health promotion, advice for higher health authority *Food*: development, monitoring and enforcement of food regulations and standards (e.g. food safety, composition and labelling), international food standards (Codex), advice for Food Safety Authority
Health sector	Programmes (e.g.nutrition education ,health promotion ,food safety) and services, patient advice and education
Non governmental organizations	Policies and programmes health promotion
Academic in stitutions	Teaching, research direction, data for research
Food industry	Food labelling, food marketing
General public	Information, advice, education

The in equitable distribution of resources, but in reality decisions on them have a better chance of influencing nutritional status.

SOURCESOFDATA

Sources of food and nutrition surveillance data can be primary or secondary. Primary data are collected through surveys specifically designed for food and nutrition monitoring. National Diet Surveys are the most important source of primary data, providing detailed and specific information on food and nutrient intake, nutritional status, and diet-related health conditions. Ideally, food and nutrition

monitoring data should be collected continuously. However, this is not a viable option for most countries due to the high cost of conducting dietary surveys. Most countries conduct regular national dietary surveys approximately every 3 to 5 to 10 years. This is believed to be sufficient to accommodate changes in dietary habits and new food technologies.

Secondary data are derived from data collected for purposes other than food and nutrition monitoring. Possible sources of secondary data include periodic health statistics, household surveys, market research surveys, industry surveys, and research studies. Aspects to consider when assessing the value of secondary data sources include:

• Periodicity of data collection (ad-hoc, periodic, continuous).

• Frequency of data collection (weekly, monthly, yearly).

• Level of aggregation (individual, household, national).

• Sample size and sampling strategy.

• Data storage format (computer, paper).

• Data availability and cost.

Table 3 shows the data sources for each monitoring item.

Table3 Summary offood and nutrition monitoringdomains and data sources

Sector	Data source	Comments
Food supply	Health economic survey (household) Food balance sheet (national)	Includes national and house hold food supply
Food consumption	Adult and child nutrition surveys; limited data on selected food groups (e.g. vegetables and fruit) from health surveys	All foods and beverages, including for tified or functional foods, dietary supplements and breast milk
Diet ary patterns	Nutrition survey data	Fact or analysis or diet quality score (e.g. Healthy Eating Index)
Nutrient in take	Derived from nutrition survey susing food composition tables	Requires maintenance of up-to-date food composition database
Nutritional status	Adult and child nutrition and health surveys	Includes an thro pometricand biochemical measurements
Nutrition-related health status	Health and nutrition surveys	Includes incidence and prevalence of is chaemic heart disease, diabetes, obesity, blood pressure, blood lipid profile

Food security	Nutrition surveys Healthy food basket pricing Food bank surveys Benefits tatistics	Includes various dimensions of house hold food security
Food culture	Nutrition surveys Survey of foods consumeda way from home Surveys of advertising and marketing	Includes food preferences, food preparation practices, social settings for eating, portion sizes, consumer knowledge, attitudes and behaviours, marketing and advertising practices
Stage of change	Nutrition surveys	Includes intention and attempts to change diet; perceived barrier so rfacilitators of dietary change
Links to other risk or protective factors	Health and health behavior survey	Includes drug use (especially alcohol and tobacco), physical activity, infant carepractices (i.e. breastfeeding)

9.4 FOOD AND NUTRITION SURVEILLANCE SYSTEM INDICATORS

Nutritional indicators are used to monitor, diagnose, and evaluate individual nutrition and nutrition-related interventions. They are also used in populations to determine the scale and trends of monitored nutrition problems, their location and causes, and to assess the impact of nutrition programs and policies. or in research to identify biological and social mechanisms affected by nutrition.

All of these activities involve measuring nutritional indicators. However, indicator selection, indicator measurement and analysis in research, patient management, public policy, or program planning and evaluation can be very different. So in general, the best indicator, the measurement of the indicator, or the best analysis of the indicator, etc. is because it comes down to what works best in each situation based on the purpose for which the indicator is intended. Nutritional indicators can be used to measure the following nutritional determinants or outcomes:

• Individual level (patient diagnosis, screening, monitoring, etc.)

• Population level (policy setting, program evaluation, nutrition monitoring, etc.).

9.4.1 TYPES OF INDICATOR

Indicators for evaluation and analysis of nutritional status

NUTRITIONAL STATUS INDEX

Combating and managing malnutrition largely depends on information about the nutritional status of the population. Such information is provided by nutritional status indicators that characterize the nature of the malnutrition problem. They are then linked to people, time and place characteristics to get an indication of the distribution of the problem in the population and get a complete picture of the situation.

When setting nutritional priorities, you should ask the following questions:

- What is the nature of the malnutrition (undernutrition, overnutrition, micronutrient deficiency, severity, etc.)?
- Who suffers from malnutrition (age, gender, place of residence, etc.)?
- Where are these malnourished people located (eg, most vulnerable zones or administrative districts, districts, regions, etc.)?
- When does it occur (eg, transient, seasonal, or annual, recurrent or non-recurrent, chronic)? • What type of issue is it (e.g. emergency or "normal situation")?

First, metrics must be collected on an individual level (e.g. weight, height, arm circumference, hemoglobin level, etc.). This information is then expressed at the level of the affected population group in the form of prevalence (i.e. health or nutritional percentage of people with ataxia). An example might be the percentage of her children under age 5 whose weight index for age is below her 3 z-score or below her 2 z-score. OR >3 Z-score, or her 2% of adults with BMI <18.5 or <16.0 kg/m².

CAUSE OF INDICATOR

Once the nutritional status of the population and its geographic or socioeconomic distribution is known and improvement targets are set, information on the determinants of the situation is required. First individuals at various levels within a population have to be analyzed for factors, events, or characteristics likely to influence nutritional status. It will then be possible to modify many of these factors to define strategies to improve the situation as reflected in the stated objectives.

The direct causes of malnutrition/malnutrition are:

- Inadequate food intake
- Disease / infections.

The underlying causes of malnutrition/under nutrition are:

- Food insecurity
- Environmental hygiene, access to health services.

Therefore, basic agro ecological and socioeconomic indicators should also be included in the causal analysis of nutritional status at the national level. These are usually available from large institutions and ministries, especially planning authorities.

INDICATORS FOR MONITORING AND EVALUATING NUTRITION PROGRAMMES

Based on current assessments of a country's nutrition situation and considering the different causes of malnutrition identified at different levels, the nutrition policy mandate sets priorities and translates them into general goals. Which are then translated into strategies to implement programs, each with specific goals and objectives.

9.4.2 CHARACTERISTICS OF INDICATORS

To facilitate indicator selection, specific characteristics are used to assess usefulness for the intended purpose.

Basic characteristics

The basic features of the indicator are:

- **Effectiveness** - A good metric is one that actually measures what it should measure, and measures it as directly as possible. This is considered the most important property.
- **Reproducibility (reliability)** - It refers to the comparability of results when repeating measures of the indicator under standardized conditions. Independence from the person or equipment involved. This is especially important for monitoring.
- **Sensitivity and specificity** - Sensitivity is the ability to correctly identify the searched cases (that is, positive responses). Then specificity is a measure well negative cases are identified, such as those who do not have the disease. In other words, certain indicators only measure real cases. A comparative reference (“gold standard”) is usually required for evaluation.

Operational characteristics

Operational characteristics relate to the applicability of indicators.

- **Availability**- Availability means the possibility of obtaining (collecting) the data required for the metric. These must be considered before all other operating characteristics, as only the available data can actually be recorded but some nutritional indicators may have been gleaned from other recently introduced nutritional programs.

- Reliability - This depends on the accuracy and representativeness of the data and the quality of the data sources. Represents trust in data.
- Representativeness - It describes how well the metric reflects the population and phenomenon being evaluated.
- Simplicity - Simplicity is another important factor to consider when collecting data, as it has a large impact on the time and effort required and the frequency that can be achieved.
- Cost - Costs can also play a role if data is not routinely and centrally collected, but this is difficult to estimate.

NUTRITIONAL INDICATORS

Traditionally, nutritional indicators have been categorized as follows:

- Biochemical
- Clinical
- Anthropometry
- Ingestion.

This classification is only relevant in relation to the personnel and facilities required to assess these indicators. But that tells us little about the metric's usefulness in achieving its intended goals. To find this information, the nutrition index should be based on what it tells us (e.g., nutritional problems, risk of current nutritional problems, risk of future nutritional problems, benefits of interventions, and their response to intervention).

There are some goals for different uses of nutrition metrics. Some types of metrics are more useful than others to help you reach your goals. Even if the goals are not mutually exclusive, the metric's requirements for achieving one goal may conflict with the achievement of another goal.

- If the goal is to identify individuals or groups to prevent malnutrition, the indicator should be an adequate indicator of future malnutrition risk. For individuals, this indicator is usually not related to individual nutritional status. This is because changes tend to be too slow for preventative interventions.
- If the goal is to identify currently undernourished individuals or groups in order to prevent the effects of undernourishment, nutritional status indicators are the best choice. Also, if the index of Good predictors of response to intervention.

- Where the aim is to identify individuals or population groups already suffering the consequences of malnutrition in order to introduce non-nutritional interventions. To solve a problem, results can be sought as long as the solution effectively overcomes the effects of the problem due to nutritional and non-nutritional causes.
- To assess individual treatments, program outcomes, or studies, outcome measures must have the potential to respond to dietary interventions or determinants in a manner that can be identified with good statistical data performance. This metric usually refers to:
    - risk of future malnutrition or its consequences
    - Damage from past malnutrition.

9.4.3 SELECTION OF NUTRITIONAL INDICATORS

Indicator selection procedure

To select a metric:

1. Development of a conceptual framework for nutrition status, including analysis at different levels (national, regional, community, etc.).
2. Identify indicators needed for different types of causes (e.g., direct, underlying, underlying) depending on monitoring objectives.
3. Evaluate the basic characteristics of potential indicators (efficacy, reproducibility, sensitivity, etc.) considering their limitations up to the time of analysis. Evaluate their operational characteristics (availability, reliability, comparability, cost, etc.).
4. Identify the data needed to build the selected metrics that are not available and define your audience (such as neighborhoods, communities, households, or individuals).
5. Select the frequency of collection based on your decision-making needs. For centrally evaluated data, specify the frequency of collection by the data collection service.
6. Design a protocol for data analysis. Cross-tabulation of various indicators to assess levels of risk, etc., according to causal hypotheses outlined in the Conceptual Framework.
7. Identify data sources from above (e.g. data required, target group and reference period, frequency of collection and analysis):
    - **Ready-to-use data**: regularly collected by governmental authorities, data on the control and influence of governmental and non-governmental organizations; Programs that are systematically transmitted and analyzed at the required level and with the required frequency.

- **Data is collected decentrally, but not transmitted**: It should be captured and analyzed at the desired level of aggregation at the desired frequency.
- Data actively collected: Specific surveys at the local, municipal or household level, repeated as often as necessary.
- Data from primary health centers, maternal and child health centers and schools.

Complete the selection of indicators based on feasibility (e.g. difficulty of data acquisition, urgency, financial, technical and human resources).

The main factors that guide the choice of indicators are:

- Reference conceptual framework. The use of conceptual frameworks when implementing surveillance systems is nothing new. Many examples have been developed, focusing on the various aspects mentioned above.

Required characteristics of the indicator:

- **Effectiveness** – Validity is the first property to look for. Often the ideal indicator from this point of view is not available or difficult to collect.
- **Reproducibility/comparability**- Ideally, the same metrics should be used everywhere and at all times to benefit from common experience in collection and analysis and to enable direct comparisons.
- **Sensitivity**- Metrics should be dynamic, not static. In other words, it is sensitive to change and can capture phenomena.
- **Operational qualities,** especially simplicity and low collection costs, strongly influence the choice of metrics.
- Source data availability.

In practice, collected data used as indicators should be compared to recognized reference or limit values such as those published by WHO.

The availability of previous repeated measurements of an indicator facilitates the identification of trends and serves as a decision criterion for choosing between multiple indicators. In some cases, preliminary research is required to determine the current level of various indicators. Many countries conducted national surveys of their nutritional status before setting up nutrition monitoring systems.

9.4.4 CRITERIA FOR SELECTING INDICATORS:THE SMART CONCEPT

The desired characteristics of the indicator are highly dependent on the chosen approach and the type of monitoring system.

Specific

Measurable (and also reliable, comparable and contextuallyappropriate)

Achievable (and also cost–effective)

Relevant

Time-bound (and also sensitive).

SPECIFIC

A metric is specific in measuring what it intends to measure and is not biased by other factors. This is also called "effectiveness". Various semantic issues arise when defining a qualitative measurement scale. This is also a problem when developing data collection tools for indicators, as even words such as “family,” “household,” and “children” are culturally and contextually biased.

MEASURABLE (AND ALSO RELIABLE, COMPARABLE AND CONTEXTUALLY APPROPRIATE)

A metric should be clearly defined so that its measurement is clear. This usually means quantitative (percentages, ratios, numbers, etc.), but it can also mean qualitative. they need to:

- **Reliable** - No matter who collects the data or when the action is repeated, the result should be the same. This criterion is also called "verifiability". For example, measurements of weight for height are a reliable measure of nutritional status, but measurements of mean upper arm circumference are more difficult to reliably reproduce.
- **Comparable** - Metrics should allow comparisons from one location to another over time (essential if metrics help prioritize levels of need). If metrics are reliable or verifiable, they are usually comparable. However, qualitative metrics are usually the most difficult to use.
- **Contextually appropriate** - The measurements used should be culturally, socially and politically acceptable to the population being studied.

Misrepresent information, under-report or over-report an event, or undermine true action. For example, direct surveys of household income and wealth are often viewed as intrusive and can lead to under- or over-reporting depending on the circumstances.

ACHIEVABLE (AND ALSO COST–EFFECTIVE)

Achievability/feasibility means that the required data can actually be measured and collected. Feasibility also needs to be considered in terms of institutional capacity. Do agencies, organizations and employees involved in data collection have the ability and willingness to do so? If the indicator is part of a monitoring system, can it be easily integrated into the routine work of program staff? Examples of this include easy sample selection, availability of specialist staff, availability of transportation options, etc. Data collection must also be cost-effective in terms of capital costs, recurring costs, and human resources—affordable and valuable.

RELEVANT

Metrics should provide information that serves the purpose of the program and support important user decisions. A metric is not good if it is chosen without reference to the needs of the decision maker.

TIME-BOUND (AND ALSO SENSITIVE)

Metrics should explain when changes are expected. Metrics should be collected and reported in a timely manner. For example, a metric that simply indicates whether a particular goal has been achieved at the end of a project cannot influence decision-making.

Indicators should quickly reflect changing conditions. They should correspond to the frequency of information required for decision making. Maternal mortality measures are not sensitive enough to program decisions, so process indicators are used as surrogate measures.

9.4.5 CRITERIA FOR SELECTION: THE SPICED CONCEPT

When change is to be measured, other properties of indicators become more important and call for different criteria:

Subjective

Participatory
Interpreted and communicable
Cross Checked and compared
Empowering
Diverse and disaggregated.

SUBJECTIVE

The expert who provides the information has a special status or experience that provides unique insights that can make very good use of the investigator's time. Therefore, this data can be considered important because of its source value.

PARTICIPATORY

Indicators should be developed in collaboration with those best positioned to evaluate them. This means not only involving key stakeholders in the project, but also local staff and other stakeholders.

INTERPRETED AND COMMUNICABLE

Locally defined metrics are less meaningful to other stakeholders and often require explanation.

CROSS CHECKED AND COMPARED

Validity of assessment should be confirmed by comparing progress against different indicators and using different informants, methods and investigators.

EMPOWERING

The process of defining and evaluating indicators should empower groups and individuals to reflect critically on changing circumstances.

DIVERSE AND DISAGGREGATED

A conscious attempt should be made to find different indicators from different groups, especially men and women. Information should be recorded so that differences over time can be assessed.

PRACTICAL STEPS FOR IDENTIFYING AND SELECTING A SET OF INDICATORS

Step1: Programmeareas

1. Create a list of programs covered by the country's current surveillance system.
2. Divide this into several program areas.
3. Indicates whether each program area is operational.
4. Comment on the scope of each program area (eg, audience, scope, duration of each program).

Step 2: Related data sources and metrics

1. Collect copies of all relevant summary report forms currently in use.
2. Review all sources and relevant data collection and reporting agencies

3. Identify sources that collect regular information, especially community or population-based information (e.g., provide denominator figures for key indicators such as the number of women of childbearing potential in the district) possible household surveys).
4. Identify metrics available from these various sources related to your surveillance system.
5. List by source.

Step 3: Review of indicators

Review and record each metric according to the following criteria:

- Can be used
- Accessible
- ethical
- Strong
- representative
- It can be understood.

Step 4: Choosing an indicator

1. Use the form for each program area to list all metrics.
2. For each metric, indicate whether the criteria are met.
3. Decide if all criteria are equally important and how much they need to be met before choosing a metric.
4. It is important that those involved in this step feel responsible and competent for the approach chosen and are able to explain and justify it at the next consultation.

Step 5: Selection of additional new indicators

At this stage, the group should spend time reflecting on the list of indicators identified. Please note the following:

1. All of these indicators are by definition available from existing sources.
2. The same sources may be used to generate additional indicators that meet all selection criteria.
3. These metrics are more desirable than those selected so far and fill gaps in the information available to planners.
4. Make a note of these new indicators and see if they meet the selection criteria described in step
5. Then apply the same approach to decide whether to select or reject them.

Step 6: Accuracy and timing of data collection

1. After selecting indicators, groups should assess the extent to which their current data collection systems allow for the accurate production and timely reporting of these indicators.
2. This will require cooperation with several relevant health care departments and may lead to proposals to change the system and introduce new data and methods. Use community-based data for selected key metrics.
3. Summarize the definitions and data requirements for each selected indicator, along with their implications for health information systems.

Step7: Review and identification of gaps

1. The final step should include an assessment of the balance of selected indicators both within and across program regions of the country.

    - Which aspects of nutrition issues are adequately covered by the identified indicators?
    - In what aspects of nutrition are indicators inadequate?

2. Determine whether imbalance in indicator distributions is justified (for example, indicators for certain nutritional issues are much higher than others).
3. Some metrics can be selected for use in multiple program areas. In this case, it is efficient to pool data collection and analysis efforts across program areas. This process also highlights program activities that are currently severely under-indexed.
4. Consider how these gaps can be filled. For example, by forming small working groups to investigate them and propose suitable solutions.

9.5 FOOD AND NUTRITION SURVEILLANCE SYSTEMS : IMPLEMENTATION STEPS

Decisions to build food and nutrition management systems should be clearly formed by consideration of resource availability, human capacity, sustainability, environmental factors, and ability to respond to emerging nutrition- and diet-related health problems. It must be based on a defined purpose.

Once the decision has been made to set up a monitoring system, the first step is to set up a central nutrition monitoring unit that will organize all the activities necessary to implement the monitoring system.

Organization

Institutionalframework

A well-organized and qualified structure is required to implement sustainable monitoring system activities. In many cases, qualified structures are already in place, but may be incomplete or inefficient (e.g., health information systems, agricultural information systems, central statistical offices, economic analysis centers, etc.). In many cases, it is also necessary to introduce surveillance activities into these agencies. The solution is to institutionalize surveillance activities to a minimum by establishing a central monitoring unit dedicated to data collection, analysis and reporting. This unit serves as a reference and support for other national agencies involved in surveillance.

THE CENTRAL NUTRITION SURVEILLANCE UNIT

The primary function of the central monitoring unit, either an individual or a small group, is to coordinate, provide and explain information. Existing data is continuously merged and additional data collection can be organized as needed. The purpose of the central unit is to:

- Short-term operational goals to meet user needs (e.g. information needs, training, advice, alternative strategies or intervention programs and research proposals).
- Improving information quality, reducing monitoring costs, expanding analysis and communication possibilities, and monitoring sustainability.

Central unit users also have other objectives related to different application areas of surveillance.

- Policy or program development, evaluation, justification, awareness raising, and information system integration.
- Research the causes of nutritional problems.

SETTING SURVEILLANCE SYSTEM ACTIVITIES

Due to the wide range of monitoring capabilities, resources, needs, and levels of support, there is no single universal model that can be applied. Monitoring can be organized at various levels like Country, region and community. You can cover specific geographic zones or population groups. It also focuses on specific types of malnutrition, such as monitoring disorders due to iodine and vitamin A deficiency,

and chronic nutrition-related non-communicable diseases such as obesity, diabetes, hypertension, dyslipidemia, and some cancers.

- Preparation or pre-monitoring
- conceptualization
- implementation
- evaluation.

PRE SURVEILLANCE

Once the decision to install a surveillance system has been made, various preparations are required. These agreements may vary from situation to situation, but generally include:

- Answer questions such as the following. Who decides whether to set up nutrition monitoring? Why? What are the expectations for monitoring? What do we already know?
- Identification of monitoring level (national, regional, local).
- Preliminary identification of potential users and their potential needs.
- A general identification of the types and types of information that may be required.
- Identification of 'Stakeholders' and selection and definition of 'Nutrition Coordinator' responsibilities.
- Preliminary decisions on possible baseline surveys.
- A general plan for monitoring activities.

At what level will surveillance be established: national, regional or community ? Which groups will be covered ? Is it for certain problems ?

From a practical standpoint, after determining utilization, we should ask two simple questions:

- “Who wants to know what?”
- “For what?”

Preliminary answers to these questions make the information provided more relevant and the data more likely to be used. In addition, proactive actions reduce operating costs and improve data collection efficiency. Finally, the exercise should also give an impression of the sustainability of the monitoring activities.

Who are the potential user soft the information? What are their expectations?

The list of monitoring initiators may not include all future end users. Potential users may also be included in other categories that have not yet been identified. In this phase, we identify our prospective users.

What types of information will most probably be required ? What are the main trends ? In which are as ? Comparing group so rregions? For which possible decisions? What types of stakeholderrs are involved?

We can identify four types of stakeholders :

- Oversight coordinator (whether individual or group, it is important to define the exact responsibilities of the coordinator early on).
- Information users.
- Data Providers.
- Proponents (usually also funders of surveillance systems).

The role of each stakeholder need to be define each player her categorical role in each phase (i.e. pre-monitoring, conceptual model building, required information selection, data selection, collection, analysis, interpretation). Each of these phases may involve multiple stakeholders.

Another important parameter to consider before starting any surveillance activity is the different levels and forms of staff training.

Is it necessary to establish a base line reference?

After identifying the various roles, defining the main objectives, and selecting preliminary indicators, it is desirable to conduct a baseline survey. This first stage of monitoring generally concludes with a joint decision and refinement of a preliminary plan for the implementation of monitoring, particularly in relation to the conceptual design stage planning. The period, scope of validation, and order of events do not follow rigid preset rules other than flexibility.

CONCEPTUALIZATION

Conceptualization is a workshop-style participatory process, involving all potential future stakeholders of the monitoring activity on an equal footing. The following steps should be followed during the envisioning phase:

1. Building a causal model of nutrition problems. Using the observation definition and causal model as a reference ensures the relevance of the responses received. Similarly, nutritional diagnostics should be performed using models designed during the preliminary research phase.

2. Precisely identify future surveillance users, their information needs, and the scope of surveillance.
3. Selecting data to collect and defining indicators using causal models. This type of data selection should simultaneously consider user requirements, cost, feasibility and potential for sustainable data procurement. Above all, the required prospective and retrospective data must be determined in a highly selective process.
4. Establish modalities for data analysis. This should be based on standardized time-stable methods (raw data analysis, trend analysis, validation of specific hypotheses from the original model, etc.). Additionally, the flow of data and information should be considered (e.g. to whom, through which channel, how often?).
5. Detailed planning of nutrition surveillance activities and interventions themselves should provide answers to standard questions such as: WHO? what? where? If? how? with who? Planning an activity requires the right variety of tools country-by-country or sector-by-sector methods such as calendars, budgets and action plans.
6. The concept of assessment strategies for nutritional monitoring. Such evaluations are only done after the program is implemented, but should be clearly planned during the pre-conceptualization stage.
7. Analysis of Conceptual Consistency. This final step is to ensure that monitoring decisions are clear, information is guaranteed to be relevant, and all precautions are taken to ensure sustainability. This means that a final thorough check is required before any monitoring action can be started.

It is important to consider how information from your monitoring system will be linked to actions or responses. Information is meaningless if not used properly.

IMPLEMENTATION

The following steps are recommended to implement the surveillance system.

1. Review the existing system.
2. Define the data needs of relevant units within the health system.
3. Determine the most appropriate and effective data flow.
4. Design the data collection and reporting tools.
5. Develop the procedures and mechanisms for data processing.
6. Develop and implement a training programme for data providers and data users.

7. Pretest and, if necessary, redesign the system for data collection, data flow, data processing and data utilization.
8. Monitor the developing steps/implementation.
9. Develop effective data dissemination and feedback mechanisms.
10. Enhance the surveillance system.

REVIEWING THE EXISTING SYSTEM

Principle

Review existing sources of nutrition information (metrics collected, frequency of collection, target population) to avoid duplication and ensure proper alignment or integration with relevant existing information systems. Don't break existing systems, take advantage of their strengths and learn from their weaknesses.

Steps

1. Make a list of forms, logs, and other tools used to record and summarize data at various levels.
2. Assess the quality of data collected using existing forms at different levels. Aspects to include in the assessment are:
    - Accuracy
    - Completeness
    - Appropriateness
    - Timeliness.
3. Identify problems in your current data collection system at various levels, such as timing and information flow.
4. Check the current status of other components of your monitoring system, such as:
    - Data processing, analysis and distribution.
    - Supply and Logistics
    - Employee development.
    - Coordination, cooperation and communication with the various departmental and inter-departmental and extra-departmental agencies of the Ministry of Health.
5. Identify aspects of the system that need to be changed or stopped.
6. Summarize the results of the evaluation into a formal report.
7. Discuss the results of the assessment with relevant authorities.

Challenges/risks

You have to deal with the following challenges:

- Identification of the authority conducting the assessment.
- Availability of technical expertise and resources to conduct the assessment.
- Cooperation among various actors in the evaluation process and involvement of end-users at all levels.
- Establish a body, ideally an inter-departmental committee, to plan, oversee and manage all stages of surveillance system development, from baseline assessment to evaluation.

DEFINING DATA NEEDS

Principle

It relates to nutritional status and defines a minimal set of core indicators for understanding the underlying causes of malnutrition. Different levels of government in the healthcare system have different roles and therefore different data needs. Not all data requests need to be generated by routine systems of data collection. Data that are not needed frequently or that are needed only for certain population groups can be generated by special surveys and sample surveys.

Steps

1. For each main program, define different roles/functions for each level. We highly recommend the following programs for setting up your surveillance system:
    - Maternal and child health programs for infants and mothers.
    - An integrated children's health program for children under the age of five.
    - School health programs for school children.
    - Community-based health programs.
    - Emergency/Response specific operations.

Data are collected at different levels (municipalities, health facilities, districts, regions and countries, Table 4).

Table4Levelsoffoodandnutritionsurveillancesystems	
Level	**Description**
Community	Represented by basic nutrition educators, mayor/leader of the village, health workers or similar are providers at village level
Health facility	Defined by each country. For surveillance purposes, the health facility may Include institutions without patient and inpatient facilities
District, regional or provincial	Intermediate administrative units. Countries may have two intermediate levels (e.g. district and provincial)
National	In many countries this is the federal level where policies are set and resources are allocated. This level usually compiles information and gives data to several programmes
Regional	At this level, surveillance data are reported to WHO or other agencies

2. Identify the metrics required for each level to perform its function. Note that some levels, especially higher administrative levels, require data from other ministries or departments relevant to the health and nutrition sector.
3. Create a formula and identify the variables or data items required to calculate the metric.
4. Determine the sources of the various data items needed for both the numerator and denominator of each metric. The most important sources of information are:
    - Periodic data from the Ministry of Health's Nutrition and Health Care Information System.
    - Special investigations and investigations conducted by the Ministry of Health.
    - Nutrition-related information systems under the responsibility of another body or agency (eg usually life reporting systems)

Departments of Justice or Statistics, and nutrition data collected by Departments or Departments of Agriculture).

Challenges / Risk

We have to deal with the following challenges:

- Lack of clear definition of the roles and functions of various entities with respect to data production and consumption.
- Defining basic minimum data requirements
- Distinguish between data that should be included in regular data collection systems and data that is best obtained through dedicated research or sample surveys.
- Staff at various levels often fail to identify data needs and lack understanding of indicators.

DETERMINING THE DATA FLOW

Principle

Not all data collected at a particular level should be communicated to higher levels. The most detailed data should be kept at the source and reporting requirements to higher levels should be minimized.

Steps

1. Decide what data to send and to whom. This refers to:
    - Identification of variables/indicators that need to be communicated to higher levels.
    - Identifying the location of the most appropriate organizations and individuals to whom summaries should be sent. In this step, the bodily or human functions to which data are transmitted in connection with the generation and use of information are decisive.
2. Decide how often to send data to each tier by considering the following factors:
    - Needs at each level.
    - How common phenomena are observed - reports of rare or rarely needed events (eg number of vaccination campaigns). You can submit quarterly or semi-annually instead of monthly.
    - Specify how to send data to each layer.
    - Raw data and summaries
    - Hard copies and electronic files.
3. Create a flowchart showing the flow of information from the periphery to the top level.

Challenges / Risk

We have to deal with the following challenges:

- Misunderstanding the purpose of data collection.
- Inability to distinguish between data necessary for service delivery and data essential for program administration and monitoring.

- Unable to produce summaries of raw data collected by lower levels of government for the following reasons.
- Lack of staff technical expertise (including computer skills)
- Lack of data processing facilities (calculators, computers, etc.)
- Lack of raw data storage facilities at lower administrative levels.
- There is a problem retrieving the data and the information cannot be generated (eg due to computer failure).

DESIGNING THE DATA COLLECTION AND REPORTING TOOLS

Principle

When designing forms, you should consider your staff's ability to complete them. When interpreting data, consider contextual issues such as seasonality, population movements, prevalence patterns, and historical trends in nutritional status. The most effective data collection and reporting tools are simple and concise.

Steps

1. Create a first draft of each required form, using the list of metrics used in the program as a guide. This step involves modifying existing molds or developing new molds.
2. Compare the first draft with the list of indicators to make sure all data requests can be generated from the form.
3. Present the first draft of the form to the appropriate staff and discuss the following aspects of the new form:
    - How does it compare to the old format?
    - What are the advantages and disadvantages of the new format?
    - What changes are required to enhance the new geometry's benefits and minimize its drawbacks?
    - If your country has multiple dialects, do you need to translate the form into the major dialects used in different parts of the country?
4. Prepare draft instructions for filling out new forms.
5. Pre-test the use of new forms and procedures.
6. Evaluate the results of the pretest.
7. Revise the form and instruction manual based on the results of the preliminary test.

Challenges / Risk

We have to deal with the following challenges

- The data provider's technical expertise/skills are not at the high level required for the data collection tools to meet the user's data expectations.
- Design pre-testing activities to ensure comparability of actual implementations and conditions : where? Who will attend? How long?

DEVELOPING PROCEDURES FOR DATA PROCESSING

Principle

The way in which surveillance system data is processed should be consistent with the purpose of data collection and the plans for analysis and utilization.

Steps

1. Evaluate the advantages and disadvantages of manual data processing and computer use, considering the following factors:
    - Cost.
    - Availability of personnel with the appropriate level of technical expertise to operate computerized systems. In particular, staff software skills should be validated at the lowest computer introduction level.
    - Availability of technical support in the event of hardware failure.
2. If a computerized system is to be implemented, determine the minimum computer level to be used for data processing. One of the most important considerations when choosing this tier is having trained personnel for system maintenance.
3. Define software development specifications in consultation with various levels of data users. Key aspects to determine include
    - Regularly generated summary reports
    - What data quality control mechanisms/checks should be built into the software?
    - Data users' data analysis needs
4. Based on the required specifications, we develop the software necessary to process data at each level where computers are used. It is also possible that software designed to produce outputs similar to those of surveillance systems has already been developed and only requires minor modifications to accommodate them. In this situation, resources should be available to

acquire and customize the software to be decided. A final decision must be made whether to develop new software or acquire and modify an existing program.

5. Test your software beforehand and be aware of the following:
    - Virus detection
    - Software features that produce the expected data
    - Availability of staff.
6. Create and test software user manuals.
7. Design a training program to train relevant employees to use the software.

Challenges / Risk

We have to deal with the following challenges:

- The ability of existing hardware to integrate software and the ability to store all data (especially at lower levels).
- Compatibility of developed software with existing software (future interaction).
- Basic system maintenance procedures.
- Security system.

DEVELOPING THE TRAINING PROGRAMME

Principle

Training programs should be designed according to the needs and levels of the target group.

Steps

1. Conduct a training needs analysis for data providers and data consumers. Four types of training are usually conducted. these are:
    - Training of trainers
    - Training data suppliers at the edge level to fill out forms
    - Computer operator training in handling software and hardware
    - Training different levels of employees on data usage. A separate training needs assessment should be conducted for each type of training. Variables collected to assess training needs include:
        - Fundamental role of each employee
        - Degree of previous training
        - When training is complete

    - Adequacy of pre-training to enable personnel to perform the expected tasks;

- Desired training area.

2. Create a syllabus/agenda for each type of training based on the results of the training needs analysis. The following aspects should be covered:
    - Target group (who are you targeting?)
    - Content (what?)
    - Strategy (how?)
    - Duration (how long?) – This refers to the total duration of the training program and the time spent on each topic included in the training. The result of this step is a syllabus. Training programs to be conducted.
3. Create training materials (Table 5). Participants in coach education courses should have access to:
    - A copy of the Data Provider Data Dictionary Guide
    - A handbook for data users.
4. Create training materials. Based on the evaluation results, there is a possibility that the format, composition, and content of the training materials will be partially changed, so we will limit the number of copies at this time.

Table5Suggestedtrainingmaterials

Typeoftraining	Trainingmaterial	Contents
Training for data providers	Data dictionary manual for data providers (separate manual for each level)	List of indicators, formulas, definitions, data sources Instructions on how to fill in the forms
Training for data users	Manual for data users (separate manual for each level)	Data analysis, interpretation and utilization
Training for computer operators	Computers of tware user's manual	Detailed instructions (with examples) on how to use the software; troubles hooting
Training of trainers	Trainer's manual	Instructions on how to implement the training programme for data providers and data users; teaching strategies; guidelines on the use of the manual for data users and manual for data providers

5. Design an evaluation strategy for your training program. Since most assessment designs require background and knowledge bases to be collected from participants prior to training, it is important to establish methods prior to training activities.

6. Identify the most appropriate participants for each type of training based on their duties and responsibilities related to data generation, management and use. An effective strategy is to identify and train dedicated employees to act as trainers for adjacent areas. Once this strategy is adopted, It is important to consider the geographic distribution of participants in a trainer's training course.
7. Conduct training for data providers.
8. Conduct data user training. This is typically done after collecting enough data from the monitoring system to use as an example during training.
9. Evaluate the training program, including the training materials used.
10. Modify training materials and programs based on the results of the evaluation. This should be done before another set of training activities.

Challenges / Risk

We have to deal with the following challenges:

- Selection of suitable participants for various training programs.
- Biographies of personnel identified to enter data and generate reports using software developed for surveillance systems. Are they very different?);
- Language/dialect of the training material.
- Level of dissemination of training materials and manuals.
- Arrangement of appropriate facilities to conduct training.

PRETESTING THE SYSTEM

Principle

The system should be pre-tested under conditions that reflect as closely as possible the conditions commonly encountered during implementation**.**

Step

1. The system pre said guidelines have to be prepare by answering the following questions:
    - where? Choice of location for preliminary testing. Criteria for selecting pretest locations should be developed. This may include technical factors such as employee expertise and qualifications. Practical considerations such as on-site personnel, proximity to the area, availability of infrastructure support, and level of staff collaboration.

- WHO? Who will participate in the pretest? How many people? It is important to include different types of data providers and data consumers in your pre-testing.
- what? What are the specific goals of the pre-test? What aspects of the monitoring system are specifically tested beforehand? What different activities should be done to achieve these goals?
- how? What data collection methods and tools are used to systematically collect the data required for efficient pre-checking of forms?
- how long? How long will the pretest run?

2. Instruct staff involved in the preliminary screening to:
    - Communicate the purpose and procedures of the pretest.
    - Training data users and data providers in various pre-test areas of the new system.
3. Conduct pretest activities.
4. Write a report on the results of the pretest.
5. Make recommendations based on the pre-test results and modify the monitoring system according to the recommendations.

Challenges / Risk

We have to deal with the following challenges:

- Introduction of systematic and proactive monitoring mechanisms during the pre-test phase.
- Systematically update software on all units that have software installed
- Ensure that all materials and staff are ready for the pre-testing phase.

ENHANCING THE SURVEILLANCE SYSTEMS

Principle

Developing a surveillance system is always a work in progress. It is a dynamic process in which managers and employees strive for continuous improvement.

Steps

1. Review the results of the monitoring and evaluation activities carried out on the monitoring system over the last few years and include any changes necessary for improvements identified in the previous phase.

2. Identify aspects of the surveillance system that require further development to facilitate the functionality of the surveillance system. The basic questions to answer are:
    - What aspects should be highlighted next? Aspects that may require further investigation include:
    - Improving and institutionalizing procedures to ensure data quality control.
    - Develop the ability to conduct specific studies and sample surveys.
    - Establish coordination mechanisms for horizontal use of data generated from vertical programs.
    - Develop strategies to keep staff at various levels interested in using data in program planning, management and evaluation.
    - Establish inter- and intra-sectoral links between bodies involved in various aspects of the system;
    - Consolidate and coordinate systematic efforts by sectors and funding agencies.
3. Identify the resources needed to implement various options to improve your monitoring system. This should include:
    - Specific types of resources for each planned expansion activity.
    - Budget requirements (if any).
    - Required support sources for each type of resource required.
4. Prioritize different options according to level and urgency of need and resource availability for proper implementation.
5. Develop a schedule for performing various system expansion activities.
6. Perform various activities required to implement the desired extension of the system.
7. Monitor and assess the impact of newly implemented aspects of the system.

Challenges / Risk

We have to deal with the following challenges –

- Maintaining the interest of various stakeholders in the ongoing development of the monitoring system.
- Generate resources to support various system improvement activities.
- Coordination of activities of various authorities to minimize duplication in areas related to data collection form preparation and system development.

- Ensure continuity of the panel or body to oversee the surveillance system after the pilot test phase.

9.6 HOW TO STRENGTHEN A SURVEILLANCE SYSTEM

This section discusses how a functioning and effective oversight system can help nutrition and nutrition-related program managers, staff, and other stakeholders throughout the healthcare system make better decisions and take timely action. Emphasize how you can help.

Nutrition monitoring is not only about collecting data, it is also about interpreting the data and communicating information so that it can be used for decision making. It is an action-based system consisting of a series of activities that can , interpret, and communicate findings and conclusions.

Before discussing the steps to harden your surveillance system, it is important to understand the characteristics of a good system.

9.7 CHARACTERISTICS OF A GOOD NUTRITION SURVEILLANCE SYSTEM

A good surveillance system has the following characteristics:

- **Ability to act on information** - First and foremost, the system must be able to act on the information generated, whether in the form of a systematic response to a growing nutrition problem or a manager using that information to remedy the problem not medium- to long-term decisions.
- **Default case definitions and report logs** - These enable accurate and timely documentation and reporting.
- **Basic and well-founded inspection methods -** Appropriate analysis and interpretation techniques should be used.
- **Appropriate laboratory support** - Appropriate action requires accurate detection. Field-discovered cases may require more complex laboratories to confirm the diagnosis.
- **Efficient communication system -** Information and feedback should be provided promptly.
- **Cost-effective use of resources** - The system should focus on prioritization to keep nutritional issues under control and collaboration where necessary to avoid duplication.
- **A network of interested people** - A system is only as good as the people who run it.

9.8 PRINCIPLES FOR TRANSFORMING A WEAK ON FUNCTIONING SURVEILLANCE SYSTEM INTO A STRONG ONE

The following principles can turn a weak system into a stronger one-

- Make appropriate systematic improvements and incorporate improvement issues identified during the evaluation phase.
- Establish ownership of all improvements at all levels.
- Training staff to develop skilled workers.
- Ensure resource availability.

By definition, transformation means change. Without change, surveillance systems will continue to function poorly, with associated nutritional and health risks and negative economic consequences. Changes and improvements must be sustainable. There are many factors that affect system sustainability, including local performance and resource availability. Competence, motivation and resources are essential to enable improved system sustainability. If changes are made but not maintained, the improvements are lost and the system may revert to its previous state or possibly degrade or collapse. Therefore, to make improvements sustainable, we need to focus on building personal responsibility through empowerment.

Country ownership motivates stakeholders to sustain improvements over the long term. The property should do the following:

- Achieve results when people understand and care enough about the surveillance system to fund interventions to implement improvements.
- Set up at each level of the system, country, region, local.
- Built by all parties: Data recorders, data analysts, decision makers. There should be a continual build of ownership to increase engagement and strengthen the ability to improve the monitoring system at each stage of the process.

Practical steps to transforma weak surveillance system into astrongerone

1. Evaluate current nutrition surveillance activities. The first step is to review current nutrition surveillance activities and how they are implemented.
2. Determine specific conditions. Under what circumstances does the surveillance system work?
3. Identify strengths, interactions, opportunities, weaknesses and gaps. Does it overlap

with other interventions or activities? What are the challenges?

4. Create an action plan. Set priorities, strategies, and schedules for implementing various action steps to transform your system into a better system.
5. Execute the action plan. The best action plan should be monitored over time.

Evaluation of current monitoring activities

To assess your current monitoring activity, you should ask a few questions about your system and its performance (that is, what is installed and how well it is being used).

- Are there guidelines for identifying nutritional problems?
- Is there a protocol of action?
- What are the norms and expectations for communication? Better monitoring means inspecting the entire system and its components. The following key partners should be included in the evaluation:
    - Department of Health (Nutrition Monitoring and Response Officer) – Personnel responsible for collecting data and responding to trends identified by nutrition monitoring.
    - Managers of vertical programs such as enhanced immunization programs, integrated child health care, and tuberculosis control strategies.
    - Laboratory personnel involved in the analysis of nutrients and nutritional issues.
    - Special project staff, eg . sentries or limited geographic surveillance.
    - The nutrition sector, governments, academia, NGOs, etc.

DETERMINING SPECIFIC CONDITIONS

After gathering the necessary information, the next step is to analyze and interpret the data. Identify strengths, interactions, opportunities, weaknesses and gaps. Where are the performance gaps? Listening to your partner's feedback and including them in the interpretation process can help you identify problems and find solutions.

When analyzing and interpreting nutritional information, focus should be on:

- What works and what doesn't? Identify successful actions/countermeasures and build an action plan based on existing competencies and strengths. This information is provided by communications with people working within the system.

- What kinds of activities can you build on? Where's the collaboration? Are there common elements that can be integrated between the activities of the surveillance system (standard setting, training, monitoring, communication, etc.)? resource management)? Is there a way to share resources such as staff, equipment (such as computers), and transportation?
- What gaps are there in the system? Does it have the power to act?
- What kind of support do you have? Do you have an effective communication system? Are resources used wisely? Are people trained to operate the system?

After reviewing current surveillance systems and identifying ways to build and strengthen existing countermeasures, an action plan should be developed. Building ownership requires empowering key personnel to integrate information from existing successful components and assessments into new action plans.

DEVELOP AN ACTION PLAN

Creating an action plan is just the beginning. For monitoring improvement to be effective, it must be implemented and continued. Sustainable improvement requires a commitment to accountability for the system. Key elements of the action plan include:

- Build on existing strengths and focus on strengthening critical core and support activities.
- Consideration of short-term and long-term needs. The monitoring system not only responds quickly to emerging nutritional issues, but also Medium- to long-term goals to assess nutritional status, identify risk trends, and modify programs and policies.
- Set priorities and realistic goals. It's impossible to do everything, and doing so will result in poor performance. Instead, focus on important health issues such as:
    - Public health issues such as morbidity, mortality and WHO policies (eg eradication, eradication).
    - Concerns about established measures (vaccination, preventive measures, awareness campaigns, etc.)
    - Concerns about the availability of laboratory, medical facility, environmental, or other relevant data.
    - Concerns for which monitoring systems and countermeasures are worthwhile.

IMPLEMENTING THE PLAN OF ACTION

To help support and encourage efforts to improve surveillance systems, the following actions are important:

1. Communicate your plan of action. Meet with partners and participants during the evaluation phase to share a draft action plan and receive feedback. Also, take this opportunity to share your draft with other key stakeholders you may not have spoken.
2. Encourage stakeholder dialogue in action plans. Consider this a draft action plan and give key stakeholders time and opportunity to provide comments and suggestions. If possible, consider their proposal or explain why their proposal cannot be considered.
3. A firm commitment to leadership, resources and action. Be specific about who is responsible for each part of the action plan, who will fund each action, and the timeframe for implementation.
4. Build partnerships and plan future actions together.
5. Set up monitoring to measure and control the implementation phase.
6. Execute the plan.
7. Monitor progress and results. Collect data to see if the implementation is going according to plan and if "improvements" are making a difference.
8. Adjust as needed. We use monitoring information to provide feedback to system users and stakeholders and to make changes and corrections where necessary.

Food and nutrition management system: The Technical Guide to Developing Food and Nutritional Control Systems provides guiding principles and technical background for policy makers, technical staff, and educators. It details the concepts and principles of the monitoring methodology, the implementation process, data collection, analysis and reporting.

9.9. CHECK YOUR PROGRESS

1- What do you understand by nutritional monitoring? ----------
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2- What is the difference between nutritional monitoring and nutritional surveillance? ----------
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3- What are the components of nutritional monitoring? ----------

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4- Throw light on Triple A cycle? ----------

5- Write a detailed note on methods of carry out in nutritional surveillance? ----------

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6- What do your understand by Nutritional indicator's? ----------

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7- What is the criteria for selecting indicator's? ----------

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8- Comment on the smart concept? ----------

9- Write a detailed note on the process of selections of surveillance unit? ----------

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10- What are the characteristics of a strong surveillance system? ----------

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11- What measures will you take to strengthen a weak surveillance system? ----------

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9.10. REFERENCES

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Uttar Pradesh Rajarshi Tandon
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MFN-109

Advance Community Nutrition

BLOCK 4

Unit-10 Basics to Food and Nutrition **329**

Unit-11 Importance of Food Standards **351**

Unit-12 Hazards to Food Products **368**

INTRODUCTION (BLOCK IV)

Unit 10 The most fundamental need for survival is food sources. Everyone consumes food, and most individuals do it with pleasure. Scientists have always been interested in the food people eat, how it moves through the body, and what consequences it has. The science of nutrition was developed as a result of this curiosity. The scientific study of food and its relationship to health is referred to as nutrition.

Unit 11 In this unit we will study about the importance of Food Standards and their role to maintain the standardization of food products.

Unit 12 In this unit we will study about the Hazards of Food Products.

Unit 10- Basics of Food and Nutrition

Structure

10.1 Introduction
10.2 Meaning and definition of food
10.3 Food science
10.4 Nutrition science
10.5 Concept of nutrition
10.6 Adequate nutrition
10.7 Malnutrition
10.8 Balance diet and factors affecting balanced diet
10.9 Functions of food
10.10 Food groups
10.11 Food guide pyramid

10.1 INTRODUCTION:

Food science is the study of the physical, chemical, and biological properties of food and the processes involved in its production, preservation, and consumption. Understanding food science helps in ensuring food safety, improving food quality, developing new food products, and promoting nutrition for better health. Food refers to any substance consumed by living organisms to provide energy, nutrients, and other substances required for growth, maintenance, and repair.

It comprises macronutrients (carbohydrates, proteins, and fats), micronutrients (vitamins and minerals), water, and non-nutritive substances (e.g., fiber, additives).

Food supplies energy in the form of calories to fuel bodily processes and physical activities.

It provides essential nutrients required for growth, maintenance, and repair of body tissues and contributes to various metabolic processes, including digestion, absorption, and metabolism of nutrients. Certain foods contain bioactive compounds that offer health benefits, such as antioxidants, phytochemicals, and probiotics.

This unit provides an in-depth understanding of the introduction to food science, the definition and meaning of food, the concept of nutrition, adequate nutrition, malnutrition, balanced diet, factors

affecting a balanced diet, functions of food, and the concept of food groups and the food guide pyramid. It forms a solid foundation for further exploration into the field of food science and nutrition.

10.2 Meaning and Definition of Food

Food can be defined as any substance consumed by living organisms to provide nourishment and support growth, development, and overall well-being. It is an essential requirement for sustaining life and maintaining the proper functioning of the body.

The meaning and definition of food encompass several key aspects:

1. Nourishment: Food serves as a source of nourishment, supplying the body with the necessary nutrients, energy, and building blocks it needs for various physiological functions. Nutrients include carbohydrates, proteins, fats, vitamins, minerals, and water, which are essential for growth, repair, and maintenance of body tissues, as well as the regulation of metabolic processes.

2. Sustenance: Food provides the energy required for physical activity, metabolic processes, and basic bodily functions such as breathing, circulation, and digestion. The caloric content of food, derived from macronutrients (carbohydrates, proteins, fats), is measured in terms of calories or joules.

3. Pleasure and Enjoyment: Food is not merely a means of sustenance; it also holds cultural, social, and emotional significance. Enjoying food is a sensory experience that involves taste, aroma, texture, and appearance. Food is often associated with celebrations, cultural traditions, and social gatherings, enhancing the overall quality of life and providing pleasure and satisfaction.

4. Social and Cultural Significance: Food plays a vital role in defining cultural identity and social interactions. Different regions and communities have unique culinary traditions, local dishes, and dietary customs that reflect their heritage and values. Sharing meals with family, friends, and communities fosters social connections, strengthens relationships, and promotes cultural cohesion.

5. Economic Importance: Food production, processing, distribution, and consumption form a significant part of the global economy. Agriculture, farming, fisheries, food manufacturing, restaurants, and retail industries contribute to job creation, economic growth, and food security. Food trade and globalization have increased the availability and diversity of food choices worldwide.

6. Health Impact: The type and quality of food consumed have a direct impact on health. A balanced and varied diet, rich in nutrient-dense foods, is essential for maintaining optimal health, preventing malnutrition, and reducing the risk of chronic diseases such as obesity, cardiovascular diseases, diabetes, and certain types of cancer. The field of nutrition science focuses on understanding the relationship between food, nutrients, and health outcomes.

It's important to note that the meaning and definition of food may vary across cultures and contexts, influenced by factors such as dietary preferences, religious beliefs, environmental availability, and socioeconomic factors. Additionally, advancements in food science and technology have led to the development of processed and engineered foods that offer convenience but may also raise questions about their nutritional value and potential health implications.

Overall, food is a fundamental aspect of human existence, providing nourishment, sustenance, pleasure, cultural identity, and economic significance. Understanding the meaning and importance of food helps individuals make informed choices about their diet and promotes the overall well-being of individuals and communities.

10.3 Food Science:

Food science is a multidisciplinary field that encompasses the study of the physical, chemical, and biological properties of food, as well as the application of scientific principles and techniques to understand and improve various aspects of food production, processing, preservation, and safety. It combines knowledge and principles from disciplines such as chemistry, biology, microbiology, nutrition, engineering, and sensory science to address challenges related to food quality, safety, nutrition, and innovation. Here are some key areas within food science:

1. Food Chemistry: Food chemists study the composition, structure, and properties of food components. They investigate the chemical changes that occur during food processing, storage, and cooking, as well as the interactions between different food components. This knowledge helps in understanding food functionality, flavor development, and the impact of processing on nutritional quality.

2. Food Microbiology: Food microbiologists focus on the study of microorganisms in food and their impact on food safety and quality. They analyze the presence, growth, and control of microorganisms, such as bacteria, yeasts, molds, and viruses, in various stages of food production, processing, and

storage. Food microbiology plays a crucial role in preventing food borne illnesses and ensuring the microbiological safety of food products.

3. Food Processing and Engineering: Food processing involves transforming raw agricultural materials into edible food products. Food process engineers develop and optimize processes for food production, preservation, and packaging. They design and operate food processing equipment and systems to ensure efficient and safe food production while maintaining product quality and sensory attributes.

4. Food Preservation and Shelf-Life Extension: Food scientists work on developing methods and technologies to extend the shelf life of food products while maintaining their quality and safety. This includes techniques such as thermal processing (e.g., pasteurization, sterilization), refrigeration, freezing, drying, fermentation, and the use of additives and preservatives. Preservation methods help prevents microbial spoilage, enzymatic degradation, and oxidative reactions that can lead to food deterioration.

5. Food Product Development and Innovation: Food scientists play a crucial role in developing new food products and improving existing ones to meet consumer demands, nutritional requirements, and sustainability goals. They collaborate with food technologists, chefs, sensory experts, and consumers to create innovative food formulations, improve sensory attributes, enhance nutritional value, and incorporate emerging ingredients or technologies.

6. Food Quality and Sensory Evaluation: Food quality assessment involves sensory evaluation and objective measurements to assess attributes such as taste, texture, appearance, aroma, and overall consumer acceptance. Food scientists use sensory analysis techniques, instrumental analysis, and consumer studies to understand and improve the sensory aspects of food products.

7. Food Safety and Regulatory Compliance: Food scientists contribute to ensuring food safety by assessing and managing risks associated with food borne pathogens, allergens, chemical contaminants, and other hazards. They develop and implement food safety plans, adhere to regulatory requirements, and conduct audits and inspections to ensure compliance with food safety standards.

8. Food Nutrition and Health: Food scientists study the nutritional composition of foods and their impact on human health. They investigate the bioavailability of nutrients, assess the effects of food processing on nutrient retention, and explore the development of functional foods with specific health benefits. They also contribute to public health initiatives, dietary guidelines, and nutritional labeling regulations.

Food science plays a vital role in addressing challenges related to food security, sustainability, public health, and food innovation. It combines scientific knowledge, technological advancements, and practical applications to ensure the production of safe, nutritious, and high-quality food products that meet the diverse needs and preferences of consumers.

10.4 Nutrition Science:

Nutrition science is a field of study that focuses on the relationship between food, nutrients, and human health. It encompasses the scientific investigation of how different nutrients are obtained, processed, and utilized by the body, as well as the effects of dietary choices on overall health and well-being. Here are some key aspects of nutrition science:

1. Nutrients and their Functions: Nutrition science examines the various nutrients that are essential for the body's proper functioning. These include macronutrients (carbohydrates, proteins, and fats) that provide energy, as well as micronutrients (vitamins and minerals) that are required in smaller quantities for various metabolic processes. It investigates the functions of these nutrients in the body, such as energy production, tissue growth and repair, immune system support, and regulation of bodily processes.

2. Digestion, Absorption, and Metabolism: Nutrition science explores the process of digestion, where food is broken down into smaller molecules for absorption and utilization by the body. It investigates how nutrients are absorbed through the gastrointestinal tract and transported to cells and tissues. Additionally, it examines metabolic pathways, such as energy metabolism and nutrient storage, to understand how nutrients are utilized and converted within the body.

3. Nutritional Requirements and Recommendations: Nutrition science establishes the nutritional requirements for individuals at different stages of life, considering factors such as age, sex, physiological status, and physical activity levels. It develops dietary guidelines and recommendations

to help individuals achieve and maintain optimal health through appropriate nutrient intake. These guidelines consider the balance of macronutrients, recommended intakes of vitamins and minerals, and other dietary considerations, such as fiber and water.

4. Nutritional Assessment: Nutrition science employs various methods to assess an individual's nutritional status and dietary intake. This may include techniques such as dietary surveys, analysis of food records, biochemical tests, anthropometric measurements (e.g., height, weight), and clinical assessments. Nutritional assessment helps identify nutrient deficiencies, imbalances, or excesses, and provides insights into the overall nutritional health of individuals or populations.

5. Nutrition and Health Outcomes: Nutrition science investigates the impact of dietary choices on health outcomes and the prevention of chronic diseases. It explores the relationship between nutrition and conditions such as obesity, cardiovascular disease, diabetes, cancer, and osteoporosis. Researchers examine the role of specific nutrients, dietary patterns, and food components in disease prevention and management.

6. Nutritional Interventions: Nutrition science explores the development and evaluation of nutritional interventions aimed at improving health outcomes. This may involve designing dietary plans for individuals with specific nutritional needs or health conditions, developing interventions to address malnutrition or nutrient deficiencies, or studying the efficacy of dietary supplements or functional foods in promoting health and preventing diseases.

7. Public Health Nutrition: Nutrition science plays a critical role in public health efforts to address nutritional challenges at the population level. It contributes to the development of public health policies, initiatives, and interventions to promote healthy eating habits, prevent nutrition-related diseases, and reduce health disparities. This includes nutrition education programs, community interventions, food fortification initiatives, and policy recommendations.

Nutrition science provides evidence-based knowledge and guidelines that help individuals make informed dietary choices for optimal health and well-being. It informs public health strategies, food industry practices, and clinical nutrition interventions. Continuous research and advancements in nutrition science contribute to the understanding of the complex relationship between diet and health and pave the way for improved nutritional practices and interventions.

10.5 Concept of nutrition:

The concept of nutrition encompasses the study of how food and nutrients are essential for maintaining health, growth, and overall well-being. It involves understanding the processes of obtaining, consuming, digesting, absorbing, and utilizing nutrients from food to support various physiological functions of the body. Here are some key aspects of the concept of nutrition:

1. Nutrients: Nutrients are substances found in food that are necessary for the body's growth, development, and maintenance. There are several categories of nutrients:

a. Macronutrients: These include carbohydrates, proteins, and fats. They provide energy (measured in calories) and are required in relatively large amounts by the body.

b. Micronutrients: These include vitamins and minerals. Although needed in smaller quantities, they are essential for various metabolic processes, enzyme function, and overall health.

c. Water: Water is also considered a nutrient as it is vital for hydration, transportation of nutrients, temperature regulation, and other physiological functions.

2. Nutritional Requirements: Each individual has specific nutritional requirements that depend on factors such as age, sex, body size, physical activity level, and health status. Nutritional requirements are typically expressed as recommended daily allowances (RDAs) or dietary reference intakes (DRIs). These guidelines provide information on the recommended amounts of nutrients needed to meet physiological needs and maintain optimal health.

3. Dietary Patterns: Dietary patterns refer to the habitual food choices and combinations that individuals or populations consume. A healthy dietary pattern typically includes a balance of macronutrients, a variety of fruits and vegetables, whole grains, lean proteins, healthy fats, and limited intake of added sugars, sodium, and saturated fats. Different cultural, regional, and personal factors influence dietary patterns.

4. Digestion and Absorption: The process of digestion involves breaking down food into smaller molecules that can be absorbed and utilized by the body. Digestion begins in the mouth with chewing

and the release of digestive enzymes. It continues in the stomach and small intestine, where further breakdown of food occurs, and nutrients are absorbed into the bloodstream. The body then transports and delivers these nutrients to cells and tissues for various metabolic processes.

5. Metabolism: Once nutrients are absorbed, they undergo metabolism, which involves chemical reactions within cells to produce energy, build and repair tissues, synthesize hormones, and carry out other physiological functions. Metabolism is influenced by factors such as genetics, physical activity, hormone levels, and nutrient availability.

6. Nutritional Status and Assessment: Nutritional status refers to the state of an individual's nutrition, including nutrient intake, nutrient utilization, and health outcomes. Nutritional assessment involves evaluating an individual's dietary intake, biochemical markers, physical measurements, and clinical evaluations to determine nutritional status. This helps identify nutrient deficiencies, imbalances, or excesses and guides interventions to improve nutrition.

7. Role of Nutrition in Health: Nutrition plays a critical role in maintaining optimal health and preventing nutrition-related diseases. Adequate and balanced nutrition supports growth and development, strengthens the immune system, maintains healthy body weight, and reduces the risk of chronic diseases such as obesity, cardiovascular diseases, type 2 diabetes, and certain cancers. It also influences cognitive function, mental health, and overall well-being.

Understanding the concept of nutrition helps individuals make informed dietary choices, develop healthy eating habits, and optimize their nutritional status. It forms the basis for public health initiatives, nutrition education programs, and the development of policies and guidelines to promote optimal nutrition and improve population health.

10.6 Adequate nutrition:

Adequate nutrition refers to the consumption of a balanced and varied diet that provides all the essential nutrients, in appropriate quantities, to meet an individual's physiological needs for growth, development, and overall well-being. It ensures that the body receives the necessary nutrients and energy to support its functions, maintain optimal health, and prevent nutrient deficiencies and related health problems. Here are some key aspects of adequate nutrition:

1. Essential Nutrients: Adequate nutrition requires the consumption of all essential nutrients, including macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins and minerals). Each nutrient has specific roles and functions in the body, and a deficiency in any of these nutrients can lead to various health issues.

2. Energy Balance: Adequate nutrition involves achieving an appropriate energy balance, which means consuming an amount of food that provides sufficient calories to meet the body's energy needs. The energy requirement varies based on factors such as age, sex, body size, physical activity level, and metabolic rate.

3. Macronutrient Balance: Adequate nutrition entails a proper balance of macronutrients. Carbohydrates are the primary source of energy, and they should come from whole grains, fruits, vegetables, and legumes. Proteins are necessary for tissue growth and repair and should come from lean sources such as poultry, fish, beans, and nuts. Fats are essential for various bodily functions and should come from healthy sources like avocados, nuts, seeds, and plant-based oils.

4. Micronutrient Adequacy: Adequate nutrition requires the intake of an adequate amount of vitamins and minerals. These micronutrients play crucial roles in metabolic processes, enzyme functions, immune system support, and overall health. Consuming a variety of fruits, vegetables, whole grains, lean proteins, and dairy products (or suitable alternatives) helps ensure sufficient micronutrient intake.

5. Dietary Fiber: Adequate nutrition includes an adequate intake of dietary fiber. Fiber is important for digestive health, promoting regular bowel movements, and reducing the risk of certain diseases, such as heart disease and type 2 diabetes. Good sources of dietary fiber include whole grains, fruits, vegetables, legumes, and nuts.

6. Hydration: Adequate nutrition involves maintaining proper hydration by consuming an adequate amount of fluids. Water is essential for various physiological functions, including temperature regulation, nutrient transport, waste removal, and overall cellular function. It is recommended to drink water and other hydrating fluids throughout the day.

7. Individual Needs and Considerations: Adequate nutrition takes into account individual needs and considerations, such as age, sex, physiological status, health conditions, and lifestyle factors. Different life stages, such as infancy, childhood, adolescence, pregnancy, and older adulthood, have unique nutritional requirements. Individuals with specific health conditions or dietary restrictions may need tailored nutrition plans to ensure adequate nutrient intake.

8. Prevention of Nutrient Deficiencies: Adequate nutrition aims to prevent nutrient deficiencies, which occur when the body does not receive enough of a particular nutrient. Deficiencies can lead to various health problems and impair growth, development, and overall well-being. Adequate nutrition helps ensure the intake of all essential nutrients, reducing the risk of deficiencies.

9. Consideration of Cultural and Personal Factors: Adequate nutrition acknowledges cultural and personal factors that influence dietary choices. Different cultures have diverse dietary preferences, culinary traditions, and food availability. Personal factors such as personal taste preferences, ethical considerations, and food intolerances or allergies should be taken into account when planning for adequate nutrition.

10. Education and Awareness: Adequate nutrition requires education and awareness about the importance of balanced and varied eating habits. Nutrition education programs, public health initiatives, and access to reliable nutrition information help individuals make informed choices and adopt healthy eating patterns.

Adequate nutrition is crucial for maintaining optimal health, promoting growth and development, and reducing the risk of nutrition-related diseases. It emphasizes the consumption of a diverse range of nutrient-dense foods to ensure the body's nutritional needs are met. By following principles of adequate nutrition, individuals can support their overall well-being and improve their quality of life.

10.7 Malnutrition:

Malnutrition refers to a condition that arises when there is an imbalance between the nutrients a person consumes and their body's nutritional needs. It encompasses both under-nutrition and over-nutrition, leading to adverse effects on health and well-being. Here are some key aspects of malnutrition:

1. Under-nutrition: Under-nutrition occurs when the body does not receive adequate nutrients, energy, or micronutrients to meet its physiological needs. It can result from insufficient food intake, poor dietary diversity, or inadequate absorption and utilization of nutrients. Under-nutrition includes various forms:

a. Protein-Energy Malnutrition (PEM): PEM occurs when there is a deficiency of both protein and energy (calories) in the diet. It includes severe forms like marasmus (characterized by severe wasting and muscle loss) and kwashiorkor (marked by edema, skin and hair changes, and organ dysfunction).

b. Micronutrient Deficiencies: Inadequate intake of specific vitamins and minerals can lead to micronutrient deficiencies. Examples include iron deficiency anemia, vitamin A deficiency leading to night blindness, and iodine deficiency causing goiter.

c. Chronic Under-nutrition: Chronic under-nutrition, also known as stunting, refers to impaired growth and development due to long-term inadequate nutrition. It typically occurs during childhood and can result in stunted height, cognitive impairments, and increased susceptibility to infections.

2. Over-nutrition: Over-nutrition occurs when there is excessive intake of calories, macronutrients, or specific nutrients beyond the body's requirements. This can lead to overweight, obesity, and related health problems. Over-nutrition is often associated with diets high in refined sugars, unhealthy fats, and processed foods. It can contribute to chronic conditions such as cardiovascular disease, type 2 diabetes, and certain cancers.

3. Causes of Malnutrition: Malnutrition can be caused by various factors, including poverty, limited food availability, inadequate access to nutritious foods, lack of knowledge about healthy eating, improper food storage and preparation, cultural and social factors, and health conditions that affect nutrient absorption or utilization.

4. Health Impacts: Malnutrition has significant health consequences. Under-nutrition weakens the immune system, impairs growth and development, increases the risk of infections, delays wound healing, and contributes to poor cognitive function. Over-nutrition, particularly obesity, is associated with an increased risk of chronic diseases like heart disease, stroke, type 2 diabetes, certain cancers, and musculoskeletal disorders.

5. Socioeconomic Impact: Malnutrition has a substantial socioeconomic impact. It can hinder economic development by reducing productivity, impairing cognitive abilities and educational attainment, increasing healthcare costs, and placing a burden on healthcare systems. The effects of malnutrition are particularly pronounced in low-income communities and developing countries.

6. Prevention and Treatment: Addressing malnutrition requires a comprehensive approach. Prevention efforts focus on improving access to nutritious foods, promoting breastfeeding and adequate nutrition during the first 1,000 days of life, educating communities about healthy diets and food preparation, and implementing social safety nets and nutrition programs. Treatment involves providing therapeutic foods, nutrient supplementation, and medical care to individuals suffering from acute or severe malnutrition.

7. Global Initiatives: International organizations, governments, and NGOs are actively working to combat malnutrition through initiatives like the Scaling-Up Nutrition (SUN) movement, the World Food Program, and the Global Nutrition Report. These efforts aim to raise awareness, mobilize resources, and implement strategies to improve nutrition and reduce malnutrition globally.

Addressing malnutrition is crucial for improving health outcomes, promoting sustainable development, and reducing health disparities. Efforts to alleviate malnutrition require a multifaceted approach that includes improving food security, ensuring access to a diverse and nutritious diet, providing education on healthy eating practices, and addressing underlying social, economic

10.8 Balanced Diet and factors affecting balanced diet:

A balanced diet refers to a pattern of eating that provides all the essential nutrients, in appropriate proportions, to support optimal health, growth, and overall well-being. It involves consuming a variety of foods from different food groups in the right quantities to meet the body's nutritional needs. Here are some key aspects of a balanced diet:

1. Macronutrient Balance: A balanced diet includes an appropriate balance of macronutrients, which are carbohydrates, proteins, and fats. Each macronutrient serves specific functions in the body:

a. Carbohydrates: Carbohydrates are the primary source of energy and should make up the largest portion of the diet. They can be found in foods such as whole grains, fruits, vegetables, legumes, and dairy products.

b. Proteins: Proteins are essential for growth, tissue repair, and the production of enzymes and hormones. Good sources of protein include lean meats, poultry, fish, eggs, dairy products, legumes, nuts, and seeds.

c. Fats: Healthy fats provide energy, help absorb fat-soluble vitamins, and support various bodily functions. Sources of healthy fats include avocados, nuts, seeds, olive oil, fatty fish, and plant-based oils.

2. Micronutrient Adequacy: A balanced diet ensures an adequate intake of vitamins and minerals, also known as micronutrients. These nutrients are required in smaller quantities but are crucial for various physiological processes, enzyme functions, and overall health. Consuming a variety of fruits, vegetables, whole grains, lean proteins, and dairy products (or a suitable alternative) helps ensure sufficient micronutrient intake.

3. Variety of Foods: A balanced diet includes a wide variety of foods from different food groups. This ensures that the body receives a broad range of nutrients and phytochemicals. Eating a diverse array of fruits, vegetables, whole grains, lean proteins, and healthy fats promotes optimal nutrition and reduces the risk of nutrient deficiencies.

4. Portion Control: A balanced diet emphasizes portion control to maintain a healthy body weight and prevent overeating. It involves being mindful of serving sizes and listening to the body's hunger and fullness cues. Balancing energy intake with energy expenditure is important for weight management and overall health.

5. Hydration: A balanced diet includes adequate hydration. Water is essential for various physiological functions, including temperature regulation, nutrient transport, waste removal, and overall cellular function. It is recommended to drink water and other hydrating fluids throughout the day.

6. Dietary Fiber: A balanced diet incorporates an adequate amount of dietary fiber. Fiber is important for digestive health, promoting regular bowel movements, and reducing the risk of certain diseases such as heart disease and type 2 diabetes. Good sources of dietary fiber include whole grains, fruits, vegetables, legumes, and nuts.

7. Moderation: A balanced diet emphasizes moderation in the consumption of foods and beverages that are high in added sugars, sodium, and saturated fats. While these foods can be enjoyed occasionally, excessive intake can contribute to health problems like obesity, cardiovascular disease, and high blood pressure. It is important to limit the intake of processed and unhealthy foods and choose healthier alternatives whenever possible.

8. Individual Needs and Considerations: A balanced diet takes into account individual needs and considerations, such as age, sex, physiological status, health conditions, and lifestyle factors. Different life stages and specific health conditions may require adjustments in the nutrient composition or specific dietary restrictions. Consulting with a healthcare professional or registered dietitian can provide personalized guidance.

A balanced diet supports overall health, reduces the risk of chronic diseases, and promotes optimal growth and development. It is important to remember that dietary needs may vary for individuals, and it is best to seek individualized advice for specific dietary concerns.

Factors Affecting Balanced Diet:

A balanced diet plays a crucial role in promoting optimal health and well-being. It provides the necessary nutrients, vitamins, and minerals required for the body's proper functioning. However, several factors influence an individual's ability to maintain a balanced diet. These factors can vary based on personal, cultural, and environmental circumstances. Understanding these factors is essential for developing strategies to overcome barriers to a balanced diet. Let's delve into the various factors affecting a balanced diet:

Age and Gender: Age and gender significantly impact nutritional requirements and influence the composition of a balanced diet. Different life stages, such as infancy, childhood, adolescence, adulthood, and older adulthood, have distinct nutritional needs. For example, infants require high amounts of breast milk or formula, while adolescents may need increased iron and calcium for growth. Pregnant and lactating women have increased nutritional demands as well.

Physiological Conditions: Certain physiological conditions, such as pregnancy, lactation, and illness, have specific nutritional requirements. Pregnant women need additional nutrients to support the developing fetus, while lactating women require increased energy and nutrients to produce breast milk. Individuals with chronic illnesses or specific medical conditions may have dietary restrictions or require modified diets to manage their conditions effectively.

Activity Levels: The level of physical activity influences the energy expenditure and nutrient requirements of an individual. Highly active individuals, such as athletes or manual laborers, need more calories to fuel their physical exertion. Increased activity levels also affect the requirements for macronutrients, such as carbohydrates and proteins, as they play a vital role in energy production and muscle repair.

Cultural and Personal Preferences: Cultural and personal preferences strongly impact food choices and dietary patterns. Different cultures have unique dietary traditions and preferences, which can influence the types of foods consumed and the methods of food preparation. Personal preferences, including taste preferences, food aversions, and dietary habits, also shape an individual's dietary choices. It is essential to respect cultural diversity and personal preferences when promoting a balanced diet.

Socioeconomic Factors: Socioeconomic factors, such as income, education, and access to food, significantly affect dietary choices and the ability to maintain a balanced diet. Limited financial resources may restrict individuals from purchasing a variety of nutrient-rich foods, leading to a reliance on cheaper, energy-dense but nutrient-poor options. Lack of education regarding nutrition and food preparation techniques can also hinder the adoption of a balanced diet.

Food Availability and Accessibility: The availability and accessibility of nutritious foods influence dietary patterns. In some areas, fresh fruits, vegetables, and whole grains may be scarce or expensive, making it challenging to include them in daily meals. This can lead to a higher consumption of processed and convenience foods that are often high in added sugars, unhealthy fats, and sodium. Limited access to grocery stores or lack of transportation can also impact an individual's ability to obtain nutritious foods.

Food Marketing and Advertising: Food marketing and advertising play a significant role in shaping dietary choices, particularly among children and adolescents. The promotion of unhealthy, processed foods, snacks, and sugary beverages can influence preferences and lead to an imbalanced diet. The accessibility and marketing of fast food and convenience foods can also contribute to poor dietary habits.

Knowledge and Awareness: Knowledge and awareness of nutrition and dietary guidelines are crucial for making informed food choices. Lack of nutritional knowledge and misconceptions about healthy eating can hinder individuals from adopting a balanced diet. Nutrition education programs, access to reliable sources of information, and effective communication of nutritional guidelines are essential for empowering individuals to make healthier food choices.

Environmental Factors: Environmental factors, such as the proximity of green spaces, availability of community gardens, and exposure to food advertisements, can impact dietary habits. Living in neighborhoods with limited access to fresh produce or safe recreational spaces may discourage healthy eating and physical activity. Creating supportive environments that promote healthy food options and active lifestyles is vital for facilitating a balanced diet.

In conclusion, maintaining a balanced diet is influenced by a multitude of factors, including age, gender, physiological conditions, activity levels, cultural and personal preferences, socioeconomic factors, food availability and accessibility, food marketing and advertising, knowledge and awareness, and environmental factors. Recognizing these factors and addressing the barriers they present can help individuals make healthier food choices and work towards achieving a balanced diet. Education, access to nutritious foods, and supportive environments are essential components of promoting and sustaining a balanced diet for overall health and well-being.

10.9 Functions of Food:

Food serves several important functions in the body, providing essential nutrients, energy, and supporting various physiological processes. Understanding the functions of food is crucial for maintaining optimal health and well-being. Let's explore the detailed functions of food:

Energy Provision: One of the primary functions of food is to provide the body with energy. Carbohydrates, proteins, and fats are macronutrients that supply calories, which are converted into energy. This energy is essential for carrying out everyday activities, from basic bodily functions like breathing and circulation to physical exercise and mental tasks.

Nutrient Supply: Food is a source of essential nutrients required for growth, maintenance, and repair of body tissues. These nutrients include carbohydrates, proteins, fats, vitamins, minerals, and water. Each nutrient has specific functions in the body:

Carbohydrates: Provide energy, particularly for brain function and physical activity.

Proteins: Essential for growth, repair, and maintenance of body tissues, as well as the production of enzymes and hormones.

Fats: Act as a concentrated source of energy, aid in the absorption of fat-soluble vitamins, and provide insulation and protection for organs.
Vitamins and Minerals: Support various biochemical processes and play crucial roles in maintaining overall health.

Water: Essential for hydration, transportation of nutrients, regulation of body temperature, and numerous physiological functions.

Metabolic Functions: Food contributes to various metabolic processes within the body, including digestion, absorption, and metabolism of nutrients. Digestive enzymes break down complex carbohydrates, proteins, and fats into simpler forms that can be absorbed and utilized by the body. Absorbed nutrients are transported to cells, where they participate in energy production, growth, repair, and other metabolic activities.

Body Composition and Structure: Food provides the building blocks necessary for the growth, development, and maintenance of body tissues. Proteins, for example, are essential for the formation of muscles, bones, skin, and other structural components. Calcium, obtained from food sources, contributes to bone health and strength. Essential fatty acids are crucial for the structure and function of cell membranes.

Hormone and Enzyme Production: Certain nutrients obtained from food play a role in hormone and enzyme production. Hormones are chemical messengers that regulate various physiological processes in the body, including metabolism, growth, and reproduction. Enzymes are proteins that facilitate biochemical reactions in the body, such as digestion and energy production.

Health Promotion: Many foods contain bioactive compounds that offer health benefits and protect against chronic diseases. For instance, fruits and vegetables are rich in antioxidants, which help neutralize harmful free radicals and reduce the risk of oxidative stress-related diseases. Fiber, found in whole grains, fruits, and vegetables, promotes digestive health, regulates blood sugar levels, and

supports cardiovascular health. Probiotic, present in certain fermented foods, contribute to a healthy gut micro biome.

Psychological and Social Functions: Food has psychological and social functions that go beyond its nutritional value. Food is often associated with emotions, pleasure, and social interactions. Sharing meals with family and friends fosters social connections and contributes to overall well-being. Food can also be used for celebrations, cultural traditions, and personal enjoyment, enhancing the quality of life.

Understanding the multifaceted functions of food emphasizes the importance of consuming a balanced and varied diet that provides an adequate intake of essential nutrients. A diet rich in whole grains, lean proteins, fruits, vegetables, healthy fats, and plenty of water supports overall health, energy, and vitality. Additionally, mindful eating practices and a balanced approach to food can enhance the enjoyment and satisfaction derived from meals, promoting a positive relationship with food and nourishing both the body and the mind.

10.10 Food Groups:

Food groups are categories that classify foods based on their nutritional composition. These groups help individuals understand the different types of foods and their specific nutrient contributions, assisting in the creation of a balanced and nutritious diet. The main food groups typically include grains, fruits, vegetables, dairy, proteins, and fats/oils. Let's delve into each food group in detail:

Grains: Grains form the foundation of a healthy diet and provide a significant source of energy, dietary fiber, vitamins, and minerals. This food group includes foods made from wheat, rice, oats, barley, corn, and other cereal grains. Examples of grain-based foods include bread, pasta, rice, oatmeal, and breakfast cereals. Whole grains, such as whole wheat, brown rice, and whole oats, are particularly nutritious as they contain the entire grain kernel, including the bran, germ, and endosperm, which provide fiber, B vitamins, and other essential nutrients. It is recommended to choose whole grains whenever possible for maximum nutritional benefit.

Fruits: Fruits are rich in vitamins, minerals, dietary fiber, and antioxidants. They provide essential nutrients while adding natural sweetness and variety to the diet. Fruits can be enjoyed fresh, frozen, dried, or as 100% fruit juice (with no added sugars). Popular fruits include apples, bananas, oranges,

berries, melons, and citrus fruits. It is recommended to consume a variety of fruits to benefit from the wide range of nutrients they offer.

Vegetables: Vegetables are packed with vitamins, minerals, fiber, and phytochemicals that promote good health and help prevent chronic diseases. This food group includes a diverse range of vegetables, such as leafy greens (spinach, kale), cruciferous vegetables (broccoli, cauliflower), root vegetables (carrots, potatoes), legumes (beans, lentils), and others like tomatoes, peppers, and cucumbers. It is advisable to consume a variety of vegetables, both raw and cooked, to obtain different nutrients and maximize their health benefits.

Dairy: The dairy food group consists of milk and milk products that are rich in calcium, protein, vitamins (such as vitamin D and B vitamins), and minerals. Dairy products include milk, cheese, yogurt, and fortified plant-based alternatives like soy or almond milk. These foods contribute to bone health, muscle function, and overall growth and development. It is important to choose low-fat or non-fat options within this group to minimize saturated fat intake.

Proteins: The protein food group provides essential amino acids necessary for growth, repair, and maintenance of body tissues. It includes both animal and plant-based sources of protein. Animal sources include meat (such as beef, pork, and poultry), fish, eggs, and dairy products. Plant-based protein sources include legumes (beans, lentils), soy products (tofu, tempeh), nuts, seeds, and whole grains. Incorporating a variety of protein sources into the diet ensures a diverse intake of nutrients.

Fats/Oils: Fats and oils are a concentrated source of energy and provide essential fatty acids, fat-soluble vitamins (such as vitamin E), and help absorb certain nutrients. This food group includes fats from both plant and animal sources, such as oils (olive oil, canola oil), nuts, seeds, avocados, butter, and margarine. It is important to choose healthy fats, such as unsaturated fats (found in plant-based sources) and limit saturated fats (found in animal products and some plant oils) and trans fats (found in processed and fried foods).

It is recommended to consume foods from all the food groups in appropriate portions to achieve a balanced and nutritious diet. A balanced diet ensures an adequate intake of carbohydrates, proteins, healthy fats, vitamins, minerals, and fiber, promoting overall health and well-being. The specific quantities and proportions of foods from each group may vary based on individual dietary needs,

preferences, and cultural considerations. Consulting a healthcare professional or a registered dietitian can provide personalized guidance to meet specific nutritional goals.

10.11 Food guide Pyramid:

The food guide pyramid, also known as the healthy eating pyramid or nutrition pyramid, is a visual representation of a balanced diet. It is designed to guide individuals on making healthy food choices and understanding the relative proportions of different food groups in a well-rounded diet. While the traditional pyramid has evolved into various forms over the years, the core principles remain consistent. Let's explore the details of a typical food guide pyramid:

1. Base/Base Layer:

The base or bottom layer of the food guide pyramid consists of plant-based foods, such as fruits, vegetables, whole grains, legumes, and nuts. These foods form the foundation of a healthy diet and should be consumed in the largest quantities. They are rich in vitamins, minerals, dietary fiber, and antioxidants, providing essential nutrients and promoting overall health.

2. Second Layer:

The second layer of the pyramid usually includes foods from the protein group, such as lean meats, poultry, fish, eggs, dairy products, legumes, and plant-based protein sources like tofu and tempeh. Protein-rich foods are important for muscle growth, repair, and overall body functioning. It is recommended to choose lean sources of protein and incorporate a variety of options into the diet.

3. Third Layer:

The third layer typically represents carbohydrates, including grains and starchy vegetables. This layer emphasizes the importance of consuming whole grains, such as whole wheat, brown rice, oats, quinoa, and whole-grain bread and pasta. These complex carbohydrates provide energy, fiber, and a range of nutrients, and they should be prioritized over refined grains, which have been processed and stripped of their natural fiber and nutrients.

4. Fourth Layer:

The fourth layer often includes healthy fats, such as plant oils (olive oil, canola oil), nuts, seeds, and avocados. These foods are rich in monounsaturated and polyunsaturated fats, which are beneficial for heart health when consumed in moderation. It is important to choose healthy fat sources and limit

saturated fats (found in animal products and some plant oils) and Trans fats (found in processed and fried foods).

5. Apex/Top Layer:

The apex or top layer of the pyramid typically represents foods and beverages that should be consumed sparingly. This includes sugary drinks, sweets, desserts, processed foods high in added sugars, and foods high in sodium and unhealthy fats. These foods provide little nutritional value and can contribute to health issues when consumed in excess. It is recommended to limit their intake for overall health and well-being.

The food guide pyramid serves as a general guide for individuals to make informed food choices and maintain a balanced diet. However, it's important to note that individual nutritional needs may vary based on factors such as age, sex, activity level, and specific health conditions. Consulting with a registered dietitian or healthcare professional can provide personalized dietary guidance based on individual needs and goals.

It's worth mentioning that different countries and organizations may have their own versions of the food guide pyramid, tailored to their specific dietary recommendations and cultural considerations. It's important to refer to the guidelines specific to your region or consult with a healthcare professional to ensure adherence to appropriate dietary recommendations.

CHECK YOUR PROGRESS EXERCISE

1- What do you understand by the term ―Food Science‖?

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2- Write down a short note on ―Adulteration.

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3- Briefly explain the functions of food.

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4- Write about Food Guide Pyramid.

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Define the Following:

a) Balance Diet
b) Nutrition science
c) Adequate nutrition
d) Malnutrition

UNIT 11: IMPORTANCE OF FOOD STANDARDS

Structure

11.1 Introduction

11.2 Introduction to Food Standards

- 11.2.1 Importance of food standards
- 11.2.2 Quality control and Assurance

11.3 Food Laws and Regulations

- 11.3.1 Prevention of Food Regulation Act, 1954
- 11.3.2 Essential Commodities Act, 1955
- 11.3.3 Food Product Order, 1946
- 11.3.4 Directorate of Grading, Marketing and Inspection of Agricultural Product
- 11.3.5 Bureau of Indian Standards, 1952
- 11.3.6 Standard weights & Measures Act, 1976

11.4 Let Us Sum Up

11.5 Glossary

11.6 Answers to Check Your Progress Exercises

11.1 INTRODUCTION

In the previous unit we learnt that different kind of food groups have their own characteristics as well as enormous importance in terms of nutritive value. Every food group is fulfilled with ability to fight with different diseases and they also provide good health.

As much as the selection of food in these groups and use of appropriate cooking method is important for good health, assurance of food quality is also very necessary to be analyzed. Here, in this unit, we shall study about Food Standards and laws. Time by time there are several laws has been made and Regulation of these laws and standard will make assurance that food is safe to consume.

In this unit we will learn about the importance and applications of different food laws& Standards in detail.

Objectives

After studying this unit, you will be able to:

- Acknowledge your rights as a customer who knows food laws & standards.
- Application of Food Laws and Standards.
- Identify the food products following the Food Standards

11.2 INTRODUCTION TO FOOD STANDARDS

A set of regulations, outlining the requirements that food must meet in order to be fit for distribution or sale is known as Food Standards. It surely help to ensure the quality of food products on various parameters such as composition, appearance, freshness, source, sanitation, maximum bacterial count, purity, maximum concentration of additives, and so on.

Food standards are independent enactments in certain nations while they are included in laws in others. Whether or not they are part of rules or stand alone, they become an integral component of the enforcement system and serve to carry out fundamental food law.

Food safety and regulations both safeguard customers from fraud and enlighten them when choosing what to eat.

There are three major factors which supports the food standard:

- To stop the disease's cause or transmission.
- To restrict the selling of substandard products.
- To render food marketing straightforward.

Food standards are not just applied on raw food product, it also covers every packaged or unpackaged product available in the market either it is in raw form or ready to eat form. So surety of following the food standard will make the customer healthy and safe from several diseases.

11.2.1 IMPORTANCE OF FOOD STANDARDS

A sufficient supply of food has consistently been a major issue for governments, dating back to the Prehistoric communities began to form over a thousand years ago. While sharing many similarities foods continue to be produced and consumed, but over the centuries, dietary tastes have evolved as the economy and nutritional research have developed. Today, every consumer needs access to a healthy and safe food supply. The main purpose of our diet is to give us the necessary nutrients to meet our metabolic needs while also making us feel satisfied and healthy.

To safeguard domestic food production and to promote trade with other countries, efficient food hygiene practices along with oversight systems are needed. All food producers must abide by the established requirements for both safety and quality, and they must routinely test their goods.

Establishing bare minimum requirements and food safety regulations for both food safety and quality is a part of following food standards. In order to meet federal criteria and produce results for food safety, they also comprise suitable and conventional practices. Any food protection programme that includes methods for safeguarding food, corrective measures, and an appropriate reaction to food complaints is frequently used to carry out food rules.

All parties in the dietary supply chain must adhere to uniform food safety measures established by food legislation. To stop concerns with poor food safety, specific rules and regulations are implemented for each link in the supply chain. They are either set up as standards for risk management against an actual threat of illegal acts that may injure, or as guidelines for creating safe food products.

More food safety concerns have been incorporated into the chain of food distribution as a result of the food industry's growing globalization. Any edible item is subject to increasingly complicated food laws in addition to the numerous new hazards and threats that could possibly be established into the supply chain. Every nation may already have food laws in place that serve to safeguard its economy and availability of food.

To safeguard a country's economy and customers, food hygiene regulations also set requirements for food importation. Concerns of food borne contamination may also be introduced into a country's domestic food supply chain by importing foreign food products.

First and foremost, when discussing and writing about food quality, it should be noted that customers and those involved in food production and distribution have distinct ideas of what is meant by quality. From the

perspective of the food industry, which creates finished goods from agriculturally sourced raw ingredients, two prerequisites are particularly significant:

1. Can the raw material be produced into a food product that satisfies consumer demands? If so, how much if any?

2. Does the unprocessed product meet the standards for modern technology use and commercially fair processing costs?

The following prerequisites will be included in food producer-consumer quality:

1. How well a product satisfies the needs of a certain consumer group, or how well a food is categorized to fit into a particular quality group to satisfy the needs of consumers?

2. How well does the product conform to regulations (food legislation, standards, other restrictions, etc.) or what is the products commonly acknowledged level of "goodness"?

3. In comparison to other items in the same genre of food products, how much is the product preferred? What qualities made it preferable?

11.2.2 QUALITY CONTROL AND ASSURANCE

More food safety concerns have been incorporated into the chain of food distribution as a result of the food industry's expanding globalization. Any food product is subject to more complicated food laws in addition to the numerous new food-borne risks that might be introduced into the supply chain. Every nation may already have food laws in place that serve to safeguard their financial system and food supply.

Quality is a crucial criterion for producing food goods since consumers are vulnerable to any type of contamination that may happen during production. Due to dietary restrictions, nutritional needs, or medical concerns, the majority of consumers typically rely on manufacturing and processing standards, specifically to know the sort of substances present.

With the development of testing and monitoring methods for food safety, assurance of quality has become an essential part of the restaurant and food service sector.

The main purpose:

- To offer wholesome foods to consumers.
- To avoid the presence of dangerous substances in food as a result of careless pesticide application, poor handling of food, and spoiling due to microbial infection.
- To avoid using the incorrect additives or adding too many food additives.

- To stop food adulteration, which harms consumers, reduces the nutritional value of food, and defrauds them.
- To lessen poisons those are present in food naturally.

11.3 FOOD LAWS AND REGULATIONS

Law governing food is currently in flux once more. As global trade grows and food is processed more before it reaches consumers, analysis and technology are advancing quickly. Due to these circumstances, there will be more adulteration, public uproar, unstable markets, and a need for tighter regulation of food safety.

All living things need food to survive. As a result, emphasis should be placed on quality. Food and food items are typically processed on a large scale. Therefore, the possibility of food adulteration exists constantly. Food contamination can pose risks and have an impact on several groups at once. The general food legislation seeks to safeguard both consumer interests and the public's health with regard to food. With the possible exception of domestic activities, the law is applicable to all phases of the production, processing, and distribution of food and agricultural products.

The broader food legislation also lists some general guidelines for food law, like the following:

- Food law should, whenever possible, be founded on risk assessments.
- Consumers' interests will be respected.
- The precautionary principle: Where risk and uncertainty remain, temporary measures to manage risks may be implemented to provide a substantial amount of health safeguarding and until more scientific knowledge is available.

The most crucial rule for achieving this is that no dangerous food shall be sold on the market. To do this, each food operator is accountable for their link in the food chain. This is another factor contributing to the significance of food chain traceability. All owners of food and feed businesses must have an arrangement in place that allows them to track their products.

Every nation requires legislation to promote the production of healthful, safe foods and to forbid the sale of fake or harmful foods. Agriculture now needs to produce more due to the expanding population. However, greater utilization of chemicals is related to the increase in agricultural production. The utilization of chemicals for food protection during storage and transportation is also possible.

Large-scale, centralized food preparation raises the possibility of contamination. Convenience meals, foods that are ready to serve or that can be rapidly prepared for serving, are becoming more and more popular. Strict hygiene and safety procedures are required since these foods frequently include food additives and therefore convenience foods are particularly prone to contamination.

Basic food legislation and regulations make up the two main components of food law. While regulations contain specific provisions governing the various product categories falling under the purview of each set of regulations, the Act itself lays out broad principles.

Basic food control law occasionally includes food standards, hygienic prerequisites, and lists of additives to food, chemical tolerances, and other items.

Detailed provisions are required for the basic food law's efficient administration and intelligent adherence. The legislative branch passes laws in regimes where there is a separation of powers between the executive and legislative branches. The fundamental legislation, while the executive agency or organizations in charge of enforcing the law develop and publish the specific rules.

The following details should be emphasized in relation to the fundamental principles or regulations of food law:

- The fundamental aims and purview of the law;
- Definitions of fundamental concepts;
- Competence for enacting the law;
- Scrutiny and analysis techniques and facilities;
- Implementation, procedures for enforcement, and penalties;
- Regulations for ingredients, pesticides, and contaminants;
- Packaging and labeling; and
- Processes for the preparation and alterations of the rules and regulations for execution of the law.

Consumers are to be guaranteed by the fundamental food law that their food is safe to eat, pure, and manufactured in hygienic conditions. Food legislation generally forbids the importation and sale of food items with contaminated ingredients or labelling that are fraudulent or deceptive in any way.

By adhering to the fundamental requirements of the food law, the appropriate implementation of such a regulation promotes fair trade practices. Because of this, sincere manufacturers and dealers are shielded from unfair competition. Additionally, it promotes the growth of the food industry because quality control based on solid scientific principles tends to increase food acceptance among consumers.

According to stringent definitions, fundamental food law should specify the precise nature of offences that are punishable by law. The following are examples of such offences:

- Willful adulteration of food items;
- Manufacturing or commercialization of foods containing illegal or unauthorized ingredients;
- Deceptive use of labeling and trademarks;
- Failure of foods to meet legal standards;
- Disregard for hygienic requirements, etc.

The most important factor for our vitality and wellbeing is food. One of the key components that maintain our body's nutrient level is food safety. It guarantees higher requirements of food free from any dangerous or harmful substances. Safe and healthful food can improve human health and shield consumers from a number of ailments. At every level, food safety must be maintained. Therefore, an improved standard regarding food should be upheld from the point of production to the point of consumption. Food laws were put into place to regulate food specifications as well as the hygienic conditions of processing and manufacture.

In India, a number of regulations that regulate the food processing sector have been passed and put into effect to date. Since many years ago, legislation governing food safety has undergone major changes. The Food Health and safety Regulations in India have undergone a significant transformation thanks in large part to the FSSAI. People's Union of Civil Liberties v. Union of India (UOI) and An [iv] was a major decision by the Supreme Court in 2001 that addressed the problem of "hunger amidst plenty" in India. The People's Union of Civil Liberties (PUCL) filed a writ petition because it was worried that people would starve to death despite having plenty of food on hand. The enforcement of the "Right to Food" as a component of the Right to Life was also emphasized.

The following food legislation that were in place before India's Food Safety and Standards Act, 2006 (FSS Act), were repealed and reintroduced together under the FSS Act:

- Prevention of Food Regulation Act, 1954
- Essential Commodities A, 1955
- Food Product Order, 1946
- Directorate of Grading, Marketing and Inspection of Agricultural Product
- Bureau of Indian Standards, 1952
- Standard weights & Measures Act, 1976

11.3.1 PREVENTION OF FOOD REGULATION ACT, 1954

The Act offers protection against food adulteration and contamination that could endanger consumers' health. The Act also addresses frauds that suppliers may commit by offering inferior or tainted food. The Act controls how chemicals, insecticides, flavors, and other additions are used when preparing food. This Act establishes a limit on the disposal of inferior foods. Under the provisions of this Act, it is possible to add vitamins or minerals to grain flour, loaf, or other cereals, iodize salt, vitamin and vanspati oil, or add vitamin "C" to particular foods.

The Prevention of Food Adulteration Act of 1954, that has remained in effect since June 1, 1955, and was revised in 1964 and once more in 1976, was one of the first acts to be published in food laws and standards. The goal of this action was to make sure that any food products sold to clients are wholesome and pure. It also promotes fair trade practices and aims to stop fraud or deception.

The Act forbids the production, sale, and distribution of toxicant-contaminated foods, adulterated foods, and foods with false labels. Under the Act, a centralized committee for food regulations was established, and its job is to advise the entire government on issues pertaining to food standards.

The Act (Sec 2) specifies multiple descriptions of meals, adulteration, misbranding, etc. The centralized committee for Foods Standard is an advisory body that can be appointed by the Centre (Sec 3). The court must review an adulterated sample in any disagreement. The National Food Laboratories offer their concluding judgment on the matter. The locations of these 4 laboratories are Calcutta, Ghaziabad, Mysore, and Pune. At the district, regional, and state levels, there are about 82 food laboratories within the nation that are employed to carry out the PFA Act's requirements. The State Governments are given the authority to designate Public Analysts and Food Inspectors, who manage the marketing, storage, and supply of food. The task of the inspector is to collect samples and send them to a lab. The central government has the authority to establish quality standards, regulate food production, distribution, and sales, as well as to pack, label, and regulate food additives.

The provision of seafood to consumers is the responsibility of the nation's Ministry of Health and Family Welfare. The state/UT authorities are in charge of applying the Act.

1. To examine the PFA Act of 1954's rules and regulations in conjunction of the centralized committee for the food industry, an authorized advisory council established by the Act, and its 9 technological subcommittees.
2. To conduct tests for chemists applying to be public analysts under the Act;
3. To plan a training curriculum for various Act-related personnel;
4. approving the state's PFA Rules;
5. To review and accept the food labels for infants.
6. To assess and track the state/ UT’s progress in implementing the Act by gathering monthly reports and conducting site visits;
7. To communicate with national as well as global organizations that oversee food quality, such as the World Trade Organization and the Codes Alimentarius Commission; Agency of Marketing and Inspection; Cabinet of Food Processing Industries; and Agmark Scheme;
8. To guarantee the caliber of food imported into India in accordance with Act provisions;
9. To educate consumers about products; and
10. To expand the facilities for testing food.

The Food Protection Act and Rules' principal goals are to safeguard customers from illness brought on by food adulteration, to limit and regulate the incorporation of food additives, and to verify the nutritional criteria of the food. Both domestically and internationally produced foods are covered by these laws.

The 1954 Prevention of Food Adulteration Act (PFA)

PFA is primarily concerned with the marketing of high-quality food items and safeguarding the health of consumers. According to PFA, the following food items are judged to be adulterated:

(a) If the item being sold by the vendor does not meet the buyer's expectations for nature, substance, or quality or is not to the buyer's prejudice.

(b) If the item is treated in a way that harms the item's nature, substance, or quality, or if the item contains any other substances that do so.

(c) If the item has been completely or partially replaced with a lower-quality or less expensive material, harming the item's nature, content, or quality.

(d) If any component of the piece has been completely or partially abstracted in a way that negatively impacts its nature, content, or quality.

(e) If the item has been prepared, baked, or stored in unhygienic ways that have caused it to become contaminated or harmful to health.

(f) If the item is insect-infested, rotting, decomposed, or made entirely of any living thing or vegetable substance that is filthy, putrid, repulsive, or otherwise unfit for food.

(g) If the item came from an infected animal.

(h) If the product contains any toxic materials or other potentially harmful components.

(i) If the container for the item is made up entirely or in part of a poisonous or harmful chemical, making the contents harmful to health.

(j) If the article contains any coloring material other than that specified in regard to it and in quantities outside the permitted range of variation.

(k) If the article includes a permissible or prohibited preservation in excess of the authorized or prohibited amounts.

(l) If the product's quality or purity is below the required requirements or if the amounts of its constituent parts are greater than the allowable range of variation.

Thus, the PFA act of 1954 establishes the rules for creating standards for different food items like grains & grain products, pulses, ghee, etc. All processed goods that are manufactured in large quantities for general consumption must adhere to these standards. A minimum sentence of one year in jail, a fine of $2,000, a maximum sentence of six years, and a larger fine as determined by the court are the penalties for counterfeiting

that is harmful to health. Adulteration that does not endanger the public's safety is punishable by up to three years in prison, an aggregate fine of $1,000, and a minimum of six months in imprisonment.

11.3.2 ESSENTIAL COMMODITIES ACT, 1955

An act that governs the production, supply, and distribution of specific commodities and to facilitate trade and commerce in certain commodities in the best interests of the public.

When India's production of food grains was insufficient, the E C Act of 1955 was introduced. However, given that India now has a surplus of the majority of agricultural products, the government's amendments to the ECA 1955 are a crucial step in achieving its goal of doubling farmers' incomes as well as improving the ease of doing company operations.

The necessary items Act of 1955 omits a detailed definition of necessary items.

A commodity included in the Act's Schedule is referred to as an "essential commodity" under Section 2(A) of this Act.

Legal Jurisdiction:

1. The Act gives the federal government the authority to include or exclude a good from the Schedule.
2. In collaboration with state governments, the Centre may declare a product to be essential if it determines that doing so is in the public interest.

Objective: By permitting the Centre to permit state governments to control commerce in a wide range of commodities, the ECA 1955 is utilized to control inflation.

Impact: The government may establish a stock limit and regulate the manufacturing, distribution, and supply of a commodity by designating it as vital.

The Economic Survey 2019–20 emphasized that while government involvement under the ECA 1955 was completely useless at reducing inflation, it frequently damaged agricultural commerce.

1. This type of action does create opportunities for harassment and rent-seeking.
2. Economists refer to unproductive revenue, especially that derived by corruption, as "rent-seeking."
3. During excess perishable harvests, traders frequently purchase much less than they normally would, and farmers frequently incur significant losses.
4. Due to the lack of expenditure in cold-room warehouses, processing, and export, farmers were unable to obtain higher prices.
5. Due to these problems, the Essential Commodities (Amendment) Bill, 2020, was approved by the Parliament.

6. However, the government was forced to repeal the legislation as a result of farmer protest.

11.3.3 FOOD PRODUCT ORDER, 1946

In 1946, the Indian government issued the Fruit Products Order. The order was updated in 1955. The Fruit Product Order (FPO) establishes legal minimum requirements for the quality of certain fruits and vegetables items and facilities for processing. The Department of Health enforces the FPO. Currently, there are just over 5198 units scattered across the nation that have been authorized under the Fruit Products Order of 1955. The majority of the units are classified as cottage or small-scale. A few contemporary processing facilities have already been built, and numerous more are currently in the works. At the end of 1999, the installed capacity, which was 11.08 lakh tones in 1993, had expanded to 21 lakh tones.

11.3.4 DIRECTORATE OF GRADING, MARKETING AND INSPECTION OF AGRICULTURAL PRODUCT

In order to execute agricultural advertising plans and initiatives for the coordinated growth of the promotional efforts of agricultural and other cooperated produce across the nation with a view to preserve the best interests of farmers as well as consumers, the Directorates of the marketing profession and Inspection (DMI), an included Bureau of the Department of Agriculture, Rural Development, and Farmers Welfare under the aegis of the Ministry of Agriculture and Rural Development & Farmers Welfare, was established in the year 1935. It keeps tight ties with both the Central and State Governments.

The main functions of the DMI are the following:

1. Providing guidance on the regulation, growth, and administration of the States' and Union Territories' agricultural produce markets.
2. The 1937 Agricultural Product (Grading and Marking) Act promotes standardization and marking of agricultural and related products.
3. Integrated Strategy of Agricultural Marketing (ISAM) promotion and implementation are items three.
4. Creation and use of the Agricultural Marketing Research and Information Network (MRIN) sub-scheme.
5. Implementation of the AMI Sub-Scheme for Agricultural Marketing Infrastructure.
6. Agriculture marketing reforms are number
7. Agricultural marketing staff training.
8. Extension of marketing.

11.3.5 BUREAU OF INDIAN STANDARDS, 1952

The Indian Standards Institution was founded as a society in 1947 under the name of the Bureau of Indian Standard (BIS), and was later designated a statutory organization by the Bureau of Indian Standards Act 1986. The Bureau is made up of representatives from business, consumer groups, scientific and academic institutions, professional and technical schools, central ministries, state governments, and parliamentary members.

1. One of the Bureau's duties is standard formulation.

2. The product, Management of Quality System, Eco Mark, Environmental Management System, Gold Jewelry Hallmarking, Risk Assessment, and important control point's certification.

3. Testing, calibration, and management in the laboratory.

4. Standard-setting.

5. Customer Affairs.

6. Programs for training and awareness

The Institution of Engineers (India) prepared the first draught of the Constitution of an Organization that could take on the task of establishing National Standards during the final years of British rule in India, while the nation was confronted with the enormous task of constructing up the industrial infrastructure. This resulted in the Bureau of Industries and Commodities officially declaring the establishment of an organization known as the "Indian Standards Institution" in a memo released on September 3, 1946. The Indian Standards Institutions (ISI) was established on January 6, 1947, and Dr. Lal C. Verman became its first Director in June of that year.

The organization focused on standardization activity in its early years. The Indian Standards Institution launched the Certification Marks Scheme in accordance with the Indian Standards Institution (Certification Marks) Act, 1952, to offer the benefits of standardization to common customers. The ISI was able to provide licenses to manufacturers who produced goods in accordance with Indian Standards and to apply the ISI Mark to their products thanks to the Scheme, which was initially introduced by the ISI in 1955–1956. In order to comply with the Certification Marks Scheme's standards, the foundation of a laboratory was established in 1963. The Indian Standard Institution Act, 1952, governed the operation of product certification, but no laws applied to the creation of standards or any related tasks. Therefore, legislation with this purpose was introduced in 26 Nov 1986.

Through a parliamentary act dated 26 November 1986, the Bureau of Indian Standards (BIS) was established on 1 April 1987 with a broader mandate and more authority, taking over the personnel, assets, liabilities, and functions of the former ISI. The government intended to create a culture for excellence in culture and

consciousness as well as increased consumer involvement in the creation and application of national standards through this transition.

The Bureau of Consumer Affairs is a body corporate made up of 25 members who represent the federal and state governments, lawmakers, business, academic institutions, consumer advocacy groups, and professional associations. The vice-president and president-elect are the labor organization's minister of consumer protection and state minister for food and public distribution, respectively.

There are 14 specialized departments involved in standardization. Currently, 17000 Standards in many technological fields have been developed based on national priorities. By including them in relevant technical committees, subcommittees, and panels, several sectors, including business, customers testing and laboratory professionals, and government organizations, contributed to the development of these standards. In order to keep up with evolving technology, the standards are periodically reviewed and revised. The BIS has created 1133 standards for food-related items.

BIS Act, Rules & Regulations

1. BIS Act, 2016
2. BIS Act, 2016 BIS (Removal of Difficulty) Order, 2019
3. Enforcement of BIS Act, 2016
4. BIS Rules, 2018 incorporating all amendments
5. The Bureau of Indian Standards (Conformity Assessment) Regulations,2018
6. BIS (Advisory Committees) Regulations, 2018 incorporating all amendments
7. The Bureau of Indian Standards (Hallmarking) Regulations, 2018
8. Notification on precious metal articles to be marked with hallmark, notified by Department of Consumer Affairs The Bureau of Indian Standards (Powers and Duties of Director General) Regulations, 2018
9. BIS (Recruitment to Laboratory Technical Posts) Regulations, 2019
10. BIS (Recruitment to Scientific Cadre) Regulations, 2019
11. BIS (Conformity Assessment) Amendment Regulations, 2020
12. BIS (Recruitment to Administration, Finance and other Posts) Regulations, 2020
13. BIS (Terms and Conditions of Service of Employees) Regulations, 2020
14. BIS (Conformity Assessment) First Amendment Regulations, 2021
15. BIS (Conformity Assessment) Second Amendment Regulations, 2021
16. BIS (Conformity Assessment) Third Amendment Regulations, 2021
17. BIS (Conformity Assessment) Fourth Amendment Regulations, 2021
18. BIS (Conformity Assessment) Sixth Amendment Regulations, 2021
19. BIS (Conformity Assessment) Amendment2022
20. BIS (Hallmarking) Amendment Regulations, 2021

21. BIS (Hallmarking) Amendment Regulations 2022

11.3.6 STANDARD WEIGHTS & MEASURES ACT, 1976

An act to regulate trading or trade in Weights, Measures, and other goods sold or supplied by Weight, Measure, or number, establishing Standard of Measurement and Weight, and to provide issues related to or incidental to such.

Weights and measures are established using the SI elements, as approved by the CGPM and acknowledged by the OIM. Specifies the types of measuring devices that may be used in industrial production, commercial transactions, and measurements involving public healthcare and human safety.

Being enacted by Parliament in the 27th year of eternity of India Standard weight & measures act is distributed is following parts:

1. Provisions applicable to every part
2. Establishment of standards of weights and measures
3. Physical representation of standard units
4. Standards of weights and measures
5. Custody and verification of standard equipment's
6. Appointment and powers of director and other staff
7. Inter-state trade or commerce in weight, measure or other goods
8. Intra - state trade or commerce in weight, measure or other goods
9. Approval of models
10. Import and export of weights and measures
11. Registration of exporters and importers
12. Export and import of weights, measures and commodities in packaged form
13. Offences and their trial
14. Training institute
15. Miscellaneous

In the course of interstate trade or commerce, every package of commodities supplied or disseminated in packaged form must include the following:

1. A clear and noticeable statement on it identifying the item within the container,
2. The net quantity in standard weights and measures and, if expressed in numbers, the precise number therein,
3. The cost of the item as a unit and the cost of the specific bundle of the commodity.
4. On the package, the manufacturer's name should be listed together with that of the packing worker or distributor.

5. The Packaging Commodities Rules were created in 1977 to address this issue.

The Packaged Commodity Rules were issued in 1977 to address this issue. These regulations cover all of India and are applicable to packaged goods that are being traded among states for sale, distribution, or delivery or those are being offered for sale, distribution, or delivery. They also cover goods that are being stored for sale, distribution, or delivery.

1. Regulation of weights and measures commerce, as well as the sale, distribution, and supply of goods using weights and measures;
2. Regulation of pre-packaged goods sold or intended for sale during interstate and commercial transactions;
3. Approval (before to manufacture) of scales and measuring instrument models that will be produced after the proposed legislation takes effect;
4. Regulation and oversight of packaged goods, weights and measures exports, and imports;
5. Creation of an Indian institution of legislative metrology to train inspectors and others in legal metrology;
6. Surveys and the gathering of data to aid in the formulation and application of the new legislation.
7. Instruments for weighing and measuring should be checked out while being used to avoid fraud.
8. Inspection officers' rights to search, confiscate, and forfeit nonstandard weights and measures
9. The ability to present a case to the court for conviction
10. The ability to compound specific cases prior to or following the prosecution of those instances.
11. Appeal guidelines
12. Power to establish rules for carrying out the act's provisions, including the power to set fees for various services supplied.

11.4 LET US SUM UP

Customers demand specific attributes from their cuisine. Various types of guidelines are created in order to achieve high-quality character tics. Food science develops and employs techniques to assess various aspects of food quality. At both the national and international levels, numerous authorities and organizations are involved in creating, implementing, and regulating standards.

In order to guarantee that food products offered to consumers are wholesome and pure, PFA was adopted in 1955. In order to provide a legally required minimum for fruits, vegetables, and meat, FPO and MPO were additionally enforced. BIS is the organization in charge of outlining the policy principles for developing standards.

11.5 GLOSSARY

Certificate : A document providing evidence of status of qualification.

CCP : Any point in the process where loss of control may result in a health risk.

Food safety : A judgment of acceptability of the risk involved in eating a food; of risk is relatively low, a food substance may be considered.

11.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1. Your answer should include following points:

- Definition
- Legal, company, industry, and consumer standards

_____

_____

_____

_____

_____

2. Your answer should include following points:

- BIS
- Function of BIS
- Formulation process

Check Your Progress Exercise 2

1. Your answer should include following points:
   - Associations information, functions
   - Status and regulations

_____

_____

_____

2. Your answer should include following points:
   • Quality assurance system, need
   • Principles, tasks

Check Your Progress Exercise 3

1. Your answer should include following points:
   • Purposes, structure
   • Functions

2. Your answer should include following points:
   • Need, Importance of MPO, FPO
   • Key elements

Unit 12-Hazards to Food Products

Structure

12.1 Introduction

12.2 Micro-biological

12.3 Environmental

12.4 Natural

12.5 Toxicants

12.6 Pesticide

12.7 Residues and food additives

12.8 Food Adulteration

12.8.1 Common Adulterants

12.8.2 Methods and Tests for detecting Adulterants

12.9 Check Your Progress

12.1 INTRODUCTION:

Hazards to food products can arise from various sources, and one significant category is microorganisms. Microbiological hazards refer to the presence of harmful microorganisms such as bacteria, viruses, parasites, and fungi in food, which can cause food borne illnesses or spoilage. These hazards can affect food safety and pose a risk to human health if consumed. Understanding and managing microbiological hazards are crucial in ensuring the safety and quality of food products.

Here are some common microorganisms associated with food borne hazards:

1. Bacteria: Bacteria are one of the primary microorganisms responsible for food borne illnesses. Examples include Salmonella, Campylobacter, Escherichia coli (E. coli), Listeria monocy to genes, and Staphylococcus aurous. These bacteria can contaminate food through various sources such as soil, water, animals, and human handling. Improper handling, storage, or inadequate cooking temperatures can promote bacterial growth, leading to food borne illnesses.

2. Viruses: Viruses are tiny infectious agents that can cause diseases such as norovirus, hepatitis A, and rotavirus. These viruses can contaminate food through infected individuals handling the food or through contaminated water sources. Shellfish, fresh produce, and ready-to-eat foods are particularly susceptible to viral contamination.

3. Parasites: Parasites are organisms that live and feed on another organism, known as a host. Examples of food borne parasites include protozoa like Cryptosporidium and Giardia, as well as helminths such as tapeworms and roundworms. Contamination can occur through infected water, soil, or inadequate cooking of infected meat and seafood.

4. Fungi: Fungi include molds and yeasts, which can spoil food and produce toxins. Some molds, such as Aspergillus flavus, can produce aflatoxins, potent carcinogens that can contaminate crops such as peanuts, corn, and tree nuts. Yeasts can cause spoilage in fruits, vegetables, and fermented food products.

12.2 Micro-biological

Microbiological hazards can enter the food supply chain at various stages, including production, processing, distribution, and preparation. Here are some common causes and sources of microbiological contamination in food:

1. Poor hygiene practices: Inadequate hand washing, improper use of gloves, and lack of cleanliness in food processing areas can introduce harmful microorganisms.

2. Cross-contamination: This occurs when pathogens from one food or surface are transferred to another. For example, using the same cutting board or knife for raw meat and ready-to-eat foods without proper cleaning and sanitation can lead to cross-contamination.

3. Inadequate cooking or processing: Insufficient cooking temperatures or inadequate processing of food products can fail to eliminate or reduce the microbial load, allowing harmful microorganisms to survive.

4. Contaminated water: Water used in food processing or irrigation can carry microorganisms, leading to contamination of crops or food products.

5. Improper storage and temperature control: Incorrect storage temperatures, such as keeping perishable foods in the temperature danger zone (40°F - 140°F or 4°C - 60°C), can promote the growth of bacteria and other microorganisms.

Preventing and controlling microbiological hazards requires implementing good manufacturing practices (GMP), Hazard Analysis Critical Control Point (HACCP) systems, and adherence to food safety regulations. Here are some preventive measures:

1. Personal hygiene: Strict adherence to proper hand washing, wearing clean uniforms, using gloves, and practicing good personal hygiene can minimize the risk of contamination.

2. Sanitation and cleaning: Regular cleaning and sanitization of food processing areas, equipment, and utensils are essential to prevent microbial growth and cross-contamination.

3. Food safety training: Proper training of food handlers and staff on food safety practices, including microbiological hazards, is crucial to ensure awareness and compliance.

4. Temperature control: Maintaining proper storage temperatures and implementing cold chain management can inhibit the growth of bacteria and other microorganisms.

5. Water quality control: Ensuring the safety and cleanliness of water used in food production, processing, and sanitation is vital to prevent microbiological contamination.

6. Effective cooking and processing: Adequate cooking temperatures and proper processing techniques must be employed to eliminate or reduce microorganisms present in food.

Regular testing, monitoring, and verification of food products and processing environments are also important to detect and control any microbiological hazards that may be present.

Hazards to food products can come from various sources and pose risks to both food safety and consumer health. These hazards can be categorized into physical, chemical, and biological hazards. Understanding and mitigating these hazards are critical in ensuring the safety and quality of food products.

1. Physical Hazards:

Physical hazards refer to foreign objects or substances that can accidentally contaminate food products. They can cause injury or harm if ingested. Common examples include:

- Glass, metal, or plastic fragments from broken equipment or packaging materials.

- Wood splinters or chips from wooden crates or pallets.

- Stones, bones, or shells from raw ingredients or processing.

- Personal objects like jewelry, hair, or fingernails from food handlers.

To prevent physical hazards, appropriate controls should be in place, including proper handling and storage of raw materials, regular equipment maintenance, effective quality control measures, and the use of metal detectors or sieves during processing.

2. Chemical Hazards:

Chemical hazards can contaminate food products through various means, including agricultural practices, food processing, packaging materials, or unintentional contamination during storage. Some common chemical hazards include:

- Pesticides and herbicides used in farming practices.

- Veterinary drugs, antibiotics, or growth hormones used in animal production.

- Food additives and preservatives in excessive amounts.

- Contaminants from environmental sources, such as heavy metals, toxins, or pollutants.

- Cleaning agents, sanitizers, or lubricants used in food processing facilities.

Prevention and control of chemical hazards involve adherence to regulatory guidelines and good agricultural practices, proper use of additives and preservatives, regular monitoring of contaminants in raw materials, and strict control of chemical usage in food processing.

3. Biological Hazards:

Biological hazards refer to the presence of harmful microorganisms, including bacteria, viruses, parasites, and fungi, that can cause food borne illnesses or spoilage. Some examples of biological hazards include:

- Bacterial pathogens such as Salmonella, Escherichia coli (E. coli), Campylobacter, Listeria monocytogenes, and Staphylococcus aureus.

- Viruses like norovirus, hepatitis A, and rotavirus.

- Parasites such as Cryptosporidium, Giardia, tapeworms, and roundworms.

- Toxigenic fungi that produce mycotoxins, such as aflatoxins.

These microorganisms can contaminate food through various routes, including improper handling, inadequate cooking or processing, cross-contamination, contaminated water, or poor sanitation practices. Prevention measures include implementing good manufacturing practices (GMP), Hazard Analysis Critical Control Point (HACCP) systems, strict hygiene practices, regular testing and monitoring, and appropriate heat treatment or processing to destroy or inhibit microbial growth.

Other Hazards:

In addition to the above hazards, there are some additional hazards to consider, including:

- Allergens: Ingredients that can trigger allergic reactions in susceptible individuals, such as peanuts, tree nuts, eggs, milk, wheat, soy, fish, and shellfish. Proper labeling, segregation, and cleaning procedures are crucial to prevent cross-contact with allergenic ingredients.

- Intentional Contamination: Acts of deliberate contamination or tampering of food products, known as food terrorism or food fraud. This can involve adding harmful substances or adulterants, counterfeit products, or mislabeling. Stringent security measures, traceability systems, and proper supplier verification are necessary to prevent intentional contamination.

In summary, hazards to food products encompass physical, chemical, biological, allergenic, and intentional contamination risks. Implementing preventive measures, adhering to regulations, conducting regular inspections, and educating food handlers and consumers are essential in safeguarding food safety and maintaining the quality of food products throughout the supply chain.

12.3 Environmental

Hazards to food products can also arise from environmental factors, which can affect the safety and quality of food during various stages of production, processing, storage, and distribution. Environmental hazards refer to the contamination or degradation of food due to factors present in the surrounding environment. Here are some common environmental hazards:

1. Contaminated Water:

Water is an essential component in the production and processing of food. If water used in irrigation, washing, processing, or cleaning is contaminated, it can introduce various hazards to food. Contaminants can include microbial pathogens, chemical pollutants, heavy metals, or agricultural runoff containing pesticides and fertilizers. Contaminated water can directly contact or be absorbed by crops, or it can contaminate food through direct use during processing or indirect use in equipment cleaning.

To mitigate the risk of contaminated water, it is crucial to ensure the use of safe and potable water sources, regularly test water quality, implement proper water treatment or filtration systems, and monitor and maintain sanitation practices throughout the food production and processing facilities.

2. Airborne Contaminants:

Airborne contaminants can pose risks to food safety and quality. These contaminants can include microorganisms, allergens, dust, pollutants, and chemicals. They can be introduced through improper ventilation systems, proximity to industrial activities or construction sites, or through air circulation systems in food processing facilities. Airborne contaminants can settle on exposed food surfaces, leading to microbial growth, chemical contamination, or foreign matter contamination.

To address airborne hazards, food processing facilities should have appropriate air filtration systems, proper ventilation, and air quality monitoring. Regular cleaning and maintenance of air handling units and air ducts are necessary to minimize the risk of airborne contamination.

3. Pest Infestation:

Pests such as rodents, insects, and birds can pose significant hazards to food products. They can contaminate food with feces, urine, hair, feathers, and pathogens they carry. Pests can also damage packaging materials and storage structures, compromising the integrity and safety of food products. Infestations can occur in production fields, storage areas, processing facilities, transportation, or retail environments.

To prevent pest infestations, food facilities should implement comprehensive pest control programs that include preventive measures such as proper sanitation, regular inspection, exclusion techniques (e.g., sealing gaps and openings), and use of appropriate pest control methods (e.g., traps, baits, or insecticides). Effective waste management and proper storage practices also help minimize pest attraction and breeding grounds.

4. Natural Disasters and Environmental Contamination:

Natural disasters like floods, hurricanes, earthquakes, or wildfires can cause significant environmental contamination and pose hazards to food products. These events can introduce contaminants such as pathogens, chemicals, toxins, or pollutants into the food supply chain. Floodwaters can carry sewage, agricultural chemicals, and industrial pollutants, while wildfires can release ash, smoke, and chemicals into the air and soil.

To mitigate risks associated with natural disasters, it is essential to have emergency preparedness plans in place, including safe storage and relocation of food products, regular monitoring of water and soil quality after disasters, and proper disposal of contaminated food or ingredients.

5. Climate Change and Agricultural Practices:

Climate change can impact food safety by altering weather patterns, temperatures, and precipitation levels. These changes can affect agricultural practices, crop growth, and the spread of pests and diseases. Extreme weather events, such as heat waves, droughts, or heavy rainfall, can impact crop yields, water availability, and increase the risk of contamination.

To adapt to climate change, sustainable agricultural practices, resilient crop varieties, efficient water management, and monitoring of environmental conditions are essential. Proper risk assessment and management strategies can help mitigate the impact of climate change on food safety.

In summary, environmental hazards pose significant risks to food products. Implementing robust food safety management systems, conducting regular monitoring and testing, ensuring water and air quality, implementing

pest control measures, and addressing the challenges posed by climate change are essential to safeguarding food safety and maintaining the quality of food products.

12.4 Natural

Hazards to food products can also arise from natural sources, presenting challenges to food safety and quality. Natural hazards refer to events or conditions that occur in nature and can directly or indirectly impact food throughout the supply chain. These hazards can originate from the environment, weather patterns, or naturally occurring substances. Here are some common natural hazards:

1. Biological Contaminants:

Natural biological hazards can include various microorganisms, parasites, and toxins present in the environment. These contaminants can contaminate crops, livestock, or water sources, leading to food borne illnesses or food spoilage. Examples of natural biological hazards include:

- Pathogenic bacteria: Bacterial pathogens such as Salmonella, Campylobacter, Escherichia coli (E. coli), and Listeria monocytogenes can contaminate crops or animal products, posing a risk to food safety.

- Toxins: Naturally occurring toxins produced by microorganisms, such as mycotoxins (e.g., aflatoxins), can contaminate crops like grains, nuts, and spices, leading to health risks if consumed.

- Parasites: Parasites like Cryptosporidium, Giardia, and Trichinella can contaminate water sources or animal products, causing food borne illnesses.

To mitigate the risk of biological hazards, it is essential to implement good agricultural practices (GAPs), including proper sanitation, water management, pest control, and hygiene practices. Effective monitoring and testing programs can help detect and prevent the presence of these hazards.

2. Natural Disasters:

Natural disasters such as earthquakes, hurricanes, floods, wildfires, or volcanic eruptions can cause significant disruptions to the food supply chain. These events can lead to physical damage to crops, livestock, infrastructure, and food storage facilities, resulting in food contamination and spoilage. Natural disasters can also impact transportation routes, disrupting the timely delivery of food products.

To manage the risks associated with natural disasters, it is crucial to have emergency preparedness plans in place. These plans should include measures to ensure the safety of food products, such as secure storage, backup power, proper handling of damaged or contaminated products, and communication with suppliers, distributors, and consumers during recovery efforts.

3. Environmental Contaminants:

Environmental contaminants can include naturally occurring substances in the environment that can contaminate food products. These contaminants can be present in the soil, air, or water sources used in agriculture or food processing. Examples of environmental contaminants include:

- Heavy metals: Naturally occurring heavy metals such as lead, mercury, cadmium, and arsenic can contaminate soil or water sources, leading to their uptake by crops or aquatic organisms.

- Radionuclide's: Radioactive materials can contaminate the environment through natural sources or human activities, posing risks if they enter the food chain.

- Natural toxins: Some plants, mushrooms, or seafood species naturally produce toxins that can contaminate food if not properly identified or controlled.

To address environmental contaminants, it is necessary to implement regular monitoring programs to assess soil and water quality. Proper irrigation practices, crop selection, and careful sourcing of ingredients can help mitigate the risks associated with environmental contaminants.

4. Climate Change:

Climate change is a global challenge that can impact food safety and quality. Changes in temperature, rainfall patterns, extreme weather events, and shifting ecosystems can affect agriculture, water availability, and the prevalence of pests and diseases. Climate change can indirectly influence food safety by altering the conditions under which food is produced, stored, transported, and consumed.

To address the impact of climate change on food safety, it is crucial to develop sustainable agricultural practices, promote water conservation and efficient irrigation methods, adapt pest and disease management strategies, and enhance monitoring and surveillance systems for emerging food safety risks.

In summary, natural hazards can pose risks to food products through the presence of biological contaminants, environmental pollutants, natural disasters, and the impact of climate change. Implementing preventive measures, regular monitoring, adherence to good agricultural practices, and effective response plans are essential in mitigating these hazards and ensuring the safety and quality of food products.

12.5 Toxicants

Hazards to food products can also arise from toxicants, which are chemical substances that can contaminate food and pose risks to human health. Toxicants can be naturally occurring in certain foods, introduced through environmental contamination, or added intentionally or unintentionally during food production, processing, or

packaging. These toxicants can have acute or chronic health effects, and their presence in food products must be carefully managed. Here are some common types of toxicants that can contaminate food:

1. Naturally Occurring Toxicants:

Certain foods can naturally contain toxic substances that can be harmful if consumed in excessive amounts. Examples include:

- Cyanogenic glycosides: Found in some fruits, vegetables, and seeds, these compounds can release cyanide when metabolized.

- Mycotoxins: Produced by fungi that grow on crops such as grains, nuts, and spices, mycotoxins include aflatoxins, ochratoxin A, fumonisins, and deoxynivalenol (DON).

- Phytotoxins: Naturally occuring toxins in plants, such as solanine in green potatoes or toxins in poisonous mushrooms.

To mitigate the risks associated with naturally occurring toxicants, it is crucial to implement proper agricultural practices, including the selection of resistant crop varieties, appropriate storage conditions, and monitoring of contamination levels. Strict regulations and guidelines are in place to ensure the safety of these foods and establish maximum allowable levels for specific toxicants.

2. Environmental Contaminants:

Environmental contaminants can enter the food chain through pollution of air, water, or soil. These toxicants can come from industrial activities, agricultural practices, waste disposal, or chemical pollutants. Common examples include:

- Heavy metals: Contaminants such as lead, cadmium, mercury, and arsenic can accumulate in the environment and contaminate crops, seafood, or animal products.

- Persistent organic pollutants (POPs): These include substances such as polychlorinated biphenyls (PCBs), dioxins, and certain pesticides that can bioaccumulate in the food chain.

- Pesticide residues: Improper use or excessive application of pesticides can result in residues on food products.

To address environmental contaminants, regulatory agencies establish maximum residue limits (MRLs) and monitoring programs to ensure compliance. Good agricultural practices, proper waste management, and control of industrial emissions are essential in minimizing environmental contamination.

3. Food Additives and Chemical Contaminants:

Some chemical substances can be intentionally or unintentionally introduced into food products during processing, packaging, or storage. These include:

- Food additives: These are substances added to food to improve its appearance, taste, texture, or shelf life. However, improper use or excessive amounts of additives can pose health risks.

- Contaminants from packaging materials: Certain packaging materials can release harmful substances into food, such as bisphenol A (BPA) from plastic containers or phthalates from packaging films.

- Processing contaminants: Chemical compounds can be formed during food processing, such as acrylamide in baked or fried foods or nitrosamines in cured meats.

Regulatory bodies set guidelines and safety limits for food additives and chemical contaminants. Strict quality control measures, adherence to good manufacturing practices, and regular testing are necessary to prevent excessive or unintended contamination.

4. Intentional Contamination:

Intentional contamination of food products is a serious concern. It involves the deliberate addition of harmful substances or tampering with food, often with malicious intent. Examples include:

- Food fraud: Involves misrepresentation or adulteration of food products for economic gain, such as substitution of ingredients or mislabeling.

- Deliberate contamination: Acts of sabotage or terrorism that involve adding toxic substances or pathogens to food products.

To prevent intentional contamination, stringent security measures, traceability systems, and vulnerability assessments are necessary. Regulatory agencies work closely with the food industry to implement preventive measures and ensure the safety and integrity of the food supply chain.

In summary, toxicants can pose significant risks to food products and human health. Regulatory frameworks, strict monitoring programs, adherence to good agricultural and manufacturing practices, and consumer education are essential in mitigating the hazards associated with toxicants and ensuring the safety of food products.

12.6 Pesticide

Pesticides are widely used in agriculture to protect crops from pests, diseases, and weeds. While they play a crucial role in ensuring food production and safeguarding crop yields, they can also present hazards to food

products if not used appropriately. Pesticide residues can contaminate food and pose risks to human health. Here's a detailed overview of the hazards associated with pesticides in food products:

1. Pesticide Residues:

Pesticide residues are small amounts of pesticide chemicals that remain on or in food products after their application. These residues can come from various sources, including the direct application of pesticides to crops, environmental contamination, and post-harvest treatments. Pesticide residues can persist on crops, contaminate soil, and water, and accumulate in animal tissues and products derived from animals fed with treated crops.

Exposure to pesticide residues in food can lead to acute or chronic health effects, depending on the toxicity of the specific pesticide and the level of exposure. Acute effects can include nausea, vomiting, dizziness, and in severe cases, poisoning. Chronic exposure to low levels of pesticide residues over time may contribute to the development of chronic diseases, including cancer, neuro developmental disorders, endocrine disruption, and reproductive disorders.

2. Incorrect Use and Application:

Hazards can arise when pesticides are used incorrectly or applied inappropriately. Factors contributing to this include inadequate training of applicators, lack of adherence to recommended application rates and safety precautions, and failure to follow the pre-harvest interval (PHI) guidelines. Incorrect use and application can lead to excessive pesticide residues on crops, posing risks to consumers.

To mitigate hazards associated with incorrect pesticide use, proper training and education for farmers and applicators are essential. Adherence to integrated pest management (IPM) practices, which involve the use of multiple pest control strategies, including biological control methods, crop rotation, and monitoring, can help minimize reliance on pesticides and reduce their potential risks.

3. MRLs and Regulation:

Maximum Residue Limits (MRLs) are regulatory standards established by government authorities to ensure that pesticide residues in food are below levels that pose a health risk. MRLs are set based on scientific assessments of pesticide toxicity and exposure data. They vary depending on the pesticide, the crop or food commodity, and the country or region.

However, challenges can arise due to variations in MRLs across different countries, as well as the potential for non-compliance with MRLs. Importing and exporting food products can be complicated when different regions have divergent MRLs, leading to trade barriers and concerns regarding consumer safety.

4. Risk Assessment and Monitoring:

To ensure the safety of food products, regulatory agencies conduct risk assessments and monitoring programs to evaluate and monitor pesticide residues in foods. These programs involve sampling and testing of various food products to assess compliance with established MRLs.

Regular monitoring helps identify instances of non-compliance and allows for corrective actions to be taken. It also provides feedback to farmers and helps identify potential issues in pesticide use and application practices.

5. Consumer Awareness and Education:

Consumer awareness and education play a crucial role in minimizing the hazards associated with pesticide residues in food products. By understanding the potential risks, consumers can make informed choices about their food consumption and adopt strategies to minimize exposure. Washing and peeling fruits and vegetables, opting for organic produce, and following dietary guidelines can help reduce pesticide exposure.

In summary, while pesticides are important tools in agriculture, their presence as residues in food products can pose hazards to human health. Proper pesticide use and application practices, adherence to MRLs, regular monitoring, consumer education, and promotion of integrated pest management strategies are vital in mitigating the risks associated with pesticides and ensuring the safety of food products.

12.7 Residues and food additives

Hazards to food products can arise from residues of pesticides and food additives. Residues refer to the small amounts of chemical substances that can remain in food products after their application or use. Food additives, on the other hand, are substances added to food during processing or manufacturing to enhance flavor, appearance, texture, or shelf life. While these substances serve specific purposes, their presence in food products can present potential risks. Here's a detailed overview of the hazards associated with residues and food additives in food products:

1. Pesticide Residues:

Pesticide residues are traces of pesticide chemicals that can remain on or in food products after their application in agriculture. These residues can come from the direct application of pesticides to crops, as well as environmental contamination and post-harvest treatments. The presence of pesticide residues in food products can pose risks to human health if consumed in excessive amounts or above established safety standards.

Exposure to pesticide residues can lead to acute or chronic health effects, depending on the toxicity of the specific pesticide and the level of exposure. Acute effects can include symptoms such as nausea, vomiting, dizziness, and, in severe cases, poisoning. Chronic exposure to low levels of pesticide residues over time may

contribute to the development of chronic diseases, including cancer, neuro developmental disorders, endocrine disruption, and reproductive disorders.

To address the hazards associated with pesticide residues, regulatory agencies establish Maximum Residue Limits (MRLs) that define the maximum allowable concentration of pesticide residues in food products. MRLs are set based on scientific assessments of pesticide toxicity and exposure data. Regular monitoring and enforcement of MRLs, proper use and application of pesticides, adherence to pre-harvest interval guidelines, and promotion of integrated pest management practices are essential in mitigating the risks associated with pesticide residues in food products.

2. Food Additives:

Food additives are substances added to food during processing or manufacturing to improve its quality, appearance, taste, texture, or shelf life. They serve various functions such as preservatives, antioxidants, emulsifiers, stabilizers, flavor enhancers, and coloring agents. While many food additives are deemed safe for consumption, excessive or improper use of additives can present hazards to food products.

Hazards associated with food additives can include:

- Allergic reactions: Some individuals may be sensitive or allergic to certain food additives, such as artificial colors or flavorings, causing allergic reactions or intolerance symptoms.

- Toxicity: Certain food additives, when consumed in large quantities or above established safety levels, can pose health risks. For example, high intake of some artificial sweeteners or preservatives may lead to adverse effects.

- Interactions: Interactions between different food additives or interactions with other substances in the food matrix can result in unintended health consequences.

To ensure the safety of food additives, regulatory agencies establish guidelines, specifications, and safety assessments for their use. These agencies conduct rigorous evaluations of the toxicological data, set acceptable daily intake levels, and determine the conditions of use for each additive. Good manufacturing practices, accurate labeling, and proper storage and handling of food additives are crucial in minimizing the hazards associated with their use.

3. Risk Assessment and Regulation:

Residues and food additives are subject to rigorous risk assessment and regulation by governmental authorities. These assessments involve the evaluation of toxicological data, exposure assessments, and consideration of vulnerable populations such as infants, children, and pregnant women.

Regulatory agencies establish safety standards, maximum allowable levels, and guidelines for the use of food additives, as well as MRLs for pesticide residues in food products. Regular monitoring programs are implemented to ensure compliance with these standards and detect instances of non-compliance. Any identified risks or non-compliance can result in corrective actions, including product recalls, regulatory actions, or modifications in production practices.

4. Consumer Awareness and Education:

Consumer awareness and education play a vital role in minimizing the hazards associated with residues and food additives in food products. By understanding the potential risks and reading food labels, consumers can make informed choices about the foods they purchase and consume. They can also adopt strategies to minimize exposure, such as selecting organic produce, avoiding processed foods with excessive additives, and following dietary guidelines.

In conclusion, residues of pesticides and the use of food additives can present hazards to food products. Proper regulation, adherence to safety standards and guidelines, regular monitoring, consumer education, and promotion of responsible agricultural and manufacturing practices are crucial in mitigating these hazards and ensuring the safety and quality of food products.

12.8 Food Adulteration

Food adulteration refers to the intentional or unintentional contamination of food products with inferior or harmful substances. Adulterants can be added to increase profits, improve appearance, mask inferior quality, or extend shelf life. Detecting adulterants is essential to ensure the safety and authenticity of food products. Here is a detailed overview of common adulterants, methods for detecting adulterants, and tests used in food adulteration analysis:

12.8.1 Common Adulterants

1. Water: Adding water to food products to increase weight or volume is a common adulteration practice. It is prevalent in milk, juices, and other liquid products.

2. Starch: Starch is used as an adulterant in various food products like spices, condiments, and milk. It increases bulk and weight but lowers the quality.

3. Synthetic Colors: Artificial colors may be added to enhance the appearance of food products. These colors can be harmful and are commonly found in sweets, beverages, and processed foods.

4. Vegetable Oil: Cheaper vegetable oils may be used as adulterants in high-quality edible oils like olive oil or extra virgin oil.

5. Chemical Preservatives: Unapproved or excessive use of chemical preservatives, such as formalin or benzoates, can extend the shelf life of food products but pose health risks.

Methods for Detecting Adulterants:

1. Physical Examination: Visual inspection and sensory evaluation can reveal signs of adulteration, such as abnormal appearance, texture, or smell. For example, milk adulterated with water may have reduced creaminess or a diluted appearance.

2. Chemical Analysis: Various chemical tests can detect specific adulterants. These tests include:

- Dilution Test: Determining the amount of water added by analyzing the specific gravity or density of the sample.

- Iodine Test: Detecting the presence of starch by adding iodine solution, this turns blue in the presence of starch.

- Chromatography: Separating and identifying components of a mixture to detect artificial colors or additives.

- pH Test: Measuring the acidity or alkalinity of a product, as adulterants can alter the pH value.

- Spectroscopy: Using techniques like UV-Visible spectrophotometry or infrared spectroscopy to analyze the composition of a sample.

3. Microbiological Analysis: Microbiological testing can detect the presence of harmful microorganisms that indicate poor hygiene or adulteration. This includes tests for total plate count, presence of specific pathogens, or spoilage indicators.

4. DNA Analysis: DNA-based techniques like Polymerase Chain Reaction (PCR) can detect the presence of specific ingredients or identify adulterated products by comparing DNA profiles. This method is commonly used to detect adulteration in meat products or herbal supplements.

5. Sensory Evaluation: Trained panelists can perform sensory tests to identify changes in taste, smell, texture, or appearance that may indicate adulteration.

It is important to note that the choice of method depends on the specific adulterant being tested and the food product in question. Regulatory authorities and testing laboratories employ these methods to ensure compliance with food safety standards and detect adulterated products.

In conclusion, food adulteration is a serious concern, and detecting adulterants is crucial for ensuring the safety and authenticity of food products. A combination of physical examination, chemical analysis, microbiological testing, DNA analysis, and sensory evaluation is employed to identify common adulterants and ensure the quality and safety of food products.

12.8.2 Methods and Tests for detecting Adulterants

Detecting adulterants in food products is essential to ensure their safety, authenticity, and compliance with quality standards. Various methods and tests are employed for this purpose. Here are the details of some commonly used methods and tests for detecting adulterants:

1. Physical Examination:

Physical examination involves visual inspection and sensory evaluation of food products to identify any signs of adulteration. This includes examining the appearance, texture, color, odor, and overall quality of the product. For example, the presence of foreign particles, unusual texture, off-putting smell, or abnormal color can indicate adulteration. Trained inspectors or quality control personnel conduct these examinations.

2. Chemical Analysis:

Chemical analysis involves using specific reagents or techniques to detect the presence of adulterants. Here are some common chemical tests used for adulteration detection:

a. Acid Value Test: This test determines the acidity of fats and oils. An increased acid value may indicate the presence of cheaper vegetable oils in high-quality oils.

b. Iodine Value Test: This test measures the unsaturation level of fats and oils. A significant deviation from the expected iodine value can indicate adulteration.

c. Detection of Synthetic Colors: Spectrophotometric methods are used to detect synthetic colors in food products. The sample is extracted, and the presence of specific color additives is determined based on their characteristic absorption spectra.

d. Thin Layer Chromatography (TLC): TLC is a technique used to separate and identify components in a mixture. It can be used to detect the presence of adulterants like artificial dyes or colorants in food products.

e. Gas Chromatography (GC) and High-Performance Liquid Chromatography (HPLC): These techniques are used to separate and analyze components in complex mixtures. They are commonly employed to detect contaminants or adulterants in food products.

f. Fourier Transform Infrared Spectroscopy (FTIR): FTIR analyzes the infrared absorption of a sample and is used to identify the presence of specific functional groups or compounds in food products.

3. Microbiological Analysis:

Microbiological analysis is conducted to detect the presence of microorganisms in food products. It helps identify indicators of poor hygiene practices or adulteration. Common tests include:

a. Total Plate Count: This test determines the total number of viable microorganisms present in a food sample, indicating the overall hygiene and quality of the product.

b. Specific Pathogen Detection: PCR-based techniques or immunological methods are employed to detect the presence of specific pathogenic microorganisms, such as Salmonella, E. coli, or Listeria monocytogenes.

c. Yeast and Mold Count: This test quantifies the number of yeast and mold colonies in a sample, which can indicate spoilage or inadequate storage conditions.

4. DNA Analysis:

DNA analysis is used to detect the presence of specific ingredients or identify adulterated products by comparing DNA profiles. Polymerase Chain Reaction (PCR) is commonly employed for this purpose. It can help identify the presence of genetically modified organisms (GMOs) or detect adulteration in meat products, herbal supplements, or other plant-based ingredients.

5. Sensory Evaluation:

Sensory evaluation involves human perception to assess the quality and acceptability of food products. Trained sensory panelists evaluate taste, smell, texture, and appearance to identify any deviations that may indicate adulteration or compromised quality.

It's important to note that the selection of methods and tests depends on the specific adulterant being tested and the type of food product. Regulatory authorities, quality control departments, and testing laboratories employ these methods to ensure compliance with food safety regulations and detect adulterated products.

In conclusion, a combination of physical examination, chemical analysis, microbiological testing, DNA analysis, and sensory evaluation is employed to detect adulterants in food products. These methods play a crucial role in ensuring the safety, authenticity, and quality of food for consumers.

12.9 CHECK YOUR PROGRESS:

1- What do you understand by Micro-biological Hazards?

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2- Write down a short note on — Residues and food additives

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3- Briefly explain the Natural hazards.

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4- Write down about Methods and Tests for detecting Adulterants.

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Write short notes on:

a) Environmental hazards

b) Toxicants

c) Pesticide

d) Common Adulterants

Note