

## 1. Details of Module and its structure

Module Detail	
Subject Name	Food, Nutrition for Healthy Living
Course Name	Food, Nutrition for Healthy Living
Module Name/Title	Assessment of Nutritional Status - I
Module Id	FNHL_10102
Pre-requisites	General knowledge about Nutritional status of individuals
Objectives	<p>After going through this lesson, the learners will be able to do the following :</p> <ul style="list-style-type: none"><li>• Express the concept and importance of assessment of nutritional status.</li><li>• Identify the methods of nutritional assessment.</li><li>• Determine the meaning, advantages and limitations of anthropometry.</li><li>• Select appropriate materials and methods for common anthropometric measurements.</li><li>• Use anthropometric methods for assessing nutritional status.</li></ul>
Keywords	Concept and importance of nutritional assessment, Methods of assessment, Anthropometry

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### **1. INTRODUCTION**

People have different weight and height – some are thin while some are fat; some are tall while some are short. They may also differ in terms of paleness and dryness of their skin and eyes – some may have dry and dull skin and eyes, while others may have bright eyes and clear skin. Some may be able to see in the dark while some cannot. Some people of the same age may eat much more than the others; and they may also have different blood hemoglobin levels. Have you ever wondered what these differences in people indicate? These indicate whether the people are adequately nourished or not and tell us about their nutritional status. Nutritional status of individuals is an important indicator of their health condition and largely depends on the food they consume. When you visit a doctor or a nutritionist, they ask you about the symptoms of your problem and check your body for any visible symptoms, look at your blood/ urine/ stool reports, or measure your weight and height; and ask you about your diet intake. They do this to assess and determine your nutritional and health status. In this and the following module, you will learn some important aspects of nutritional status and its assessment.

### **2. NUTRITIONAL STATUS – CONCEPT AND IMPORTANCE OF ASSESSMENT**

Nutritional status is the state of health that is affected by intake of food and utilization of nutrients in the body. It indicates whether a person is malnourished or normal. Nutritional status is likely to be good when a person consumes a diet that is sufficient to meet his needs to function optimally; while decreased or excessive food intake and inefficient utilization of nutrients may result in a person having a poor nutritional status. The spectrum of nutritional status spreads from severe undernutrition and nutrient deficiencies to obesity.

Nutritional status is influenced by multiple interrelated factors which may be categorized as internal or external factors. Internal factors include heredity, ethnicity, age, sex, food behaviour, physical activity, disease; while social, cultural, economic situation, food availability, access, safety etc. are the external factors. Some internal factors such as heredity and ethnicity that have an important influence on some of the health parameters such as an individual's height and weight cannot be

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modified. For example, Asians are normally shorter than their western counterparts. While some other modifiable internal as well as external factors such as food behaviour, lifestyle practices, economic condition, religious and cultural practices etc. may both deteriorate or improve the nutritional status. However, it is essential to first assess nutritional status so that it can be modified as desired. You will learn more about the factors causing malnutrition and strategies to improve nutritional status in a separate module.

Assessment of nutritional status of individuals and communities has several advantages; some of which have been enumerated as follows:

**o For individuals**

- It helps them know their state of nutrition/ malnutrition and take appropriate measures to improve it. It helps them decide what to eat, and what to avoid etc.
- It helps them identify their health problem - whether it is due to a deficiency, excess or imbalance of nutrients.

**o For communities**

- It helps to identify groups in the community who are malnourished or who are 'at risk' of becoming malnourished.
- It helps to determine the various factors in the community that contribute to malnutrition. These may be factors such as state of poverty, religious beliefs and cultural practices, availability of health and education related services, geographical and climatic conditions prevailing in the area that affect food availability etc.
- It helps to know the state of food and nutrition security in the community. This is indicated by how much food is available to the community members, whether it is being distributed properly among all members in required amounts, and whether people are suffering from diseases that can affect the effective utilization of the food consumed.
- It helps to estimate the nutritional problems of the community – whether the entire community or different genders or age groups are suffering from some specific nutrition-related problems. For example, one can know whether the prevalence of iron-deficiency anaemia is higher among adolescent females and pregnant women or it is the same in females and males of all age groups.
- It helps the government and other agencies to allocate their resources properly and plan suitable nutrition programmes for the communities to improve their nutrition situation and reduce mortality and morbidity related to malnutrition.

- It helps to evaluate the effectiveness of the nutrition programmes and interventions initiated for combating malnutrition in the communities.

Now that you know the importance of assessing nutritional status, let us learn about the different methods that can be used for assessment.

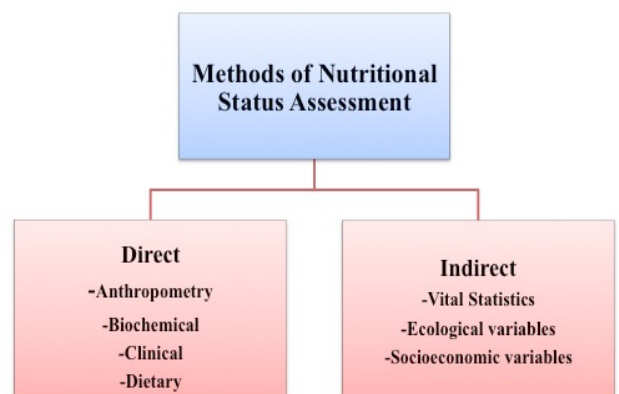
### 3. METHODS OF NUTRITIONAL STATUS ASSESSMENT

There are several methods of assessment of nutritional status having their own advantages and limitations. These have to be chosen with care. No single method may be ideal or most suitable for nutritional assessment. The method of nutritional assessment should be chosen depending on the number of people to be assessed, objective of assessment and the resources available. Most often, several methods may be used together so as to get a clear picture of the nutritional status of individuals.

Nutritional assessment may be done using direct or indirect methods.

Direct methods deal with the individual and measure certain indicators such as weight, height, clinical signs, food and nutrient intake, nutrients levels in blood and urine etc. The direct methods can be classified as the 'ABCD' methods which are:

1. **A**nthropometry
2. **B**iochemical
3. **C**linical
4. **D**ietary



Indirect methods use community health indices that reflect nutritional influences. These include vital and other health statistics, ecological and socioeconomic variables.

You will learn about the biochemical, clinical, dietary methods and indirect methods of nutritional assessment in the next module. In this module, you will learn about anthropometry as a method of assessment of nutritional status in detail.

### 4. ANTHROPOMETRY

It involves measurement of the physical dimensions, proportions and gross composition of the body at various ages and levels of nutritional status and comparing them with age and sex appropriate standards. In simple words, it is the measurement of body size and includes measurements such as

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weight; height; arm, chest and head circumferences; and skinfold thickness etc., all of which are valuable indicators of nutritional status.

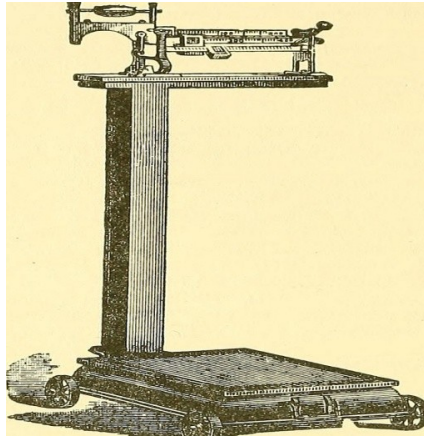
Measurement of changes in body size over a period of time helps us to know whether there is appropriate growth occurring or not, especially in infants and children. In adults too, loss of body weight or gain in fat or muscle mass will indicate their food intake and nutrient utilization. For making use of simple body measurements such as height, weight, and body circumferences it is essential to know the correct age, especially in case of children. If the correct age is not known, it will not be possible to assess their nutritional status accurately. Age should be calculated from the date of birth which could be obtained from the birth certificate, school or other records of the child. If it is not known, as may be the case in some disadvantaged families, a local calendar of events depicting festivals, cropping patterns etc. can be prepared to estimate the child's age. For example, if the mother informs that her child was born two days after the festival of *Basant Panchami* in the year 2015, and if the date of this festival (24<sup>th</sup> January, 2015) is marked in the local calendar for that year, the child's current age can be easily computed. Sometimes, attainment of milestones such as eruption of teeth; start of crawling, sitting, walking etc. may be used to estimate the age of the child.

Some of the commonly used anthropometric measurements are discussed as follows:

**a. Weight:**

Body components such as body water, fat, muscle, bone etc. together constitute the body weight. Weight is simple to measure and is easily understood by all people alike, even if they are uneducated or illiterate. Compared to other body measurements such as height, it reflects a more recent status of nutrition and is sensitive to even small changes in nutritional status. Weight may be measured at one time; or several measurements may be done over a period of time as is done for monitoring the growth of infants and young children.

Weighing instruments are of two types, i.e. spring balance and beam balance; and the accuracy of measurement depends on the type chosen. Though beam balance type weighing scales are more accurate, the spring balance type is used more frequently in the field due to easy portability. However, both types of balances should be periodically tested for accuracy using known standard weights. The zero error of the weighing scale should be checked and the reading should be adjusted to zero before measuring body weight. The individual while being weighed should be wearing minimal clothing, and be without shoes and any other accessories.



**Weighing equipment**  
– beam balance type



**Weighing equipment**  
– spring balance type

**b. Height:**

The skeletal size of individuals is referred to as their height. It is influenced by both genetic and environmental factors. Though the maximum height attained by individuals is dependent on their genes, the environmental factors such as good nutrition help in achievement of their maximum genetic potential. Therefore, height is a useful measure of nutritional status as optimum nutrition and healthcare help individuals to attain their maximum height and lack of it may result in growth retardation or stunting.

Several equipment such as non-stretchable flexible tape, anthropometric rod, wall mounted staturemeter, stadiometer etc. can be used to measure the height of individuals. It should be measured with the individual standing barefoot and erect on a flat surface with the arms hanging naturally at the sides. The feet should be together and the heels, buttocks, shoulders and back of the head should be touching the wall or the measuring board. The individual should look straight ahead and then a horizontal bar, or a rectangular block of wood or the headpiece of anthropometric rod or stadiometer etc. should be made to rest on top of the head without applying pressure. The height is measured at this point to the nearest 0.1cm. In case of infants and young children who cannot stand, infantometers are used to measure their length in reclining position.





**Height measurement  
using stadiometer**

**Length measurement  
using infantometer**

**c. Body circumferences:**

Circumference measurements of mid upper arm, head and chest are useful measures of undernutrition in infants and young children. All these measurements can be made using non-stretchable flexible measuring tapes.

Arm circumference comprises bone, muscle and fat; of which fat and muscle are respectively the energy and protein reserves of the body. In case of undernutrition, especially deficient intakes of energy and protein, these reserves are reduced thereby, decreasing the arm circumference. Between 1 to 5 years of age, the arm circumference remains constant as during this time, the baby fat is replaced with the muscle. Measuring mid upper arm circumference (MUAC) is useful for assessing thinness or muscle wasting in the age group of 1 to 5 years and a value less than 13.5cm indicates that the child is suffering from Protein Energy Malnutrition (PEM).



**Measurement of mid  
upper arm circumference**

Head circumference is mainly related to the brain size which increases rapidly during the first year of life and thereafter, increases slowly. It is measured at the broadest circumference of the head and in case of Protein Energy Malnutrition, the increase in its size is compromised. Chest circumference also reflects growth failure and along with head circumference, it is useful to detect PEM in children. If the child is



**Measurement of head  
circumference**

well nourished, the chest circumference becomes larger than the head circumference at around six months of age. Thereafter, the skull grows slowly while the chest grows more rapidly. Therefore, a head circumference to chest circumference ratio of more than one is indicative of PEM in children between the ages of six months to five years.

Measurement of Waist and Hip circumferences is useful for assessing the extent of obesity and therefore, the risk of cardiovascular and other lifestyle diseases. Adult men with waist circumference  $\geq 102$  cms and adult women with  $\geq 88$ cms are considered as having abdominal obesity. For Asian adult men and women, these values are 90 cms and 80 cms respectively. Waist hip ratio (WHR) can be calculated by dividing the waist circumference by hip

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circumference values. Adult men with WHR of  $\geq 0.95$  and women with  $\geq 0.80$  are considered as having central obesity.

**d. Skinfold thickness:**

It is a measure of subcutaneous fat, i.e. fat under the skin, and reflects the fat reserves in the body. Insufficient intake of food over a long period of time reduces the thickness of fat layer under the skin, and is thus indicative of undernutrition. Skinfold measurements are made at different sites of the body such as biceps and triceps etc., using skinfold calipers. This method, however, requires well-trained expert personnel, and is not a very commonly used anthropometric method.



**Skinfold calipers**

For getting reliable results through anthropometric assessment, the following is extremely important:

- Selection of appropriate equipment
- Use of appropriate techniques
- Standardization and accuracy in taking measurements
- Selection of appropriate reference data for interpretation of results.

Body measurements obtained from healthy well-to-do population are referred to as 'reference standards' or 'reference values'. The measurements that you take are compared with these reference values to get information about the nutritional status. Availability of appropriate reference data is extremely important for any meaningful interpretation of anthropometric measurements. Different countries may develop their own reference data or use data given by International agencies such as the World Health Organization (WHO). However, international reference values may not always be very useful as they may not take care of genetic and ethnic variations among individuals from different parts of the world. Therefore, as far as possible, local reference values which are based on the Indian population such as those given by Indian Council of Medical Research (ICMR) can be used for nutritional assessment of Indians.

In 2006, WHO released the International Child Growth Standards for infants and young children by age as well as gender. These standards are based on a multi-country study conducted on more than eight thousand children. These standards known as the WHOMGRS Child Growth Standards confirm that across large populations, regionally and globally, the average growth among children is remarkably similar if given an optimum start in life. These standards prove that difference in



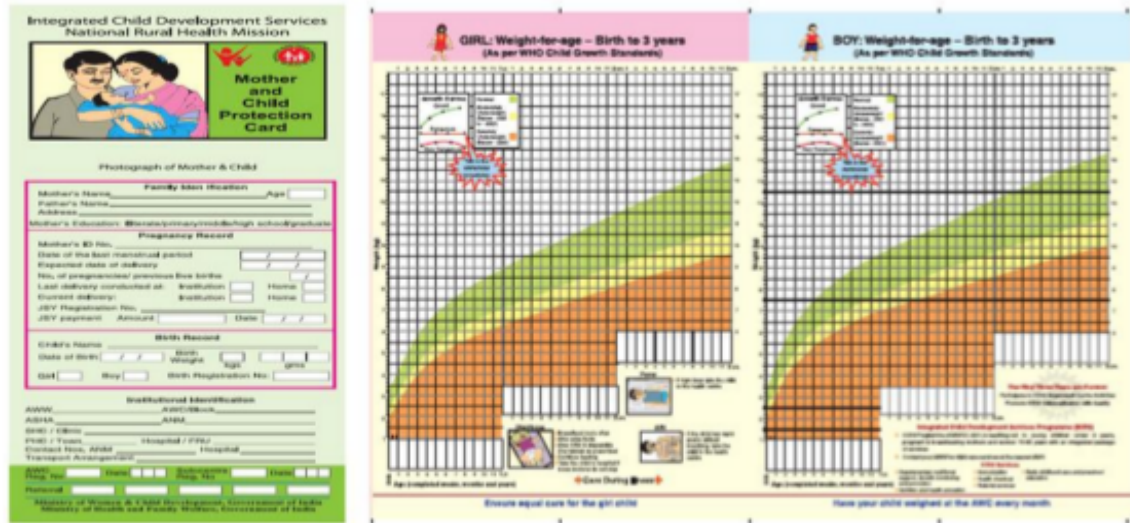
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children's growth till the age of five years is influenced more by nutrition, feeding practices, environment and health care than genetics or ethnicity. Based on these standards, WHO has also brought out reference values for older children in the age group of 5 – 19 years. These reference values can be used for Indian infants and children and are available at [www.who.int/childgrowth/en](http://www.who.int/childgrowth/en). Based on age and weight and/ or height measurements, the following indices are there which indicate the nutritional status of individuals.

**1. Weight-for-age:** This index reflects both past (chronic) and/ or present (acute) malnutrition, although it is unable to distinguish between the two and is recommended as the indicator to assess the changes in magnitude of malnutrition over time. Low weight-for-age identifies the condition of being underweight for a specific age. The WHO reference charts and tables for weight-for-age for children between 5 – 10 years are available at [http://www.who.int/growthref/who2007\\_weight\\_for\\_age/en/](http://www.who.int/growthref/who2007_weight_for_age/en/)

Under Integrated Child Development Services (ICDS) Scheme and National Rural Health Mission (NRHM), growth monitoring of children is done with the help of growth charts using weight-for-age index. These growth charts are based on the WHO Child Growth Standards. As per these standards, there are separate Growth Charts for girls and boys, as they have different weights and lengths beginning at birth and grow to different sizes related to their age. Growth charts are used to identify normal growth for a given child, as well as growth problems or trends that suggest that a child is at risk of a problem, and for early preventive action. The following is a sample of the Mother and Child Protection Card which includes the growth charts for children.

**2. Height-for-age:** For children below 2 years of age, the index is referred to as length-for-age and for above 2 years of age, as height-for-age. Low length or height-for-age is called stunting. This index cannot measure short term changes in malnutrition. It is often a consequence of chronic or long duration nutrition deprivation. The WHO reference charts and tables for weight-for-age for children between 5 – 19 years are available at [http://www.who.int/growthref/who2007\\_height\\_for\\_age/en/](http://www.who.int/growthref/who2007_height_for_age/en/)



Mother and Child Protection Card –  
Front Cover and Growth Charts

3. **Weight-for-height:** It is a very useful index when exact ages are difficult to determine. Of the three anthropometric indicators, this one is the best indicator of current and acute malnutrition. Low weight-for-height is referred to as wasting. It results from failure to gain weight or actual weight loss that may occur due to inadequate food intake, incorrect feeding practices, disease, infection, or more frequently a combination of these factors.

4. **Body mass index(BMI):** It is measured as weight (in kg) divided by height<sup>2</sup> (in metres<sup>2</sup>). BMI has been used since the 1960s to assess obesity in adults. In normal adults, BMI ranges from 18.5 to 24.9; and the values below and above this range indicate underweight/ thinness and overweight/ obesity respectively. The International classification of adult underweight, overweight and obesity according to BMI is available at

[http://apps.who.int/bmi/index.jsp?introPage=intro\\_3.html](http://apps.who.int/bmi/index.jsp?introPage=intro_3.html)

Let us understand how to calculate BMI using the following example:

A 20 year old woman weighs 85.4kg, and her height is 1.67metres.

Using the formula, BMI can be calculated as:  $85.4 / (1.67)^2 = 85.4 / 2.79 = 30.61$

According to the International classification, this woman will be in **Obese Class I**.

With the availability of BMI cut-offs for children and BMI reference charts from 0 - 19 years given by the World Health Organization ([http://www.who.int/growthref/who2007\\_bmi\\_for\\_age/en/](http://www.who.int/growthref/who2007_bmi_for_age/en/)), the use of BMI has been extended for assessing thinness in children and adolescence.

If you are 19 years or below and you check your own BMI in these tables (based on percentiles) to assess whether it is normal or not, you must know that BMI below 5<sup>th</sup> centile for age and gender is considered as undemourished, between 5<sup>th</sup> and 85<sup>th</sup> centiles as normal, between 85<sup>th</sup> and 95<sup>th</sup> centile as overweight and more than 95<sup>th</sup> centile as obese. The tables in percentiles for girls between 5 – 19 years are available at [http://www.who.int/growthref/bmifa\\_girls\\_5\\_19years\\_per.pdf?ua=1](http://www.who.int/growthref/bmifa_girls_5_19years_per.pdf?ua=1) and for boys at [http://www.who.int/growthref/bmifa\\_boys\\_5\\_19years\\_per.pdf?ua=1](http://www.who.int/growthref/bmifa_boys_5_19years_per.pdf?ua=1).

**Example:** If a 15 years and 4 months (15:4) old boy has a BMI of 24.2, he will be categorized as overweight as this BMI value lies between the 85<sup>th</sup> and 95<sup>th</sup> centile as per the BMI for age reference values for boys.

In terms of Z-score (SD), the following cut-off values will be used:

Classification	Z-score values
Obesity	>+2 SD
Overweight	>+1 SD
Thinness	< -2 SD
Severe thinness	< -3 SD

The tables in percentiles for girls between 5 – 19 years are available at [http://www.who.int/growthref/bmifa\\_girls\\_5\\_19years\\_z.pdf?ua=1](http://www.who.int/growthref/bmifa_girls_5_19years_z.pdf?ua=1) and for boys at [http://www.who.int/growthref/bmifa\\_boys\\_5\\_19years\\_z.pdf?ua=1](http://www.who.int/growthref/bmifa_boys_5_19years_z.pdf?ua=1).

So if we take the above example of a 15 years and 4 months (15:4) old boy who has a BMI of 24.2, he will be categorized as overweight as his BMI value lies between +1SD and +2SD values as per the BMI for age reference values for boys.

Anthropometry as a method of assessing nutritional status has some advantages and limitations.

#### Advantages:

- It is a relatively simple and objective method. It can be performed by individuals at home also.
- It can be done on a large sample.
- It is relatively economical to carry out as it does not require any sophisticated equipment or chemicals.
- It requires minimal training of the investigators.

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- It gives information about growth in terms of body size, proportion and composition of human body. It is easily understood and well accepted by the population at large; and helps them to take corrective measures to improve their nutritional status.

**Limitations:**

- It has limited nutritional diagnosis and may not be able to indicate specific nutrients responsible for malnutrition.
- Nutritional inadequacy/ imbalance may already be there for quite some time before it gets reflected through anthropometric measurements.

**5. SUMMARY**

In this module, you have learnt the meaning of nutritional status and the reasons its assessment is important for both individuals and groups. You now know the direct and indirect methods of nutritional assessment. Anthropometry, which is a direct method of assessment of nutritional status involves simple measurements like weight, height, body circumferences and skinfold thickness. There are several equipment that can be used to take these measurements. However, after the measurements have been taken, they have to be interpreted correctly using appropriate reference standards so as to decide whether the individuals are malnourished or adequately nourished. Anthropometry has its own advantages and limitations as a method of nutritional assessment and may be used when it seems to be an appropriate method depending on the objectives of assessment and resources available.