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UGHN-113

Nutritional Assessment and Surveillance

UGHN-113 NUTRITIONAL ASSESSMENT AND SURVEILLANCE

Unit I:	**Direct Nutritional Assessment of Human Groups**
Unit II:	**Dietary Assessment**
Unit III:	**Clinical Assessment**
Unit IV:	**Nutritional Anthropometry**
Unit V:	**Secondary Sources of Community Health Data**
Unit VI:	**Rapid Assessment Procedures**
Unit VII	**Sociological Factors**
Unit VIII:	**Surveillance Systems**

BLOCK INTRODUCTION

In this block we explained in detail about the nutritional status of an individual and how we come to know about various diet and nutrition related diseases by assessing the person's nutritional status using various assessing methods like anthropometry, biochemical, clinical and dietary through proper monitoring of a person, assessing the prevalence of nutritional disorders, planning corrective measures, and evaluating the effectiveness of the implemented strategies simultaneously.

In nutritional assessment, we will learn to obtain information about the prevalence and geographic distribution of nutritional disorders within a community or a specified population group. It can also be used to identify high-risk groups and to assess the role of different epidemiological factors in nutritional deficiency. It is the systematic process of collecting and interpreting information in order to make decisions about the nature and cause of nutrition related health issues that affect an individual.

Nutrition monitoring and evaluation is to determine and measure the amount of progress made for the nutrition intervention and whether the nutrition related goals/expected outcomes are being met. It promotes more uniformity within the nutrition field in assessing the effectiveness of nutrition intervention. Determining what to measure for nutrition monitoring and evaluation: Practitioners should select nutrition care indicators that will reflect a change as a result of nutrition care. The monitoring and evaluation phase should be considered during the assessment phase, while determining the Nutrition Diagnosis and the Nutrition Intervention. Monitoring and evaluation (M&E) information can be used to inform and improve program design, management and supervision; to report results (outcomes and impacts) of food and nutrition interventions in order to provide accountability to donors and meet reporting requirements; and to advocate for support and expansion of effective approaches.

Nutrition Surveillance system is an instrument for the formulation, modification and application of the food and nutrition policy of a country. Such surveillance is intended to provide information on the basis of which decisions are made. It is based on the regular collection of data,these data are analysed to define indicators of present or future change of nutritional status. The types of information from which indicators can be devised cover a broad range.

Assessment of nutritional status is necessary to ensure that this information contributes towards identifying specific nutrition requirements and timely provision of services to the areas of greatest need. Actions under this strategic objective therefore aim at addressing these problems in nutrition surveillance, monitoring and evaluation systems in the country.

Introduction may safeguard the nutritional status of its population and is not intended purely for research or academic purposes. Adequate nutrition, a prerequisite for good health, depends on many factors that intervene in the relationship between food and health. Accurate and relevant information is generated from the periodic and systematic measurement of some of these factors. In conjunction with data on population nutrition and health status assessment, this will provide a good foundation for understanding trends in health and nutrition and for taking appropriate action to promote the well-being of populations.

UNIT-I DIRECT NUTRITIONAL ASSESSMENT OF HUMAN GROUPS

Structure:

- Introduction
- General definition
- Types of Nutritional Assessment
    - Direct
    - Indirect
- Advantages of Nutritional Assessment
- Answers to check your progress exercises

Introduction:

The nutritional status of an individual is usually a result of multiple factors that helps in recognizing the role of diet at the onset of many diseases and assessing the nutritional status of an individual, family and community are important for public health. Following a structured assessment path enables health professionals to carry out a quality nutritional assessment in order to identify those who need nutritional intervention, and to improve clinical decision making using a person centred approach. The process promotes consistent quality of practice; is user friendly; and allows effective monitoring of patients. A structured assessment pathway does not remove autonomy; it encourages professional judgement and informed decision making at every stage. The process provides a rationale for the nutritional intervention, and allows for revision of the plan as individual circumstances change over time.

Nutritional assessment of the subjects (e.g. Infants, children, boys, girls, adult man adult woman, and elderly) is a process to identify an individual who is malnourished or who is at risk for malnutrition (over or under nutrition).It is influenced by food intake, quantity & quality, & physical health.

Learning Objectives:

- To know the different methods for assessing the nutritional status
- To understand the basic anthropometric techniques, applications, & reference standards.

Definition of nutritional assessment:

Nutritional assessment is the interpretation of anthropometric (height, weight, Mid Upper Arm Circumference, biochemical (laboratory), clinical (sigs & symptoms) and dietary data to determine whether a person or groups of people are well nourished or malnourished (over-nourished or under-nourished).

- Nutritional assessment methods are further divided in two categories based on mode on assessment:
- Direct Methods: Deals with the individual and measure objective criteria. These are summarized as ABCD

  - Anthropometric methods
  - Biochemical, laboratory methods
  - Clinical methods
  - Dietary evaluation methods

- Indirect methods: It uses a community health index that reflects nutritional influences. These include three categories:

  - Ecological variables including crop production
  - Economic factors e.g. per capita income, population density & social habits

- Vital health statistics particularly infant & under 5 mortality & fertility index

Anthropometric Methods:

The word **anthropometry** comes from two words: *Anthropo* means 'human' and *metry* means 'measurement'. With the help of assess of anthropometry measurements it will be possible to describe how either growth or change in the body composition of the people are responsible for. There are various measurements occupied to assess growth and body compositions are presented below.

1. Anthropometric measurements used to assess growth

To assess growth in children you can use several different measurements including length, height, weight and head circumference.

Length:

A wooden measuring board is used for measuring the length of children under two years old to the nearest millimetre (as shown in Figure 1). Measuring the child lying down always gives readings greater than the child's actual height by 1-2 cm.

Plan of action

To measure the length of a child less than two years, we need one helper and a measuring board.

As you can see in Figure 1, we need a helper to help you measure a child.

1. Both helper and subject (measurer) are on their knees.
2. The helper holds the child's head with both hands and makes sure that the head touches the base of the board.
3. The helper's arms should be straight.
4. The line of sight of the child should be perpendicular to the base of the board (looking straight upwards).

5. The child should lie flat on the board.
6. The measurer should place their hands on the child's knees.
7. The measurer's foot have to be flat against the foot.
8. Read the length from the tape attached to the board.
9. Record the measurement on the questionnaire.

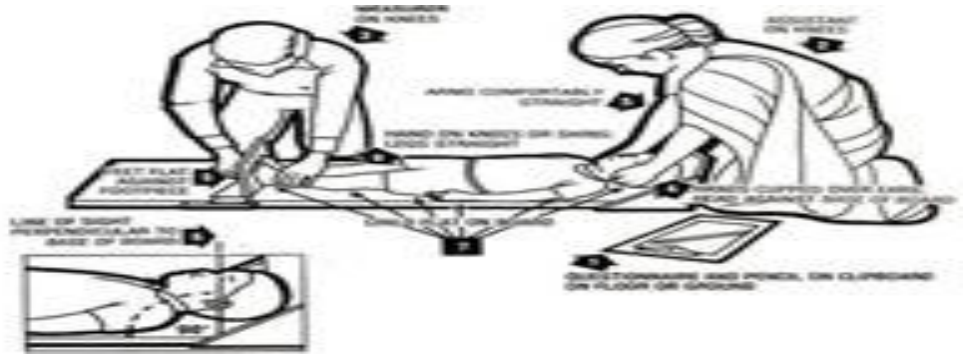


Figure 1 Measuring length. (Source: UNICEF, 1986, *How to weigh and measure children: assessing the nutrition status of young children*)

Height:

This is measured with the subject (child or adult) in a standing position (usually children who are two years old or more). The head should be in the **Frankfurt position** (a position where the line passing from the external ear hole to the lower eye lid is parallel to the floor) during measurement, and the shoulders, buttocks and the heels should touch the vertical standMeasurements are recorded to the nearest millimetre.

Plan of action

As with measuring a subject's (child's) length, to measure a child's height, we need to have another individual. Figure 2 demonstrate the procedures, and in Figure 2 you can see a young child having his height measured.

1. Both the helper and subjects should be on their knees.

2. The right hand of the helper should be on the shins of the subject against the base.
3. The left hand of the helper should be on the knees of the subject to keep them close to the board.
4. The heel, the calf, buttocks, shoulder and **occipital prominence** (prominent area on the back of the head) should be flat against the board.
5. The subject should be looking straight ahead.
6. The hands of the subject ‘should be by their side.
7. The measurer’s left hand should be on the subject’s chin.
8. The child’s shoulders should be levelled.
9. The head piece should be placed firmly on the subject’s head.
10. The measurement should be recorded on the questionnaire.

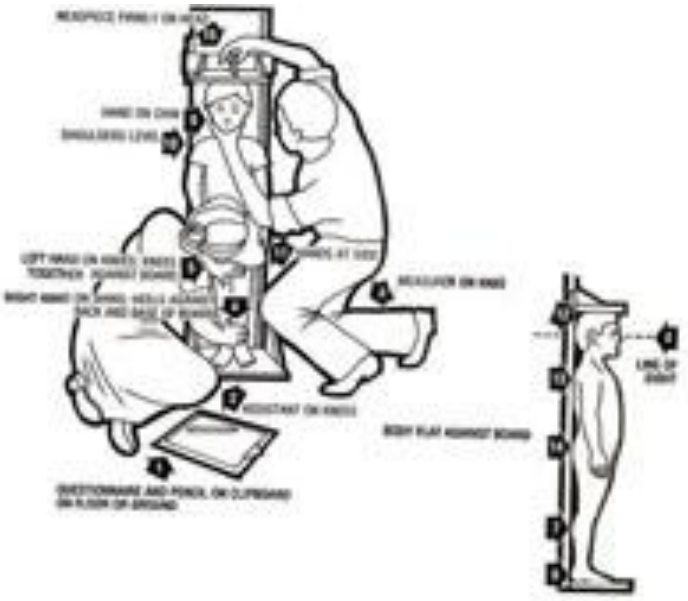


Figure.2 Measuring height. (Source: UNICEF, 1986, *How to weigh and measure children: assessing the nutrition status of young children*)

Weight

The '**Salter Scale**' is used for measuring the weight of the subject under two years age, to the almost 0.1 kg. For the measurement of subject over two years a beam balance is used. Digital electronic scale can be used in both cases. Before each weighing we should re-adjust the scale to zero.

Plan of action

In Figure 3 we can see the method for weighing a subject(under two years old)using a Salter Scale

Figure.3 Measuring child's weight using the Salter Scale. (Source: UNICEF, 1986, *How to weigh and measure children: assessing the nutrition status of young children*)

1. Adjust the Salter scale to zero.
2. Remove the subject'sclothes, shoes and other accessories.
3. Hold the child's legs.
4. Hold the subject's.
5. Hang the subjects on the Scale.
6. Read the scale carefully.

7. Remove the child slowly.

Head circumference:

The head circumference (HC) is the measurement of the head along the **supra orbital ridge** (forehead) anteriorly and **occipital prominence** (the prominent area on the back part of the head) posteriorly. It is measured to the nearest millimetre using flexible, non-stretchable measuring tape around 0.6cm wide. HC is useful in assessing chronic nutritional problems in children under two years old as the brain grows faster during the first two years of life. But after two years the growth of the brain is more sluggish and HC is not useful. In Ethiopia, HC is measured at birth for all newborn babies.

Note: How to take different measurements you are going to learn how the measurements are converted into different indices.

Converting measurements to indices:

An index is a combination of two measurements or one measurement plus the person's age. The following are a few indices that you may find useful in your work:

Weight-for-age is an index used in growth monitoring for assessing children who may be underweight. You assess weight-for-age of all children under two years old when you carry out your community-based nutrition (CBN) activities every month.

Height-for age is an index used for assessing **stunting** (chronic malnutrition in children). Stunted children have poor physical and intellectual performance and lower work output leading to lower productivity at individual level and poor socioeconomic development at the community level. Stunting of children in a given population indicates the fact that the children have suffered from chronic malnutrition so much so that it has affected their linear growth.

Stunting is defined as a low height for age of the child compared to the standard child of the same age. Stunted children have decreased mental and physical productivity capacity.

Weight-for-height is an index used for assessing **wasting** (acute malnutrition).

Wasting is defined as a low weight for the height of the child compared to the standard child of the same height. Wasted children are vulnerable to infection and stand a greater chance of dying.

Body mass index is the weight of a child or adult in kg divided by their height in metres squared: Weight (kg)/(Height in metres)^2

Here is how to calculate each index for children in your community.

Birth weight is weight of the child at birth and is classified as follows:

more than 2500 grams

1500–2499 grams

less than 1500 grams

$$\text{Weight for age} = \frac{\text{Weight of the child}}{\text{Weight of the reference child of the same age}} \times 100$$

$$\text{Weight for height} = \frac{\text{Weight of the child}}{\text{Weight of the reference child of the same age}} \times 100$$

Indicator:

An **indicator** is an index (for example, a scale showing weight for age, or weight for height) combined with specific *cut-off values* that help you determine whether a child is underweight or malnourished; for example, a child whose weight for age, or weight for height, falls below the cut-off values shown in Table 5.1 is considered to be underweight or malnourished.

You will be able to use anthropometric indicators to assess nutritional status, to evaluate the effects of interventions, to admit children to an intervention (treatment) programme and to discharge them from a programme. These indicators are therefore very important and knowing how to use them will

help you plan effective nutrition interventions. Table 1 summarises how indicators of underweight, wasting and malnutrition are derived from the weight and height of children relative to their age, with the cut-off values (column 2) for each indicator (column 1) based on the standard deviation (SD) of the child's measurement from the norm for a child of that age.

Table.1 Indicators of underweight and malnutrition derived from the weight and height of children relative to their age.

Index	Cut-off value based on standard deviation (SD)/percentage
Weight-for-age	Less than -2 and more than -3
Weight-for-age	Less than -3
Height-for-age	Less than -2 and more than -3 (i.e. 70–79.99% of the norm)
Height-for-age	Less than -3 (i.e. less than 70% of the norm) and/or bilateral pitting oedema

Measuring fat-free mass (muscle mass)

An accurate way to measure fat-free mass is to measure the **Mid Upper Arm Circumference (MUAC).** The MUAC is the circumference of the upper arm at the midway between the shoulder tip and the elbow tip on the left arm. The mid-arm point is determined by measuring the distance from the shoulder tip to the elbow and dividing it by two. A low reading indicates a loss of muscle mass.

MUAC is a good screening tool in determining the risk of mortality among children, and people living with HIV/AIDS. MUAC is the only anthropometric measure for assessing nutritional status among pregnant women. It is also very simple for use in screening a large number of people, especially during community level screening for community-based nutrition interventions or during emergency situations.

MUAC is therefore used as a screening tool for community based nutrition programmes such as an outpatient therapeutic programme (OTP), for community-based interventions, supplementary feeding programmes and enhanced outreach programmes throughout Ethiopia. MUAC is also used for screening target children and pregnant women for severe acute malnutrition (SAM) and moderate acute malnutrition (MAM).

Measuring the MUAC of children

A special tape is used for measuring the MUAC of a child (see Figure 4). The tape has three colours, with the red indicating severe acute malnutrition, the yellow indicating moderate acute malnutrition and the green indicating normal nutritional status. Figure 5. shows you how to use the tape to measure a child's MUAC.

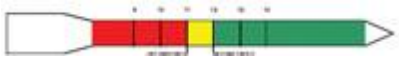


Figure 4. MUAC measuring tape.

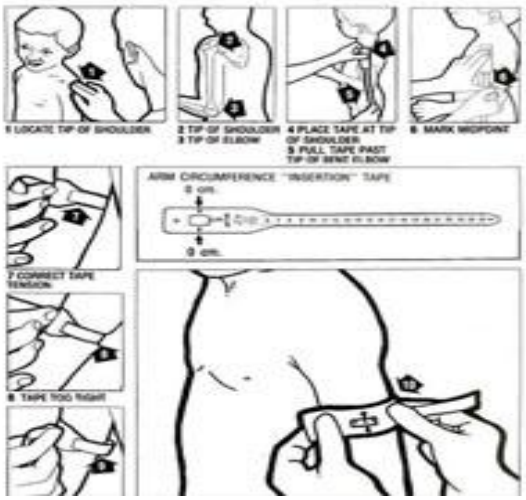


Figure 5. Measuring MUAC. (Source: UNICEF, 1986, *How to weigh and measure children: assessing the nutrition status of young children*)

Procedures for measuring MUAC

1. Ask the mother to remove any clothing that may cover the child's left arm. If possible, the child should stand erect and sideways to the measurer.
2. Estimate the midpoint of the left upper arm.
3. Straighten the child's arm and wrap the tape around the arm at the midpoint. Make sure the numbers are right side up. Make sure the tape is flat around the skin.
4. Inspect the tension of the tape on the child's arm. Make sure the tape has the proper tension and is not too tight or too loose. Repeat any step as necessary.
5. When the tape is in the correct position on the arm with correct tension, read the measurement to the nearest 0.1 cm.
6. Immediately record the measurement.

Table 2. sets out the cut-off values using the MUAC measurement and how these relate to the level of malnutrition in children and adults.

Table 2. Cut-off points for screening in the community for SAM and MAM using MUAC

Target Groups	MUAC (in cm)	Malnutrition
Children under five	11-11.9	Moderate acute malnutrition (MAM)
	<11 cm	Severe acute malnutrition (SAM)
Pregnant women/adults	17-21 cm	Moderate malnutrition
	18-21 cm with recent weight loss	Moderate malnutrition
	<17 cm	Severe malnutrition
	<18 cm with recent weight loss	Severe malnutrition

Nutritional Indices in Adults

- The international standard for assessing body size in adults is the body mass index (BMI).
- BMI is computed using the following formula: BMI = Weight (kg)/ Height (m^2)
- Evidence shows that high BMI (obesity level) is associated with type 2 diabetes & high risk of cardiovascular morbidity & mortality

BMI (WHO - Classification)

- BMI < 18.5 = Under Weight
- BMI 18.5-24.5= Healthy weight range
- BMI 25-30 = Overweight (grade obesity)
- BMI >30-40 = Obese (grade 2 obesity)
- BMI >40 =Very obese (morbid or grade 3 obesity)

Waist/Hip Ratio

- Waist circumference is measured at the level of the umbilicus to the nearest 0.5 cm.
- The subject stands erect with relaxed abdominal muscles, arms at the side, and feet together.
- The measurement should be taken at the end of a normal expiration.

Waist circumference

- Waist circumference predicts mortality better than any other anthropometric measurement.
- It has been proposed that waist measurement alone can be used to assess obesity, and two levels of risk have been identified

	MALES	FEMALE
LEVEL 1	> 94cm	> 80cm
LEVEL2	> 102cm	> 88cm

- Level 1 is the maximum acceptable waist circumference irrespective of the adult age and there should be no further weight gain.
- Level 2 denotes obesity and requires weight management to reduce the risk of type 2 diabetes & CVS complications.

Hip Circumference:

- Is measured at the point of greatest circumference around hips & buttocks to the nearest 0.5 cm.
- The subject should be standing and the measurer should squat beside him.
- Both measurement should taken with a flexible, non-stretchable tape in close contact with the skin, but without indenting the soft tissue.

Interpretation of WHR:

- High risk WHR= >0.80 for females &>0.95 for males i.e. waist measurement >80% of hip measurement for women and >95% for men indicates central (upper body) obesity and is considered high risk for diabetes & CVS disorders.
- A WHR below these cut-off levels is considered low risk.

Anthropometric measurements used to assess body composition:

In assessing body composition (fat content) the body is considered to be made up of two compartments: the fat mass and the fat free mass. Therefore different measurements are used to assess these two compartments.

Measurements of fat-mass (fatness):

As you read earlier **Body Mass Index (BMI)** is the weight of a person in kilograms divided by their height in metres squared. A non-pregnant adult is considered to have a normal BMI when it falls between 18.5 and 25 kg/m^2. Table 3. shows you the different categories of nutritional status based on a person's BMI.

Table 3. Cut-off values for BMI for assessing adult nutritional status.

BMI(Kg/m2) cut-offs	Nutritional status
more than 40.0	Very obese
30.0-40.0	Obese
25-29.9	Overweight
18.5-24.9	**Normal**
17-18.49	Mild chronic energy deficiency
16-16.9	Moderate chronic energy deficiency
less than 16.0	Severe chronic energy deficiency

If an adult person has a BMI of less than 16 kg/m^2 they will not be able to do much physical work because they will have very poor energy stores. In addition they will be at increased risk of infection due to impaired immunity.

Risk of mortality and morbidity is related to the nutritional status as assessed by the BMI. If people are too fat or too thin their health suffers. The risk of mortality and morbidity increases with a decrease in the BMI. Similarly, when the BMI increases to over 25 kg/m^2, the risk of mortality and morbidity increases. The relationship between BMI and risk of morbidity and mortality.

ADVANTAGES OF ANTHROPOMETRY:

- Objective with high specificity & sensitivity
- Measures many variables of nutritional significance (Ht, Wt, MAC, HC, skin fold thickness, waist & hip ratio & BMI).
- Readings are numerical & gradable on standard growth charts

- Readings are reproducible.
- Non-expensive & need minimal training

Limitations of Anthropometry:

- ❖ Inter-observers errors in measurement
- ❖ Limited nutritional diagnosis
- ❖ Problems with reference standards, i.e. local versus international standards.
- ❖ Arbitrary statistical cut-off levels for what considered as abnormal values.

Biochemical Assessment:

- Involves measurement of nutrient levels or their metabolites in body tissues or fluids
- Estimation of tissue desaturation, enzyme activity or blood composition
- Tests are confined to 2 easily obtainable fluids namely blood and urine and results are generally compared to standards
- An objective method of nutritional assessment
- Provides specific information on the body's status regarding specific nutrients and may also identify borderline nutritional deficiencies or excesses
- Can be used to assess the nutritional status of large population groups
- Results are generally compared to standards, i.e. normal levels for age and sex

Advantages:

- <u>Objectivity</u>
    - Independent of the emotional and subjective factors that usually affect the investigator

    - Free from bias compared to other methods of nutritional status
- Can detect early subclinical states of nutritional deficiency
    - Can identify nutritional deficiency before appearance of clinical signs
    - Reveals nutrient deficiency at an early stage
- Can confirm existence of abnormality, since clinical signs are non-specific
- Precision and accuracy

Disadvantages:

- Costly, usually requiring expensive equipments
- Time consuming
- Difficult to collect samples
- Lack of practical standards of sample collection

Objectives:

1. To detect marginal nutritional deficiency in individuals, particularly when dietary histories are questionable or unavailable; their use is especially important before overt clinical signs of diseases appear, thus permitting the initiations of appropriate remedial steps
2. To supplement or enhance other studies such as dietary or community assessment among specific population groups in order to pinpoint nutritional problems that these modalities may have suggested or failed to reveal

Factors affecting accuracy of results:

1. Method of sample collection
2. Method of transport and storage of samples
3. Technique employed

Ideal Biochemical Tests:

1. Specific
2. Simple
3. Inexpensive
4. Reveal tissue depletion at an early stage
5. Require less sophisticated equipment and skill

Common biochemical parameters/tests:

Fluid	Parameter	Nutritional deficiency
Blood	**Serum albumin**	**Protein deficiency**
	Amino acid imbalance	**Protein deficiency**
	Serum vitamin A	**Vitamin A deficiency**
	Serum carotene	**Vitamin A deficiency**
	Serum alkaline phosphatase	**Vitamin D deficiency**
	Serum ascorbic acid	**Vitamin C deficiency**
	Hemoglobin	**Iron and Vitamin B12 deficiency**
	Hematocrit	**Iron deficiency**
Urine	**Hydroxyproline excretion**	**Protein deficiency**
	Urinary urea	**Protein deficiency**
	Urinary creatinine	**Protein deficiency**
	Urinary thiamine	**Thiamine deficiency**
	Urinary ribiflavin	**Riboflavin deficiency**

Choosing the biochemical assessment method:

1. Direct measurement of the nutrient

a. Serum proteins (albumin, globulin, fibrinogen, carrier proteins)

b. Blood glucose

c. Blood lipids : free fatty acids, total cholesterol, LDL-cholesterol, triglycerides

d. Serum retinol, ascorbic acid, calcium, sodium, B-vitamins

2. Measurement of substances that indirectly reflect level of the nutrient in the body

a. Hematocrit, hemoglobin

b. Hormones (e.g. Thyroid hormones)

c. Binding proteins (e.g. Retinol binding proteins)

d. Urinary excretion of metabolites (iodine, B6 deficiency: increased excretion of xanthurenic acid, other tryptophan metabolites)

3. Know the physiology and metabolism of the nutrient to be measured

a. Is it a water or fat soluble nutrient?

b. Can it be stored by the body in significant amounts?

c. How are levels of the nutrient in the body regulated?

d. What are the normal roles of the nutrient in the body?

e. What will likely happen if the nutrient becomes deficient?

Blood:

- Arterial, venous, plasma, serum, blood cells – erythrocytes
- Measurements of nutrients/ metabolites are often controlled by homeostasis tend to reflect recent intake

- Random sample
    - Taken at any time of the day
    - Depending on what is being measured, may be influenced by recent food intake, physical activity, fluid intake

Urine:

1. First voided morning urine sample
    - Assumed that subjects have been asleep for the past 6-8 hours
    - No food and fluid intake immediately before sample taken
    - Physical activity standardized between different subjects
2. 24-hour sample
    - More difficult to make a complete collection, especially in free-living subjects

“Mid-stream sample”:

- Breastmilk, saliva, sweat, adipose tissues, feces, hair and nails, buccal mucosal cells

Preservation of biological samples:

- Any separation/initial processing required
- Containers for storage and transport
- Considerations (cold storage, transport)

It is of utmost importance to preserve the integrity of the collected samples prior to actual analysis in the laboratory

Assay:

- Analysis done to determine the presence of a substance and the amount of that substance

- May be done for example to determine the level of thyroid hormone in the blood of a person suspected of being hypothyroid (or hyperthyroid)

Analysis of biological samples:

- Methods to be used in analysis:
- Spectrophotometry- Based on the principle that different substances have different characteristics with regard to light spectrum
- Immunological methods- Radioimmunoassay, enzyme immunoassay methods, based on the principle that substances have specific ability to bind to certain antigens/antibodies
- Chromatography- Gas chromatography, HPLC-based on the principle that substances have differences in chemical characteristics (mol wt) that allow then to be isolated from each other

Analysis of biological samples:

- Coordination of sample collection, storage and transport
    - Techniques for collection of samples
    - Informed consent from subjects
    - Methods vary in cost, reliability, degree of technical expertise required

Interpretation of results:

1. Low nutrient levels

a. Dietary deficiency

b. Poor absorption

c. Impaired transport

d. Abnormal utilization

e. Combination of factors

2. Compare individual results with normal reference values appropriate for:

a. Age

b. Sex

c. Physiological state

Biochemical measurements of selected nutrients:

Protein status:

Laboratory indices of protein status measure somatic protein status, visceral protein status, metabolic changes, muscle function and immune function. Proteins-body stores are determined from by-products of protein catabolism and products of protein synthesis

- Urinary creatinine excretion:Used to assess the degree of depletion of muscle mass in marasmic patients, and degree of repletion after long terms intervention, provided that 72-hour urine collections are made
    - Frequently expressed as creatinine height index

Guidelines for the interpretation of creatine height index:

	Less than acceptable		**Acceptable (low risk)**
	Deficient (high risk)	**Low (medium risk)**	
Creatinine height index (3 months to 17 years of age)	**< 0.5**	**0.5 – 0.9**	**> 0.9**

Source : Gibson, 1991

- Factors affecting daily creatinine excretion:
- Strenuous exercise
- Emotional stress

- Dietary intakes of creatine and creatinine
- Menstruation
- Age
- Infection, fever and trauma
- Chronic renal failure
- Serum proteins:
    - Index of visceral protein status
    - Easily measured but a rather insensitive index of protein status

Factors affecting serum protein concentrations:

- Inadequate protein intake
- Altered metabolism
- Specific deficiency of plasma protein
- Reduced protein synthesis
- Pregnancy
- Capillary permeability
- Drugs
- Strenuous exercise

Serum albumin:

- Reflects **changes occurring within the intravascular space and not the total visceral protein pool**
- Not very sensitive to short-term changes in protein status
- Has a long half-life of 14 to 20 days

Serum transferrin:

- Transferrin
- is a serum beta-globullin protein synthesized primarily in the liver and is located almost totally intravascularly

- Serves as the **iron transport protein**
- Is bacteriostatic (binds with free iron and prevents the growth of gram-negative bacteria which require iron for growth)

Serum retinol-binding protein:

- is a **carrier protein for retinol**
- Serum RBP concentrations tend to fall rapidly in response to protein and to energy deprivation and respond quickly to dietary treatment

Serum amino-acid ratio:

- Children with kwashiorkor generally have serum NEAA:EAA ratios above 3
- Normal children and those with marasmus, ratios are usually less than 2
- Serum amino-acid ratio

Urinary urea nitrogen: creatinine ratios:

- Urea is the largest source of urinary nitrogen and is synthesized in the liver
- Urinary urea nitrogen:creatinine ratios are used as an **index of dietary protein intake** but not an index of long-term protein status

Functional tests of protein status:

- Include muscle function and immunological tests
- Muscle function measure changes in muscle contractility, relaxation rate, endurance, and hand grip strength
- Immunological tests include lymphocyte count, delayed cutaneous hypersensitivity, measurement of thymus-dependent lymphocytes, and lymphocyte nitrogen assays

Iron:

- Total body composition of iron in adults: 3 – 5 grams elemental iron

Found in three components:

- Essential iron
- Transport iron
- Storage iron

Iron:

Essential iron:

- in RBC (70%)

- in myoglobin (4%)
- in enzymes (<1%)

- Transport iron (bound to transferrin)
- Storage iron
- Ferritin (seen primarily in liver, smaller amounts in bone marrow and spleen; some in circulation)
- Hemosiderin

Iron status:

Three stages of the development of iron-deficiency anemia

- Iron depletion
- Iron-deficient erythropoesis
- Iron deficiency anemia

Iron depletion:

- Characterized by **progressive reduction in the amount of storage iron in the liver**
- Level of transport on iron and hemoglobin are normal but the depletion of iron stores **reflected by a fall in serum ferritin concentrations**
- Iron-deficient erythropoeisis
- **Complete exhaustion of iron stores**; thus, plasma iron supply to the erythropoietic cells is reduced and **decreases in transferrin saturation** occur but the **erythrocyte photoporphyrin concentrations increase**
- Hb levels decline slightly and exercise performance is reduced
- ron deficiency anemia
- **Final stage of iron deficiency**
- Caused by exhaustion of iron stores and declining levels of circulating iron; microcytic, hypochromic anemia
- **Reduced concentration of Hb in RBC, hematocrit and red cell indices**

Iron status:

- Hemoglobin concentrations
- Hematocrit
- Mean cell volume

- Mean cell Hb concentrations
- Mean cell Hb
- Serum ferritin

- Hemoglobin concentrations- Iron is an essential component of the Hb molecule, the oxygen carrying pigment of RBC. Measurement of the **concentration of Hb in whole blood is the most widely used screening test for IDA**
- Hemoglobin concentrations- **Low hemoglobin is associated with hypochromia (characteristic of IDA)**. Provide information on the **absence, presence or severity of anemia** but do **not** provide information on the **iron stores of the individual**

Hematocrit:

- defined in SI units as the **volume fraction of packed red cells in whole blood**
- **Hematocrit concentrations falls only after hemoglobin concentration has become impaired**
- Hematocrit normal values
- Females 37 - 47%
- Males 45 - 52%

- Suggested criteria for diagnosis of anemia using hematocrit determinations

- Mean cell volume
- Measure of the **average size of the RBC**
- **Low values of MCV only occur when iron deficiency becomes severe**
- Calculation:

$$\text{MCV (fL)} = \frac{\text{Hematocrit (volume fraction)}}{\text{Red blood cell count per liter}}$$

- Mean cell Hb concentrations
- Least useful of the red cell indices
- **Last to fall during iron deficiency**
- Calculation:

$$\text{MCHC (g/dL)} = \frac{\text{Hemoglobin (g/L)}}{\qquad}$$

Hematocrit (vol. fraction

- Mean cell Hb
- **Hb content of the individual RBC**
- Calculation:

MCV (fL) = Hemoglobin (g/L)
Red blood cell count (10^{12}/L)

Serum ferritin:

- Determines **iron stores as they are the first to decline.** The only iron status index that can reflect a deficient, excess, and normal iron status**.** Serum concentrations correlates with total amount of storage iron; provides an **estimate of the amount of iron stores**
- Not a simple or cheap test to do
- Serum ferritin levels are influenced by infections and chronic disease
    - Biochemical measurements of selected nutrients
    - Protein
    - Iron
    - Vitamin A
    - Vitamin D
    - Vitamin E
    - Vitamin C
    - Thiamine
    - Riboflavin

Serum retinol concentration

- Reflects vitamin A status only when liver vitamin A stores are severely depleted (below 20 ug/dl liver)
- Guidelines recommended by NHANES II Committee for interpreting low serum total vitamin A concentrations in three age categories
- Methods
- Assessment criteria
- During collection of samples

- Plasma was separated from RBD by centrifugation and kept frozen in liquid nitrogen tanks or in ice chests with dry ice in the field and in transit to the FNRI laboratory where it was kept frozen at -80°C until analyzed

- Serum retinol was measured using High Pressure Liquid Chromatography (HPLC)

Serum 25-hydroxyvitamin D concentration

- **Most useful** index of vitamin D status in humans because it reflects the **amount of vitamin D in the liver** which is the major tissue store of vitamin D
    - Serum 25-hydroxyvitamin D concentration
- In general, concentrations below 3.0 ng/mL (7.5 nmol/L) have been associated with clinical signs of vitamin D deficiency

Serum tocopherol concentrations

- **Most frequently used** index of vitamin E
- A ratio of 0.6 mg total tocopherols per gram of total serum lipids indicates adequate vitamin E status
- Tissue tocopherol concentration
- **Analysis of liver biopsy or adipose tissue samples** is useful index of body stores of vitamin E and thus, long-term vitamin E status
- But the **method is invasive** and not suitable for large population studies

Serum ascorbic acid concentrations

- **Most frequently used** and **practical** index of vitamin C status
- Not used to identify persons regularly consuming low ascorbic acid intakes but it **reflect body ascorbic acid content**
    - Leukocyte ascorbic acid concentrations
- **More reliable index** of tissue stores of ascorbic acid
- Less responsive to short-term fluctuations in recent vitamin C intakes than serum
- **Not widely used** as an index of ascorbic acid status
    - Urinary excretion of ascorbic acid and metabolites
- Reflects **recent dietary intake**

- Levels in the **urine decline with increasing depletion of vitamin C** until levels are undetectable particularly in persons with scurvy
- Not a very sensitive index of ascorbic acid status
    - Salivary ascorbic acid concentrations
- **Not a promising tests**even if its non-invasive and simple to perform
- Ascorbic acid concentrations in the saliva is low and change very little and they are **not correlated with vitamin C intake**

Erythrocyte Transketolase Activity (ETKA)

- Transketolase is a thiamine pyrophosphate-dependent enzyme
- **Measurement of the activity of this enzyme** is used as an **index of thiamine nutritional status** as the erythrocytes are among the first tissues to be affected by thiamine depletion
    - Erythrocyte Transketolase Activity (ETKA)
- **Most widely used** biochemical index of thiamine status
- Reflects the adequacy of body stores and is **very sensitive to marginal thiamine deficiency**
- Urinary thiamine excretion
- Thiamine levels in the urine do not adequately reflect body stores but provides an **index of the dietary intake**

A **thiamine load test** has also been used as an index of thiamine status

- Urinary thiamine excretion
- Excretion of thiamine in a four-hour period after the parenteral administration of 5 mg of thiamine is measured
- If subjects are deficient in thiamine, usually less than 20 ug of the 5 mg thiamine load during the four-hour period is excreted
    - Erythrocyte glutathione reductase activity coefficient
- A **useful and sensitive measure** of impaired riboflavin status

Glutathione reductase is a nicotinamide adenine dinucleotide phosphate and FAD-dependent enzyme, and is the major flavoprotein in erythrocytes

- Erythrocyte glutathione reductase activity coefficient

- Catalyzes the oxidative cleavage of the disulfide bond of oxidized glutathione to form reduced glutathione
- Urinary riboflavin excretion
- Reflects **recent dietary intake** rather than body stores

Niacin status

- Urinary excretion of N'-methylnicotinamide and N'-methyl-2-pyridone-5c-carboxylamide

- Urinary excretion of N'-methylnicotinamide and N'-methyl-2-pyridone-5c-carboxylamide

- **Not very specific indices** of niacin deficiency since excretion of both in the urine is also **reduced in subjects with generalized malnutrition**
- In normal healthy adults, ratios range from 1.3 to 4.0
- Values below 1.0 indicate niacin deficiency

Plasma pyridoxal-5'-phosphate (PLP) concentration

- Provide a direct measure of the active coenzyme and **reflect tissue levels of vitamin B6 in healthy, non-pregnant persons**
- Urinary excretion levels and erythrocyte aminotransferase activities
- Reflect **recent dietary intakes** of Vitamin B6; **tryptophan load tests** is a functional test used to provide an indirect measure of tissue vitamin B6 status

Folate status

- Commonly use static biochemical tests (folate levels in serum and erythrocytes)
- Homocysteine in serum or plasma increasingly used as functional test
- Measurement of folate deficiency should be performed with assessment of vitamin B12 concentrations
- Serum folate levels
- **Reflects folate balance**, fluctuate rapidly with recent changes in folate intake, and provide no information on the size of tissue folate stores
- A serum folate value of less than 3ng/mL (6.8 nmol/L) indicates negative folate balance
- Serum folate levels
- Reflects **acute folate status** but provide **no information on the size of the folate tissue stores**

Erythrocyte folate concentrations

- Estimated by measuring erythrocyte folate concentrations which **fall in subjects in persistent negative folate balance**
- Formed in the bone marrow, and levels remains constant throughout the life span of the cell (~120 days)
- Less sensitive than folate to short-term fluctuations in folate status and decrease much more slowly than serum or plasma folate during folate deprivation
- Correlate with liver stores
- Can be assayed using microbiological or competitive binding assays (through microbiological using L. Casei is the best method to date)
- As erythrocytes contain the polyglutamase forms of folate, must be first lysed and then treated with conjugase before analysis
- Cut-off for deficiency < 317 nmol/L

Serum homocysteine

- Fasting blood samples as intake affects levels
- Rigorous precautions must be taken when collecting the samples
- Assayed by HPLC method with fluorescence detection (widely used)

Vitamin B12 status

- Vitamin B12 **deficiency due to poor dietary intake is relatively rare**
- **Schilling test** is often used to ascertain whether malabsorption is the cause of the deficiency

Serum calcium concentration

- **Low levels of serum calcium occur after prolonged periods of calcium deprivation or poor absorption**
- Serum Ca concentration in normal healthy adults range from 8.8 to 10.6 mg/dL (2.20 to 2.64 mmol/L)
- Used to **identify Vitamin D intoxication**

Phosphorus status

- Serum phosphorus concentration
    - Phosphorus deficiency due to poor dietary intake is rare

- Serum phosphorus is the **most frequently used** index but it has a **low specificity and sensitivity**

Magnesium status

- Serum Mg concentration
  - Most frequently used index of Mg status
  - The mean serum Mg concentration in adult humans is approximately 0.85 mmol/LMg deficiency develops in association with disease states such as severe malabsorption, GIT disorders, alcoholism, cirrhosis, severe burns, and congestive heart failure or prolonged diuretic therapy

Iodine status

- The adult human body contains 15-20 mg iodine
- Main function is for thyroid hormone synthesis (T3 and T4)
- Required for normal growth and development and maintenance of a normal metabolic state
  - Main method of biochemical assessment
  - Urinary iodine excretion
  - Reflects dietary intake of iodine
  - Used in large scale surveys
  - Sample : 24 hour urine ideal but not feasible in large surveys
  - Random urine samples for large surveys
  - Serum levels of thyroid hormones

Urinary iodine

- Most widely used
- If mean iodine excretion is below 50 µg/g creatinine then it is usually concluded that iodine deficiency is a problem in the population
- Levels below 20 µg/g creatinine are considered very low
- When 24-hour urine collection is done, or where creatinine determinations are not conducted, urinary iodine levels below 5 µg/dL suggest iodine deficiency

Serum thyroxine (T4)

- Measure of thyroid function
- If low is an evidence of poor thyroid function, which may be related to goiter

- Blood levels of TSH
- Blood is taken from the umbilical cord or heel of all infants born in hospital and sent on filter paper to a special laboratory for determination of thyroxine or TSH
- Test is done because about one in 4,000 infants born is hypothyroid because the thyroid gland did not develop properly
- Blood levels of TSH
- If the condition is not diagnosed and treated soon after birth, there will be serious consequences, including poor brain development
- Generally, T4 levels below 4 µg percent are considered low, requiring treatment

Blood levels of TSH

- As with urinary iodine, few hospitals in most developing countries are equipped to do T4 and TSH concentrations
    - Blood lipids and Fasting Blood Sugar or Glucose classification

Hair zinc

- **Low hair zinc concentrations** were reported in the first documented cases of human zinc deficiency in young adult male dwarfs from the middle East (Strain et al., 1966)
- **Hair zinc concentrations probably reflect a chronic suboptimal zinc status** when the confounding effect of severe PEM is absent
- Standardized procedure for sampling, washing and analyzing hair samples are essential
- Collected from close to the occipital portion of the scalp with stainless steel scissors, and only the proximal 1.0 – 1.5 cm of the hair strands retained from analysis
- Any nits and lice must be removed before washing the hair samples using a standardized method
- A non-ionic detergent (e.g.Actinox) with or without acetone is often used

Serum zinc

- 12-22% of zinc in the blood is in the serum, the rest is within the erythrocyte
- Transported in three serum bound to proteins
    - Albumin (70%)
    - α 2-macroglobulin (18%)

- Rest – other proteins like transferrin and ceruloplasmin and to amino acids (histidine and cysteine)

Advantages of Biochemical Method:

- It is useful in detecting early changes in body metabolism & nutrition before the appearance of overt clinical signs.
- It is precise, accurate and reproducible.
- Useful to validate data obtained from dietary methods e.g. comparing salt intake with 24-hour urinary excretion.

Limitations of Biochemical Method:

- Time consuming
- Expensive
- They cannot be applied on large scale
- Needs trained personnel & facilities

UNIT -III CLINICAL ASSESSMENT:

- It is an essential features of all nutritional surveys
- It is the simplest & most practical method of ascertaining the nutritional status of a group of individuals
- It utilizes a number of physical signs, (specific &non specific), that are known to be associated with malnutrition and deficiency of vitamins & micronutrients.
- Good nutritional history should be obtained.
- General clinical examination, with special attention to organs like hair, angles of the mouth, gums, nails, skin, eyes, tongue, muscles, bones, & thyroid gland.
- Detection of relevant signs helps in establishing the nutritional diagnosis

ADVANTAGES:

- Fast & Easy to perform
- Inexpensive
- Non-invasive

LIMITATIONS

- Did not detect early cases
- Clinical signs of nutritional deficiency

HAIR:

Spare & thin: Protein, zinc, biotin deficiency

Easy to pull out: Protein deficiency

Corkscrew and Coiled hair: Vit C & Vit A deficiency

MOUTH

Glossitis: Riboflavin, niacin, folic acid, B12 , pr.

Bleeding & spongy gums: Vit. C,A, K, folic acid & niacin

Angular stomatitis, cheilosis & fissured tongue: B 2,6,& niacin

Leukoplakia: Vit.A,B12, B-complex, folic acid & niacin

Sore mouth & tongue: Vit B12,6,c, niacin ,folic acid & iron

EYES

Night blindness, exophthalmia: Vitamin A deficiency

Photophobia-blurring, conjunctival inflammation: Vit B2 & vit Adeficiencies

NAILS

Spooning: Iron deficiency

Transverse lines: Protein deficiency

SKIN

Pallor: Folic acid, iron, B12

Follicular hyperkeratosis: Vitamin B & Vitamin C

Flaking dermatitis: PEM, Vit B2, Vitamin A, Zinc & Niacin

Pigmentation, desquamation: Niacin & PEM

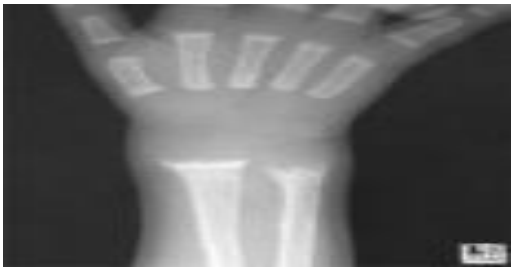
Bruising, purpura: Vit K ,Vit C & folic acid

Thyroid gland

- In mountainous areas and far from sea places Goiter is a reliable sign of iodine deficiency.

Joins & bones

- Help detect signs of vitamin D deficiency (Rickets) & vitamin C deficiency (Scurvy)



Clinical methods of assessing nutritional status:

As a frontline health worker providing health services at community level, you will almost certainly encounter many people with nutritional deficiency problems. In addition to the anthropometric assessments, you can also assess clinical signs and symptoms that might indicate potential specific nutrient deficiency.

Clinical methods of assessing nutritional status involve checking signs of deficiency at specific places on the body or asking the patient whether they have any symptoms that might suggest nutrient deficiency from the patient. Clinical signs of nutrient deficiency include: pallor (on the palm of the hand or the conjunctiva of the eye), Bitot's spots on the eyes, pitting oedema, goitre and severe visible wasting (these signs are explained below).

Checking for bilateral pitting oedema in a child:

In order to determine the presence of oedema, you should apply normal thumb pressure on both feet for three seconds (count the numbers 101, 102, 103 in order to estimate three seconds without using a watch). If a shallow print persists on both feet, then the child has nutritional oedema (pitting oedema). You must test for oedema with finger pressure (see Figure 6) because you cannot tell by just looking.

Figure 6 Checking for bilateral pitting oedema on a young child in Ethiopia. (Photo: UNICEF/Dr Tewoldeberhan Daniel)

Grades of oedema:

Depending on the presence of oedema on the different levels of the body it is graded as follows. An increase in grades indicates an increase in the severity of oedema.

0 = no oedema

+ = Below the ankle (pitting pedal oedema)

++ = Pitting oedema below the knee

+++ = Generalised oedema.

Bitot's spots:

These are a sign of vitamin A deficiency. Look at Figure 7; as you can see, these spots are a creamy colour and appear on the white of the eye.

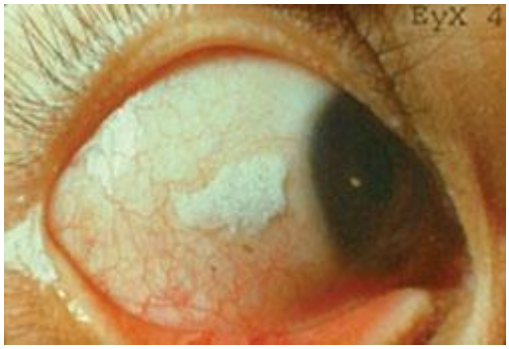


Figure 7 Bitot's spots (signs of vitamin A deficiency). (Photo: UNICEF Ethiopia)

Goitre:

Goitre is a swelling on the neck and is the only visible sign of iodine deficiency (Figure 8).

Figure 8 Goitre

Visible severe wasting:

In order to determine the presence of visible severe wasting for children younger than six months, you will need to ask the mother to remove all of the child's clothing so you can look at the arms, thighs and buttocks for loss of muscle bulk. Sagging skin and buttocks indicates visible severe wasting (as you can see in Figure 9).

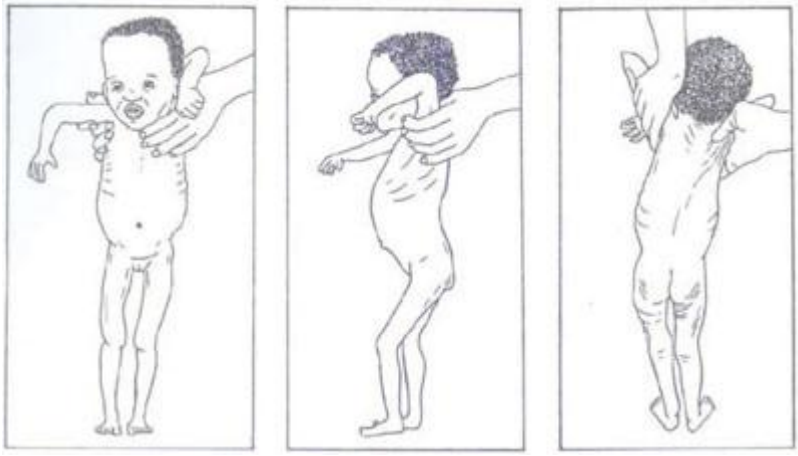


Figure 9 A child with severe visible wasting.

Table 4 summarises the main symptoms of nutritional problems and the deficiencies they signal.

Table 4 Clinical signs and symptoms of nutritional problems.

Sign/symptom	**Nutritional abnormality**
Pale: palms, conjunctiva, tongue Gets tired easily; loss of appetite shortness of breath	Anaemia: may be due to the deficiency of iron, folic, vitamin B12, acid, copper, protein or vitamin B6
Bitot's spots (whitish patchy triangular lesions on the side of the eye)	Vitamin A deficiency
Goitre (swelling on the front of the neck)	Iodine deficiency disorder

UNIT- II DIETARY ASSESSMENT

A dietary assessment is a comprehensive evaluation of a person's food intake.

In simple terms, one can categorize people as being well-nourished or malnourished based on whether their intake of food matches their food energy needs or nutrient requirements.The appropriate tool for dietary assessment will depend on the purpose for which it is needed. The purpose may be to measure nutrients, foods or eating habits.Information on food consumption patterns of people, is often needed

- To see adequacy of the diet to meet energy and nutrient requirements,
- To establish the presence of a link between a dietary risk factor and a given health outcome, or
- To monitor for clinical purposes, the response of a patient to manipulations of the diet.

Diet enquiries mainly two types:

1. **Qualitative:**

   Qualitative aspects of food consumption includes information on

   - types of foods consumed,
   - frequency of consumption (regular or during festival or occasions),
   - opinion and attitudes towards food and
   - the cultural significance attached in health and disease and under different physiological conditions such as pregnancy, lactation, infancy and adolescence.

   ex. Kinds of foods eaten, habitual, occasional, attitudes etc.

2. **Quantitative:**

   Quantitative aspects of food consumption includes information on

- the estimation of the exact amounts (weight/volume) of foods / beverages and their nutrients (calculated from food composition tables) consumed.
- This estimation helps to assess adequacy or inadequacy of food/nutrient consumption by comparing with the Recommended Dietary Allowances (RDA)

  ex. How much food eaten and compares with RDA.

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- Information on food consumption patterns of people, is often needed
  - to see adequacy of the diet to meet energy and nutrient requirements,
  - to establish the presence of a link between a dietary risk factor and a given health outcome, or
  - to monitor for clinical purposes, the response of a patient to manipulations of the diet.

- Nutritional intake of humans is assessed by five different methods. These are:
  - 24 hours dietary recall
  - Food frequency questionnaire
  - Observed food consumption
  - Dietary history since early life
  - Food dairy technique

Diet History:

The diet history method assesses an individual total daily intake and usual meal pattern over a varied periods of time. Usually it covers past one month, six months and one year.

Three steps are involved in traditional method.

1)Collection of data on daily diet pattern with quantities specified in household measures.

2) Cross check using a detailed list

3) Subjects record the food intake for three days at home.

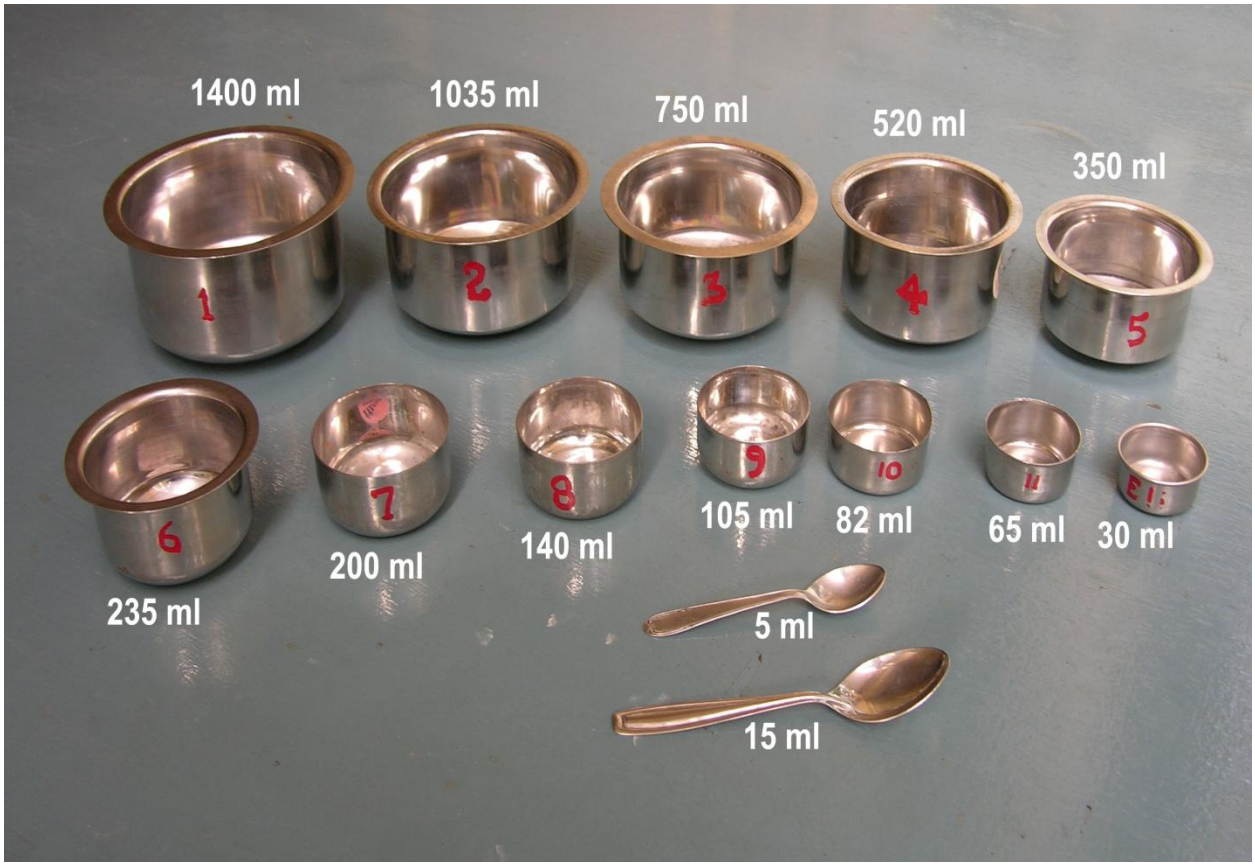
It is generally employed to obtain data on different physio-pathological conditions such as specific populations groups like pregnant women, infant and young children, and in different disease conditions like chronic degenerative disorders like cardio-vascular diseases, diabetes mellitus etc.

24 hours Dietary Recall:

The 24-hour recall method is more appropriate for assessing the intake of large populations than of individuals. Usual intake of an individual cannot be captured by a one-day recall. In this method a dietitian or a trained interviewer asks an individual to recall all foods consumed in the past 24 hours. The individual or respondent should be the person who will prepare the meals or have knowledge about the preparations made for the family.

- A trained interviewer asks the subject to recall all food & drink taken in the previous 24 hours.
- It is quick, easy, & depends on short-term memory, but may not be truly representative of the person's usual intake
- A set of standard cups suited for local conditions should be standardized at lab for their volume for data collection.

Information on types of food preparations made at breakfast, lunch, tea and dinner and amount of raw ingredients used for each preparation should be obtained



Individual intake (cooked) and raw equivalent ingredients used mixed vegetable curry

Amount of Raw food ingredients used in the curry		**Total cooked volume**	**Individual intake (vol.)**
Potato	**250 g**	**Cup No.2 (1035ml)**	**Cup No.6 (235ml)**
Onion	**250 g**		
Cauliflower	**500 g**		
Salt	**1 tsp**		
Chilli powder	**1 tsp**		
Oil	**2 tbsp**		

Individual intake (Raw) = *Amount of raw food used* *Amount of*
✖*Ind. Intake*
Amount of total cooked food

Eg. The Cauliflower consumed by the individual will be= ----- X 500/1035 = 235 = 113.5 g

Conversion factor for the intake of each food item (raw) of an individual is derived by:

Raw quantity of food item in each preparation / Total quantity of cooked food item **X** Intake of cooked

Strengths:

· Low respondent burden

· Suitable for large scale surveys

Weaknesses:

· Estimation of portion sizes

· Single observation provides poor measure of individual intake

· Bias in recording "good/bad" foods

· Memory dependent

Food record (dietary records) method

- In this method the individual is asked to maintain a daily diary/record of the type and quantities of the foods consumed during the days of survey.
- The investigator or member of the household should weigh the foods (raw as well as cooked) using a standard weighing scale at each meal before individual distribution/consumption and maintain a record of the same.

- The ideal reference period is around 7 days including weekends, to consider day to day variability.
- This method requires dissemination of proper instructions to the respondents and random checks by the investigator. The method requires most motivated participant, tedious and difficult for subjects with low literacy.
- This method is the most accurate to obtain food consumption data of individuals, but however requires compliance from the respondent.
- It is a labour and cost intensive process in terms of time, procedure and co-operation from the respondents / family is very essential.

Food Frequency Questionnaire:

- Food frequency questionnaire (FFQ) is the most commonly used method in epidemiological studies to assess the diet and its relation to chronic disease.
- This method is either self administered or recorded by the trained worker.
- The participants in the study are asked to report the frequency of consumption and amount of food usually consumed over a definite period of time. e.g.: last week, last month and last year etc.
- First step of this method is to identify and organize the list of most commonly consumed foods of the study population. It provides culturally appropriate dietary information for specific study population.
- An important advantage of this method of dietary assessment is the low burden on the study subjects, compared to recording methods.
- Limitations of the method are questionnaire are usually long, errors may occur in estimating serving size, needs updating to keep pace with changing dietary habits.

Name of the food		Frequency of consumption during last year						
	Portion Size (g)	Never	1-2 times / month	1-2 times /week	3-4 times /week	1-2 times / day	3-4 times /day	5-6 times /day
Rice							√	
Wheat Roti				√				
Tomatos					√			
Pumpkin			√					
Groundnut oil								√

- In this method the subject is given a list of around 100 food items to indicate his or her intake (frequency & quantity) per day, per week & per month.
- Inexpensive, more representative & easy to use.

Use Complete Food Composition Tables:

- Once food intakes are obtained, these must be translated into nutrients using food, beverage, and supplement composition tables.
- Accurate nutrient intakes can be obtained if up-to-date and complete food composition tables are available; that is, the composition of fortified foods, nutrient supplements, and beverages must be included and tables must be complete for all nutrients and other bioactive substances of interest.

Requirements:

- The field-investigator SHOULD speak the local language and should be well trained regarding the survey methods and the survey tools.

- Thorough knowledge of local measures, local preparations and method of preparation is required for data collection.
- In case of foods like milk/curd/buttermilk and sambar dilution must be assessed.
- Calorie dense items like oils should be noted very accurately
- Certain foods like coconut, fish etc. dry or fresh should be mentioned.

Equipment for Diet surveys:

- Pretested Survey forms suitable to objectives of the study.
- Scales: Quantities consumed can be weighed using standard scales. They should be accurate to at least 2g and weigh up to 1.5 kg for individual intake.
- Food photographs, models and food drawings can be used to facilitate data collection.
- Food tables are required to convert information collected on foods into nutrients.
- Computer software can be used in data processing and also for converting foods into nutrients.

Systematic errors:

- The commonly reported error in intake surveys is the under reporting.
- Initially it was thought under reporting is only prevalent in obese people, but most surveys reported about 1/4th under report their intake especially with reference to sugars and fats.
- The ability to relate actual consumption to descriptions of portion sizes and estimates of frequency will vary substantially between groups, and quantification of portion sizes is one of the sources of error in collecting food.
- This is not an easy problem to solve no statistical method exists to correct the reporting problems.

Limitations:

- It is impossible to calculate precise nutrient values in certain foods.
- Databases may not contain new food items and do not account for loss of nutrients through cooking, or geographic differences in soil nutrients where vegetables are grown.
- Nevertheless, a methodology does exist that can obtain adequate estimates of dietary intake. These estimates can then be used to describe intakes of populations and examine relationships between dietary intakes and disease.
- Long Questionnaire
- Errors with estimating serving size.
- Needs updating with new commercial food products to keep pace with changing dietary habits.

FOOD DAIRY:

- Food intake (types & amounts) should be recorded by the subject at the time of consumption.
- The length of the collection period range between 1-7 days.
- Reliable but difficult to maintain.

Observed Food Consumption:

- The most unused method in clinical practice, but it is recommended for research purposes.
- The meal eaten by the individual is weighed and contents are exactly calculated.
- The method is characterized by having a high degree of accuracy but expensive & needs time & efforts.
- Food Pyramid.

The base or widest part of the pyramid indicates the need for higher quantities of consumption of carbohydrate source foods, while the tip is narrow, indicating the need for eating only small amounts of fats and sweet things. If a person consumes any examples of the food type from each of the six groups in 24 hours, we can say that their dietary diversity score is six. Dietary diversity score is an indicator of both the **balance of nutrient consumption** and the level of food security (or insecurity) in the household. The higher the dietary diversity score in a family, the more diversified and balanced the diet is and the more food-secure the household.

Interpretation of Dietary Data:

Qualitative Method

- Using the food pyramid & the basic food groups method.
- Different nutrients are classified into 5 groups (fat & oils, bread & cereals, milk products, meat-fish-poultry, vegetables & fruits)
- Determine the number of serving from each group & compare it with minimum requirement.

Quantitative Method

- The amount of energy & specific nutrients in each food consumed can be calculated using food composition tables & then compare it with the recommended daily intake.
- Evaluation by this method is expensive & time consuming, unless computing facilities are available.

Dietary methods of assessing nutritional status:

Dietary methods of assessment include looking at past or current intakes of nutrients from food by individuals or a group to determine their nutritional status. You can ask what the family or the mother and the child have eaten over the past 24 hours and use this data to calculate the dietary diversity score.

Dietary diversity is a measure of the number of food groups consumed over a reference period, usually 24 hours. Generally, there are five food groups that our body needs to have every day. These can be represented in the food pyramid.

Summary:

1. Nutritional assessment is the interpretation of data to determine whether a person or groups of people are well nourished or malnourished (over nourished or under-nourished).

2. Anthropometry is the measurement of physical dimensions such as height or weight, as well as the fat mass composition of the human body to provide information about a person's nutritional status.

3. An index is a combination of two anthropometric measurements or an anthropometric measurement plus age. An indicator is a combination of an index and a cut-off point.

4. There are procedures for measuring length, height, weight and MUAC.

5. Weight-for-age is an index used to assess child growth.

6. MUAC is used for community-based screening of children who are less than five years old and for pregnant women. Knowing the MUAC can help when assessing severe acute malnutrition and moderate acute malnutrition.

7. Body mass index is the best measure of non-pregnant adult nutritional status.

8. Bilateral oedema and the different grades of oedema are checked on the top of the foot and around the ankle using both hands and pressing each foot for three seconds. Its presence indicates severe acute malnutrition.

9. Clinical signs and symptoms, such as goitre or Bitot's spots, are also important indicators of micronutrient deficiencies.

10. Checking for the iodine level of salt in households is done by using a single solution kit, and should be done twice yearly.

11. There are procedures for measuring length, height, weight and MUAC.

12. Weight-for-age is an index used to assess child growth.

13. MUAC is used for community-based screening of children who are less than five years old and for pregnant women. Knowing the MUAC can help when assessing severe acute malnutrition and moderate acute malnutrition.

14. Body mass index is the best measure of non-pregnant adult nutritional status.

15. Bilateral oedema and the different grades of oedema are checked on the top of the foot and around the ankle using both hands and pressing each foot for three seconds. Its presence indicates severe acute malnutrition.

16. Clinical signs and symptoms, such as goitre or Bitot's spots, are also important indicators of micronutrient deficiencies.

17. Checking for the iodine level of salt in households is done by using a single solution kit, and should be done twice yearly.

Answers to Check Your Progress Exercises:

1. Calculate BMI for a male of

- Height -176 cm
- Weight- 72 kgs. A

   Also categorize his nutritional status according to the ranges of BMI i.e.

   - Underweight,
   - Normal,
   - Over-weight or
   - Obese.

2. If you have to assess children (boy or girl) of less than 5 years of age, enlist what all clinical signs and symptoms you look for?
3. Stepby step give points, tools and questions that you ask & follow while taking 24 hours dietary recall of a person and also mention frequency of consumption of food items by using five food groups.
4. An adolescent girl having some marginal nutritional deficiencies identified through assessment as:

   - Anthropometry- Underweight
   - Clinical signs- nail spooning, night blindness, bitot spot, Spare & thin hairs, skin pallor.
   - Dietary assessment- low intake of micronutrients, protein and iron as compare than RDA.

How would you assess her by using different indicators and biochemical test for an appropriate outcome of her current health status?

Critical thinking skills:

- Selecting appropriate indicators/measures/biochemical test
- Using appropriate reference standards for comparison
- Defining where the adolescent girl is in terms of expected outcomes

NUTRITION MONITORING AND EVALUATION

Structure

- Introduction
- Nutrition Monitoring
- Purpose of Nutrition Monitoring and Evaluation
- Determining what to measure for nutrition monitoring and evaluation:
- Terminology
- Objectives and Components of Nutrition Monitoring
- Current Programmes of Nutrition Monitoring in India
- Nutrition Surveillance System (NSS)
- Objectives of Nutrition Surveillance
- Uses of Nutrition Surveillance System
- Infrastructure for Nutrition Surveillance System
- Key Indicators of Successful Nutrition Surveillance Programme
- Computerization for Monitoring and Surveillance
- Answers to Check Your Progress Exercises

INTRODUCTION:

In the previous Units, we learnt about different methods of assessment ofnutritional status of communities. Now we would like to know whether the nutritionalstatus of communitiesimproving or not and, if not, then what actions could be takento improve the nutritional status. For this purpose, we use the processes of nutritionmonitoring and nutritional surveillance.

We have learntin the previous units that, in direct assessment of nutritional status,nutrition surveys are used to collect information on population. Most often, the nutritionsurveys are conducted not

only at one point of time to understand the current statusof a given community, but also are repeated periodically- to find out the changes thatmay occur over Lime. The Union and State Governments in India have been investinglarge sums of money on several direct and indirect interventions to improve the overallhealth and nutrition of vulnerable groups of population. It is essential to know whether there has been anychange in the nutritional status as a result of these interventions or not; if not, thenappropriate corrective steps could be introduced, where necessary.Nutritionmonitoring is one of the tools adopted for the purpose.

During our day-to-day life, we hear regularly about the disease surveillance (cholera,encephalitis etc.) by the health authorities. The health administration maintains a constantvigil on occurrence of certain notifiable diseases so that they can initiate prompt controlmeasures to prevent the spread of these infectious diseases. This process is calleddisease surveillance. In the case of nutrition, early diagnosis of malnutrition in "atrisk" population groups is crucial to institute immediate corrective action to prevent under-nutrition. More importantly, this would also help in the promotion of optimalnutrition. Hence, effective nutrition surveillance system **is** required to achieve this.

In this unit, you will now learn about nutrition monitoring and surveillance and thevarious mechanisms in place in the country. What is nutrition monitoring and surveillance?What is the aim of nutrition monitoring? How is nutrition monitoring and surveillancecarried out at the community level? These are a few issues discussed in this unit.

Objectives:

After studying this unit, you will be able to:

Describe the concept of nutrition monitoring and nutrition surveillance,

- enumerate the aim of nutrition monitoring and surveillance and the basic principles,
- explain the various programmes through which these activities are being carriedout in India, and
- organize activities related to nutrition monitoring and surveillance at communitylevel.

The terms 'monitoring' and 'surveillance' are often used as synonyms in nutritionassessment. However, it is importan1 to understand the difference between these twoterms. Let us begin by understanding what we mean by monitoring. Monitoringliterally means 'to supervise' or 'to keep an eye on' or 'to scrutinize'. 'Monitoringrefers to the collection, analysis and feedback quantitatively precise measures from a relatively large representative sample of a population - at the Nationaland

State levels - essentially for the purposes of tracking time trends andunderstanding population sub-group differences in diet, nutritional status andnutrition-related health and disease risks.

You may be aware that the governments provide for built-in monitoring systems in most of the programmes that are implemented by them particularly with respect to theinputs either in terms of money or material. On the other hand, the aim of anymonitoring should be to assess whether the goals (with respect to the outcomes), setat the beginning of launching such interventions have been met. Therefore, nutritionmonitoring is a tool to keep a watch on the nutritional status of communities toassess the changes in nutritional status of communities over a period of time.WHO defines nutrition monitoring as the "measurement of changes over time in thenutritional status of a population or a specific group of individuals". Thus,nutrition monitoring involves repeated measurements on a representative population.You would also realize that quite often, the terms of monitoring and evaluation areused together. Evaluation is, in fact, a detailed appraisal of an intervention programmebyexamining the processes of implementation (pertaining to delivery inputs likeoutreach of the programme etc.) and the outcome variables (e.g.nutritional status) to determine as to how far the programme goals have been achieved andif not, then reasons for non achievement of goals.

Let us now learn about the purpose, determining measures, objectives and components of nutrition monitoring,

Purpose: The purpose of nutrition monitoring and evaluation is to determine and measure the amount of progress made for the nutrition intervention and whether the nutrition related goals/expected outcomes are being met. The aim is to promote more uniformity within the dietetics profession in assessing the effectiveness of nutrition intervention.

Determining what to measure for nutrition monitoring and evaluation:

Practitioners should select nutrition care indicators that will reflect a change as a result of nutrition care. The monitoring and evaluation phase should be considered during the assessment phase, while determining the Nutrition Diagnosis and the Nutrition Intervention. Additional factors to consider are the medical diagnosis, health care outcome goals, nutrition quality management goals, practice setting, patient/client population, and disease state and/or severity.

Terminology for nutrition monitoring and evaluation is organized in following categories:

Food/Nutrition-Related History Outcomes	Anthropometric Measurement Outcomes	Biochemical Data, Medical Tests, and Procedure Outcomes	Nutrition-Focused Physical Finding Outcomes
Food and nutrient intake, food and nutrient administration, medication, complementary/alternative medicine use, knowledge/beliefs, food and supplies availability, physical activity, nutrition quality of life	Height, weight, body mass index (BMI), growth pattern indices/percentile ranks, and weight history	Lab data (e.g., electrolytes, glucose) and tests (e.g., gastric emptying time, resting metabolic rate)	Physical appearance, muscle and fat wasting, swallow function, appetite, and affect

Nutrition-Focused Physical Finding Outcomes Food and nutrient intake, food and nutrient administration, medication, complementary/alternative medicine use, knowledge/beliefs, food and supplies availability, physical activity, nutrition quality of life Height, weight, body mass index (BMI), growth pattern indices/percentile ranks, and weight history Lab data (e.g., electrolytes, glucose) and tests (e.g., gastric emptying time, resting metabolic rate) Physical appearance, muscle and fat wasting, swallow function, appetite, and affect.

Collection and use of nutrition monitoring and evaluation outcome data: This step consists of three components: monitoring, measuring, and evaluating the changes in nutrition care indicators. Practitioners monitor by providing evidence that the nutrition intervention is or is not changing the patient/client's behaviour or status. They measure outcomes by collecting data on the appropriate nutrition outcome indicator(s). Finally, food and nutrition professionals compare the current findings with previous status, nutrition intervention goals, and/or reference standards (i.e., criteria) and evaluate the overall impact of the nutrition intervention on the patient/client's health outcomes. The use of standardized indicators and criteria increases the validity and reliability of outcome data collection. All these procedures facilitate electronic charting and aggregation of data for reporting outcomes of food and nutrition professional's interventions for patient/client care.

Objectives and Components of Nutrition Monitoring

In the section above, we learnt that nutrition monitoring is a means to keep a watch on the nutritional status of communities. In fact, the objectives of nutrition monitoring aretwofold. These are enumerated herewith:

Objectives of nutrition monitoring

The objectives include:

1)to assess the nutritional status of representative groups of communities on acontinuous basis in order tostudy the changes in the nutritional status, if any, and

2)to evaluate the various nutrition intervention programmes in operation to determinethe achievement or otherwise of the goals,

In fact, a well-planned and integrated national nutrition monitoring system should coverthe 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 the household level,
- the above information focused on selected high risk sub-population groups likeBelow Poverty Line (BPL) population, population in chronically drought pronearea and tribal populations,
- identification of vulnerable sub-groups of the population at higher risk of nutritionrelatedhealth problems,
- food supply- agricultural and horticultural, and
- food safety.

You should know that it requires at least a year to demonstrate changes in nutritionalstatus **at** the community level, so the periodicity of nutrition monitoring is usually oncea year.

The objectives of nutrition monitoring, the target groups to be monitored and theavailability of resources determine the components of nutrition monitoring. In countrieslike India, where clinical malnutrition is still widely prevalent, monitoring of both clinical(for example, assessment of clinical signs in case of kwashiorkor/marasmus,xerophtahlmia and goitre etc.) and of sub-clinical nutritional status (anthropometric andbiochemical indicators) would be required. However, with improvement

in the nutritionalstatus of communities, the emphasis can be shifted to sub-clinical forms. The nutritionalmonitoring data could also be used in the revision of the Dietary Guidelines for Indiansat regular intervals of about 10 years.

Components of nutritional monitoring

Let *us* look at the two main components of nutrition monitoring. These are:

1) Population groups, and

2) Key indicators used in monitoring.

We shall start with the population groups.

1) **Population for Monitoring**

For nutrition monitoring, it is necessary to decide the groups of population, especiallythose, at risk of developing malnutrition. Considering the current status of nutrition ofdifferent groups, monitoring of nutritional status of mothers and children should receiveutmost priority. Since the nutritional status of preschool children is accepted to reflectthe of a community, under conditions of resource constraints, it may be adequate to collect data on this age group only, However, the aim should be to monitorthe whole population.

2) Key Indicators

An effective nutrition monitoring system should be able to provide information on prevalence of nutrition disorders either by direct measurement and observation or byself-reported disease prevalence in different groups, personal attributes, nutritionbehaviours and information on utilization of health and nutrition services. It isrecommended that as far as possible, information which indicates various aspects ofnutritional status e.g. underweight, wasting and stunting in addition to clinical assessmentshould be included. Since anaemia is a major problem among all the groups of population,particularly among pregnant women and young children, laboratory supported haemoglobinestimations at least once in five years may also be included. Dietary consumption byall the individuals would provide also information on the intra-family distribution ofintakes within a family. In addition, data on various aspects of implementation ofintervention programme participation of the beneficiaries would help in linking thenutritional status and the intervention programmes. Such data would help in assessingthe current status of the programmes and in

introducing appropriate changes required.The data so collected should be accurate and be representative of the communities.

Having studied about the indicators of nutrition monitoring, it is also important for usto know that only standard methods should be used to conduct nutrition monitoring.Emphasis should be placed on obtaining accurate data using sensitive indices by trainedinvestigators. They should use standardized equipments to indicate the nutritional statusof communities, with reasonable certainty.

Current Programmes of Nutrition Monitoring in India

The assessment of nutritional status of different segments of the population, particularlyin relation to dietary intakes, has been one of the important activities of nutritionresearch in India for more than six decades. These have been mostly isolated studies,either of specific groups or in specific regions of the country and they rarely assumedan all-India character. However, with an increasing emphasis on planned developmentthrough five-year plans, a number of organizations and departments have geared theiractivities to meet the stringent needs of the planning process at national and regionallevels. These organizations provide a more systematic approach in collection andcompilation of data.

2) National Sample Survey Organization

3) National Family Health Survey

4) *District Level household Survey (RCH-2)*

1) ***National Nutrition Monitoring Bureau***

The National Nutrition Monitoring Bureau (NNMB) is the only organization involvedin nutrition monitoring for the past 32 years. The Indian Council Medical Research(Medical Research Council under the Ministry of Health and Family Welfare,Government of India) established NNMB in 10 states, in 1972, to periodically collectinformation on the diet and nutritional status of communities and to evaluate variousnational nutrition intervention programmes in operation. NNMB is located at the NationalInstitute of Nutrition, Hyderabad, India. Though it is in operation only in 10 states(Andhra Pradesh, Tamil Nadu, Uttar Pradesh, West Bengal, Kerala, Gujarat, Maharashtra,

Karnataka, Orissa) NNMB has been the only large-scale dynamicdatabase on diet and nutrition in the country providing information on nutritional status of different age groups and dietary pattern at individual level. NNMB has two mainobjectives. These are given as follows:

Objectives of *NNMB*

The objectives of NNMB are:

- To collect, on a continual basis, on representative segments of population in eachof the states, data on dietary pattern and nutritional status adopting standardizedand uniform procedures and techniques, and
- To periodically monitor and evaluate the ongoing national nutrition programmes, to identify their strengths and weakness and to recommend mid-course appropriatecorrective measures to improve their effectiveness.

It has several unique features.These are given as follows:

Unique features of NNMB:

1. Organization of repeat surveys in 1988-90 and 1996-97, in the same villages inall the states that were surveyed during 1975-79, to assess time trends in diet andnutrition surveys.

2. Periodic generation of data on diet and nutritional status of socially vulnerablegroups of population like the tribals living in integrated tribal development projectareas, and the population physiologically at risk like elderly and adolescents.

3. Continuous collection of data on actual dietary intakes of families and individualsbelonging to different physiological and age groups, in different states. NNMB isthe only organization generating this type of data.

4. Assessment of intra-family distribution of foods and nutrients.

Regular generation of data by NNMB on various aspects as discussed above has beenvery useful for the Planning commission, Union and State governments and Internationalorganizations. The changes in the nutritional status over a period time could be ascertainedwith the help of NNMB surveys and the results so far indicate that over the last 25years there has been gradual and significant reduction in the prevalence of both moderateand severe forms of under-nutrition as measured by anthropometry and clinicalassessment.

2) ***National Sample Survey Organization (NSSO)***

NSSO, a permanent survey organization, was set up in the Department of Statistics ofthe Government of India n 1950 to assist in socio-economic planning and policy making,by collecting data on various facets of the Indian economy through nationwide largescalesample surveys. The NSSO has been carrying out Consumer ExpenditureSurveys quinquennially since 1972-73. As a part of these quinquennial surveys dataon dietary intake at National and State levels and monthly per capita expenditure onfood are collected.The data on food consumption per head is calculated from the data, which provideinformation on *per capita* energy consumption for different states. In fact, the calculationof the proportion of population below poverty line (indicator of poverty) is calculatedbased on this information. It should be recognized that these data do not provideindividual dietary intakes of different age groups but indicate the availability at consumerlevel. These data have been used to monitor the consumption expenditure over years.This survey provides calorie, protein, and total fat intake per capita and per consumptionunit, using the two reference periods of 7 and 30 day immediately preceding the dayof the survey.

The NSSO data on nutritional intake gives data by rural and urban areas of States andIndia on:

- Average quantity of consumption of different cereals per 30 days,
- Average value of these in rupees,
- Food security at the household level,
- Per capita and per- consumption unit intake of calories, protein and fat per day,
- Percentage of total intake of protein and calorie from different groups of fooditem,
- Distribution of households and individuals by calories intake level, and
- Cross-tabulations of the above by monthly consumption expenditure classes.

3) *National Family Health Surveys (NFHS)*

The Ministry of Health and Family Welfare, Government of India, initiated the firstNational Family Health Surveys (NFHS-1) in 1991.

The main objective of the first survey was to provide State and National level estimatesof fertility, infant and child mortality, contraception prevalence, maternal and childhealth care and the utilization of services provided by the government health systemfor mothers and children. As part of this survey, data on infant feeding, child nutritionwere also collected. Anthropometric data were collected on children under 4 years ofage. In addition to data on infant feeding and anthropometry and prevalence of anaemiain children below 4 years, in the NFHS-2, haemoglobin estimations in

pregnant women,preschool children and non-pregnant and non-lactating women were also collected. The survey also collected data on food consumption.Government and International agencies have extensively used these data to assess thechanges in nutritional status.From NFHS we move on to the fourth monitoring system **i.e.**district level householdsurvey.

4) ***District Level Household Survey (DLHS)***

The International Institute for Population Sciences, Mumbai, at the request of theGovernment of India, carried out a district level household survey (DLHS-RCH)covering 300 districts in 2002-2003. The main focus of the DLHS was to create adatabase on the reproductive and child health at the District level. In the subjectscovered in this survey was a component on the nutritional status (weight/age) ofchildren below 72 months. Haemoglobin levels were estimated in preschool children,adolescent girls (10-1 4 years) and pregnant women of 15 to 44 years of age.Consumption of iodized salt (at concentration of 7 ppm and 15 ppm) at the householdlevels was also assessed.

From our discussion above it must be clear that we have few organizations in ourcountry, which provide a more systematic approach in collection and compilation ofhealth and nutrition data.

Answers to Check Your Progress Exercises:

1. Give full form of
    - NSSO
    - DLHS
2. Brief about importance of Nutrition Monitoring and Evaluation in our day to day life.
3. Keeping in mind about objectives of Nutrition Monitoring, write down few points that you will follow for rural community in India (Hint- Follow planned National Nutrition Monitoring system).
4. Briefly describe about current Nutrition monitoring Programme in India
    - NFHS
    - NNMB

NUTRITIONAL SURVEILLANCE

Structure:

- Introduction
- Purposes of Nutritional Surveillance
- Objectives of Nutrition Surveillance
- Uses of Nutrition Surveillance System
- Infrastructure for Nutrition Surveillance System
- Key Indicators of Successful Nutrition Surveillance Programme
- Answers to Check Your Progress Exercises

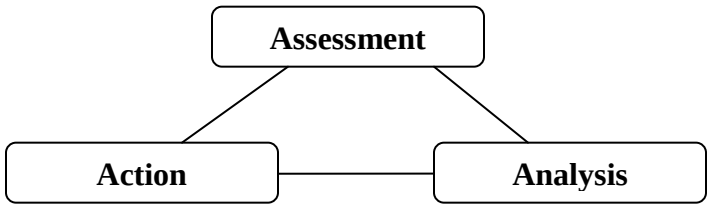
Introduction:

Earlier in this unit we studied about nutrition monitoring. Nutrition monitoring you wouldrealize is usually an integral part of nutrition surveillance. Quite often, the terms"nutrition surveillance" and "nutrition monitoring" as mentioned earlier too are usedsynonymously. What then is nutrition surveillance? Nutrition surveillance means watching over nutrition in order to makedecisions, which will lead to improvement of nutritional status ofpopulation.Nutrition surveillance isa continuous and systematic process of collection, analysis,interpretation of information to assess nutritional status and initiate appropriateearly action to promote optimal nutrition.

The concept of nutritional surveillance is derivedfrom disease surveillance, andmeans "to watch over nutrition, in order to make decisions that lead to improvementsin nutrition in populations". Three distinct objectives have been defined forsurveillance systems, primarily in relation to problems of malnutrition in developingcountries: to aid long-term planning in health and development; to provide inputforprogramme management and evaluation; and to give timely warning of the needforintervention to prevent critical deteriorations in food consumption. Decisionsaffecting nutrition are made at various administrative levels, and the uses ofdifferenttypes of nutritional surveillance information can be related to national policies,development programmes, public health and nutrition programmes, and timelywarning and intervention programmes.

Nutrition monitoring is usually an integral part of nutrition surveillance and you alreadyknow,it refers to "repeated measurements of the nutritional status, at regular intervals of

population or a specific group of individuals over a period of time.’Surveillance', on the contrary, is concerned with data on the current, status/activitiesat local levels for initiating action in response to events occurring during specific programme implementation in the population. Nutrition surveillance, therefore,encompasses analysis and action to promote better health and nutrition.While studying about nutrition surveillance it is important for us to familiarize ourselveswith a term "Triple A Cycle". What is Triple A? Let's find out. Triple A meansAssessment, Analysis and Action. Nutrition Surveillance is carried out adapting triple .A



The Triple A cycle

The first step in the cycle is assessment of the nutritional status of an individual, which is followed by analysis of the causes for deterioration in nutritional status. For example,the reasons could be delayed complementary feeding, inadequate dietary intake, frequentattacks of morbidity and non-utilization of services provided by the government etc.The health and nutrition workers should carefully enquire the reasons at the householdlevel and initiate suitable action, which is the next step in nutrition surveillance. Theaction may be education of the mother about initiation of complementary feeding bythe age of 6 months or frequent feeding of energy rich foods or controlling morbidity.The triple A cycle is not one time activity but a continuous process.

Nutritionalsurveillance systems were being developed:

(a) for long-term planning in health and in development;

(b) for programme management and evaluation; and

(c) for timely warning and intervention to prevent critical deteriorations in foodconsumption.

Objectives:

- To know about the purpose and objectives of Nutrition Surveillance.
- To understand the working of the program by knowing about its uses, implementation programmes and infrastructure.

PURPOSES OF NUTRITIONAL SURVEILLANCE:

Decisions that influence the nutritional conditions of populations may be made atseveral different levels of administration. These decisions may be in relation to

(1) policiesand programmes that can fundamentally affect people's living standards in the long term,(2) programmes that provide for more immediate alleviation of hunger and malnutrition,or

(3) a number of intermediate possibilities.

The decisions essentially involve theallocation of resources for the benefit of deprived groups of people through alternativeactivities. Generally, the objective of nutritional surveillance is to provide information sothat decisions can be made that are more favourable to nutrition; this in turn will lead to theallocation of resources for the benefit of the malnourished in such a way that their nutritionwill improve. We have suggested a classification of policies and programmes that arerelated to nutrition as follows:

(a) National policies

(b) Development programmes

(c) Public health and nutrition programmes

(d) Timely warning and intervention programmes.

Objectives of Nutrition Surveillance

The main aim of nutrition surveillance is early identification of at risk groups of population like children and mothers so as to institute appropriate interventions/actions to prevent under nutrition. Thus, objectives of effective nutrition surveillance are:

1**.** It should identify the prevalent nutrition-related problems and the high-risk groups.

2. The information collected in'NSS should prompt initiation of appropriate intervention programmes to prevent the occurrence of nutritional disorders. Surveillance shouldnever exist in isolation from action.

3**.** It also should provide information on nutrition and health of communities to helpin the preparation of action plans at different levels.

4. It should assist in the management and evaluation of health and nutrition relatedprogrammes.

5. The nutrition surveillance should also be able to provide timely warning aboutimpending nutrition disasters.

Uses of Nutrition Surveillance System:

Nutrition surveillance system can have various uses. Some of the important usesinclude:

1. The most important contribution of NSS is to help in easily diagnosis, initiating ofprompt and immediate remedial measures to control under-nutrition and thuspromote the nutritional status.

2. The NSS provides information on the current nutritional status, the geographicdistribution of nutrition problems (identification of geographic areas), causes and changes in the prevalence/incidence over time, the actions initiated and theireffects.

3. The NSS can help to identify the seasons of nutritional stress.

4. The NSS can also be used for performance evaluation of the ongoing intervention programmes and assessment of contributory factors.

5. It can help the administration in prioritizing actions, so as to modify policies andprogrammes from time to time.

6.The NSS can provide information on nutritional trends over a period of time and help in establishing a database on nutrition and related indicators to enableassessment, constantly, of the extent of achievement of the national nutritionalgoals.

Infrastructure for Nutrition Surveillance System

The important step in the establishment of national NSS is identification of suitable infrastructure. It would be preferred that we use an existing infrastructure rather thanestablishing a new set up. In India, Integrated Child Development Services (ICDS) isone of the largest nation-wide child development programmes. What is ICDS? We will discuss here how it could be used todevelop NSS.ICDS is best suited for developing NSS at the national level for the following reasons:

1. It is currently in operation in most of the community development blocks in thecountry and, as per the National Nutrition Policy (NNP) it will be expanded to theentire rural and 50% of the urban areas of the country.

2. It has the necessary infrastructure and trained manpower with a built-in management information system from the village level up to the national level.

3.Growth monitoring, an important requisite to find out the nutritional status ofchildren is an integral part of ICDS. All the nutrition goals set by the NNP arecovered by the ICDS activities.

4. More importantly, ICDS has a built in monthly progress reporting (MPR) system, which could be an important tool for NSS.

What is Monthly Progress Reporting (MPR) system? Let us find out more about it.

Monthly Progress Reporting (MPR) systemat present, Anganwadi Workers (AWW) at the Anganwadi centre (village) level monitorthe ICDS scheme through a system of monthly progress reports (MPR). The Supervisorsand the Child Development Project Officers (CDPOs) consolidate these MPRs. Thesecontain mostly quantitative information on the coverage under different components ofICDS (Process variables). For effective NSS, there should be a provision to identify,at different levels, "children at-risk" or "problem areas" so that corrective action couldbe immediately initiated. Information should be collected about the reasons for lowcoverage for various nutrition programmes like supplementary feeding programme,semi-annual distribution of massive dose of vitamin A,nutritional anaemia controlprogramme, universal immunization programme etc. The information so collected shouldhelp the workers in taking immediate action. Critical review of the MPRs is essentialat various levels i.e. village to the level of State, to improve the performance of theprogrammes.

In addition to ICDS, the Department of Health, which has extensive infrastructure inthe rural areas, can also be considered as the delivery mechanism for nutrition surveillance. In fact, the nutrition surveillance should be a combined,approach both by the Health and ICDS departments.Thus, we saw how we could use the existing infrastructure for establishing NSS. Nowlet us review the key indicators, which would be critical for a successful nutritionsurveillance programme.

Key Indicators of Successful Nutrition Surveillance Programme:

ICDS and Health department do collect information on several health and nutritionindicators. However, we would mention here some key indicators which are criticalfor a successful nutrition surveillance programme. These are:

- Enrolment and attendance of different beneficiaries for supplementary nutrition and preschool education,
- Nutritional status of children and its trends, Growth faltering among children,

- Prevalence of nutritional deficiency signs like edema (kwashiorkor), wasting (marasmus), Bitot spots, night blindness and visible goiter.
- Coverage under national programmes namely:
  a. Immunization of children and expectant women,
  b. Vitamin 'A' distribution to children,
  c. Distribution of IFA tablets to children, pregnant woman and lactating women.
- Prevalence of low birth weight, Vital rates in different age and physiological groups, and
- Prevalence of common morbidity in children and causes for deaths. Thus, the indicators given above could provide necessary information on nutritional status andcoverage of target population in nutrition and health intervention programmes.

Answers to Check Your Progress Exercises:

1. Describe Triple A cycle.
2. Give classification of policies and programmes that arerelated to nutrition
3. Give uses of Nutrition Surveillance System
4. Give key**i**ndicators of successful Nutrition Surveillance Programme