

## **2. ASSESSMENT OF NUTRITIONAL STATUS**

Nutritional status is the physical health of a person as it results from consumption and utilization of food in the body. Defined by Christakis 1973 as health condition of an individual as influenced by his intake and utilization of nutrients determined by physical (anthropometric), biological, clinical and dietary studies

The effect of diet on health is measured by an assessment of nutritional status. Nutritional assessment procedures were used as early as in 1932 in survey designs to describe the nutritional status of population on a national basis. Nutritional assessment has become an essential component of nutritional care of hospitalized patient.

Nutritional assessment can be defined as the interpretation of information obtained from anthropometric, dietary, biochemical and chemical studies. The information obtained is needed to determine the health status or population groups as influenced by their intake and utilization of nutrients.

Nutritional assessment is done for survey, surveillance screening and monitoring.

### **Nutritional Survey:-**

The nutritional status of a selected population may be assessed in cross sectional survey. The cross sectional data can be used for baseline nutritional data or can ascertain the overall nutritional status of a population. It can also identify the population at risk, so that there could be allocation of resource to the much needed population and also to form policies to improve the overall nutrition.

### **Nutritional surveillance:**

Surveillance means continuous monitoring of nutritional status of a selected population group. Here the data is collected analysed and utilized for an extended period of time. Surveillance studies identify the possible causes of malnutrition and hence can be used to formulate and initiate intervention measures as population or sub population level.

### **Nutritional screening:-**

The identification of malnourished individuals requiring intervention can be accomplished by nutritional screening. This involves a comparison of an individual's measurement with predetermined risk levels or cut off points. Screening can be carried out at the individual level or at a specific sub population considered to be at risk.

### **Nutritional Monitoring: -**

This is required during the nutritional management of the patients. Base line parameters are compared during and after the nutritional intervention.

## **METHODS USED IN NUTRITIONAL ASSESSMENT**

Nutritional assessment systems utilize 4 types of methods which are used with alone or in combination. They are;

- (1) Anthropometric assessment
- (2) Biochemical assessment
- (3) Clinical assessment
- (4) Dietary methods

For the assessment of nutritional status in a community basically Dietary and Anthropometric measurements are used.

: The methods are simple, less time consuming and do not require sophisticated instruments.

### **ANTHROPOMETRIC ASSESSMENT:**

This involves physical measurements of body and dimensions. Body composition maybe estimated from anthropometric measurements. The measurements vary with age and degree of nutrition and as a result are useful in assessing imbalances of protein and energy. They can be used to defect moderate as well as severe degree of malnutrition. The technique also provides information on past nutritional history which cannot be obtained in other assessment techniques. Anthropometric measurements are of 2 types – growth and body composition measurement. Anthropometric indices are wieght for age, hieght for age, head circumference for age, or from combination of raw measurement such as wieght and hieght, skinfold thickness at various sites.

### **Advantage of Anthropology Assessment**

- (1) The procedure is simple, safe and non-invasive and can be used for large population
- (2) Equipment required is inexpensive
- (3) The methods are precise and accurate
- (4) An unskilled person can also perform the measurement procedure
- (5) Mild to moderate malnutrition can be detected
- (6) Information on past long term nutritional history can be retained

(7) Changes in nutritional status over time or over generation changes can be absorbed.

## Techniques

### Weight for age

The development of a child is determined by the increase in weight over a given time. This in turn is determined by weight measurements over regular intervals. Here the child weight is compared with reference weight value for his age. The most widely used method is that of Gomez and Co-workers (1956). The observed weight of a child is expressed as a % of expected weight of a child of that age using the 50<sup>th</sup> percentile (medium) of Havard Standards.

### Gomez Classification

% expected weight for age	Classification	Category of nutritional status	
>90%	Normal	Normal	
76-90% malnutrition	Mild malnutrition	1 <sup>st</sup>	degree
61-75% malnutrition	Moderate malnutrition	2 <sup>nd</sup>	degree
< 60% malnutrition	Severe Malnutrition	3 <sup>rd</sup>	degree

In 1972 nutrition sub-committee of Indian Academy of Paediatrics (IAP) proposed another classification.

% of expected water	classification
>80%	Normal
71 – 80%	Grade I
61 – 70%	Grade II
51 – 50%	Grade III severe malnutrition
< 50%	Grade I severe malnutrition

**Disadvantage for the 2 classifications**

- (1) It takes no account of other measurements
- (2) It assumes that children are of the same height
- (3) Single measurement of weight does not indicate definite malnutrition when former weight measurement are not known
- (4) Harvard references are not easily available

**Advantages:**

- (1) It is very simple to measure.
- (2) It is widely used.

**Height for age:**

It is used as an indication of nutritional status of groups of population for estimating past and chronic malnutrition but not necessarily the present nutritional status. The disadvantage is that the deficiency in height takes some time to occur and it may not be manifested in malnourished infants. Also genetical differences are partly responsible for the variation in height in any group in any population.

### **Weight for height**

This can be expressed as a % of the reference median weight for median height at any age. The advantage for using weight for height as an index of nutritional status is its apparent age independence, this allows its use in populations where ages are uncertain or unknown. Marked decrease in weight for height is a more reliable finding in the determination of PEM in all age groups.

Disadvantages: The difficulty in measuring body length in young infants which may make it difficult to obtain adequate data in this age group.

### **MID ARM CIRCUMFERENCE (MAC)**

One of the most widely used indices for the assessment of nutritional status especially during childhood because the tape used is inexpensive and portable.

Advantage: measurement is easy and simple, takes less time to perform. It involves only a simple measurement, can be taught to lay people, equipment is inexpensive. MAC correlates well with weight and weight for height. It indicates state of muscle protein. MAC should be measured only when weighing scale, cannot be supplied.

Cut oft points:	AC > 14cm	normal nutritional state
	AC 14 – 12.5	mild/modest undernutrition
	AC < 12.5	severe underrutrition

### **ASSESSMENT OF DURATION OF MALNUTRITION**

Children with poor linear growth but adequate weight for height may be classified as normal but the condition is not justifiable, but if height for age is also taken into consideration then it may be okay. Seone and Lytham 1971 further made thier own classification.

<u>Nutritional Status</u>	<u>Height for age</u>	<u>Weight for age</u>	<u>Weight for ht</u>
Normal	Normal	Normal	Normal
Past Chronic Malnutrition (Nutritionally dwarf)	low	low	low
Current short duration Malnutrition	Normal	Low	Low
Current long duration Malnutrition	Low	Low	Low

### **Body Mass Index**

In adults low weight for height may indicate inadequate nutrition whereas high weight for height may indicate overweight and obesity. In recent years BMI is used. It is the best simple and quantitative anthropometric indicator of body composition and thus nutritional status.

$$\text{BMI} = \frac{\text{Body weight (Kg)}}{\text{Height}^2 (\text{m}^2)}$$

Normal range = 18.5 – 25kg/m<sup>2</sup>, below it = underweight, above it = overweight and obesity.

17 – 18.5      1<sup>st</sup> degree malnutrition

16 – 17        2<sup>nd</sup> degree malnutrition

Below 16      3<sup>rd</sup> degree malnutrition

18.5 – 25      Normal

> 25            Obese

### **SKINFOLD THICKNESS**

The most direct measure of fatness in people is measurement of skinfold thickness using skinfold calliper. These springs loaded callipers exert a constant pressure on a fold of skin, the thickness of skin is indicated in a meter. The thickness depends in the amount of fat stored subcutaneously in the region of the skinfold. It is measured at several sites and it is still the representative of the total amount of body fat. Typically, it is determine at 4 sites (i) over the triceps muscle (ii) over the biceps (iii) in the subscapular region (iv)



in the supra-iliac region. The single triceps muscle is sometimes used in nutritional survey because it can be measured quickly.

## **BIOCHEMICAL ANALYSIS**

The biochemical evaluation of nutritional status is when quantitative determination of nutrients or related metabolites in such tissues as blood and urine. Low blood levels of a nutrient may reflect a low dietary intake, defective absorption, or increased utilisation, destruction in excretion. The data serves to confirm findings from clinical observations and dietary studies or to identify subclinical deficiencies before clinical symptoms are evident. They can be used for some nutrients to assess the range for frank deficiency levels through adequate optimal and excessive levels of nutrition intake.

**CLINICAL OBSERVATIONS:-** Clinical observations, the least sensitive approach lend themselves to use in nutritional surveys of population groups because they involve an assessment of the health of those part of the body that can be readily observed in a routine physical examination and do not involve obtaining blood, urine or tissue samples. The most commonly observed are eyes, skin, mucous membranes, hair, mouth teeth, tongue, thyroid gland, and lower extremities.

Although clinical observation are of limited value in the early diagnosis of a deficiency state or in identifying marginal changes that prevail for that periods, they are widely used to confirm biochemical and dietary data. Because of the subjective nature of the judgement in a clinical evaluation, the method is quite unreliable even when used by highly skilled observers.

## **Observed symptoms**

### **Eyes**

Dryness of the cornea and conjunctiva – associated with lack of vitamin A.

### **Membranes**

Colour of mucous membranes (underside of the eyelid) to observe the pigmentation of the blood – if pale = anaemia, if highly colored =adequate Hemoglobin level

### **Skin**

Is often a reflection of nutritional state of an individual. Deficiency of some vitamin manifest in varying forms and degrees of dermatitis.

### **Mouth and teeth**

Cracks at the corners of the mouth (angular stomatis) vertical cracks followed by redness, smelling ulcerations reflect lack of riboflavin. Loss of papillae on the tongue and flavin and scarlet and raw appearance of the tongue are associated with niacin deficiency. Soft spongy and bleeding gums in vitamin C deficiency. The presence of mottling in the tooth enamel results from a high intake of fluorine. The incidence of dental caries reflects deficient diets during the teeth forming years of life.

### **Other tissues**

Enlargement of the thyroid gland – associated with iodine deficiency or intake of food **goitrogen** or iodine excess. Oedema of the lower extremities, depigmentation, lack of lustre.. Bowed and beading of ribs – vitamin D deficiency. Neurological abnormalities associated with thiamin and vitamin B<sub>12</sub> deficiency (identified by testing reflexes in the lower extremities).

## DIETARY ASSESSMENT METHODS

### Two Methods

1<sup>st</sup> is a group method, 2<sup>nd</sup> is based on dietary intake of an individual. It is determined by record or recall of all foods consumed over a specified period of time. This is the most commonly used method for the field surveys.

### Group Method

#### 1 Food Balance sheet

On the basis of food availability food balance sheet from the entire population is prepared. The mean annual amount per person is obtained by dividing the total amount of different foods with the total population of the area. The mean intake of different nutrients is an essential part of food balance sheets.

### Advantage

- 1 The food balance sheet gives view of the total food supplies of a community. It indicates whether food consumed by the population is inadequate, adequate or more than adequate.

2. It seems as a basis for planning of food programme and for emergency rationing of food
3. Valuable in inferring general food habits of the people

Disadvantage:

1. The reliability of such data depends on the statistics used for calculation and level of development of the country.
2. The data shows the total amount of food available and not the actual amounts consumed
3. Longitudinal differences in food consumption are not reflected for mean total consumption data of the whole population.

## **FOOD ACCOUNTS**

This method of dietary assessment is commonly used for subjects living in institutions, families or groups. It involves detailed recording of the amount of food consumed over a period of time. This is compiled by an inventory of food supplies both at the start and end of the survey. The method provides accurate information on food consumption.

**Advantage:**

1. Larger samples can be obtained and food consumption data for longer period of time can be collected.

2. As seasonal variation are taken into account, the method provides excellent information on the annual mean food consumption
3. The method is cheap and does not alter the diet of the subjects to a great extent

### **Disadvantage**

1. Families or household are not always representative of the whole population
2. It can be used only with the likely population
3. Precision may decrease after four days
4. Food distribution within the family is not known
5. The records may not always reveal how much food was actually consumed or thrown away due to spoilage or plate wastage

### **Individual Dietary Intakes**

Dietary data on individuals is collected to obtain more precise measurement of average nutrient intake and to determine inadequacies if any. Assessment ranges from a qualitative type of inquiry to those of a more quantitative nature. It is one of the most accurate methods and is referred to as Precise and Weighed Individual inventory method. An inventory of the food supply both at the beginning and end of survey is made. As more food is acquired it is weighed and recorded. Weights and recording of food consumption at home and outside and food wastage are maintained. At the end, the amount of food wasted is added to the amount of food left over to obtain total wastage. Then divided the total food consumed by the no of adults given daily food with

consumption per person. i.e. (initial inventory + issues or purchases) – (final inventory + waste)

Food consumed/person/day

Total weight of food item consumed / (days of survey X no of persons fed daily)

### **Advantage**

1. The information can be collected by the subjects themselves and require minimal supervision
2. The amount consumed can be recorded accurately

### **Disadvantage**

1. The sample size is not representative as **whinkein** are selected and the results cannot be generalised.
2. It is costly and requires trained personal
3. It changes the diet of the respondents so that it does not represent normal consumption pattern.

**Interview method:** - to collect food consumption data

- (1) Diet recall                      (2) Diet history

**Diet Recall:** - Food consumption for a specified period of time prior to the survey can be recalled often referred to as the 24hours recall method.

Individual intake (in volume) X              Raw amount = Y

Total cooked quantity (in volume)

Standardised volumetric measures of the ingredient are recorded

### **Advantage**

Useful method is recapitulation of one's habitual diet

It is helpful in revealing extreme daily variation in the diet

### **Disadvantage**

A day intake may not represent usual intake.

Estimate becomes difficult when diet has a lot of variety.

Subjects reporting may not be sure about intake.

By weight of foods consumed by a single individual. All the food items mixed and blended for chemical analysis. At same time the weight of prepared food is obtained as it leaves the kitchen and the weight of leftover diet. The method is only for research purposes when facilitates from chemical analysis are available.

### **Diet History:-**

Provide a more comprehensive assessment of diet and it permits investigation of lesser known or unidentified dietary factor that can be retained for future examination.

The normal daily dietaries are 1<sup>st</sup> recorded along with the left over of each meal, the composition, snacking etc. Seasonal variations are also included.

Advantage

It is inexpensive and convenient

The representative and large sample size / events

Disadvantages:

It demands greater **compartment** , personal character of the investigator.

Does not give precise data on individual food consumption.

Diet histories are subject to problems of recall.

Nutrient uptakes tend to be overestimated especially from trace elements.

**Food frequency method:** - Intakes in terms of frequency with which various foods items are consumed is recorded.

**Questionnaire method:** - It is identical to diet history. Questionnaire are sent to the respondents to fill and return.

**Advantage:**

- (1) It is possible to collect data in large samples in short period with a small budget.
- (2) Random samples can be used.

**Food composite analysis for laboratory estimate**



This method involves sampling of each item during meals with subsequent blending of representative samples and analysis for various nutrients.