

NUTRITION SCIENCE



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NUTRITION SCIENCE



ABSTRACT:- Nutrition is the science that interprets the nutrients and other substance in food in relation to maintenance, growth, reproduction, health and disease of an organism. It includes ingestion, absorption, assimilation, biosynthesis, catabolism and excretion.

INTRODUCTION TO NUTRITION SCIENCE

Nature has provided a variety of foods for man to consume & be healthy. We consume and food for maintenance of health, grow and to develop greater resistance against infections.

Food contains substances called nutrients in varying proportions, which are needed for proper growth and maintenance of life processes. Knowledge of the functions of these nutrients & major food sources is necessary for man to formulate a nutritious diet.

DEFINITION AND HISTORY OF NUTRITION

Nutrition is defined as a science concern with the role of food & nutrients in the maintenance of health.

Nutrition is defined by Robinson (1982) is “the of food and nutrients, their actions, interactions and balance in relationship to health and disease, the processes by which the organism ingests, digest, absorb, transports and utilizes nutrients and disposes of their end products.”

Nutrients are the constituents in food that must be supplied to the body in adequate amounts. These include carbohydrates, proteins, fats, minerals and vitamins. Nutritional status is the condition of health of the individuals as influenced by the utilization of the nutrients.

The science of nutrition has been developed by using the combined knowledge of the physical and biological sciences. Their application involves the social sciences related to man’s behavior – psychology, sociology, anthropology and economics.

Until World War 1 the significance of nutrition was recognized by a relatively small group of scientists and physicians. Since then, a wider awareness has developed on the role nutrients in health of individual and the economics development of the nation.

A great number of important discoveries and developments in this field have enabled health care professionals to understand the nutrients needs of people and the means of supplying them. It is difficult to set in a

Chronological order of events that show the development of nutrition. Many aspects developed simultaneously or overlapped each other. Some discoveries went unnoticed for several years because scientific attention was occupied with other development and theories.

Some progresses were stimulated by national emergencies. Others depended on technical development of the supporting sciences. Nutrition research in India, as beri - beri inquiry was started in 1918, under the guidance of sir Mc carrions at coonoor in south India.

It has blossomed into an important national institution, at Hyderabad called national institute of nutrition. It is currently engaged in carrying out basic as well as applied research work in nutrition. This national institute comes under the Indian council of medical research (ICMR).

RELATION BETWEEN GOOD NUTRITION AND HEALTH

Health is defined by the world health organization (WHO) as the “state of complete physical, mental and social well being and not merely the

Absence of disease or infirmity’’. To maintain good health and nutritional status one must eat a balanced food, which contains all the nutrients in the correct proportion.

The essential requisites of health would include the following:

1. Achievement of optimal growth and development, reflecting the full expression of one’s genetic potential.
2. Maintenance of the structural integrity and functional efficiency of body tissues necessary for an active and productive use.
3. Mental well – being
4. Ability to withstand the inevitable process of aging with minimal disability and functional impairment.
5. Ability to combat disease such as
 - Resisting infections
 - Preventing the onset of degenerative diseases
 - Resisting the effect of environmental toxins/ pollutants

Till three decades ago the role of nutrition in growth and development and tissue integrity alone was clear, but now the persuasive role nutrition plays in the other dimensions of health is implicit.

CONCEPT OF MALNUTRITION- UNDER NUTRION AND OVER NUTRITION AND OVER NUTRITION

Malnutrition as defined by world health organization (WHO) is a pathological state resulting from a relative from a relative or absolute deficiency or excess of one or more essential nutrients, this state being clinically manifested or detected only by biochemical, anthropometric or physiological tests.

Four forms can be distinguished:

Under nutrition - the pathological state resulting from the consumption of an adequate quantity of food over an extended period of time.

a) Marasmus is synonymous with severe under nutrition. Starvation implies total elimination of food over an extended period of time.

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a) Specific deficiency – the pathological state resulting from a relative or absolute lack of an individual nutrient.

b) Over nutrition – the pathological state resulting from a disproportion of essential nutrients with or without the absolute deficiency of any nutrient as determined by the requirement of a balanced diet.

**SIGNS OF WELL NOURISHED CHILD AS AGAINST THOSE OF AN
ILL NOURISHED CHILD**

Table

| S.no. | Signs of well nourished child | Signs of ill nourished child |
|--------------|---|--|
| 1. | Skin is smooth, pliable and elastic and of a healthy color. | Lack of color of skin -paleness |
| 2 | Bright and clear eyes and pink eye membranes | Pale, dark red or purple mucous membrane lining the eyes. Failing eye sight. |
| 3 | Firm pink nails | Rigid brittle nails. |
| 4 | The hair is lustrous and firmly attach to the scalp. | Dull hair lacking sheen, dry, and can be easily plucked. |
| 5 | Healthy gums and membrane of the mouth | Pale, dark red or purple colour of gums. |
| 6 | Reddish pink tongue. Not coated, pink lips. | Sores on skin, lips or tongue, pale lips. |
| 7 | Desirable height for age and desirable weight for height. | Stunted growth and weight deficit. |
| 8 | Good appetite and sound nutrition. | Loss of appetite ,digestive disturbances, |
| 9 | Normal body temperature, pulse rate and breathing rate. | Above normal body temperature, shortness of breath while performing normal activity. |
| 10 | Healthy children are alert. | Listless, irritable and depressed. |

NEED FOR METHODS OF ASSESSING NUTRITIONAL STATUS

Nutritional status is the conditions of health of the individual as individual as influenced by the utilization of the nutrients. It can be determined by correlation of information obtained through medical and dietary history thorough physical examination and laboratory investigation.

Nutritional assessment aids in identifying

- a) Under nutrition
- b) Over nutrition
- c) Nutritional deficiencies
- d) Individuals at the risk of developing malnutrition
- e) Individuals at the risk of developing nutritional related diseases
- f) The resources available to assist them to overcome nutritional problems.

The nutritional status can be assessed by the following methods:

- I. Direct methods
 - a) Nutritional anthropometry
 - b) Clinical examination
 - c) Biochemical tests and
 - d) biophysical
- II. Indirect methods
 - a) Vital statistics of the community
 - b) Assessment of socio-economic status
 - c) Diet surveys

ANTHROPOMETRIC MEASUREMENTS AND INDICES

Nutritional anthropometry is concerned with the measurements of the variations of physical dimensions and body compositions at stages of life cycle and different planes of nutrition. It is a field-oriented method, which can be easily adopted and interpreted.

The basic measurements which should be made on all age groups are weight in kg, length / height and arm circumference in cms. In young children it should be supplemented by measurements of head and chest circumference.

Weight:

Weight gain is an indicator of growth in children. It is measured with the help of the weighing scale. Body weight should be determined after the first void and before ingestion of food.

The weight for age can be compared with the standards of ICMR and the nutrition status can be interpreted.

The standard reference body weight (kg) of Indians of different age groups is given in the table:-

Reference body weights (kg) of Indians of different age groups

| Reference body weight (kg) | | | |
|----------------------------|------------|-------|--------|
| | Age(years) | Male | Female |
| Infants | 0-1/2 | 5.4 | 5.4 |
| children | ½-1 | 8.6 | 8.6 |
| | 1-3 | 12.61 | 11.81 |
| | 4-6 | 19.20 | 18.69 |
| | 7-9 | 27.00 | 26.75 |
| | 10-12 | 35.54 | 37.91 |
| Adolescents | 13-15 | 47.88 | 46.92 |
| | 16-18 | 57.28 | 49.92 |
| | 20-50 | 60 | 60 |

Source: ICMR 2002. Nutrient requirements and recommended dietary allowances for Indians. NIN.

Anthropometric indices: weight for age:- The nutritional status can be interpreted using Gomez classification as follows

Weight $\geq 90\%$ weight for age. Normal

76- 90% weight for age. Grade 1 malnutrition

61 \leq 75% weight for age. Grade 2 malnutrition

$\leq 60\%$ weight for age. Grade 3 malnutrition

Linear measurements

Two types of linear measurement are commonly used.

- i. Height or length of the whole body
- ii. Circumference of the head and the chest.

Table

The standard references height for Indians of different age groups

| Age (years) | Height in cm | |
|-------------|--------------|--------|
| | Boys | Girls |
| 1+ | 80.07 | 78.09 |
| 2+ | 90.01 | 87.93 |
| 3+ | 98.36 | 96.21 |
| 4+ | 104.70 | 104.19 |
| 5+ | 113.51 | 112.24 |
| 6+ | 118.90 | 117.73 |
| 7+ | 123.32 | 122.65 |
| 8+ | 127.86 | 127.22 |
| 9+ | 133.63 | 133.08 |
| 10+ | 138.45 | 138.90 |
| 11+ | 143.91 | 145.00 |
| 12+ | 148.91 | 150.98 |
| 13+ | 154.9 | 153.44 |
| 14+ | 161.70 | 155.04 |
| 15+ | 165.33 | 155.96 |
| 16+ | 168.40 | 156.00 |

Source: ICMR 2002. Nutrient requirement and recommended dietary allowances for Indians. NIN.

Head circumference:

The measurement of the Head circumference is a standard procedure to detect pathological condition in children. Head circumference is related mainly to brain size. At birth the circumference of head is greater than that of the chest.



Measuring head circumference

Source: Jelliffe, D.B., 1989, The Assessment of Nutritional Status of the community WHO Monograph Series, Geneva

Chest circumference:

The circumferences of the head and the chest are about the same at 6 months of age. After this the skull grows slowly and the chest more rapidly.

Therefore between the age of 6 months and five years the chest/ head circumference ratio of less than one may be due to failure to develop or due to wasting of muscles and fat of the chest.

In nutritional anthropometry the chest / head circumference ratio is of value in detecting under nutrition in early childhood.



Measuring chest circumference

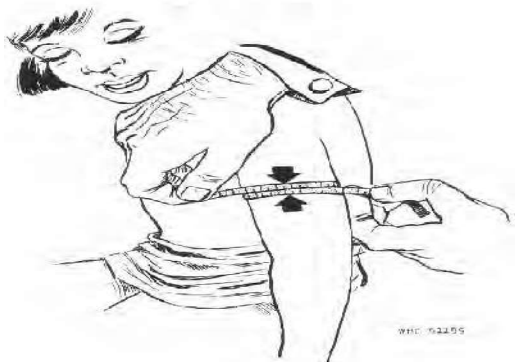
Source: Jelliffe, D.B., 1989, The Assessment of Nutritional Status of the community WHO Monograph Series, Geneva

Mid upper arm circumference (MUAC):

MUAC at birth in a healthy child is between 10-11 cm over the 1st year the increment in MAUC is 3 to 4 cm as the muscles of the arms start to develop. In the preschool age the increases in MUAC is only one cm. Hence there is not much difference between the MUAC of a 3 year old from that of a 5 year old. So MUAC is an age independent index.

The WHO has recommended 14 cm as a desirable value for MUAC for preschool children.

Hence in screening malnourished children in a community this method is used with ease. When the MUAC is less than 12 cm among 1-5 year old children they are designated as malnourished.



Measuring mid upper arm circumference

Source: Jelliffe, D.B., 1989, the Assessment of Nutritional Status of the community WHO Monograph Series, Geneva

CLINICAL SIGNS OF NUTRITIONAL DEFICIENCY DISORDERS

Clinical examination is an important practical method for assessing the nutritional status of a community. Essentially, the method is based on examination for changes, believed to be related to inadequate nutrition that can be seen or felt in the superficial epithelial tissues especially the skin, eyes, hair and buccal mucosa or in organs near the surface of the body such as the parotid and thyroid glands.

Clinical assessment must always be carried out by individuals with adequate training. The following simple guide is employed to interpret the following deficiencies.

Guide for the interpretation of deficiencies and identifying the clinical signs.

| Condition | Clinical signs |
|--------------------------------|--|
| i. Protein Energy Malnutrition | : Odema, depigmentation, sparseness and easy pluck ability of hair, moon face, Enlarged liver, muscle wasting. |
| ii. Vitamin A Deficiency | : Night blindness, bitot's spots in the eye, xerosis of skin. |
| iii. Riboflavin Deficiency | : angular stomatitis, cheilosis. |
| iv. Thiamine deficiency | : edema, sensory loss, calf muscle tenderness |
| v. Niacin deficiency | : raw tongue, pigmentation of the skin. |
| vi. Vitamin C Deficiency | : Spongy and bleeding gums. |
| vii. Vitamin D Deficiency | : Rickets, beading of ribs, knocks knees, bowed legs. |
| viii. Iron deficiency | : pale conjunctiva, spoon shaped nails. |
| ix. Iodine deficiency | : enlargement of thyroid gland. |

Biophysical methods:

The biophysical methods are used to assess the alterations in functions associated with inadequate nutrition. For e.g. Dark adaptation test is used to evaluate the ability to see in the dim light.

Biochemical test:

Biochemical tests can be used to detect the deficiencies by analysis blood, urine, stools and phlegm. For e.g. Estimation of hemoglobin in blood to detect iron deficiency.

Indirect method:**Vital statistics:**

Malnutrition influences morbidity, mortality life expectancy and other health statistics. Hence vital statistics may therefore be considered as indirect indication of the nutritional status of the community.

Infant mortality rate, maternal mortality rate and morbidity rate are the vital statistics that can be used to assess the nutritional status of the community.

Assessment of socio- economic status:

Low food availability, increased family size, unsanitary living conditions, inadequate knowledge of nutritional needs, inappropriate weaning practices are powerful social cultural and economic factors, which influence nutritional status.

Diet surveys:

Diet surveys are helpful in studying the quality and quantity of food consumed by the family and the community. The techniques of collecting information on family food consumption include:

- 1) **Food inventory method:** this method is usually employed in institutions where homogeneous group of people take their meals in a common kitchen eg. Hostels, orphanages. In this method the amount of food stuff issued to

The kitchen as per the issue register is taken into consideration. No direct measurement or weighing is done. A study period of one week is desirable.

- 2) **Food expenditure pattern method:** in this method information on the amount spent on the food and non food items during the previous month or week is collected using a questionnaire. This method avoids actual weighing of foods.
- 3) **24 hour recall:** in this method a set of standardized cups suited to local conditions are used. The standard cups help the respondent to recall the quantities of the food prepared and fed to individual's members on the previous day. This is usually done for the three consecutive days. The advantages of this method is that the intake of each food item by the specific individuals in the family such as pre- school child, adolescent, pregnant women's can be assessed using the cups.
- 4) **Weighment method:** in this method, the food either raw or cooked is actually weighed using an accurate balance. It is ideal to conduct the survey for seven consecutive days. Every day food is weighed in the morning and evening before actual cooking. The age, sex, physiological status of the family members should be noted down. Nutrient intake is then calculated using the ICMR food composition tables. Though this method is accurate as the foods are directly weighed, it requires extreme co-operation of the house wives.
- 5) The information on foods and nutrient consumption is compared with the allowances of the ICMR and the adequacy is determined. A combination of dietary, clinical and biochemical assessment is desirable for the assessment of the nutritional status of individuals or communities.
- 6) **Diet history:** this method is useful for obtaining qualitative details of the diet and studying patterns of food consumptions at households and industrial levels. The procedure includes assessment of the frequency of consumptions, different foods, daily or numbers of items in a week or for night or occasionally. This method is used to study meal pattern, dietary habits, food preferences, and avoidances during sickness.



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