

E-text compendium on



# COMMUNITY NUTRITION

FND-314



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## **DISCLAIMER**

The E-Compendium on **COMMUNITY NUTRITION** is prepared according to the syllabus offered to students of College of Community and Applied Sciences, MPUAT, Udaipur, enrolled for undergraduate degree programme in Food Nutrition and Dietetics.

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# Community Nutrition

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## UNIT 1

### BASIC CONCEPT OF COMMUNITY NUTRITION ROLE OF NUTRITIONIST IN IMPROVING NUTRITION IN COMMUNITY

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It has long been recognized since Ancient times that food habits influence physical strength and the development of certain disease conditions. In the scientific era, a great body of evidence supports the role of diet in the onset of many chronic diseases (OMS, 1990; WRCF, 1997; Kafatos & Codrington, 2001).

The 21st century is open to nutrigenomics and the possibility to design optimal feeding strategies and nutrition fitting individual needs on the basis of genetic determinants. Scientific evidence has placed community nutrition among the front line strategies in health promotion and as an obligatory area to be included in every health plan.

#### Definition

Community nutrition is the process of helping individuals and groups develop healthy eating habits in order to promote wellness and prevent disease.

Community nutrition incorporates the study of nutrition and the promotion of good health through food and nutrient intake in populations.

Community nutrition (public health nutrition) requires a population approach. The community rather than the individual is the focus of interest. This area of nutrition focuses on the promotion of good health and the primary prevention of diet-related illness. The emphasis is on maintenance of health in the whole population, although it will also include working with high-risk groups and other subgroups within the population. Community nutrition includes nutritional surveillance; epidemiological studies of diet; and also the development, implementation, and evaluation of dietary recommendations and goals. A community may be any group of individuals, for example, the population of a town or country, or the residents of an old people's home.

**The goal** of community nutrition is to educate individuals and groups so that they adopt healthy eating habits. Dieticians and nutritionists work with many other health care professionals in promoting improved community nutrition. Their efforts emphasize a preventive approach in educating individuals in how a change in dietary habits will reduce the risk of illness. Community nutrition focuses on all age groups. The groups targeted range from babies to pregnant women to older adults. For example, a young pregnant woman may not realize how poor eating habits affect her developing fetus or she may be unaware of the importance of breastfeeding. Older adults may lose interest in eating due to loneliness, inability to prepare meals, or a physical condition such as difficulty chewing. Individuals with diabetes may not understand the need to control their blood glucose levels through diet as well as medication.

Obesity is an issue for many age groups. Causes include lack of physical education programs in schools and an overly busy lifestyle for adults. The availability of fast food and “supersized” items are regarded

positively because of their cost and convenience. Their accessibility and convenience often prompts people to make unhealthy food choices. In a school cafeteria, for example, a child may bypass a salad in favor of fries and a soda. A moviegoer may choose to buy a tub of buttered popcorn because the purchase price includes a free refill.

Community nutrition programs attempt to change attitudes so that a diet rich in fruit, vegetables, and whole grains is more appealing than diet high in fats and sugars. While sweet, high fat foods may be an occasional treat, community nutrition emphasizes a lifetime of routine healthy eating.

### **Precautions**

Since the objective of community nutrition is for people to adopt healthy eating habits, there are usually no reasons that a person would be prevented from participating in a community nutrition program. Some individuals such as those with diabetes who participate in community nutrition programs may have special dietary needs.

### **Description**

Community nutrition programs are administered by organizations such as public health agencies, public schools, residential facilities for the elderly, hospitals, social service organizations, and health-care systems. Programs range from lunch programs for school children and senior citizens to health fairs and “5-A-Day” public awareness promotions that urge the public to eat at least five fruits and vegetables every day.

Health care professionals may develop a community nutrition project aimed at groups such as new immigrants or the elderly. They may implement an existing project such as a food distribution program. Nutritionists and dietitians may work as part of a team with representatives from other groups such as businesses, schools, or churches. Sometimes nutrition programs are linked with exercise programs.

Participants may need to meet eligibility requirements for some programs. These projects may be limited to people of a certain age or income level. Some community nutrition programs, such as lunch programs, are ongoing. Others such as a diabetic cooking class have an established duration. Costs for programs vary. There is often no cost for public agency programs; however, classes offered by a health maintenance organization may not be covered by insurance. Community nutrition projects may also be operated by groups such as social service agencies and churches.

Community nutrition addresses health conditions such as obesity and economic conditions such as poverty, which limit access to healthy food, lack of nutritional information, and cultural traditions that promote unhealthy eating. Community nutrition programs strive to improve eating habits through food banks that distribute food as needed. Some cities have monthly food distribution programs. Distributors provide discounted packages that contain healthy foods such as meat, eggs, vegetables, fruit, bread and rice.

## **Community Nutrition Programmes (Objectives)**

- To improve overall nutritional status vulnerable group
- To overcome specific nutritional deficiencies among mothers and children
- To help to achieve better nutrition through indirect schemes

## **UNDERSTANDING THE TERMS: NUTRITION, HEALTH AND PUBLIC NUTRITION**

The terms nutrition and Health are often used in daily life, though not so often the term "public nutrition". To study the course of public nutrition in detail, it is important to gain a good understanding of these terms - nutrition, health and public nutrition in a scientific way.

### **Nutrition**

Nutrition may be defined as the science of food and its relationship to health. It is concerned primarily with the part played by nutrients in body growth, development and maintenance. Good nutrition means, "Maintaining a nutritional status that enables us to grow well and enjoy good health." The subject of nutrition is very extensive. Since our concern is with community aspects of nutrition, it is paramount to understand the other two terms i.e. health and public nutrition. Let us try to understand what health means.

### **Health**

The most widely accepted definition of health is the one given by WHO (1948) in the preamble to its constitution. WHO definition has recently been expanded and includes "the ability to lead a socially and economically productive life". However; this concept of health is considered idealistic by many people and by using this yardstick very few, if any, would qualify as being healthy. But, if people consciously follow this goal, then it would enable most people to achieve more positive side of health. In the absence of a better way of defining health, this definition of health continues to have universal acceptance.

### **WHO Definition of Health**

It states "Health is a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity."

WHO definition has recently been expanded and includes "the ability to lead a socially and economically productive life".

### **Public Nutrition**

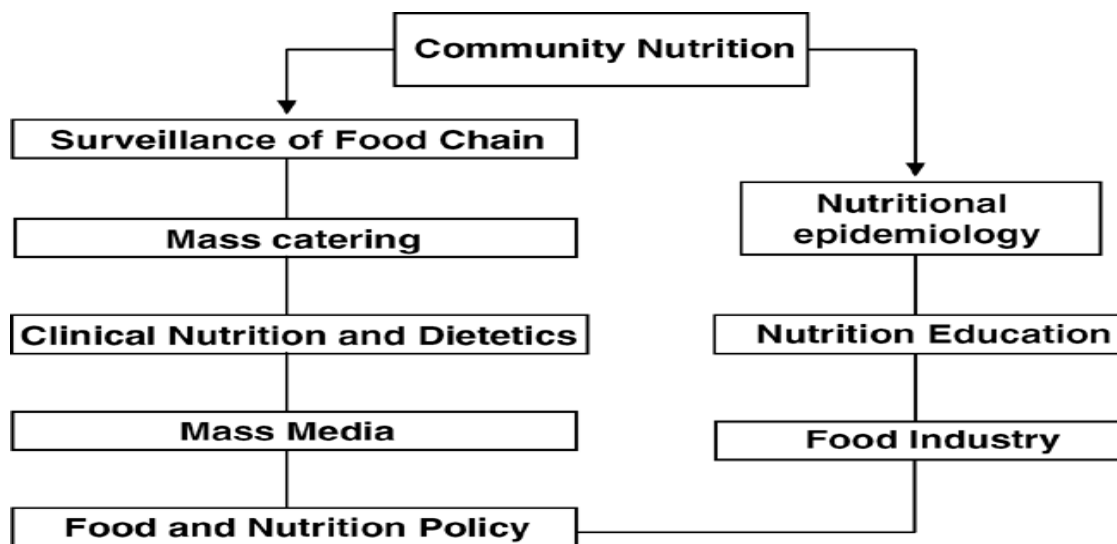
Public nutrition is concerned with improving nutrition in populations in both poor and industrialized countries, linking with community and public health nutrition and complementary disciplines. Public nutrition is an applied and very vast field. It includes many activities as follows:

- an understanding and a raising awareness of the nature, causes and consequences of nutrition problems in society,
- epidemiology, including monitoring, surveillance and evaluation,
- To nutritional requirements and dietary guidelines for populations,
- programmes and interventions: their design; planning, management and evaluation,
- community nutrition and community-based programmes,
- public education, especially nutrition education for behavioural change,
- timely warning and prevention and mitigation of emergencies, including the use of emergency food aid,
- Advocacy and linkage with, for example, population and environmental concerns, and public policies and programmes relevant to nutrition in several sectors, for example, economic development, health, agriculture and education.

### Concept and framework

Community nutrition has been defined as the group of activities linked to Applied Nutrition within the context of Public Health, whose main goal is to tailor individual and population food patterns according to updated scientific knowledge, in a certain region with a final aim of health promotion (Aranceta, 2001).

Figure 1 describes key elements of interest related to community nutrition action. These elements should be addressed by specific objectives in health plans and policies at the regional and national level.



A number of the areas covered by community nutrition are close to health care actions. Transition of individual patients through hospital and health care services is usually a short break in their living experience as an individual member within the community. Therefore, both areas of action must be coordinated in order to achieve the best nutrition condition prior to accessing the hospital or care services and the best possible condition when living in hospital and care premises and during convalescence stages.



At the population level, traditional food habits have progressively changed. In Spain, the traditional pattern was close to the so-called 'Mediterranean Diet' or other derived patterns with higher consumption of fish, dairy products, vegetables and wine, those called as Atlantic Diet in the last few years (Serra-Majem et al, 2002).

Changes have been more dramatic among children and young people, although it can be recognised in population subgroups or even among elderly people. Children and young people have higher consumption of refined cereal products, dairies, meat, butchery products and sausages; bakery products such as buns, cakes and biscuits, sugary and salted snacks, sweets and soft drinks (Serra-Majem et al, 2002).

The combination of the consumption pattern described above along increasing sedentary lifestyles have contributed to an important increase in the prevalence of overweight and obesity in children and adolescents. The prevalence of obesity in Spanish children has increased from 6.4% in 1984 to 13.9% in 2000 (Serra-Majem & Aranceta, 2001).

### **Key aspects**

Efforts should now focus on three key aspects: nutrition education in schools and in the community; food safety and enhanced culinary skills in all age groups.

### **Nutrition education**

It is required to structure health and nutrition education programmes to be implemented or included in the school curriculum. In many cases it would be required to organise additional workshop activities in order to master cooking and other preparation skills according to the developmental stage of children. Self-efficacy and responsibility for their own food habits should be fostered among children (Boyle & Morris, 1999).

Immigrants and some ethnic minorities are at risk of difficult adaptation to prevailing food patterns. In both cases, comfortable integration should be encouraged while being respectful to their own habits, culture and traditions. Objectives should be planned in the mid and long term as well, not only limited to the short term; thus 'politically correct' decisions may not always be acceptable.

School meals and other catering services provided at work or community sites should be consistent with the educational message. They are the closest chance to practice 'healthy eating'. Catering services should support educational activities as part of the same project. They should be acknowledged as profit companies, but not withstanding their three basic objectives: ensure adequate nutritional supply; foster healthy eating practices and encourage participation in gastronomic culture and social learning (Aranceta, 2001).

### **Food safety and food security**

Food safety has become a major priority for public health across the world. The concept includes the procurement of a safe adequate food supply in sufficient amounts to cover the nutritional requirements of all individuals (Aranceta, 2001).

On the basis of the responsibility of food producers and manufacturers, the food production chain and novel foods should be rapidly under programmes monitoring food safety and zero risk. Food trace-ability, monitoring and research related to their potential impact on health together with ongoing improvement of food labelling may contribute to reduce a new source of risks for consumers.

### **Culinary skills**

Healthy family meals need the consensus among all family members regarding daily foods available at home. It is required that all members in the family progressively are involved in the different tasks concerned, that is, buying food, preparing meals and planning the family menu.

Two additional variables should be considered for a healthy diet: time available to prepare and eat food and cooking skills. Many people do not have the skills or have lost any interest in food preparation, traditional cooking styles, low-fat cooking or how to prepare fruits and vegetables—which can be time consuming- in more attractive ways. Modern societies have lost cooking experts and have gained ‘food warming’ and fast food experts, who often base their diets on processed, frozen, canned or ready-to-eat foods.

This situation contributes to higher intakes of salt, hydrogenated fats, sugar, food additives, refined cereal foods linked to appealing foods due to their taste, flavour, texture, packaging, etc, which continuously invites consumption. Such a cooking style favours inadequate diets, with a poor content in regulatory elements and fibre while being highly energy dense.

## **ROLE OF PUBLIC NUTRITIONIST IN**

### **HEALTH CARE DELIVERY**

It is clearly evident that nutrition is an important, though not the only, determinant of health of an individual. The root cause of many health problems of the community can be traced to faulty nutrition. It could be a lack, excess or an imbalance of certain nutrients in the diet, which compromises the nutritional status leading to health problems. Hence, nutrition can be viewed as a subset of the set, health. Since, attainment of health for all is a universal goal of all nations and communities, public nutrition has to be an integral part of any strategy designed to achieve this goal. As signatory to the Alma Ata declaration, primary health care becomes the major approach to achieve an acceptable level of health for maximum number of people in the community. It has already been stated that the promotion of food supply and proper nutrition is one of the eight basic essential services included in the primary health care. Thus, we can conclude that public nutrition is an essential component of health and health care. The continuing changes in the health scenario of nations across the world present varied and newer challenges to the public nutrition professional.

## Concept of Public Nutrition

Public Nutrition involved with providing nutrition support in all health care activities. The shift in accent on health promotion from the earlier one primarily on prevention and cure has added more responsibilities to all those engaged in health care of the community. Today, much of the ill health is related to lifestyle and environmental factors whereas a lot of the illness could be attributed to the causation of germs when the first movement for public health began. Though the latter has been contained in the developed and less successfully in the developing nations, the former situation continues to be of concern in the public health arena. The public nutritionist equipped with the knowledge of food, nutrition and health is eminently suited to participate in all the strategies of health promotion required to combat this situation. In the Indian context, where under nutrition is extensively present in the preschool children and pregnant and nursing mothers on the one hand and the threat from lifestyle related health diseases like obesity and degenerative heart diseases show alarming trends on the other, the role of public nutritionist assumes tremendous importance along with responsibility. A public nutritionist can perform the following:

- ✚ In the hospital-based set up, she is a part of the team delivering therapeutic and rehabilitative services to the patient. She is responsible for food service management, nutritional care of the patients including diet counseling and imparting nutrition education to various categories of medical personnel. The Directorate General of Health Services has recommended the appointment of at least an assistant dietitian for every 100 bed hospital with progressive increase in their numbers as the hospital beds increase.
- ✚ There is a role for the public nutritionist in the national health set up at the centre as the Nutrition Advisor and Research Officer. At the State level, they can function as the State Nutrition Officers.
- ✚ The public nutritionist can make a significant contribution in all the programmes of development undertaken by voluntary, non-government organizations.
- ✚ At the international level organizations like WHO, FAO and UNICEF provide opportunities for public nutritionists at the policy making, planning and implementation stages.

From the discussions above, you must have realized that public nutritionist can perform wide variety of functions ranging from health promotion, curative services to advocacy and programme planning.

### The community dietitian role is to:

- Plan, implement and evaluate community nutrition programs for those groups identified as 'at risk'
- Network with Health Promotion and the Healthy Communities Coordinator to help facilitate health promotion activities around Federal, State and Local Government funding initiatives
- Advocate for and support healthy nutrition interventions within our AHS and provide nutrition education workshops for Community Health service providers and priority populations within the Hastings/Macleay Network
- Work inter sectorally with Community Service providers to improve the nutritional status of our local population.

## **“Let food be thy medicine and medicine be thy food.” — Hippocrates**

This idea that food should be our medicine is not a new one. In fact, it is the cornerstone of a modern day nutritionist's work. The role of a nutritionist is to help prevent disease and promote good health by encouraging an active lifestyle combined with healthy eating habits.

March has been designated as National Nutrition Month. This year's theme, “Savor the Flavor of Eating Right,” is aimed at encouraging mindful eating—the practice of being aware of how, when, why, and where we eat—while choosing nutritious and flavorful foods.

### **How Nutritionists Improve Health**

#### **1. Encourage Healthier Eating Habits**

Nutritionists use a scientific and food-based approach to evaluate an individual's eating habits and to create a personalized dietary plan. As a nutritionist, you will guide your clients toward eating fresh, natural foods, and offer accompanying education to further promote healthy eating.

#### **2. Help People Achieve Health and Weight Loss Goals**

Nutritionists help create individualized meal plans for improved weight, mood, and energy. Family meal planning is often part of a weight loss plan, as well. In addition to meal planning, a nutritionist may also suggest basic wellness supplementation to assist a client in achieving health and weight loss goals.

#### **3. Implement Behavioral-Change Modifications and Dietary Approaches**

The underlying behaviors that affect healthy lifestyle choices also need to be addressed and modified. A nutritionist can help a client identify destructive eating habits and help implement a healthier dietary plan. In addition, a nutritionist can assess a client's level and choice of activity and make appropriate modifications based on individual needs and goals.

#### **4. Suggest Ways to Improve Lifestyle and Manage Stress**



Nutritionists also teach classes on wellness and holistic nutrition to help clients improve their lifestyles and manage daily stress.

#### **5. Work with a Licensed Health Care Provider**

Nutritionists do not practice medical nutrition. They also do not diagnose or treat diseases. When a client has medical issues, a nutritionist will refer him or her to a licensed physician.

### **Career Opportunities**

As a certified nutritionist, there are a variety of nutrition-based career paths you can take:

-  Nutrition and wellness consultant
-  Nutrition coach

- ✦ Food or supplement salesperson
- ✦ Nutrition and wellness writer
- ✦ Wellness center specialist
- ✦ Weight-loss center specialist
- ✦ Health food and nutrition retail store management
- ✦ Nutrition and wellness instructor

Nutritionists work in a variety of settings, including hospitals, retail establishments, and public, or private fitness centers. After completing the required education—this varies according to the state you reside in and the career path you choose—you can then choose the setting where you would like to work.

As a nutritionist, you will be offering inspiration and encouragement to clients as they begin their journey towards health. As clients begin to understand why they need to make better food and lifestyle choices, you can encourage them to go beyond their goals and permanently alter how they approach their health.

## UNIT 2

### MAJOR NUTRITIONAL PROBLEMS PREVALENT IN INDIA AND THE STATE,

IRON DEFICIENCY ANAEMIA

VITAMIN A DEFICIENCY

IODINE DEFICIENCY DISORDERS

CALCIUM AND VITAMIN D DEFICIENCY

FLOURINE DEFICIENCY AND TOXICITY

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India is the second most populous country in the World next to China. Among its population majority of the people belongs to rural community and they are from low socio- economic status, illiteracy and lack of basic human needs. From the nutritional point of view majority are undernourished and only a small group are well-fed. The high income groups are suffering from the diseases of over nourishment.

The urban population is rapidly expanding because of large-scale migration to cities for a possible better life. The cities and towns are also expanding but the sheer volume of people compromises the ability of the city to meet their basic needs. A large proportion of this migrating population ends up residing in slums in inhuman conditions. As a result, urban poverty and hunger are increasing in many developing countries.

Lack of basic amenities like safe drinking water, proper housing, drainage and excreta disposal make this population vulnerable to infections which further compromises the nutrition of those living in the slums. It is projected that more than half of the Indian population will live in urban areas by 2020 and nearly one third of this urban population will be of slum dwellers. The ongoing process of rapid urbanization has deleterious repercussions on health and nutrition especially for children. Malnutrition in young children has long-term negative effects on physical and cognitive development. Addressing nutritional problems of urban poor is therefore must for overall development of the country.

### REASONS OF MAJOR NUTRITIONAL PROBLEMS IN INDIA

- ✓ Low socio economic status
- ✓ Illiteracy
- ✓ Lack of awareness regarding nutrients and their requirement
- ✓ Overpopulation
- ✓ Decreased food production
- ✓ Lack of health care facilities
- ✓ Large families
- ✓ Cultural influences
- ✓ Infections
- ✓ Over nourishment among the group of high socio economic status
- ✓ Superstitious beliefs, misconceptions
- ✓ Limited availability/ inadequacy of food products
- ✓ Dietary practices etc.

## IRON DEFICIENCY ANAEMIA (IDA)

### Introduction

1. In India IDA is an important public health problem.
2. It affects people from all walks of life.
3. The disease is of particular significance in preschool children, school going children and pregnant women because of high prevalence and adverse functions.
4. There is reduction in the hemoglobin level in anemia. WHO has suggested cut off points for Hemoglobin values for diagnosis of anaemia (WHO, 1972)

Group	Hemoglobin (g/dl)
Adult men	<12
Adult women	<12
Pregnant Women	<11
Lactating women	<12
Children up to 6 years	<11
Older children	<12

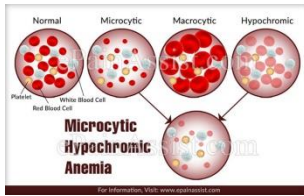
### Prevalence

Young children and pregnant women are the most affected group with an estimated global prevalence of about 40% and 50% respectively. Anemia is also prevalent in non pregnant women (35%) and among adult male (18%).

In India, its incidence varies from 20-70% and it is an important public health problem affecting people from all walks of life. Anemia is very wide spread, more among females than males and higher among infants and children than adults. Severe anemia (with hemoglobin level <8gm/dl) is more frequently seen in severely under nourished children, who also exhibit signs associated with deficiencies of energy, proteins, vitamins and minerals. Many studies showed that the incidence of anemia in adolescent girls varies from 50-80%.

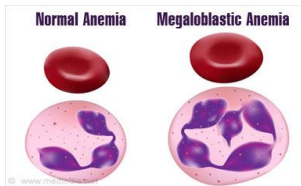
## Types of Anemia

- **Hypochromic and microcytic:**



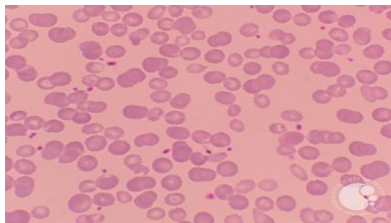
If there is an insufficiency of iron for the formation of haemoglobin, the red blood corpuscles are pale and small and the anemia is said to be Hypochromic and microcytic

- **Megaloblastic anemia:**



Vit B12 and folic acid are coenzymes in the DNA synthetic path way. Vit A deficiencies are impairment in utilization results in damage or inadequate synthesis of DNA. The synthesis of RNA and protein is unaffected. So there is cytoplasmic enlargement, not matched by DNA synthesis which appears to delay or block mitotic division. Thus there appears to be asynchronism between cytoplasmic maturation and nuclear maturation. If the maturation of red blood corpuscles in the bone marrow is impaired by lack of folate or vit B<sub>12</sub>, the cells which enter the blood stream are irregular in size and shape but usually larger than normal and contain their full complement of hemoglobin. This anemia is also known as arthochromic macrocyate.

- **Dimorphic:** If both iron and either folate or Vit B<sub>12</sub> are deficient, it gives raise to Hypochromic macrocytic or dimorphic anemia.



### DIMORPHIC ANEMIA

- When two causes of anemia act simultaneously, e.g : macrocytic hypochromic due to hookworm infestation leading to deficiency of both iron and vitamin B12 or folic acid
- following a blood transfusion

## Consequences of anemia

1. In school children anemia impairs scholastic performance.
2. In young women, the reproductive performance is impaired.
3. It is also responsible for 10-20% of maternal deaths directly or indirectly.
4. High incidence of premature births.
5. Interactive malnutrition.

## Aetiology

**1. Inadequate iron intake:** Inadequate consumption of iron rich food. The average cereal legume based diets as consumed in most developing countries would appear adequate in iron content (20-22mg) for an adult. But, the availability of iron from such diets is very poor.



## 2. Poor absorption and transport of iron in the body.

- Various factors inhibit iron absorption of which phytates and tannins present in plant foods are most important.
- Deficiencies of ascorbic acid, calcium and protein commonly found in the diets tend to lower iron absorption.

3. **Poor iron stores of the body:** Most of our population have negligible iron stores as indicated by poor bone marrow haemosiderin levels and low levels of liver iron.

Most women enter pregnancy with little or no iron reserve. Repeated and closely spaced pregnancies and prolonged periods of lactation as noticed in poor socio-economic groups, deplete iron stores with each successive pregnancy and this is reflected in the high incidence of anemia with higher parity.

4. **Lack of awareness and realization** of the adverse consequences of anemia in the community.

5. **Inadequate utilization:** Defective release of iron from iron stores in to the body and defective iron utilization.

## 6. Blood losses

- Accidental hemorrhage
- Chronic diseases such as tuberculosis, ulcers or intestinal disorders or excessive blood donation or due to blood loss in hookworm infestation.
- Excessive loss of blood during menstruation and child birth increases the requirement for iron.
- In rural areas post partum hemorrhage on account of poor obstetric care leads to iron depletion to a considerable extent.
- In women, using intrauterine contraceptive device, menorrhagia (increased blood loss) may result in further depression of already poor store of iron.

## 7. Increased demand for iron

- Demand for iron substantially increases during pregnancy and growth failure to provide iron through diet or medication would lead to anaemia.
- Rapid growth during infancy and childhood increases iron requirement.
- Infants often born with poor reserves & solely breast fed for prolonged periods of time, aggravate anemia.

8. **Deficiency of folic acid and B12 vitamins:** Folic acid and B12 are essential for the formation and normal growth of red cells along with iron.

Diet poor in folic acid and Vit B<sub>12</sub>, low dietary folate absorption, infestations and infections, mal absorption of vitamins in tropical sprue, causes megaloblastic anemia.

## Diagnosis

- Plasma Ferritin levels give an idea of iron stores.
- Transferrin saturation gauges iron supply to tissues.

- Hemoglobin and Hematocrit measurements can indicate anemia.
- Ratio of zinc protoporphyrin to heme indicates iron supply to developing RBCs.

### Diagnosis of iron deficiency

Indicators	Interpretable guidelines
Peripheral smear	Microcytic hypochromic
MCHC $\mu\text{g}$	<30
Serum iron $\mu\text{g}/\text{dl}$	<60
Total iron Binding capacity $\mu\text{g}/\text{dl}$	>300
Transferrin saturation (%)	<15
Erythrocyteprotoporphyrin $\mu\text{g}/\text{dl}$	>100
Protoporphyrin haemeratio	>32
Serum ferritin $\mu\text{g}/\text{dl}$	<12
Bone marrow iron (by perlstain)	0 or +

Source: Raman Leela and K. V Rameshwara Sarma. Nutrition and Anaemia. Text book of Human Nutritiona. Edited by Bamji M S et al. Oxford and IBH Publishing Co, Pvt Ltd., new Delhi.

### Clinical symptoms

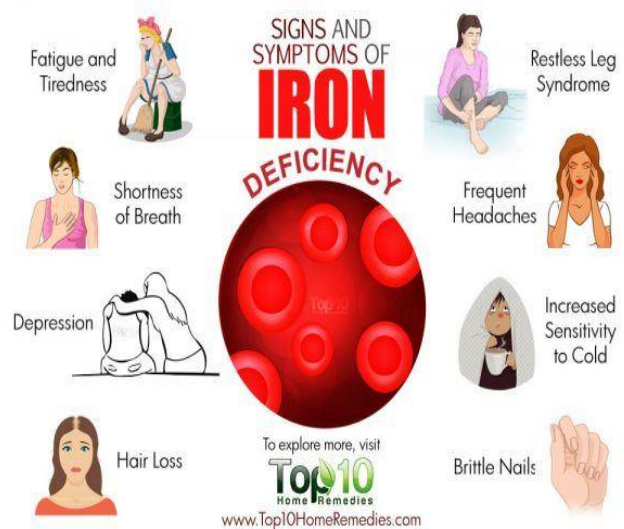
The end result of iron deficiency is nutritional anemia which is not a disease entity. It is rather a syndrome caused by malnutrition in its widest sense. Besides anaemia there may be other functional disturbances such as impaired cell-mediated immunity, reduced resistance to infection, increased morbidity and mortality and diminished work performance.

When iron deficiency become more severe, then defect arise in the structure and function of the epithelial tissues, especially of the tongue, nails mouth and stomach.

The skin may appear pale and the inside of the lower eyelid may be light pink instead of red. Finger nails become thin and flat and eventually koilonychia (spoon shaped nails) develops. Mouth changes include atrophy burning redness, smooth waxy and glistening appearance to the tongue (glossitis).

## Symptoms

- General fatigue
- Weakness
- Pale skin
- Shortness of breath
- Dizziness
- Strange cravings to eat items that are not food, such as dirt, ice, or clay
- A tingling or crawling feeling in the legs
- Tongue swelling or soreness
- Cold hands and feet
- Fast or irregular heartbeat
- Brittle nails
- Headaches



Gastritis occurs frequently and may result in achlorohydrria. Progressive untreated anemia results in cardiovascular and respiratory changes that can eventually lead to cardiac failure.

Chronic long term deficiency symptoms reflect a malfunction of a variety of body systems. The general symptoms are lassitude, fatigue, breathiness on exertion, palpitations, dizziness, headache, dimness of vision, insomnia, paraesthesia in finger toes and angina; finally, it results in reduced activity leading to poor performance.

**Treatment:** Treatment should focus primarily on the underlying diseases or situation leading to anemia.

- ✓ Oral administration of inorganic iron in the ferrous form—ferrous sulphate 50-200mg (60mg elemental iron) 3 times daily for adults and 6mg/kg for children.
- ✓ Iron is best absorbed when the stomach is empty.
- ✓ Iron therapy, should be continued for several months even after restoration of normal hemoglobin level to allow for repetition of body iron stores.
- ✓ An improvement in riboflavin status may stimulate iron absorption.
- ✓ Deworming done periodically would help in reducing anemia and improve the efficiency of iron supplement.

## PREVENTION

### 1. Dietary improvement

- ✚ Promoting the consumption of iron rich foods (whole grain cereals and pulses, whole grains, nuts, dates, jiggery and foods of animal origin).

- ✚ Promoting the consumption of Vit C rich foods (amla, all citrus fruits, guava, green leafy vegetables, salads and seasonal fruits), which help in the absorption of non-haem iron.
- ✚ Discouraging the consumption of tea or coffee, this reduces the absorption of non-haem iron.
- ✚ Promoting the consumption of sprouted pulses regularly after giving some heat treatment which increases bioavailability of iron and it increases amount of Vitamin C and B complex vitamins in the grains and heating destroys the inhibiting factors.
- ✚ Incorporating green leafy vegetables, seasonal vegetables and fruits in the diet of infants and preschool children, once or twice daily.

**2. Supplementation:** In reproductive and child health programme, young children and adolescent girls are given iron and folic acid.

Children <5 years are given 20 mg of elemental iron and 100 mg folic acid. To adolescent girls & pregnant women -one IFA tablet (100mg of elemental iron +500 µg of folic acid).

**3. Fortification:** Fortification of foods with iron would act as a long term measure to improve the iron status of the entire population.

Salt fortification with iron has been considered as one of the practical approaches for the prevention and control of iron deficiency anemia.

Fortification with iron has been successfully tried for wheat flour, salt, rice, sugar, milk, fish, sauce and curry powder.

**4. Nutrition Education:** Nutrition education related to iron and anemia prevention is a must.

- Promotion of consumption of pulses, green leafy vegetables, other vegetables (which are rich in iron and folic acid) and animal foods rich in bioavailable iron, particularly by pregnant and lactating mothers.
- Creation of awareness in mothers attending antenatal clinics, immunization services, anganwadi centers and crèches about the prevalence of anemia, ill effects of anemia and its preventable nature.
- ✚ Addition of iron rich foods to the weaning foods of infants.
- ✚ Regular consumption of foods rich in vitamin C such as oranges, guava, amla etc need to be encouraged to promote iron absorption.
- ✚ Promotion of home gardening to increase the availability of common iron rich foods such as green leafy vegetables.
- ✚ Discouraging the consumption of foods and beverages like tea and tamarind that inhibits iron absorption essentially by the vulnerable groups like pregnant women and children
- ✚ Control of parasitic worms and malaria.

## VITAMIN A DEFICIENCY (VAD)

### Introduction

Nutritional blindness due to xerophthalmia is an important public health problem among young children in India. Epidemiological evidence indicating that Vitamin A deficiency even at subclinical level is associated with increased risk of morbidity/mortality in children has shifted the focus from xerophthalmia to systemic effects.

### Prevalence and Magnitude

1. The corneal xerophthalmia has been reported to be 0.05-0.1 per 100 preschool children in south India.
2. A great majority of the cases of corneal xerophthalmia occur between 1 and 3 years, coinciding with the peak prevalence of severe protein energy malnutrition.
3. Children from rural and tribal families belonging to low-income group are more vulnerable to Vitamin A deficiency.
4. Recent NNMB surveys indicate that there is a decline in the prevalence of Bitot spots in preschool children from 2% in 1975-79 to about 0.2% in 2004-05.
5. WHO –Government of India National Survey (1989) reports that Vit A deficiency contribute to only 0.04% of the total blindness in India.
6. Over the past two decades there appears to be a decline in the magnitude of xerophthalmia, though it still remains an important public health nutrition problem in India.

### Aetiology

1. **Age:**
  - Vit A deficiency is rare in infancy
  - Preschool children are at greater risk because it coincides with the peak prevalence of severe protein energy malnutrition.
  - Majority of the cases of corneal xerophthalmia occur between 1 and 3 years.
  - There is a progressive increase in the prevalence up to the age of 12-13 years.
  - The normal lesions, however are rarely seen in the children above the age of 6 years.
2. **Gender:** Xerophthalmia is more frequent in boys than in girls. However, incidence of keratomalacia is similar in both the sexes.
3. **Socio-economic factors:**
  - Low purchasing power of families.
  - Children from rural and tribal families belonging to low income groups are vulnerable to Vit A deficiency.
  - The incidence is high in interior and remote villages with no transport facilities and no access to any services.
  - Illiteracy of mothers and lack of awareness of importance of diet in diseases.

**4. Food fads and false beliefs:**

- Avoidance of Vit A rich foods like colostrum, green leafy vegetable, papaya etc by Young children, pregnant & lactating women, because of false beliefs.

**5. Inadequate dietary intake:**

- Vitamin A deficient diets are consumed by pregnant and lactating mothers as a result, the off spring is born with poor liver stores of Vitamin A.
- Also the intake of vitamin A by the children either during the weaning period or at later ages is inadequate and provides only 25-30% of recommended intake.
- Animal foods like eggs, milk and liver provide vitamin A. But these are expensive and the communities cannot afford these. Consequently they depend on plant foods which provide only provitamin A.

**6. Illiteracy & Ignorance:** Due to female illiteracy and consequent ignorance, supplementation with vitamin A rich foods is delayed and certain rich sources of  $\beta$ -carotene like green leafy vegetables and papaya are avoided with the belief that these are deleterious to the health of children, due to lack of awareness, the community does not make use of primary health services like diarrhea control, immunization, Vitamin A supplementation and other basic health services.

**7. Improper methods of cooking:** Boiling or prolonged heating at high temperature has deleterious effects in the retention of carotenes. Presence of oil helps in retaining  $\beta$ -carotene better. Vitamin A is lost by oxidation also.

**8. Seasonal effects:** Seasonal changes in vitamin A deficiency are related to time of harvest. Green leafy vegetables availability is high in rainy/ winter season. Mangoes are available for two months in summer. Vit A status during this season may change towards positive side.

**9. Drought:** Extent of vitamin A deficiency is more during drought, due to non availability of leafy vegetables. Prevalence is higher in areas which are chronically drought prone.

**10. Regional differences:** In India, prevalence of Vitamin A deficiency is more than the WHO critical limits in most of the states. It is relatively higher in southern and eastern parts of the country. NNMB surveys indicate higher prevalence of xerophthalmia in the states of AP, Gujarat, Karnataka, Orissa, Uttar Pradesh and West Bengal.

**11. Physiological Reasons:**


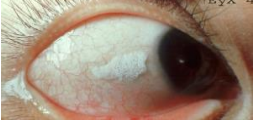


- Inadequate dietary intake of vitamin A or its precursor ( $\beta$ -carotene) in pregnancy, lactation & infancy is the most important contributing factor.
- As a result of low dietary intake of Vitamin A in pregnant women off spring is born with poor liver stores of Vit A.
- Intake of vitamin A by the children either during weaning period or at later ages is obviously inadequate and provides only 25-30% of the recommended intakes.

**12. Infections and associated morbidity:** Common childhood infections like measles, diarrhea, respiratory tract infections and infestations like ascariasis and giardiasis interfere with the absorption of vitamin A.

**Determination of public health significance of VAD**

The WHO /IVACG (International vit A consultative group) recommended the following criteria to decide the public health significance of VAD in any area.

Prevalence rates of xerophthalmia and vitamin A deficiency defining Public health significance

Sign/symptoms/Biochemical indications	% prevalence
Night blindness(XN) 	>1.0
Bitot's spots 	>0.5
Corneal xerosis 	>0.01
Corneal scar related to xerophthalmia (XS) 	>0.05
Serum retinol level less than 10µg/dl	>5.0

**Treatment**

- Immediately on diagnosis, an oral dose of 200,000 IU of oil miscible vitamin A should be given to children in the age group of 1-6 years.
- In the case of those with persisting vomiting and diarrhea an intra muscular injection of 1,00,000 IU of water miscible vitamin A can be substituted for the oral dose.
- Xerophthalmic children with severe protein energy malnutrition should be closely monitored. They may require additional doses of Vitamin A.
- In case of women in the reproductive age with either night blindness and /or Bitot's spot, a daily oral dose of 10,000 IU of vitamin A in oil is recommended for 2 weeks. Pregnant women unless absolutely essential, should not be given large doses of Vit A because of teratogenic risk to the fetus.

## Strategies to combat

Vitamin A deficiency is one of the simplest preventable nutrition disorders.

- Periodic dosing (supplementation of Vit A)
- Dietary modifications to promote production and consumption of Vit A/ $\beta$ -carotene rich foods through nutrition education and or horticulture intervention
- Fortification of commonly and widely consumed foods with vit A are the strategies needed.

**Periodic dosing of Vitamin A:** Oral supplementation of 2 lack I.U of vit A to young children (1-6 years) once in 6 months.

**Dietary modification:** Inclusion of foods rich in Vit A or its precursor, in the daily diets is the most rational and sustainable long term solution to control Vit A deficiency.

- Major inexpensive dietary sources of pro vitamin A are dark green leafy vegetables and deep yellow and orange fruits and vegetables.
- Dark green leafy vegetables like spinach, amaranth, spinach, drum stick leaves, agasthi etc which are affordable by the rural or urban poor are ubiquitous in India.
- Vit A is found only in animal foods such as egg yolk, fish liver, animal liver and dairy products.
- Promotion of home gardening along with appropriate food promotion technology.
- Promotion of production of  $\beta$ -carotene rich fruits and vegetables.
- Nutrition education, through appropriate communication procedures, is an important tool to increase awareness and improve consumption of Vit A foods.
- Social marketing strategies i.e adopting marketing methods to promote social goals like nutrition, are increasingly being used for nutrition and health education
- Multidisciplinary approach with expertise from the fields of agronomy, horticulture, education, communication and health improve availability and consumption of vit A rich foods.
- UN agencies like FAO and UNICEF, SAUS, ICAR and FNB of GOI are making efforts in the direction of horticulture intervention for promotion of Vit A nutrition.

**Food fortification:** Fortification or enrichment of widely consumed foods with Vit A is another strategy to prevent and control Vit A deficiency.

In India, foods like vanaspathi (hydrogenated oil) bread, salt and milk are fortified with Vit A in limited scale and are quite expensive and out of reach for poor.

## IODINE DEFICIENCY DISORDERS

### Introduction

Goiter has been a health concern ever since the beginning of human race. More important is that the iodine deficiency does not only result in goiter but a range of anomalies, still births, defect in



neuropsychological development and mental retardation. Hence the concept of iodine deficiency disorders (IDD) was introduced in 1983 by Hetzel (Iamberg, 1993).

### **Prevalence**

Earlier iodine deficiency disorder was restricted to endemic goiter belt of Himalaya region, but it has been found recently that it is a persistent problem in several other regions of the world. Out of total 183 countries, it is found that in 118 countries, IDD has been a public health concern and 51 countries are blessed without IDD.

As per the national IDD survey carried out in 40 districts all over India by NNMB in 2003, the prevalence of total goiter ranges between 7.2 to 39.6%. Higher prevalence is seen in most eastern Indian states and some of the northern states. Nearly 197 districts all over India were found to be endemic for IDD.

### **Aetiology**

The responsible factors for IDD can be broadly classified in to two groups namely

#### **1. Extrinsic (Environmental) factors:** There are two important factors

- a) **Environmental iodine deficiency:** Iodine deficiency is likely to occur in all elevated regions subject to higher rainfall with run-off in to rivers. High rainfall, snow and flooding increase the loss of soil iodine, which has often been already demanded by past glaciations. This causes the low iodine content of food for man and animals.

Iodine exists in nature in large quantities in sea water (50-60µg/l). sea water along with iodine evaporates to form clouds which condense in the form of rain and enrich the top layers of soil with iodine. The food crops that are grown on the soil and the animals while grazing on the plants assimilate iodine. Water from deep well can provide a major source of iodine.

- b) **Goitrogens:** Goitrogens are certain chemical substances which interfere with iodine metabolism in the body. Thiocyanates, isothiocyanates, cyanogenic glycoside, flavanoids and thiourea are considered as goitrogens. These goitrogens are known to interfere with iodine metabolism at various levels. Some of the goitrogenic substances are found in abundance in certain tubers and vegetables like tapioca, cabbage and cauliflower. Common foods like sorghum, ragi, mustard and groundnut are known to contain a fair amount of goitrogens.

#### **2. Intrinsic factors:** Failure to synthesize the thyroid hormone due to inherited and congenital defects in the hormone synthesis and secretion.

### **Effects of IDD**

IDD covers a myriad of consequences of iodine deficiency at all stages of human growth and development from fetus, neonate, childhood, adolescence and adult hood.

Fetus	Abortions Stillbirths Congenital anomalies Increased perinatal mortality Neurological cretinism Myxomatous cretinism Psychomotor defects
Neonate	Neonatal goiter Neonatal chemical hypothyroidism
Children and Adolescents	Goiter Juvenile hypothyroidism Retarded physical development
Adults	Goiter with complications.

**Goitre:**



- ✚ Goitre is defined as non-neoplastic (tumor), non-inflammatory and non-toxic enlargement of thyroid gland.
- ✚ The enlargement is apparently a compensatory adaptation to lack of iodine required for the synthesis of thyroid hormones.
- ✚ The direct stimulus of the enlargement is an abnormality high level of TSH, it self-brought about by low plasma levels

of the thyroid hormones. The examine TSH causes an increase in both the number and size of the user of the thyroid gland.

- ✚ Simple goiter is a painless condition but if uncorrected it can lead to pressure on the trachea, which may cause difficulty in breathing. Administration of appropriate doses of iodine results in a slow reduction in the size of the thyroid gland.
- ✚ The prevalence of goiter is generally more among adolescents, Young adults and school age children. More females are affected than males.

**Classification of Goiter severity (WHO/UNICEF, 1994) with signs and symptoms**

**Grading of IDD:** Depending upon the urinary iodine excretion levels and prevalence of TGR (total goiter rate) in the community, the severity of endemicity of IDD is graded as follows.

Category	Urinary Iodine level mg/dl
Mild IDD	5.0 – 9.99
Moderate IDD	2.0 – 4.99
Severe IDD	≤ 2.0

**a. Mild IDD:** IDD is an endemic area, with median urinary iodine level 5.0-9.99 µg/dl. TGR 5.0 -19.9% is considered as mild. Mental and physical development will be normal.

**b. Moderate IDD;** In this category of endemics, the median urinary iodine excretion level is 2 - 4.99 µg/dl and TGR is 20.0-29.9%. In these communities, there may be impaired thyroid hormone levels, with the risk of hypothyroidism. However, there will not be overt (open) cases of cretinism.

**c. Severe IDD:** Endemic with median urinary iodine level of 20µg/dl or less and TGR >30% are considered to be severe. The population will be at risk of marked hypothyroidism, mental retardation and overt cretinism.

Cretinism is the visible but small component of IDD, whereas the other components, through large are generally invisible.

### Epidemiological Assessment

The parameters that is helpful in the assessment of the problem of IDD ranges from simple clinical signs through analysis of biological fluids like urine, serum to radioactive iodine uptake studies. Depending upon the infrastructural facilities available, the following indicators may be employed.

1. Goiter prevalence
2. Cretinism prevalence
3. Urinary iodine excretion
4. Serum thyroxin T 4 level and pituitary thyrotrophic hormone
5. Serum TSH level
6. Prevalence of neo-natal chemical hypothyroidism.
7. Iodine levels in drinking water. (less than 2mg per lit)

In large scale community surveys clinical examination of individuals for prevalence of goiter and cretinism and laboratory estimation of urinary iodine excretion and iodine in water, form the important investigations.

If in an area, the total goiter rate (TGR) =Number with goiter grade 1 +2 among the children aged six to twelve years is equal to or more than 5%, that area is said to be endemic (WHO/UNICEF/ICCID/2001).

(ICCID- International Council for Control of Iodine Deficiency)

## Strategies to combat

There are two important ways in controlling the disease.

1. To provide Iodine to the community by fortification or by direct iodine supplementation.

The only way to combat the problem of IDD is to provide iodine to the community. Fortification of food items such as wheat flour, bread, milk, sugar, drinking water and common salt are in practice in different parts of the world.

✚ **Iodised salt:** Common salt has been selected as a suitable vehicle for fortification of iodine to control IDD. Salt is fortified with potassium iodate. In India the level of iodization is fixed under the prevention of food Adulteration Act and is not less than 30 ppm at the production point and not less than 15 ppm of iodine at the consumer level on dry weight basis.

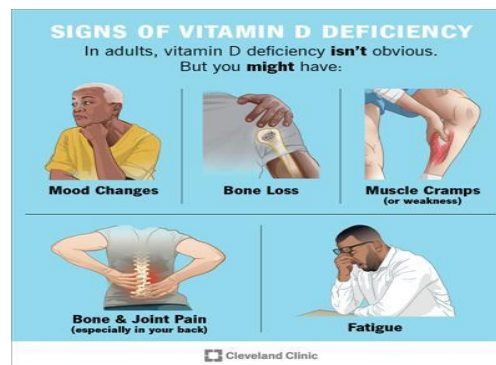
✚ **Iodized oil:** Oil fortification with iodine is available for oral or intra muscular injections.

2. Discouraging people from consuming foods known to contain high levels of goitrogens.

## CALCIUM AND VITAMIN D DEFICIENCY

### Vitamin D Deficiency

Getting enough, but not too much, vitamin D is needed to keep your body functioning well. Vitamin D helps with strong bones and may help prevent some cancers. Symptoms of vitamin D deficiency can include muscle weakness, pain, fatigue and depression. To get enough D, look to certain foods, supplements, and carefully planned sunlight.



Symptoms of vitamin D deficiency

### What is vitamin D deficiency?

Vitamin D deficiency means that you do not have enough vitamin D in your body. Vitamin D is unique because your skin actually produces it by using sunlight. Fair-skinned individuals and those who are younger convert sunshine into vitamin D far better than those who are darker-skinned and over age 50.

## Why is vitamin D so important?

Vitamin D is one of many vitamins our bodies need to stay healthy. This vitamin has many functions, including:

- **Keeping bones strong:** Having healthy bones protects you from various conditions, including rickets. Rickets is a disorder that causes children to have bones that are weak and soft. It is caused by a lack of vitamin D in the body. You need vitamin D so that calcium and phosphorus can be used to build bones. In adults, having soft bones is a condition called osteomalacia.
- **Absorbing calcium:** Vitamin D, along with calcium, helps build bones and keep bones strong and healthy. Weak bones can lead to osteoporosis, the loss of bone density, which can lead to fractures. Vitamin D, once either taken orally or from sunshine exposure is then converted to an active form of the vitamin. It is that active form that promotes optimal absorption of calcium from your diet.
- **Working with parathyroid glands:** The parathyroid glands work minute to minute to balance the calcium in the blood by communicating with the kidneys, gut and skeleton. When there is sufficient calcium in the diet and sufficient active Vitamin D, dietary calcium is absorbed and put to good use throughout the body. If calcium intake is insufficient, or vitamin D is low, the parathyroid glands will 'borrow' calcium from the skeleton in order to keep the blood calcium in the normal range.

## What are the health effects of vitamin D deficiency?

Getting enough vitamin D may also play a role in helping to keep you healthy by protecting against the following conditions and possibly helping to treat them. These conditions can include:

- Heart disease and high blood pressure.
- Diabetes.
- Infections and immune system disorders.
- Falls in older people.
- Some types of cancer, such as colon, prostate and breast cancers.
- Multiple sclerosis.

What are the sources of vitamin D?

You can get vitamin D in a variety of ways. These can include:

- Being exposed to the sun. About 15-20 minutes three days per week is usually sufficient.
- Through the foods you eat.
- Through nutritional supplements.

What does sunlight have to do with getting enough vitamin D?

Vitamin D is produced when your skin is exposed to sunshine, or rather, the ultraviolet B (UV-B) radiation that the sun emits. The amount of vitamin D that your skin makes depends on such factors as:

- **The season:** This factor depends a bit on where you live. In areas such as Cleveland, OH, the UV-B light does not reach the earth for six months out of the year due to the ozone layer and the zenith of the sun.
- **The time of day:** The sun's rays are most powerful between 10 a.m. and 3 p.m.
- The amount of cloud cover and air pollution.
- **Where you live:** Cities near the equator have higher ultraviolet (UV) light levels. It is the UV-B light in sunlight that causes your skin to make vitamin D.
- **The melanin content of your skin:** Melanin is a brown-black pigment in the eyes, hair and skin. Melanin causes skin to tan. The darker your skin, the more sun exposure is needed in order to get sufficient vitamin D from the sun.

### What does your diet have to do with getting enough vitamin D?

Vitamin D doesn't occur naturally in many foods. That's why certain foods have added vitamin D. In fact, newer food nutrition labels show the amount of vitamin D contained in a particular food item.

It may be difficult, especially for vegans or people who are lactose-intolerant, to get enough vitamin D from their diets, which is why some people may choose to take supplements. It is always important to eat a variety of healthy foods from all food groups. The vitamin content of various foods is shown in the following table.

### Vitamin D content of various foods

Food	Vitamin D content in International Units (IUs) per serving
Cod liver oil, 1 tablespoon	1360
Swordfish, cooked, 3 ounces	566
Salmon (sockeye) cooked, 3 ounces	447
Tuna, canned in water, drained, 3 ounces	154
Orange juice fortified with vitamin D, 1 cup	137
Milk, vitamin-fortified, 1 cup	115-124
Yogurt, fortified with 20% of the daily value of vitamin D, 6 ounces	80

Food	Vitamin D content in International Units (IUs) per serving
Sardines, canned in oil, drained, 2 sardines	46
Liver, beef, cooked, 3 ounces	42
Egg yolk, 1 large	41
Cereal, fortified with 10% of the daily value of vitamin D, 1 cup	40
Cheese, Swiss, 1 ounce	6

*Source: Vitamin D. Health Professionals. Dietary Supplement Fact Sheet. National Institutes of Health. Office of Dietary Supplements. August 7, 2019.*

It is important to check product labels, as the amount of added vitamin D varies when it is artificially added to products such as orange juice, yogurt and margarine.

### How much vitamin D do you need?

In healthy people, the amount of vitamin D needed per day varies by age. The chart below shows the often-cited recommendations of the Institute of Medicine, now the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine. It is important to know that these are general recommendations. If your doctor is checking your blood levels, he or she might recommend higher or lower doses based on your individual needs.

If you have osteoporosis, your doctor might suggest a blood test of your vitamin D levels. The amount of vitamin D supplement can be customized for each person, based on the results. For many older patients, a vitamin D supplement containing anywhere between 800 to 2000 IUs daily, which can be obtained without a prescription, can be both safe and beneficial. It is important to speak with your doctor about your individual needs.

People by age	Recommended dietary allowance (IU/day)	Upper level intake (IU/day)
Infants 0-6 months*	400	1,000
Infants 6-12 months*	400	1,500
Children 1-3 years old	600	2,500

People by age	Recommended dietary allowance (IU/day)	Upper level intake (IU/day)
Children 4-8 years old	600	3,000
People 9-70 years old	600	4,000
People over 70 years old	800	4,000
Females 14-50 years old, pregnant/lactating	600	4,000

*\*refers to adequate intake vs recommended dietary allowance of the other age groups.*

### What causes vitamin D deficiency?

Vitamin D deficiency can be caused by specific medical conditions, such as:

- **Cystic fibrosis, Crohn's disease, and celiac disease:** These diseases do not allow the intestines to absorb enough vitamin D through supplements.
- **Weight loss surgeries:** Weight loss surgeries that reduce the size of the stomach and/or bypasses part of the small intestines make it very difficult to consume sufficient quantities of certain nutrients, vitamins, and minerals. These individuals need to be carefully monitored by their doctors and need to continue to take vitamin D and other supplements throughout their lives.
- **Obesity:** A body mass index greater than 30 is associated with lower vitamin D levels. Fat cells keep vitamin D isolated so that it is not released. Vitamin D deficiency is more likely in obese people. Obesity often makes it necessary to take larger doses of vitamin D supplements in order to reach and maintain normal D levels.
- **Kidney and liver diseases:** These diseases reduce the amount of an enzyme needed to change vitamin D to a form that is used in the body. Lack of this enzyme leads to an inadequate level of active vitamin D in the body.

### What other factors can lead to vitamin D deficiency?

- **Age:** The skin's ability to make vitamin D lessens with age.
- **Mobility:** People who are homebound or are rarely outside (for example, people in nursing homes and other facilities) are not able to use sun exposure as a source of vitamin D.
- **Skin color:** Dark-colored skin is less able to make vitamin D than fair-colored skin.



- **Human breast milk:** A woman's breast milk only contains a small amount of vitamin D. Often infant formulas also only include a small amount of D also. Therefore, infants are at risk of not receiving enough vitamin D. This is especially true for infants who are only fed breast milk.

### Can medications cause a vitamin D deficiency?

Yes. Vitamin D levels can be lowered by certain medications. These include:

- Laxatives.
- Steroids (such as prednisone).
- Cholesterol-lowering drugs (such as cholestyramine and colestipol).
- Seizure-control drugs (such as phenobarbital and phenytoin).
- A tuberculosis drug (rifampin).
- A weight-loss drug (orlistat).

Always tell your doctor about the drugs you take and any vitamin D supplements or other supplements or herbs/alternative health products that you take.

### What are the signs and symptoms of vitamin D deficiency?

Severe lack of vitamin D causes rickets, which shows up in children as incorrect growth patterns, weakness in muscles, pain in bones and deformities in joints. This is very rare. However, children who are deficient in vitamin D can also have muscle weakness or sore and painful muscles.

Lack of vitamin D is not quite as obvious in adults. **Signs and symptoms** might include:

- Fatigue.
- Bone pain.
- Muscle weakness, muscle aches, or muscle cramps.
- Mood changes, like depression.

## FLOURINE DEFICIENCY AND TOXICITY

### Role of fluoride -

Fluoride has proven to be an essential element with preventative and protective properties. Fluoride is capable of combating and working against tooth decay and increases resistance to the "demineralisation of tooth enamel during attack by acidic bacteria". While essential for all individuals, it is significant for children, as when ingested, the fluoride is incorporated into their developing enamel. This in turn causes their teeth to become less prone to decay. Therefore, a relationship can be formulated, in that the more fluoride entering the body, the overall decline in the rate of decay.

## **Sources of fluoride -**

Fluorine is the 13th most abundant element in the Earth's crust. The ionic form of fluorine is called fluoride. Fluoride is most commonly found as inorganic or organic fluorides such as naturally occurring calcium fluoride or synthetic sodium fluoride. There are a number of sources of fluoride, these include:

- **Water**

In Australia fluoride occurs naturally within water supplies, at a concentration of approximately 0.1 mg/L. However, this number varies amongst different populations, as specific fluoridated communities exceed this amount, ranging from 0.6-1.0 mg/L of fluoride present. The process of incorporating more fluoride into water systems is an affordable mechanism that can provide many beneficial effects in the long term.

- **Dentifrices**

Fluoride toothpaste came into production in the 1890s, after its benefits were investigated. This product has become available to most industrialized countries, and within Australia accounts for "90% of total toothpaste purchased".

- **Fluoride supplements**

Fluoride supplements were first recognized and highly suggested by health professionals, in areas where the practice of fluoridating water was not accepted. Such mechanisms are recommended for individuals, primarily children (whom of which are at a greater risk of caries) in low-fluoride areas.

## **FLUORINE DEFICIENCY**

Fluoride or fluorine deficiency is a disorder which may cause increased dental caries and possibly osteoporosis, due to a lack of fluoride in the diet. Common dietary sources of fluoride include tea, grape juice, wine, raisins, some seafoods, coffee, and tap water that has been fluoridated. The extent to which the condition truly exists, and its relationship to fluoride poisoning has given rise to some controversy. Fluorine is not considered to be an essential nutrient, but the importance of fluorides for preventing tooth decay is well-recognized, although the effect is predominantly topical. Prior to 1981, the effect of fluorides was thought to be largely systemic and preeruptive (prior to the formation of eruptions), requiring ingestion. Fluoride is considered essential in the development and maintenance of teeth by the American Dental Hygienists' Association. Fluoride is also essential as it incorporates into the teeth to form and harden teeth enamels so that the teeth are more acid resistant as well as more resistant to cavity forming bacteria. Caries-inhibiting effects of fluoride were first believed to have been seen in 1902 when fluoride in high concentrations was found to stain teeth and prevent tooth decay.

## **FLUORIDE TOXICITY**

Fluoride toxicity is a condition in which there are elevated levels of the fluoride ion in the body. Although fluoride is safe for dental health at low concentrations, sustained consumption of large amounts of soluble fluoride salts is dangerous. Referring to a common salt of fluoride, sodium fluoride, the lethal dose for most adult humans is estimated at 5 to 10 g. Ingestion of fluoride can produce gastrointestinal discomfort at doses at least 15 to 20 times lower than lethal doses. Although it is helpful topically for dental health in low dosage, chronic ingestion of fluoride in large amounts interferes with bone formation. In this way,

the most widespread examples of fluoride poisoning arise from consumption of ground water that is abnormally fluoride-rich.

### **What is a safe fluoride level?**

That group found that the upper limit for fluoride, at 4 ppm, was too high to prevent a certain percentage of kids from developing severe dental fluorosis and recommended the EPA (Environmental Protection Agency) lower this limit. The CDC (Centers for Disease Control and Prevention) says that the level at which it is added to the water (1 ppm) is safe and effective.

### **What are the symptoms of too much fluoride?**



When above normal amounts of fluoride are ingested, the fluoride combines with hydrochloric acid in the stomach and forms hydrofluoric acid. As a result, the hydrofluoric acid has a burning effect on the gastric lining causing gastrointestinal (GI) symptoms such as nausea, vomiting, abdominal cramping, and discomfort.

Exposure to excess fluoride in children is known to result in dental fluorosis, a condition in which the teeth enamel becomes irreversibly damaged and the teeth become permanently discolored, displaying a white or brown mottling pattern and forming brittle teeth that break and stain easily. The first sign of fluoride toxicity is dental fluorosis and that fluoride is a known enzyme disruptor.

## UNIT 3

### MALNUTRITION – DEFINITION AND CAUSES, PEM, MARASMUS, KWASHIORKAR, VICIOUS CYCLE OF MALNUTRITION

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#### Introduction and definition

The WHO defined protein energy malnutrition (PEM) as a range of pathological conditions arising from co-incident lack in varying proportions of proteins and energy occurring most frequently in infant and young children commonly associated with infection (WHO 1972). The intensity of pathological condition of PEM ranges from mild to moderate to severe degrees.

The term kwashiorkor was first introduced by Cicely Williams in 1935. This is local name used by the Gatribe in Accra, West Africa and means “disease of the displaced child”. PEM is due to inadequate intake of food and is not due to lack of dietary protein alone.

Protein Energy Malnutrition is a major public health problem in many developing countries and it continues to be a major public health problem. It affects mostly children below 5 years of age of poor under privilege communities. Condition is serious during post-weaning stage and is often associated with infection. Respiratory infections and diarrhoea precipitates severe PEM and death.

PEM is a consequence not only of inadequate food intake but also of

- ✚ Poor living conditions
- ✚ Unhygienic environment
- ✚ Lack of health care
- ✚ It is primarily disuse of socioeconomic inequalities and mal distribution of food and health.

The term protein energy malnutrition covers a wide spectrum of clinical stages ranging from severe forms like kwashiorkor and marasmus to milder forms in which main detectable manifestation is growth retardation.

Edema is the striking feature of **kwashiorkor**,

while severe growth retardation and wasting are the cardinal features of **marasmus**.

Combined forms showing oedema and wasting is described as **marasmic kwashiorkor**.

## Classification of PEM (FAO/WHO)

Type of PEM	Body <u>weight</u> as percentage of standard	Oedema	Deficit in <u>weight</u> for height
Kwashiorkor	80-60	+	+
Marasmic kwashiorkor	<60	+	++
Marasmus	<60	0	++
Nutritional dwarfing	<60	0	Minimal
Underweight child	80-60	0	+

## Effects of PEM

- It contributes to high child mortality & morbidity.
- Stunted growth
- Poor learning ability
- Reduced work efficiency

Thus PEM has serious repercussion on human development and national productivity.

## Prevalance of protein energy malnutrition

- PEM is still the most common nutritional disorder among children in developing countries.
- Surveys carried out by NNMB in different states in India showed significant decline in the prevalence of severe (Grade III) malnutrition. A decline from 15% in 1975-79 to 5% in 2006-07, with corresponding increase in proportion of moderate (grade II) malnutrition.
- The prevalence of clinical forms of PEM have been reduced to less than 1%.
- Hospitals admissions due to PEM have come down considerably.

## AETIOLOGY

1. **Age:** Preschool age children are most seriously affected because of their increased nutritional requirements compared to adults.

Infections occur more frequently in this age group.

The long term intake of insufficient food can result in marasmus before one year.

Kwashiorkor is common after 18 months.

2. **Diet related factors:**

Diluted milk formula which is grossly deficient in energy.

Prolonged breast feeding

Delayed introduction and inadequate amount of supplementary feeds.

Introduction of adult diet after prolonged breast feeding. Inability of child to eat sufficient quantity, due to the bulk of adult/family diet.

Diets low in energy & protein.

3. **Role of free radicals and aflotoxins:** Free oxygen radicals produced in the body during various infections and the aflatoxin poisoning from food are usually buffered by protein and neutralized by antioxidants such as Vitamin A, C and E and selenium.

A child on protein & energy deficient diets in the presence of infection or aflatoxin accumulates toxic, free oxygen radicals, which in turn damage liver cells, leading to kwashiorkor.

#### 4. Infections:

An overcrowded and unsanitary living conditions lead to frequent infections like diarrhoea.

Kwashiorkor is often preceded by an episode of infection, diarrhea and respiratory infections being the most common precipitating factors.

Repeated attacks of diarrhea are responsible for poor growth of children.

Acute diarrhea leads to mal absorption of fat and protein.

Infections arouse negative nitrogen balance.

Measles is the other common infectious diseases that occur during childhood.

The impact of measles is more than that of other infections because of secondary complications and prolonged illness.

During acute infections, appetite is often impaired and the food intake is reduced. Apart from low intake, dietary restriction is often imposed by the mother or family or community.

Mal absorption of nutrient and metabolic losses during infection can also aggravate malnutrition.

#### 5. Socio-economic factors:

- Poor economic status, faulty feeding habits due to ignorance and prejudice
- Larger families and high birth rate
- Superstitions and taboos concerning food are powerful social factors,
- Deprivation of maternal care and attention due to work pressure away from home by the mothers.
- PEM is basically a problem of poverty

Inadequate diet

Poor environment

High incidence of infections results – in PEM.

### Measures to combat protein Energy Malnutrition

**Treatment:** Severe cases of PEM, especially those with complications like severe infection or dehydration require intensive care and should be admitted to a hospital for treatment. Once the condition is controlled, the treatment can be continued outside the hospital. Nutrition support is the primary consideration in such cases.

#### Dehydration

- Patients with mild to moderate dehydration can be treated by oral or nasogastric administration of fluids.

- The oral rehydration solution (NaCl 3.5 g: NaHCO<sub>3</sub> 2.5g: KCL 1.5 g and glucose 20 gm dissolved in 1 lit of water) recommended by the WHO can be safely used for correcting dehydration in PEM children.
  - This amount should be given in small quantities at frequent intervals over a period of 4-6 hours.
  - For patients with severe dehydration, intravenous fluid therapy is required to improve the circulation and expand plasma volume rapidly.
  - About 70-100 ml of fluid can be given in the first 3-4 hours.
  - As soon as urine flow is established, potassium supplements can be given orally (1-2g/kg/day).

### **Infections**

- Diarrhoea and measles are often the immediate cause of death of PEM.

Appropriate antibiotics therapy can be given.

- Intestinal infections such as giardiasis and ascariasis must be treated with appropriate deworming agents.

**Hypothermia:** Marasmic children are prone to have low body temperature. If the room is cold, the child should be properly covered with a blanket. The state of shock should be treated with intravenous injection of glucose-saline or blood transfusion.

**Anaemia:** Severe anemia is dangerous as it can result in heart failure. If the haemoglobin falls below 5g/day, blood transfusion should be given.

### **Dietary management**

- The child should be given a diet providing sufficient quantities of calories and protein in gradually increasing amounts, without provoking vomiting or diarrhoea.
- It is best to begin with a liquid formula with diluted milk.
- When this is accepted, vegetable oil can be added to increase energy content.
- Milk based formulae should be used for feeding children.
- If the child has milk intolerance, milk formulas can be substituted by buttermilk or cereal foods.
- In elder children, easily digestible solid foods like bread +milk +sugar can be given.
- A mixed cereal based diet can be given with added oil to increase energy density.

### **Suggested diet during convalescence** (gradual healing after illness)

- Increasing the quantity of existing food.
- Increasing the number of meals to satisfy calorie and protein requirement.
- Addition of oil or ghee 1 to 2 tsp to increase calories without increasing bulk.
- Consumption of sugar and banana can be increased to increase calories in the diet.
- The child can be given cereal and pulse mixture in 5:1 proportion.
- If the patient can afford, milk, egg and skimmed milk can be included in the diet.
- Locally available, inexpensive and easily digestible foods should be used.

**The following steps are suggested by FAO/WHO nutrition expert committee.**

#### **Health promotion**

- Measures directed to pregnant and lactating women (education, distribution of supplements).
- Promotion of breast feeding.
- Development of low cost complementary foods. The child should be made to eat more food at frequent intervals.
- Measures to improve family diet.
- Nutrition education, promotion of correct feeding practices.
- Home economics.
- Family planning and spacing of births.
- Improving family environment.

#### **Specific protection**

- The child's diet must contain protein and energy rich foods, milk, eggs, fresh fruits should be given if possible.
- Immunization schedule should be followed.
- Food fortification may help the child in meeting requirements.

#### **Early diagnosis and treatment**

- Periodic surveillance.
- Early diagnosis of any lag in growth.
- Early diagnosis and treatment of infections and diarrhea.
- Development of programmes for early rehydration of children with diarrhea.
- Development of supplementary feeding programmes during epidemics.
- Deworming of heavily infested children.

**Integrated child development services (ICDS):** Isolated feeding programmes will not be effective unless efforts are made simultaneously to improve the environment and control infections.

#### **Supplementary food is therefore integrated with other health activities like**

- Immunization
- Treatment of minor illness
- Growth monitoring
- Health education
- Supplementary feeding.

**Nutrition Education:** Education to improve child nutrition should stress

- The importance of breast feeding
- Timely introduction of supplements.
- Use of local available foods.
- Feeding sufficient quantity

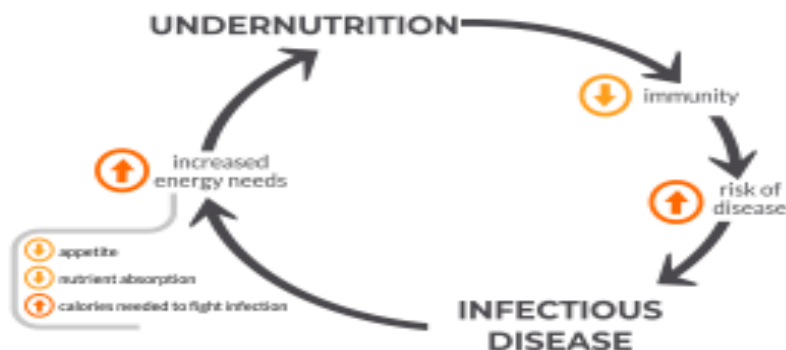


- Maintenance of hygiene.
- Feeding balanced diets for children.

## VICIOUS CYCLE OF MALNUTRITION

A vicious cycle: undernutrition and infection

Figure 1: The vicious cycle of undernutrition and infectious disease

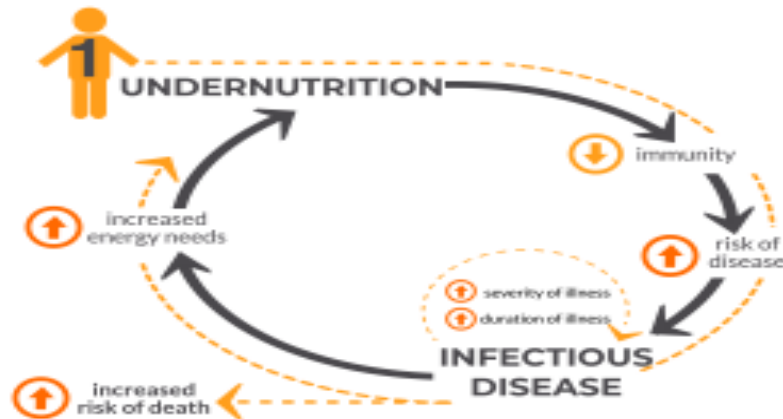


*Undernourished children have less nutritional reserves to grow properly and to fight off infections.*

Undernutrition has been called the most common cause of immunodeficiency worldwide. With poor nutrition, some parts of a child’s immune system do not function properly. The skin and gut cannot effectively block disease-causing bacteria, viruses and parasites from entering the body. The thymus, a gland in the neck which helps develop the disease-fighting T cells, becomes smaller and other parts of the immune system do not function properly. Thereby undernourished children are put at increased risk of developing diseases to which they are exposed in their environment and against which they otherwise would normally be able to defend themselves.

With each episode of disease, some of the energy and calories a child would otherwise use for growth and development is diverted to fight off the infection. Calories are consumed to mount a fever, one of the body’s protective mechanisms. If the child has pneumonia, breathing requires more work and this will require more calories, too. If the child has diarrhea, less nutrients are absorbed while the gut is inflamed and infected. For these reasons, a sick child needs more energy and calories to fight off the infection and recover, and an undernourished child – who has fewer energy reserves and likely less access to nutrient-rich food to begin with – falls even further behind in fulfilling their nutritional needs and is more susceptible to the next bout of illness.

Figure 2: Child #1 is Undernourished



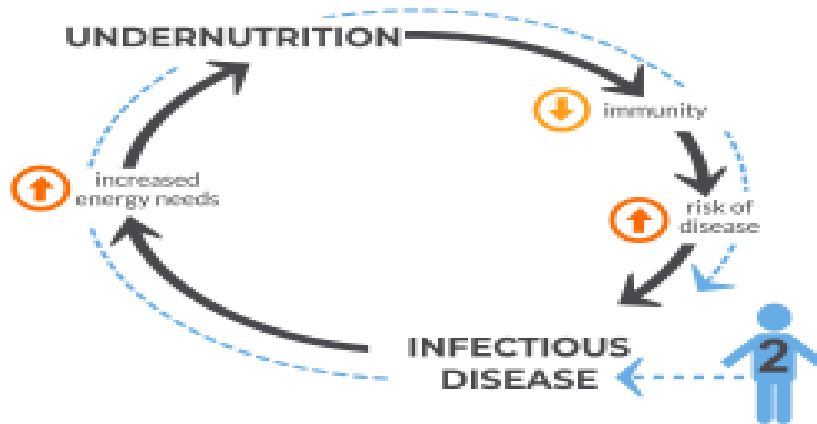
This decreases their immune system function, increases disease risk, duration and severity and significantly increases the risk of death. Infections further negatively impact nutritional status, potentially increasing the severity of undernutrition in this child and pushing them around the vicious circle once more.

A child who is sick also may not eat as much, taking in fewer calories and nutrients for the duration of the illness, putting the child at risk for falling further behind in growth. A prospective case-control study conducted in several developing countries found that children with moderate-to-severe diarrhea grew significantly less in length in the two months following their episode compared to age- and gender-matched controls.

Not only are undernourished children – like child #1 in Figure 2, above – more susceptible to getting sick, but their disease course is more likely to be severe or even fatal. A study of Bangladeshi children found that severely undernourished children had a nearly eight-fold increased risk of death from diarrhea than those who were not severely undernourished. In the case of pneumonia, those who are undernourished are at a 15-times higher risk of death. In this way, undernutrition is a hidden co-killer, masked behind the number of deaths due to diarrhea, pneumonia and other infections such as measles and malaria.

An otherwise healthy child – like child #2 in Figure 3, below – can also become temporarily undernourished because of an infection such as pneumonia, due to the increased energy needs of the infection. This can put the child at increased risk of other infections until a healthy nutritional status is attained once again.

Figure 3: Child #2 was not undernourished, but became undernourished due to an episode of infection.



This may set them upon the path of recurrent infection and undernutrition.

Sickness and undernutrition have long-term consequences for children’s growth and development

Recurrent disease, severe disease and undernutrition interact to shape the trajectory of a child’s growth and cognitive development in the critical first 1000 days of life with long-term implications. Certain severe infections such as meningitis leave many children with long-term cognitive impairment and neurological sequelae. In a systematic literature review of studies from Africa, it was found that one quarter of children who survived pneumococcal or Hib meningitis—two vaccine-preventable causes of meningitis—had long-term neuropsychological deficits.

Stunting has been linked with lifelong consequences such as diminished cognitive development and decreased economic productivity for affected individuals. Studies have estimated that undernutrition decreases a nation’s economic growth by 8% or more due to the reduced potential of its people to study or work to their full potential.

## UNIT 4

### Assessment of Nutritional Status-

Clinical signs and symptoms,

Nutritional anthropometry

Growth Monitoring

Biochemical tests, biophysical tests,

Diet survey methods

Understanding of Z tables

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### Introduction

Assessment of nutritional status of community is the first step to plan any public health strategy to combat malnutrition. The nutritional status of population influenced profoundly by diet and other environmental factors like infections and parasitic diseases.

### Objectives of Nutritional Assessment

1. To assess the severity and geographical distribution of malnutrition.
2. To identify individuals or population groups at risk of becoming malnourished.
3. To identify and analyze the ecological factors that are directly or indirectly responsible.
4. To suggest appropriate corrective measures or to develop suitable health care programmes.
5. To provide factual evidence for the incidence of malnutrition to concerned authorities or policy makers to make them realize the extent of the problem.
6. To determine the impact of nutritional programmes.

The nutritional Assessment of a community should aim at discovering facts and guiding actions intended to improve nutrition and health.

### Methods of Nutritional Assessment

There are two types of methods.

**Direct Method:** Deals with the subjects and measure objectively.

- Nutritional Anthropometry
- Clinical assessment
- Biochemical assessment
- Biophysical examination.

**Indirect methods:**

- Dietary Assessment
- Vital health statistics

## Nutritional Anthropometry

**Definition:** Nutritional Anthropometry is concerned with the measurement of the variations of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition (Jelliffe, 1966). The pattern of growth and the physical state of the body are profoundly influenced by diet and nutrition. Hence, anthropometric measurements are useful criteria for assessing nutritional status.

Physical dimensions of the body are influenced by

- ✓ Biological factors: (Sex, intrauterine environment, birth orders, birth weight, parental size etc).
- ✓ Genetic factors
- ✓ Environmental factors (season, climate, socio-economic level, nutrition exposure to infection) and
- ✓ Physiological factors.

**Age Assessment:** Exact age assessment is desirable in the anthropometry of young children. Age can be determined based on

1. Documentary evidence presented by the parents (e.g. Birth certificates or horoscopes).
2. Child's dental eruption and other milestones of development (e.g. Eruption of permanent teeth at the age of 6-7 years).
3. by developing local event calendar-construction of local calendar based on events in the preceding years, including agricultural, climatic and political occurrences, as well as natural or manmade disasters.

### Significance and measurement techniques

- 1) Weight
- 2) Height/ Length
- 3) Head and chest circumference
- 4) Waist-Hip ratio circumference ratio (WHR)
- 5) Soft tissues
- 6) Body fat

### Weight

Body weight is mainly made up of muscle, fat, bone and internal organs. The evaluation of the significance of weight measurements must take in to account length, frame size, proportions of fat, muscle, bone and the presence of pathological weight, for example edema or spingomegaly (enlarged spleen). Accordingly, weight measurements should be combined with other appropriate measurements and with clinical examination.

### Significance:

- ✚ Sensitive indicator of current nutritional status.
- ✚ Deficit in weight indicate short term under nutrition.
- ✚ PEM is best identified by weight.

**Equipment:** Equipment used should be sturdy, inexpensive, easily transportable and accurate. They must be checked frequently through the complete range weights envisaged at least twice daily during survey by the use of objects of known weight supplied for this purpose.

**Technique of measurement:**



- **Young children:** Young children should be weighed nude on spring balance.



- **School Children and adults:** The platform beam balance is most usually employed. Weighing should not be done after a full meal. Theoretically, the bladder should be emptied prior to measurements.
  - The subjects should stand on the centre of the platform without touching anything. Shoes should be removed and the minimum clothing should be worn. For adults, especially in field circumstances, weighing usually has to be carried out, while they are wearing ordinary clothing.
  - Weighing should not be done after a full meal

**Height assessment**

**Height:** the height of an individual is made up of the sum of four components legs, pelvis, spine and skull.

In subjects > 2 years “height” is measured

< 2 years “recumbent length” (crown-heel length) is measured

**Significance:**

1. Gives a picture of past nutritional status.
2. Deficit in height indicates chronic and prolonged under nutrition.

**Equipment and Technique:**

✚ In young children

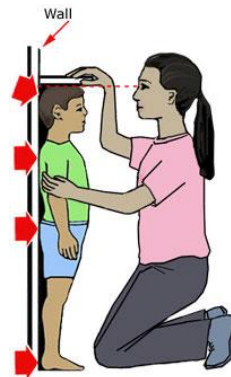
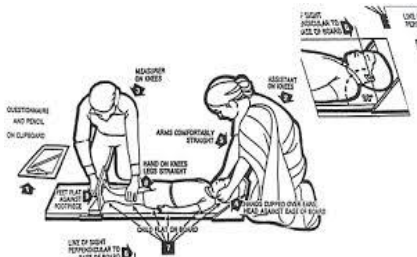
In children below the age of two years, who cannot stand properly, recumbent length (crown-heel length) should be measured using an infantometer. The legs need to be held straight and firm with the feet touching the sliding board.

✚ In older children and adults

A vertical measuring rod or a scale fixed to a wall can be used.

### Steps in taking measurements

- i. Remove the shoes
- ii. Should stand on a flat floor with feet parallel and with heels, buttocks, shoulders and back of head touching the upright.
- iii. The head should be comfortably erect.
- iv. The head piece which can be a metal bar or a wooden block is gently lowered, crushing the hair and making contact with the top of the head.
- v. The measuring scale should be capable of measuring to an accuracy of 0.5cm.



## Head and Chest circumference

### Head circumference

**HOW TO MEASURE HEAD CIRCUMFERENCE**

- The head circumference is determined by measuring the greatest occipitofrontal circumference (from the occipital prominence to the frontal prominence – taking the biggest measurement of three).
- Average HC: 35 cm at birth (13.5 in).
- HC increases: 1 cm per month for first year (2 cm per month for first 3 months, then slower)



Head size relates mainly to the size of brain, which increases quite rapidly during infancy. The chest in a normally nourished child grows faster than head during the second and third year of life. As a result, the chest circumference over takes head circumference by about one year of age. In protein energy malnutrition due to poor growth of chest, the head circumference may remain to be higher than the chest even at

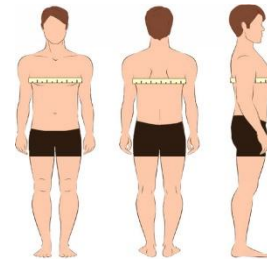
the age of 2½ to 3 years. Brain size vary with nutritional status. Head circumference is slightly affected in the second year of life. This helps as an additional guide in the age assessment.

### Chest circumference

Use of this measurement is important in the second and perhaps third year of life. This is because the circumference of the head and the chest are about the same at six months of age. After this, the skull grows slowly and the chest more rapidly. Therefore, between the ages of six months and five years, a chest/head circumference ratio of less than one may be due to failure to develop or to a wasting of the muscle and fat of the chest wall and can be used as community indicator of protein energy malnutrition

of early childhood. The chest circumference is taken at the nipple level preferably in mid inspiration waist-Hip circumference ratio.

**CHEST CIRCUMFERENCE**  
 Normal CC range from 30.5 to 33 (12 to 13 inches), usually 2 cm less than HC.  
 The CC is measured at the level of the nipple using a tape measure.  
 A CC less than 30 cm indicates prematurity. An enlarged heart may make the left side of the chest larger.



**Equipment and Technique**

A narrow flexible, non-stretch tape, made of steel or preferably fiber glass should be used. The child’s head should be steadied and the greatest circumference measured by placing the tape firmly round the frontal bones just superior to the supra-orbital ridges, passing it round the head at the same level on each side and laying it over the maximum occipital prominence at the back. Measurement should be made to the nearest 0.1cm. The chest circumference is taken at the nipple level preferably in mid inspiration.

**Waist-Hip ratio circumference ratio (WHR)**

1. WHR indicates abdominally located adipose tissue
2. Excess fat around the abdomen or central obesity is associated with increased health hazards.
3. Cut off point for WHR is < 1 for male, < 0.8 for female
4. This indicator is relevant only.

**How to Calculate Waist-Hip Ratio**

**INSTRUCTIONS**

1. Measure your waist – just under your lowest rib.
2. Measure your hips – at the widest portion of your buttock.
3. Divide waist measurement by hip measurement to get the ratio.

**For women, the ratio should be less than 0.85**

		<p><b>MALE WAIST TO HIP RATIO</b></p> <ul style="list-style-type: none"> <li>• <b>Less than 0.9</b> Low risk of health problems due to weight</li> <li>• <b>0.9 to 0.99</b> Moderate risk of health problems due to weight</li> <li>• <b>1 or Over</b> High risk of health problems due to weight</li> </ul>

**Soft Tissues: Mid Upper Arm Circumference (MUAC)**

Muscle and fat constitute the soft tissues that vary with deficiency of protein and energy.





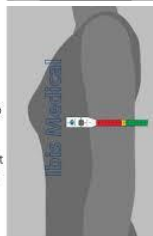
#### STEP - 1

Bend the left arm in 90 degree angle to find the mid of the arm.



#### STEP - 4

Keep the patient's arm hanging straight down to start measuring. Place the head of the MUAC tape towards right hand direction as shown in the image.



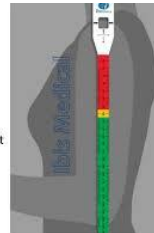
#### MUAC TAPE - Child

Color Code As Per WHO Growth Standards

Color	Measurement
RED	0.00 - 11.5 cm
YELLOW	11.5 - 12.5 cm
Green	12.5 - 25.5 cm

#### STEP - 2

Keep the head of the MUAC tape on top and align the marker (0 Cm) inline with top most part of hand as shown in image.



#### STEP - 5



Wrap the MUAC tape's tail around the arm above the marked mid point of arm. Insert the tail of the MUAC tape through the slit in the head of the MUAC tape as shown in the image.

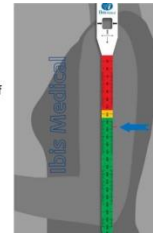
#### MUAC TAPE - Adult

Color Code As Per WHO Growth Standards

Color	Measurement
RED	0.00 - 21.0 cm
YELLOW	21.0 - 23.0 cm
Green	23.0 - 61.0 cm

#### STEP - 3

Find the center point of the arm and mark it using a pen.



Poor musculature and wasting are cardinal features of protein energy malnutrition in early childhood. Mid upper arm circumference (MUAC) and calf circumference are recognized to indicate the status of muscle development. The mid-calf and mid upper arm are heavily muscled and approximately circular of the two, the mid-upper arm is considered more feasible as it is simpler and easily accessible in any age and sex and so is practical to measure.

### Equipment and technique

The mid upper arm circumference is taken on the left hand. The mid point between the tip of the acromion of scapula and tip of the olecranon of the forearm bone, ulna is located with the arm flexed at the elbow and marked with a marker pen. Fiber glass tape is used and the reading is taken to the nearest millimeter.

### Indication:

- Poor muscle development, muscle wasting are features of all forms of protein energy malnutrition.
- Muscle wasting reflects acute current malnutrition.
- Useful in determining the mortality risk in children.
- It has been reported to correlate well with weight, weight for height and clinical signs.
- When measured along with fat fold at triceps, MUAC in addition can be used to calculate Mid Arm Muscle circumference.

## Body fat

The adipose tissue is distributed over a large number of sites in the body. Subcutaneous fat constitutes the body's main store of energy reserves. The thickness of fat at various sites of the body has been found to be correlated with measures of body fat.

Assessment of human subcutaneous fat can be carried out by various methods. But only physical anthropometry using skin fold calipers is practicable in field circumstances.

The skin fold thickness may be taken on different trunk sites (sub-scapular, supra-liac, abdominal etc) or extremities (triceps, thigh, mid calf). The skin fold at triceps is more reliable than that at sub-scapular in the assessment of obesity.

### Equipment and Technique – Skinfold caliper



#### Fat fold at triceps:



The measurement should be made on the **dorsal side at the same mid-point, where mid upper arm circumference is measured**. The skin fold is picked up between the thumb and the fore finger about one centimeter above the midpoint taking care not to include the underlying muscle.

The tips of the skin fold caliper should be applied at the mid-point at a depth equal to the skin fold. The skin fold should be held gently in the left-hand throughout the measurement. Average of two measurements should be taken. Fat fold at triceps is the least error prone.

#### Fat fold at sub-scapula:



The fat fold is measured **just below and lateral to the angle of the left scapula** by picking it up with the thumb and fore finger in line running approximately 45° to the spine in the natural line of skin cleavage.

The calipers used should have standard contact surface (pinch area) of 20-40 mm and an accuracy of 0.7mm. It should exert a constant pressure of 10g/cm<sup>2</sup> throughout the whole range of the skin fold thickness at all distances of separation of the jaws of the caliper.

Some of the standard calipers used are Harpenden long and Best una caliper.

## **ANALYSIS AND INTERPRETATION OF ANTHROPOMETRIC DATA**

### **Introduction**

Analysis of anthropometric data collected is very important for proper interpretation. The growth standards/norms are mainly used

- To detect whether the child is normal or abnormal.
- To compare measurements made in different places/different times by relating them to a single reference population.

### **Standards**

#### **Types of Standards available are**

1. Local standards developed by ICMR
2. International standards.
3. Harvard Standards- based on well nourished children in Boston in 1930s.
4. Standards used in Road to health card- based on homogenous group of British children.
5. NCHS (U.S. national Centre for Health Sciences) - based on economically and ethnically heterogeneous U.S. child population.
6. WHO (1998) international standards.

#### **Limitations in the use of local standards**

- ✓ Improvement in nutrition in a country changes the standards itself.
- ✓ Time consuming
- ✓ Expensive
- ✓ Difficult to derive

There is good evidence from various research studies from different parts of the world that ethnic differences in growth are minimal. Hence, use of a common international reference standards appears to be strong.

#### **Criteria followed for development of a standard**

- Measurement should be related to a well nourished population.
- Sample should include at least 200 individuals in each age and sex group.
- The sample should be cross sectional, since the comparisons made will be of cross sectional in nature.
- Sampling procedure should be well defined and reproducible.
- Measurements should be carefully made and recorded by trained people in anthropometric techniques, using equipment of well tested, designed and calibrated at frequent intervals.

## Presentation of growth data

### Standards of growth employ

✚ **Percentiles division:** Refers to the value of measurement of that particular number in a series of hundred, when they are arranged in an ascending order.

50th percentile – (Median) refers to the 50th value in a series of 100.

3rd percentile indicates that 3% of children are below the value and 97% above that value.

Common percentiles are – 3, 5, 10, 25, 50, 75, 90, 95 & 97th.

✚ **Standard deviation (SD)**

The relationship of percentiles to S.D in a normally distributed characteristic is shown in figure below.

3rd & 97th percentile include 94% of the population and coincide with values + or – S.D from the mean.

Conventionally -2 S.D units are taken as cut offs to determine retardation in growth.

**S.D classification** - Standard deviation (S.D) classification is shown in table below.

<b>SD Classification</b>	<b>Weight for age</b>	<b>Height for age</b>	<b>Weight for height</b>
≥ Median- 2SD	Normal	Normal	Normal
Median- 2SD to ≥Median-3SD	Moderate under nutrition	Moderate stunting	Moderate wasting
< Median- 3SD	Severe under nutrition	Severe stunting	Severe wasting

### Percentage deviation from the median of standard

To classify children into Nutrition grades or grades of deficit (mild, moderate, severe) – by establishing arbitrary cut-off points.

Ex: Gomez Classification

### Velocity of growth

Velocity is the rate of growth per unit time, usually one year and is referred to as annual increment.

It is the difference in the measurements obtained at initial point of time (T1) and at the end of one year (T2), in a longitudinal study.

Distance Charts: are prepared using data collected in cross sectional studies.

Children belonging to different ages are measured at one point of time. Means for different ages are plotted on graphs and are joined by a smoothed curve.

## **Indicators of Nutritional status**

### **Classifications based on weight for Age:**

#### **Gomez Classification**

- $\leq 60\%$  weight for age: Grade III malnutrition
- 61-75% weight for age: Grade II malnutrition
- 76-90% weight for age: Grade I malnutrition
- $>90\%$  weight for age : Normal.

#### **Indian Academy of Pediatrics (IAP) Classification**

- $\leq 50\%$  weight for age: Grade IV
- 51-60% weight for age: Grade III malnutrition
- 61-70% weight for age: Grade II malnutrition
- 71-80% weight for age: Grade I malnutrition
- $>80\%$  weight for age : Normal

#### **Jellief classification**

- $< 60\%$  of weight for age: Grade III
- 60-80% of weight for age: Grade II
- 80-90% of weight for age: Grade I
- 90-110 % of weight for age: Normal

### **Classifications based on Height for Age:**

#### **1. McLaren's classification**

- $< 80\%$ : dwarf
- 80-93%: Short
- 93-105%: Normal

#### **2. Water low's classification**

- $<85\%$  expected height for age: Severe retardation
- 85-90% expected height for age: Moderate retardation
- 90-95% expected height for age: Mild retardation
- $>95\%$  expected height for age: Normal

#### **3. Classifications based on Weight for Height: Water low's classification based on height for age and weight for height.**

- Normal Weight for height  $\geq 80\%$  standard
- Height for age  $\geq 90\%$  standard

- Stunted : Weight for height  $\geq$  80% standard
- Height for age  $<$  90% standard
- Wasted : Weight for height  $<$  80% standard
- Height for age  $\geq$  90% standard
- Wasted and stunted : Weight for height  $<$  80% standard
- Height for age  $<$  90% standard

**4. Body Mass Index (BMI):** The ratio of weight in kg/Height 2 mts is referred to as Body Mass Index. BMI has good correlation with fitness. It also can be used as an indicator of health risk. BMI in relation to energy status-

Presumptive diagnosis	BMI
Chronic energy deficiency Grade-III severe	$< 16.0$
Chronic energy deficiency Grade-II Moderate	16.0-17.0
Chronic energy deficiency Grade-I Mild	17.0-18.50
Low <u>weight</u> –Normal	18.5-20.0
Normal	20.0-25.0
Obese grade-I	25.0-30.0
Obese grade-II	$>30$

**5. BMI classification, as suggested by WHO (for Asian Population)**

- 20.0-23.0-Normal
- 23-30-over weight
- 30-35-obesity I
- 35-40-obesity II
- $\geq 40$ - obesity II

**Broka’s Index**

- Height in cms -100=Ideal weight (kg)
- Broka’s Index correlates with BMI and weight/height

**Weight/Height ratios**

These ratios are generally termed as body mass indices/obesity indices as those ratios are highly correlated with obesity. Advantages of Weight/Height ratios

- It is an age independent parameter
- Weight/height can be measured easily.
- It is quick method
- More precise than skin fold thickness measurement.

- Hence widely used as indirect measures of obesity.

**There are two types of Weight/Height ratios**

**Relative Weight/Height indices-** Expressed weight of a person as percent of average weight of persons of the same height.

**Power type indices** -Weight relative to some power function of height or height relative to some power function of weight, P is derived from weight/height ratio and the regression coefficient of weight or height for age, sex and population.

**6. Waist and Hip Circumference Ratio:** A waist hip ratio >1.0 in men and >0.8 in women is indication of android obesity and increases the risk of atherosclerosis.

**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.

Male	Female
Level 1	>94cm
Level 2	>102 cm
	>80cm: max acceptable
	>88cm: Obesity

Best set of measurements/Indices found useful for nutritional status.

Details	Measurements/Indices
• Newborns	<a href="#">Weight</a> , height, <a href="#">weight</a> for height (%) or <a href="#">weight/height 2</a>
• Infants	<a href="#">Weight</a> , height, <a href="#">weight</a> for height (%) or <a href="#">weight/height 2</a> , head circumference, chest circumference.
• Preschool children	<a href="#">Weight</a> , height, <a href="#">weight</a> for height (%) or <a href="#">weight/height 2</a> , arm circumference and calf circumference
• School age children adolescents	<a href="#">Weight</a> , height, <a href="#">weight</a> for height (%) or <a href="#">weight/height 2</a>
• Adults	<a href="#">Weight</a> , height, <a href="#">weight</a> for height (%) or <a href="#">weight/height 2</a> <a href="#">Weight/height</a> , <a href="#">weight/height3</a> of Broka’s index.

## **7. Mid-upper Arm circumference (MUAC)**

< 12.5 cm: Severe malnutrition

12.5-13.5cm: Moderate malnutrition

> 13.5cm: Normal

## **8. Head/chest circumference ratio (for children above 6 months of age)**

<1 normal

>1 malnourished

### **Advantages of Anthropometry**

1. The procedures are simple, safe, non-invasive techniques which are applicable to large sample size.
2. Equipment required is inexpensive and portable.
3. Objective with high specificity and sensitivity.
4. Readings are numerical and gradable can be interpreted effectively.
5. Inexpensive and need minimal training.
6. Can be used as parameter for evaluation of nutrition programs.
7. It indicates severity of the deficiency.

### **Limitations of Anthropometry**

1. Anthropometry is relatively insensitive method and it cannot detect disturbances in nutritional status, over short periods of time or identify specific nutrient deficiencies.
2. Limited nutritional diagnosis
3. Procedural error (observer's bias)
4. Problems with reference to standards i.e. local versus international standards.

## **CLINICAL SIGNS AND SYMPTOMS (EXAMINATION)**

### **Introduction**

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

When two or more clinical signs characteristic of a deficiency disease, are present simultaneously, their diagnostic significance is greatly enhanced.

### **Advantages**

- Inexpensive
- Easy and quick method
- Invasive



## Disadvantages

Lack of specificity of clinical signs to a particular nutrient.

## Clinical changes in different parts of body

WHO expert committee has described physical signs to achieve uniformity of terminology and the standardization of results. They are listed above

### 1. Hair

Thinnes and sparseness	:Very few hair present on the scalp.
Dispigmentation of hair	:Distinct lightening of its normal colour.
Flag sign	:Alternate bond of light and dark colour along the length of the hair.
Easy Pluckability	:A tuft of hair can be easily plucked.

### 2. Face

#### 3. Eyes

Pale Conjunctiva	:Pallor of the conjunctiva
Conjunctival Xerosis	:Dry, thickening, pigmentation and lack of luster and transparency of the bulbar conjunctiva.
Bitot's Spots	:These are usually well – demarcated, superficial, dry, grayish silvery or chalky– white foamy plaques, often triangular in shape, present at the temporal side or nasal side of the eyes.
Corneal Xerosis	:The cornea is hazy or opaque, frequently with a bluish milky appearance, usually most marked in the lower central area. It is due in part to cellular infiltration of the corneal stroma. Corneal xerosis is usually accompanied by conjunctival xerosis. Both cornea usually show change, sometimes to a widely varying degree. Photophobia, pain and inflammatory congestion are not usually present.
Keratomalacia	:Softening of the entire thickness of part or more often the whole of the cornea, leading to perforation and iris prolapse.

#### 4. Lips

Angular stomatitis	:Excoriated lesions associated with fissuring at the angles of the mouth.
Angular scars	:Healed angular stomatitis may result in pink or blanched scars at the angles of the mouth.
Cheilosis	:This lesions characterized by redness, swelling and ulceration of the lips, other than the angles.

#### 5. Tounge

Oedema of tongue	:This can be detected by the indentations made by pressure of teeth along the edges of the tongue.
Scarlet and raw tongue	:The tongue is bright red in colour, slightly atrophic, denuded and very painful.
Magenta tongue	:The tongue is purplish red in colour. Numerous morphological changes may co-exist.

Atrophic papillae :The filiform papillae disappears, giving the tongue an extremely smooth appearance. The distribution may be central or marginal.

## 6. Teeth

**7. Gums:** Spongy bleeding gums: purplish or red spongy swelling of the interdental papillae and or the gum margins, which usually bleed easily on slight pressure.

## 8. Glands

Thyroid enlargement :The gland is visibly and palpably enlarged. The enlargement may be diffuse or nodular.

Parotid enlargement :This sign is positive if there is a chronic visible, non-inflammatory, bilateral swelling of the parotids.

## 9. Skin

Xerosis : Generalised dryness with branny desquamation.

Follicular hyperkeratosis:Type 1: In which the lesion consists of hyperkeratosis surrounding the mouths of hair follicles and forming plaques that resemble spines.

Type 2: In which the lesions have a similar appearance, but the mouths of the hair follicles contain blood or pigment.

Petechiae :Small hemorrhagic spots in the skin or mucus membranes.

Pellagrous Dermatitis :Typical pellagrous skin lesions are symmetrical, clearly demarcated, hyper pigmented areas with or without exfoliation. The lesions are common in parts of the body exposed to sunlight, including the cheeks and the fore arms. When they appear around the neck, the condition is called "Casal's necklace".

In acute cases, the skin is red, slightly swollen and may show vesicular exudation and cracking. The lesion itches and burns. In chronic cases, the dermatitis occurs as a roughening and thickening of the skin with dryness, scaling and brown pigmentation.

Flaky-Paint dermatitis :Extensive often bilateral hyper pigmented patches of skin which desquamate to leave hypo pigmented skin or superficial ulceration, often resembling a second degree burn.

## 10. Nail

Koilonychia : Bilateral, spoon shaped deformity of the nails in older children and adult

**11. Subcutaneous fat:** An approximate estimate of any increase or decrease can be gauged by palpation of a skin-fold.

## 12. Subcutaneous Tissues

**Oedema** : Accumulation of water in the body usually first apparent over the ankles and feet, it may extend to other areas of the extremities. It may involve the genitals, face and hands. In firm pressure for three seconds with one digit on the lower portion of the medial surface of the tibia.

## 13. Muscular and skeletal systems

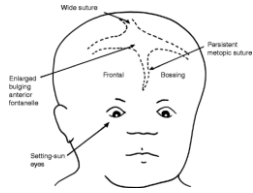
Muscular and Skeletal Systems

**Craniotabes:** Softening of the skull, usually involving the occipital and parietal bones. The sign is positive only in infancy.

**Frontal and Parietal Bossing:** Localized thickening and heaping up of the frontal and parietal bones of the skull. Frontal bossing is the development of an unusually pronounced forehead which may also be

associated with a heavier than normal brow ridge. It is caused by enlargement of the frontal bone, often in conjunction with abnormal enlargement of other facial bones, skull, mandible, and bones of the hands and feet.

#### Persistently open anterior fontanelle:



This may be defined as an anterior fontanelle which is open on palpation after the age of eighteen months.

**Epiphyseal Enlargement:** Enlargement of the epiphyseal ends of long bones particularly affecting the radius and the tibia and fibula at the level of the ankle. In wasted persons, the ends of the long bones appear unusually prominent.

**Beading of the Ribs:** A symmetrical nodular enlargement of the costo-chondrial junctions, producing a "rosary" effect. It is essentially a special localized form of epiphyseal enlargement.

**Bow-legs:** Legs are bent because they cannot withstand the weight of the body.

**Deformities of the Thorax:** The two most important are Harrison's sulcus – an indentation running laterally around both sides of the chest and pigeon chest and musculo – skeletal haemorrhages.

## 14. Internal systems

Muscular and Skeletal Systems

### Gastrointestinal systems

**Hepatomegaly** : Enlargement of liver. Enlarged palpable liver found in young children in many tropical regions. Appear to have mixed etiologies, including chronic malaria, malnutrition and may be due to migration of helminth larvae through the liver.

### Nervous System

**Psychomotor Change** : Listlessness can occur at any age, but is most strikingly seen in severe protein-energy malnutrition of early childhood.

**Mental Confusion** : Clinical tests of the central nervous system may include sensory loss, motor weakness, loss of position sense, loss of vibration sense, loss of ankle or knee jerks, and calf tenderness.

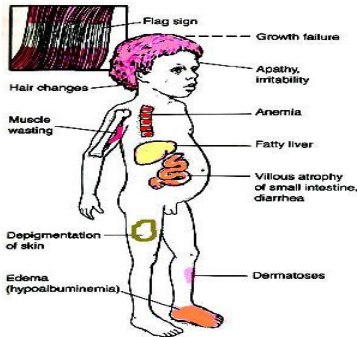
### Cardio Vascular System

**Cardiac enlargement** : The simplest test of value in survey work is an examination by palpation to assess the presence of cardiac enlargement.

**Tachycardia** : The resting pulse rate may be of value in a nutritional status survey, because tachycardia can occur in anemia, beriberi and certain probably nutritional cardiopathies.

## Guide to the interpretation of Groupings of clinical signs

### Protein - energy deficiency



- ✓ Edema
- ✓ Muscle wasting
- ✓ Low - body weight
- ✓ Psychomotor change
- ✓ Dyspigmentation of the hair
- ✓ Easy pluckability of the hair
- ✓ Moon - face
- ✓ Flaky paint dermatosis
- ✓ Diffuse depigmentation of the skin

**10 Differences between Kwashiorkor and Marasmus**  
[www.majorifferences.com](http://www.majorifferences.com)  
 Comparison Table

Kwashiorkor	Marasmus
It develops in children whose diets are deficient of protein.	It is due to deficiency of proteins and calories.
It occurs in children between 6 months and 3 years of age.	It is common in infants under 1 year of age.
Subcutaneous fat is preserved.	Subcutaneous fat is not preserved.
Oedema is present.	Oedema is absent
Enlarged fatty liver.	No fatty liver.
Ribs are not very prominent.	Ribs become very prominent.
Lethargic.	Alert and irritable.
Muscle wasting mild or absent.	Severe muscle wasting
Poor appetite.	Voracious feeder.
The person suffering from Kwashiorkor needs adequate amounts of proteins.	The person suffering from Marasmus needs adequate amount of protein, fats and carbohydrates.

**Kwashiorkor vs Marasmus**

### Vitamin A deficiency

**Vitamin A Deficiency Clinical Manifestations**

1. Night blindness
2. Bitot's spots  
- Abnormal squamous cell proliferation and keratinization of the conjunctiva  
Xerophthalmia
3. Irreversible eye conditions:  
Xerosis  
Corneal perforation  
Keratomalacia  
Punctate keratopathy

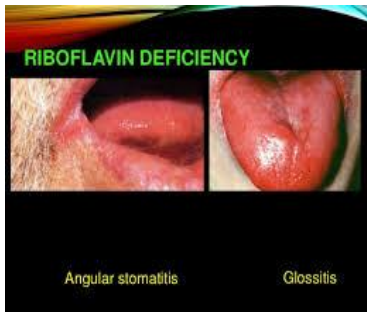
- ✓ Xerosis of skin
- ✓ Follicular hyperkeratosis, type 1
- ✓ Xerosis conjunctiva
- ✓ Keratomalacia
- ✓ Bitot's spots

### Thiamine deficiency

**Vitamin B1 (Thiamine)**

- ✓ Loss of ankle jerks
- ✓ Loss of knee jerks
- ✓ Sensory loss and motor weakness
- ✓ Calf - muscle tenderness
- ✓ Cardiovascular dysfunction
- ✓ Oedema

## Riboflavin deficiency



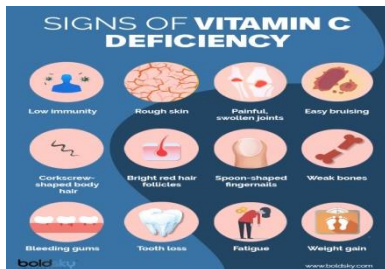
- ✓ Angular stomatitis; angular scars
- ✓ Cheilosis
- ✓ Magenta tongue
- ✓ Central atrophy of lingular papillae
- ✓ Naso - labial dyssebacea
- ✓ Angular palpebritis
- ✓ Scrotal and vulval dermatosis
- ✓ Corneal vascularization

## Niacin deficiency



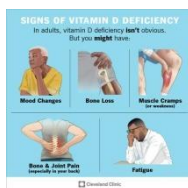
- ✓ Pellagrous dermatosis
- ✓ Scarlet and raw tongue
- ✓ Tongue fissuring
- ✓ Atrophic lingual papillae
- ✓ Molar and supra orbital
- ✓ Pigmentation

## Vitamin C deficiency

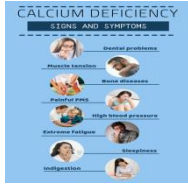


- ✓ Spongy and bleeding gums
- ✓ Follicular hyperkeratosis, type 2
- ✓ Petechiae
- ✓ Ecchymoses
- ✓ Intramuscular or subperiosteal
- ✓ Haematoma
- ✓ Epiphyseal enlargement ( painful)

## Vitamin D deficiency

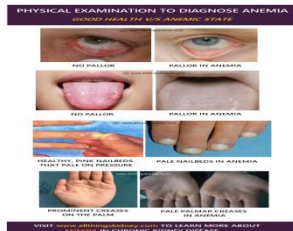


- ✓ Active rickets ( in children)
- ✓ Epiphyseal enlargement (over 6 months of age), painless beading of ribs  
Craniotabes(under 1 year of age) Muscular hypotonia.
- ✓ Healed rickets(in children or adults)
- ✓ Frontal and parietal bossing, Knock-knees or bow-legs, deformities of thorax.



- ✓ Osteomalacia( in adults) Local or generalized skeletal deformities.

**Iron deficiency**



- ✓ Pallor of mucous membranes
- ✓ Koilonychia
- ✓ Atrophic lingual papillae.

**Iodine deficiency - Enlargement of thyroid**

**Signs and symptoms ... ..**

**Hyperthyroidism:**

- Weight loss,
- heat intolerance,
- trembling hands,
- palpitations,
- insomnia,
- anxiety,
- increased bowel movement frequency.

**Hypothyroidism:**

- Weight gain,
- cold intolerance,
- constipation,
- very dry skin,
- depressed mood,
- muscle cramping .
- sluggish brain function,
- short stature,
- mental and motor development delayed or slowed.
- In extremes general neurological development delayed.

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**Excess of fluorine (Fluorosis)**

Mottled dental enamel, (difficult to distinguish in early stages from enamel hypoplasia).



**Rapid clinical surveys**

These are designed to detect the most characteristic signs of one or several nutritional deficiencies. They are of most value when the plane of community nutrition is low. They can be carried out by medical staff or by paramedical personnel, who have been specially selected and trained and are working under the supervision of a competent nutritionist. The data collected should be recorded on a special record form which lists the signs that are considered to be both particularly characteristic and easily identifiable during a field survey.

## **Rapid clinical survey includes**

A simple schedule -which elicit information about some of the important clinical symptoms, as shown below.

### **Hair:**

- Dyspigmentation
- Easy pluckability.
- Sparseness

### **Face:**

- Moon face

### **Eyes:**

- Bitot's spots
- Conjunctival xerosis
- Pale conjunctiva

### **Mouth:**

- Angular stomatitis
- Cheilosis
- Glossitis
- Swollen bleeding gums

### **Thyroid gland**

- Goitre

### **Skin:**

- Oedema (bilateral)
- Follicular hyper keratosis(type I)
- Pellagrous dermatosis

### **Skeleton:**

- Epiphyseal enlargement(wrist)
- Rickety rosary
- Persistently open anterior fontanelle
- Harrison's sulcus
- Bossing of skull
- Knock –knees
- Bow legs

## Interpretations of signs in relation to Nutrient deficiencies

Because of lack of specificity of the signs, the interpretation of clinical signs can be best made by using a “grouping of signs” which have been commonly found to form a pattern associated with the deficiency of a particular nutrient.

More often, however, survey work based on clinical signs, even with the grouping suggested, is best supported and confirmed by

- Appropriate anthropometric measurements.
- Selected biochemical tests
- Investigation of the local diet, preferably by food consumption surveys considered in relation to local ecological circumstances.

Each of these methods is imperfect and incomplete when it is used together in carefully planned and locally relevant combinations, they can give best results.

## Monitoring Growth and Development in a child

Growth denotes increase in physical size of the body and development denotes improvement in skills and function of an individual. Together they denote physical, intellectual, emotional and social well-being of a person.

Normal growth and development is observed only if there is proper nutrition, without any recurrent episodes of infections and if there is freedom from adverse and environmental influences.

## Determinants of growth and development

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- Genetic inheritance - especially height, weight, mental, social development and personality.
- Nutrition before and after birth - Retardation in an infant indicates malnutrition.
- Age - Growth rate is maximum during fetal life, first two years of life and during puberty.
- Sex - Men usually are larger in size than women. During puberty girls grow fast and earlier than boys, but boys grow more.
- Infections and infestations - Infection with TORCH during intrauterine life retards growth of fetus. Recurrent infections like diarrhea and measles especially in a malnourished child will adversely affect the growth.
- Physical surroundings - Sun shine, good housing, lighting ventilation have their effect on growth and development.
- Psychological factors - Love, tender care and proper child parent relationship are all found to influence growth in a child.
- Economic factors - Higher the family income better is the nutritional status of an infant.



- Other factors - Birth order, Birth spacing, Education of parents (higher the educational level better the growth).

## Assessment of nutritional status

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### Normal growth

- In children, parameters used to measure growth are weight in kilograms, height in meters and head and chest circumferences. Assessment can be longitudinal where serial measurement of the same child is recorded over different periods of time or cross-sectional where recorded measurement is compared to that of his peers.
- In India, we are using the new WHO child Growth Standards (2006) for children. However, values differ substantially among adults of different ethnic groups. We have ICMR values as Indian standard.

### Physical growth

#### ➤ Weight

Most widely used and simplest, reproducible anthropometric measurements for the evaluation of nutritional status.

- It indicates body mass
- It is sensitive to even small changes in nutritional status due to childhood morbidity like diarrhoea.
- Rapid loss of weight indicates a potential malnutrition
- Serial weight recording is more valuable for progressive growth of a child when age of a child is not known.

#### Technique for measurement

To measure weight beam or lever accentuated scales with an accuracy of 50-100 g are preferred. Portable Salter scale: the child is suspended from the scale which is hung from a branch or a tripod. Special "pants" are used to weigh babies. Robust, cheap, and easy to carry, these scales should be replaced after one year because of stretching of the spring and inaccurate readings. The model with readings up to 25 kg (x 100 g) is recommended.

Bathroom scales are not recommended as errors up to 1.5 kgs can occur with this.

#### Precautions to be taken while weighing

- Zero error has to be adjusted.
- Minimal clothing should be worn and be without shoes.
- While recording the value do not lean against or hold anything.
- Preferably record under basal conditions in early morning.
- Most types of scales (especially beam scales) are sensitive to dust and mud.

### Standards

- On an average, a baby weighs double the birth weight by five months, trebles its birth weight by one year and quadruples its birth weight by two years.
- A baby should gain at least 500g per month in the first three months of life. If the growth is less than this it points to malnutrition. In different parts of India, the average birth weight is between 2.7 to 2.9 kgs.
- Weight for age is used to classify malnutrition.

### ➤ Height

- Height of an individual is influenced by genetic as well as environmental factors.
- Maximum growth potential is decided by genetic factors.
- Nutrition and incidences of infection determine the extent of exploitation of that genetic potential.
- Inadequate dietary intake and/ or infections reduce nutrients available at the cellular level. This results in growth retardation. A prolonged period of severe deprivation leads to stunting.

### Technique for measurement

- Children below two years are measured by using an infantometer.
- Baby is made to lie on the scale and crown heel length is measured.
- For children above two years and adults a vertical measuring rod anthropometer- is used and maximum height is measured.
- Measuring scale should be capable of measuring to an accuracy of 0.1 cm.

### Standards

- Length of the baby at birth is 50 cm.

- By first year it increases by 50% to 75cm.
- By third year end it increases by 12cm.
- During puberty, growth spurt, boys add 20cm to their height and girls gain about 16 cm.
- Indian girls reach 98% of their final height by 16.5 yrs. and boys reach the same stage by 17.75 yrs.
- Low height for age indicates nutritional stunting or dwarfing. It reflects past or chronic stunting. Cut off point for diagnosis of stunting is 90% NCHS values.

#### ➤ **Mid upper arm circumference**

- Mid upper arm circumference and calf circumference indicate the status of muscle development. Mid-calf and mid upper arm are heavily muscled and is approximately circular.
- Mid upper arm circumference is simple, easily accessible in any age and sex and practical to measure.
- Well-nourished children have a nearly constant arm circumference (about 16 cm) between 1 and 5 years. Undernourished children have a thinner upper arm and a smaller AC.
- Children can be classified as malnourished if their AC falls below an arbitrarily specified level. If ages are not known, AC can be related to height (arm circumference or height).
- As poor musculature and wasting are cardinal features of PEM in early childhood, MUAC helps in identifying malnutrition and in determining mortality risk in children. It correlates well with weight, weight for height and clinical signs. (QUAC stick).

#### **Technique**

- Usually left arm is measured. Arm is flexed at the elbow.
- The circumference is measured on the left upper arm half way between the end of the shoulder (acromion and the tip of the elbow (olecranon). To locate this point, the arm is flexed at a right angle. Then the arm is allowed to hang freely and a tape-measure (preferably of fibreglass) put firmly round it. Do not pull too tight.
- Tapes or strips can be made locally from thin cardboard or X-ray films which are marked in centimetres. Special plastic tapes (insertion tapes) have been manufactured.
- Fibre glass tape is preferred to tailor's cloth tape as it is seen to lose accuracy.

### ➤ **Body Fat**

- Subcutaneous fat constitutes body's main store of energy reserves. Muscle and fat constitute the soft tissues that vary most with a deficiency of protein and calories.
- Many accurate and near accurate methods like densitometry and DEXA but physical anthropometry using skin-fold calipers are practicable in field circumstances to determine the nutritional status of a person.
- For this a standard skin fold caliper has to be used. The skin fold measured consists of a double layer of skin and subcutaneous fat.
- For adults multiple sites are selected like triceps, the abdomen and the sub scapular and subcostal sites. By using different formulae we can derive at the amount of total body fat.
- In young children, the triceps skin-fold is used. The site is exactly at the mid upper arm as determined by the method used for mid arm circumference.
- The technique needs prolonged supervised practice and repetition to obtain reliable and reproducible results.
- Values differ in different communities thus necessitating local standards for comparisons. Hence it is used mostly by researchers and academics in the field.

### ➤ **Head and Chest circumference**

- Head size relates to the size of the brain which increases rapidly during infancy.
- In a normally nourished child, chest grows faster than the head circumference during second and third years.

### **Technique**

- Use a fibre glass tape.
- Head circumference is recorded by passing the tape around the head over the supraorbital ridges of frontal bone in front and the most protruding point of occiput on the back of the head.
- Chest circumference is measured at the level of nipple in mid inspiration.

### **Standards**

- At birth head circumference is 34 cm and chest circumference is 32 cm.
- By 6-9 months both become equal.

- In PEM, due to poor growth of chest, the head circumference may remain to be higher than the chest even at the age of 2.5 to 3 years due to poor development of thoracic cage.
- Both the measurements are not useful beyond the preschool age.

➤ **Behavioral development**

It is a complex affair spread in four fields

- Motor development
- Personal and social development
- Adaptive development
- Language development

For proper behavioral development, it is important to have

- Assured emotional and moral stability
- Regular discipline
- Accepting parents who provide him with models of balanced conduct.

➤ **Growth chart**

- It is a visible display of the child's physical growth and development and it is useful for longitudinal follow-up of a child.
- We have growth charts for children below five years which compares weight for age of the child and for children in 5-19 years which compares their BMI for age.
- There are separate charts for boys and girls.

In a growth chart other information like identification and registration, date of birth, weight, chronological age, immunization record, introduction of supplementary foods, episodes of sickness etc, are recorded. This chart can be easily understood by the mother and the health worker thus motivating them to improve the nutrition of the child.

**How to use the chart?**

**Growth charts for children below five years**

- Pink border growth charts are for girls and blue border charts are for boys.

- Each growth chart has two axes. The horizontal line at the bottom of the chart is the X axis. This is for recording the age of the child and is called "month axis". It has sixty squares and can be used for a child up to five years or sixty months. Age is recorded in completed weeks /months/years.
- The vertical line at the far left of the chart is the Y axis. This is for recording the weight of the child in kilograms and grams. Each thick extended line represents 1 kg., each line extended from a small square represents 500 gms. and the very thin line represents 100 gms.
- A point on a growth chart where a line extended from a measurement on the "month axis" i.e. age, intersects with a line extended from a measurement on the "weight axis" i.e. weight is called a plotted point. A circle is drawn around the dot so as to know the position of the plotted point.
- On each growth chart there are 3 printed growth curves. These are Reference Lines or Z Score Lines and are used to compare and interpret the growth pattern of the child. The 1st / top curved line on the growth chart is the median or average. The other 2 curved lines are below the average and are at a distance.
- Interpretation:
  - When the plotted point is above the second curve the child's growth is normal.
  - When the plotted point is between the second and third curve the child is moderately underweight.
  - When plotted point is below the third curve the child is severely underweight.
  - If the child is severely underweight clinical signs of marasmus and Kwashiorkor may be observed.
  - If a child has oedema of both the feet, mark clearly on the growth chart close to the plotted point that the child has oedema and refer the child for specialised care.
- The direction of curves is important. Interpretation:
  - Upward growth curve: Good. Indicates adequate weight gain for the age of the child. The child is growing well and is healthy.
  - Flat growth curve: Dangerous. Indicates that the child has not gained weight and is not growing adequately. The child needs to be investigated.
  - Downward growth curve: Very dangerous. Indicates loss of weight. The child requires immediate referral and health care.
- Flattening of curve or falling of curve signals growth failure- an early symptom of PEM. This may precede the clinical symptoms by weeks or by months. Such a child needs special care.

## Uses of growth chart

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- Useful tool for growth monitoring.
- Diagnostic tool to detect a high risk child.
- Educational tool for the mothers to participate more actively in growth monitoring and to teach them the importance of adequate feeds during illnesses like diarrhea.
- Tool for action on the type of intervention that is needed and helps make referrals easier.
- Helps in evaluating the effectiveness of corrective measures and thus to note the impact the programs.
- Helps in policy making at local and central levels.

### Growth monitoring should be

- Every month- during first year
- Every two months – during second year
- Every three months up to five to six years.

Plot the growth curve and note that growth faltering can be deleterious.

### Growth chart for 5-19 years.

- We have separate charts for boys and girls.
- Body mass index (BMI) of the child is taken. It is calculated with the formula

$$\text{BMI} = \text{Weight in Kgs} / (\text{Height in metres})^2.$$

- We can also use the simplified nomogram to calculate the BMI.
- Calculated BMI is plotted against the relevant age of the child.
- There are five reference lines.
- The third curve is the average or the median.
- The plotted point should be between the second and fourth curves of the graph.
- If it falls above the second curve it denotes over nutrition and if it falls below the fourth curve it denotes under nutrition. Both need to be appropriately handled.

**STEPS IN GROWTH MONITORING** - Five steps :-

Step 1: Determining correct age of the child

Step 2: Accurate weighing of the child

Step 3: Plotting the weight accurately on a growth chart of appropriate gender

Step 4: Interpreting the direction of the growth curve and recognising if the child is growing properly

Step 5: Discussing the child's growth and follow-up action needed with the mother

## **BIOCHEMICAL ASSESSMENT OF NUTRITIONAL STATUS**

### **Introduction**

Biochemical changes occur prior to clinical manifestation. Therefore, biochemical tests, which can be conducted on easily accessible body fluids such as blood and urine, help to diagnose at the subclinical stage. These tests confirm clinical diagnosis, if symptoms are nonspecific.

### **Functional Biochemical Measurements**

- ✓ Measurement of the nutrient level in the blood.
- ✓ Measurement of the urinary excretion rate of the nutrient.
- ✓ Measurement of urinary metabolite of the nutrient.
- ✓ Measurement in blood/urine of abnormal metabolic products resulting from deficient or sub marginal intake of the nutrient.
- ✓ Measurement of changes in blood components or enzyme activities that can be related to intake of the nutrient and
- ✓ Measurement of some end functions. (Ex-Blood clotting)
- ✓ Analysis of tissues (hair, nails, skin etc).

### **Collection of Blood samples**

- The sample to be taken for the analysis of nutrients varies with the type of nutrient analysis, eg: plasma is required for examination of albumin, vitamin A, Carotene, ascorbic acid and alkaline phosphatase. Fresh whole blood preserved with sequestrene is used for the determination of haemoglobin and haematocrit.
- Blood samples are collected into stoppered or screw-capped glass vials containing an anticoagulant, such as dried oxalate or heparin lithium.
- Each container should have a previously affixed blank label.
- Blood obtained by finger prick can be collected in heparinized capillary tubes and sealed.
- All blood samples must be kept chilled until tested.
- In the field, this is achieved in thermos flasks, which contains ice cubes or in the mobile refrigerators.



### Assessment of protein status

**Blood:** The important proteins which are much altered are albumin and globulin. The normal albumin levels are 3.5-5.5g/dl. During Protein Energy Malnutrition (PEM) the levels may slowdown to 2.0-2.5g/dl. Also the albumin globulin ratio shows a tendency to decrease.

**Urine:** The end products of protein metabolism are urea, uric acid, creatine, hydroxyl proline etc. Reduced protein intake is reflected in decreased protein turnover which in turn affects the levels of proteins in blood and the levels of protein end products in urine. The indices calculated based on these above said protein metabolites indicate the protein status.

In normal children, the index is 4.7, the index decline in kwashiorkor and marasmus. It should be more than 12. The measurement provides an approximate idea of the musculature of the child and it is of value in assessing the recovery of malnourished children as well as the detection of marginal nutrition. Fasting urinary urea nitrogen and creatinine nitrogen ratio, It should be more than 12. Children eating diets low in protein show low ratios of urinary urea to creatinine. Serum Amino acid ratio (AAR): This ratio of non-essential/essential amino acids is very sensitive at an early stage of PEM as also for kwashiorkor. This test is not sensitive to marasmus.

Biochemical methods for assessing nutritional status of vitamins and minerals

Nutrient	Principal Method	Normal	Deficiency
Vitamin A	S. vitamin A Relative Dose Response test (450-1000 µg retinol) 100 µg /kg dehydroretinol dehydro retinol  Vitamin A	30 µ/d	< 20 µg/dl  > 20%  > 0.06
Vitamin D	S. 25- hydroxy	> 10 ng/ml	< 5 ng/ml
Vitamin E	S. vitamin E/total lipid	> 0.8	-
Vitamin K	Protein induced by vitamin K absence PIVKAS	Absent	Accumula
Thiamine	Urinary thiamine  Erythrocyte Transketolase (ETK-AC) Activated	100 µg /24 hr 65 µg/g of creatinine  < 1.15	-  > 1.25
Riboflavin	Erythrocyte glutathione (EGR - AC)	< 1.2	> 1.4
Niacin	N - methyl 1-2 pyridone - 5 carboxylamide (2-pyridone) and N1 - methyl	1 - 4	< 1.0
Vitamin B6	Urinary excretion of B6 Erythrocyte aspartate transferase (EAspAT - AC)	< 1.7-2.0	< 20 µg/g creatinine
Folic acid	Serum folate RBC folate Formimino glutamic acid	> 6.0 ng/ml > 160 ng/rnl < 20 mg FIGLU in 8 hours after histidine	< 3.0 < 140 ng/ml > 100 mg

		load of 0.26 g/kg body weight	
Vitamin B12	Serum B12	200 – 900 pg/ml	80 p g/ml
Ascorbic acid	P. ascorbic acid levels Leucocyte ascorbic acid	> 0.3 mg/dl > 15 rng/dl	< 0.2 < 8 mg/dl
Iron	Serum ferritin levels Serum iron Serum transferrin  Haemoglobin	   > 13g/dl (Men) > 12 g/dl(Women)	   12 µg/dl < 40 < 0.16
Iodine	Urinary excretion of iodine	> 50 rng/g creatinine	
Zinc	P. zinc	84 - 1 04 µ/dl	
Copper	S. copper	75 - 125 µg/dl	

## BIOPHYSICAL OR RADIOLOGICAL MEASUREMENTS

These tests are used in specific studies, where additional information regarding change in the bone or muscular performance is required. Radiological methods have been used in studying the change of bones in rickets, ostemalacia, osteoporosis and scurvy.

When clinical examination suggests radiographic examination, the following is done.

- ✚ In active rickets there is widened concave(cupped) rarified, frayed distal end of long bones usually the radius and ulna.
- ✚ In rickets, there is healed concave line of increase density at distal ends of long bones usually the radius and ulna.
- ✚ In infantile scurvy there is ground glass appearance of long bone with loss of density.
- ✚ In beri beri there is increased cardiac size as visible through rays.
- ✚ Changes in bone also occur in advanced florosis.

These give more accurate information. The results can be used as a supporting data to other methods.

Equipment required for these tests is expensive and technical knowledge is required in interpreting data. It is difficult to transport the equipment to interior parts of any village.

## DIET SURVEY

### Introduction

Diet Survey or food consumption surveys are essential to know the dietary pattern of countries, states, regions and communities. Food consumption assessment methods produce both qualitative and quantitative information about food consumption. The food consumption data can be collected at the National, Household or Individual level and can be expressed in terms of nutrient and or foods.

## Purpose of Diet Survey

1. To assess, what people eat, qualitatively and quantitatively
2. To know the regional variation in the diet
3. To find out whether the existing dietary patterns are satisfactory or not.
4. To know the inadequacies in the existing dietary pattern.
5. To find out the association between diet and disease.
6. To formulate plans to improve the existing dietary patterns through final nutrition programmes at the national level.
7. To fix minimum wages and rations.

## Types of dietary Surveys

**Qualitative enquiry:** Concentrates on qualitative aspects of food consumption like information on the types of food eaten, people's opinion and attitude towards food and the cultural significance they attach to special foods or drink, food practices during health and disease and also under special physiological conditions like pregnancy, lactation and infancy.

**Quantitative enquiry:** Exact amounts of foods consumed in terms of grams or liters are assessed and their nutrient contents estimated. Comparisons of nutrient intakes with the Recommended Daily Allowance (RDA) provide a measure of adequacy or inadequacy of food or nutrient consumption.

## Methods of Diet Survey

A number of diet survey methods are available. Depending on the purpose, level at which survey is required (household or community or country) and the availability of time and resources in terms of trained man power, equipment, transport facility etc, survey method is chosen.

- ❖ National level
- ❖ Institutional level
- ❖ Household level
- ❖ Oral Questionnaire (24 hour recall)

### National level

#### Food Balance Sheet (FBS):

This method is employed, when information regarding the availability of food is needed at macro level i.e. country or region.

The FBS are computed on the basis of total food supplies available for human consumption at retail level for a given country/region from different sources during a reference period of one year. The computation takes into account the amount of the food used for purpose of animal feeds, exports, seeds and wastages.

The availability of any specific food is estimated using the following formula

#### FBS Equations:

• **Available Supply** = Production + Imports - Exports + Change in stocks

• **Food available for human consumption** = Total Food Supply - Feed - Seed - Food Manufacture - Other uses - Waste

• **Food Supply Per Capita (Example: Wheat Flour):**

☐ **Annual Per Caput Supply** = (Food/Population)\*1000 (1901/27650)\*1000 = 68.8 Kg/year)

☐ **Daily Per Caput Supply** = (Annual Per Caput Supply/365)\*1000 (68.8/365 = 188.4 Grams/day)

☐ **Daily Per Caput Supply in terms of Calories** = (Quantity of Daily Per Caput Supply\*Food Composition Factor)/100  
(188.4\*364/100 = 686 Calories/day Number)

☐ **Daily Per Caput Supply in terms of Protein** = (Quantity of Daily Per Caput Supply\*Food Composition Factor)/100  
(188.4\*10.9/100 = 20.5 (Protein/day Grams)

☐ **Daily Per Caput Supply in terms of Fat** = (Quantity of Daily Per Caput Supply\*Food Composition Factor)/100  
(188.4\*1.1/100 = 2.1 (Fat/day Grams)

• **Import Dependency Ratio (IDR)** = [Imports/(Production+Imports-Exports)]\*100

(How much of the available domestic food supply has been imported and how much comes from the country's own production)

• **Self-Sufficiency Ratio (SSR)** = [Production/(Production+Imports-Exports)]\*100

(The SSR expresses the magnitude of production in relation to domestic utilization. The higher the ratio the greater the self-sufficiency)

#### **Merits:**

- It gives a comprehensive picture of pattern of country's food supply.
- Trends in food supply in a country is known, if compiled over different years.
- Dietary pattern of the population can be known
- The availability of food supplies per person relative to other countries can be known.
- Administrators and planners can have a broad idea about the availability and deficit of food in the country and to take proper steps to remedy them.
- Useful for food programme formulation/ for rationing of food/for exceptional conditions.

#### **Demerits:**

- The allowance is made for inedible portion also. No allowance is made for the wastage of edible portion between the retail level and consumption level.
- Since the distribution and other things are not taken care of, and only the average is calculated, the actual dietary consumption will not be known through the food balance sheets.
- Accuracy depends on reliability of statistics of population/ supply/ non food supply/ wastage etc.

## Institutional level

To assess the food intake at institutional level, there are two methods.

**Inventory Method:** (Food list Method): This method is often employed in institutions like hostels, army barracks, homes for the aged etc, where homogenous group of people take their meals from a common kitchen.

In this method, the quantity of food stuff issued to the kitchen as per the records maintained by the warden, are taken in to account for computation of consumption and there is no direct measurement.

Stock at beginning of week \_ Stock at the end of week

The average intake per person per day =  $\frac{\text{Stock at beginning of week} - \text{Stock at the end of week}}{\text{Total inmates participating in meal} \times \text{No. of days of surveys}}$

It is ideal to conduct the survey for 7 consecutive days to know the true picture of diet. This method though takes less time, not very accurate, compared to actual weighment method.

**Actual weighment method:** In this method the total raw foods for cooking are weighed taking in to consideration wastage of food. This procedure is repeated for at least seven days. To assess the intake per person per day, the following formula is used.

Intake in terms of raw food per person per day =

## Household level

Household food consumption methods measure all food and beverages available for consumption by a household/ family group, during a specified time period. The following methods can be used-food accounts, list recall method, inventory method, food records, telephone surveys, actual chemical analysis of the diet etc.

**Food account Method:** A food account consists of a daily record, prepared by the house holder, of all food entering the household, either purchased, received as gifts or produced for household use, during a specified period usually seven days. Quantities of each food item are recorded. Generally no account is taken of food and beverages consumed outside the home or food discarded as plate waste, spoilage or fed to pets. This method is relatively inexpensive.

**Inventory method:** The inventory method aims at recording acquisitions and changes in the food inventory of households during the survey period. An inventory is prepared of the weights and type of all food commodities in the house at the beginning and end of the survey period, which is generally for one week.

**Weighment method:** This method can be used for weighing of raw as well as cooked foods. In community surveys, usually the raw foods rather than cooked foods are weighed, since it is easy and meets with lesser resistance from the households. Weighing of cooked food however is feasible and can be used for household dietary survey.

Foods are actually weighed using on accurate balance. A balance with standard weights and volumetric measures form the main equipment and a structured diet schedule is the study instrument.

In order to obtain the representative picture of the diet, investigator should keep in mind the following do's and don'ts.

**Do's:**

- ✓ Every day make at least two visits. One in the morning and the other in the evening before actual cooking is begun by the house wife.
- ✓ Weigh only the edible portions of raw foods.
- ✓ Make note of correct age, sex and physiological status and activity of each member in the household, who is partaking meals on the day of survey.
- ✓ Account for guests, visitors, pets and the absentees in the computations.
- ✓ Collect additional information on socioeconomic status of the household and culinary practices i.e., the way the food is cooked, preserved and consumed.

**Don'ts:**

- Avoid fast and festival days.
- Do not make false promises of incentives or raise hopes to obtain co-operation from the households.
- Results of the weighment method employed at household level are expressed usually as intake of foods in grams per Consumption Unit or per person per day. Foods are converted to nutrients by referring to food composition tables, which provide information on quantities of different nutrients. The nutrient intake thus can be expressed per Consumption Unit (CU) or per capita.

**Consumption Unit (CU):** On the basis of energy requirement of the body for carrying out its legitimate functions of growth, wear and tear, maintenance of body weight etc, arbitrary calorie coefficient values have been assigned for person's different age, sex and activity group. The value assigned for adult male during sedentary work is one (unit). The energy requirement (RDA) per CU is 2400 kilocalories. For other age, sex and activity/physiological groups, the values assigned form a fraction of this unit as shown below.

<b>Group</b>	<b>Consumption Units( CU)</b>
1 Adult male (Sedentary worker)	1.0
2 Adult Male (moderate worker)	1.2
3 Adult Male (heavy worker)	1.6
4 Adult Female (Sedentary worker)	0.8
5 Adult Female (moderate worker)	0.9
6 Adult Female (heavy worker)	1.2
7 Adolescent (12-21 years)	1.0
8 Children ( 9-12 years)	0.8
9 Children ( 7 to 9 years)	0.7
10 Children ( 5 to 7 years)	0.6
11 Children ( 3 to 5 years)	0.5
12 Children ( 1 to 3 years)	0.4

**Consumption units for computing calorie requirement of different groups**

Intake per CU per day: This is calculated using the following formula

$$\text{Intake per CU per day (g or ml)} = \frac{\text{Raw amount of each food group or nutrient}}{\text{No. of consumption units}}$$

**Demerits:**

Calorie co-efficient values used in computation of intakes are considered to hold good only for calories and hence, their applicability to other nutrients like proteins, vitamins etc is not valid.

Precise consumption level of specific age and physiological groups, within in the family cannot be assessed.

### **Oral Questionnaire (24 hour recall)**

In the 24 hour recall method, subjects, their parents or care takers are asked by the nutritionists, who have been trained in interviewing techniques, to recall the subjects exact food intake during the previous 24 hours period. Detailed description of all food and beverages consumed, including cooking methods and brand names are recorded by the interviewer. In this method quantities of food consumed are usually estimated in household measures.

A set of standardized cups suited to local conditions are used.

#### **The steps involved are**

1. The respondent is asked to list the food preparations made from morning to night i.e., at breakfast, lunch, teatime, dinner etc.
2. An account of the weights of all raw ingredients used for each of the preparations is obtained.
3. Information on the total cooked volume of each preparation is noted in terms of standardized volumetric measures.
4. The intake of each food item by the specific individual in the family is assessed using standardized volumetric measures. The measures are used mainly to aid the respondent to recall the quantities prepared and fed to the individual member.

#### **The success of the 24 hour recall depends on**

- ✓ Interviewer's skill and training received.
- ✓ Physical setting of the interview
- ✓ Presence of neighbors
- ✓ Social class difference between interviewer and respondent
- ✓ Degree of interviewer's familiarity with respondent.
- ✓ Rapport, the interviewer establishes with the respondent.
- ✓ Ability of the interviewer
  - To ask right questions
  - To probe for details of consumption
  - To converse freely with the respondent without the need for interpreter.
  - To identify whether the respondent is providing reliable data or not.

#### **Measuring food consumption of individuals**

1. **24 hour recall method and Weighment method**
2. **Records of food intake**
3. **Chemical analysis:** In this method the individual is required to save a duplicate sample of each type of food eaten by the subject during the day. These samples are then collected and send to the laboratory for chemical analysis. It is the most accurate method but is costly and needs a good laboratory support.
4. **Telephone Survey:** Conducting diet survey through telephone.



5. **Photographic method:** Photographs of food items can be taken at specified distances and at perfect angles of all food items and left overs. Instruct the subject to record all descriptions of each food stuff including method of preparation. Estimates of the weights of food items consumed can be obtained by viewing the photographs alongside previously prepared standard photographs of portions of food stuffs of known weights.
6. **Food frequency questionnaire**
7. **Dietary score:** This method is useful where one is trying to assess the dietary intake of specific nutrient. Example: Iron content of diet. Depending on the content of iron, a food item is given a score. The frequency of intake of those foods is noted by questionnaire method. The frequency of consumption of foods and total score and percentages are then calculated. The value of this qualitative method is enhanced when it is combined with quantitative method of survey and nutritional status assessment.
8. **Diet history:** This method is useful for obtaining qualitative details of diet and studying patterns of food consumption at household levels and at individual level. The procedure includes assessment of the frequency of consumption of different foods daily or number of times in a week or fortnightly or occasionally. This method has been used to study meal pattern, dietary habits, people's food preferences and avoidances during physio-pathological conditions like pregnancy, lactation, sickness, Infant weaning practices, breast feeding practices and the associated cultural constraints which are often prevalent in the community.

### **Food records**

1. The respondent is asked to record at the time of consumption all foods and beverages consumed for a specified time.
2. Detail description of all foods and beverages and their methods of preparation and cooking are recorded.
3. Food portion size can be estimated by using standard household measuring cups and spoons or supplemented by measurements.
4. Portion sizes are later converted to grams by the investigator to calculate nutrient intake.

It involves maintenance of dietary records of weighed quantities of foods consumed by an individual according to number of days of survey. If this method is followed well with proper instructions, a large sample can be covered in short time, sometimes through mailed questionnaire also, provided the population is educated.

### **Food frequency questionnaire (FFQ)**

A food frequency questionnaire is designed to obtain qualitative information about food consumption; this does not provide quantitative data on food or nutrient intake.

FFQ has two aspects

- A list of food
- A set of frequency of use of particular foods

It may be a focused questionnaire focusing on specific groups of food/particular foods/occasionally consumed foods.

Aim is to assess frequency with which certain food items of food groups are consumed during a specific time period. (Example: Daily, weekly, monthly, yearly)

Questionnaire should be simple, with a defined food categories open ended questions should be avoided.

Often this method is used by scientists to study association between dietary habits and disease.

## **ASSESSMENT OF NUTRITIONAL STATUS BASED ON VITAL STATISTICS**

### **Introduction**

The principle aim of the nutritional assessment of a community is to map out the magnitude and geographical distribution of malnutrition as a public health problem to discover and analyze the ecological factors that are directly or indirectly responsible and where possible to suggest appropriate corrective measures. The nutritional assessment of a community should aim at discovering facts and guiding action intended to improve nutrition and health.

Nutritional assessment of human groups based on vital statistics is an indirect method of nutritional assessment. The term vital statistics signifies the data and analytical methods for describing the vital event occurring in communities. The data on vital statistics is generally obtained through the

### **Sources of population census**

- Sample surveys
- Vital statistics registers.

Malnutrition influences morbidity rates for various diseases mortality rates, life expectancy and other health statistics. A variety of statistics may therefore be considered as indirect indicator of the nutritional status of the community.

Vital statistics include the counts of births, deaths, illness and the various rates and ratios that may be computed from them.

### **MORTALITY RATE**

- ✚ **Age-specific mortality rates** : Some types of malnutrition have a particularly high incidence at certain ages, so that the mortality rates at this specific age-period have been suggested as indicators of the incidence of certain types of malnutrition.
- ✚ **Cause specific mortality rates**: Mortality due to a special cause e.g. Diarrheal diseases is called cause specific mortality.

## 1. Mortality rates:

**Death rate:** is defined as number of deaths per 1000, estimated midyear population in one year. It measures the rate at which deaths are taking place for various causes in a given population during a specified period. It may be calculated from the following formula

$$\text{Death rate} = \frac{\text{Total no. of deaths in a calendar year}}{\text{Estimated mid-year population that year}} \times 1000$$

**Maternal mortality rate (MMR):** is the number of maternal deaths pertaining to child births per 1000 live births.

$$\text{MMR} = \frac{\text{number of maternal deaths}}{100000 \text{ live births}}$$

**Infant mortality rate (IMR):** Is the number of babies dying in the first year of life per 1000 live births.

$$\text{IMR} = \frac{\text{number of babies dying in the first year of life}}{1000 \text{ live births}}$$

**Neonatal mortality rate:** Is defined as deaths occurring within 4 weeks or 28 days of birth.

$$\text{Neonatal mortality rate} = \frac{\text{deaths occurring within 4 weeks or 28 days of birth}}{\text{number of live births in that year}}$$

**Peri-natal mortality rate:** This is the number of deaths of infants under 1 month and still births per 1000 total births. This rate gives an index of maternal nutrition though many other factors like genetic makeup of mother and child, the degree of exposure to infections and the standard of medical care available also influence.

$$\text{Peri natal mortality rate} = \frac{\text{number of deaths of infants under 1 month} + \text{still births}}{1000 \text{ total births}}$$

**Still birth rate:** Is the foetal deaths occurring after 28 completed weeks of gestation

$$\text{Still birth rate} = \frac{\text{Number of stillbirths (in which the gestation period was 28 weeks or more) in the first 7 days of life}}{100000 \text{ live births} + \text{stillbirths in the same year}}$$

**Toddler Mortality rate:** This is the number of deaths between 1 to 4 years per 1000 toddlers born. The manifestations and effects of malnutrition are well known to be severe in toddlers.

$$\text{Toddler Mortality rate} = \frac{\text{Number of deaths between 1 to 4 years}}{1000 \text{ toddlers born}}$$

## MORBIDITY RATES

Morbidity relates to types and varieties of diseases one faces or experiences affecting the day to day activity. It can be incidence rate or prevalence rate of a specific disease.

a. **Incidence rate:** Incidence Morbidity Rate Calculation is the number of new cases in the time period divided by the number of people in the specified population x 100. This gives you the morbidity incidence rate.

$$\text{Incidence rate (per cent)} = \frac{\text{number of new cases in the time period}}{\text{number of people in the specified population} \times 100}$$

b. **Prevalence rate:** They are calculated by dividing the total number of cases in a given time period by the total number of persons in the population.

$$\text{Point Prevalence rate} = \frac{\text{Number of current cases (new and preexisting) at a specified point(date) in time}}{\text{Population at the same specified point in time}}$$

$$\text{Period Prevalence rate} = \frac{\text{Number of current cases (new and preexisting) over a specified period of time}}{\text{Average or mid-interval population}}$$

### Vital statistics

#### Advantages:

- It does not need much human resources.
- Less time, money and work is involved.
- Easy to interpret.

#### Disadvantages:

- Sometimes collection of accurate information is not possible.
- Availability of local statistics and its acceptability by the public is difficult.
- Stated cause of death may be quite unreliable.

## UNDERSTANDING OF Z TABLES

### Percentile or Z-score graphs

- Of 100 healthy children at a given age:
  - ✓ 3 per cent have height measurements less than the 3rd percentile

- ✓ 97 of 100 children have measurements below the 97th percentile
- ✓ 50 per cent above or under the 50th percentile
- ✓ 50th percentile measurements correspond to the mean and median
- Z-scores or SD scores are used to describe mathematically how far a measurement is from the median (average).
- The mean (median) is the same in both types of graph

### **What is Z score in Nutrition -**

Z-score, also known as Standard Deviation (SD) score is the measure of dispersion/relative deviance of the data from the mean/median value i.e. measure of the distance between the child's value and value of the reference population.

### **The Z-score or standard deviation classification system**

There are three different systems by which a child or a group of children can be compared to the reference population: Z-scores (standard deviation scores), percentiles, and percent of median. For population-based assessment—including surveys and nutritional surveillance—the Z-score is widely recognized as the best system for analysis and presentation of anthropometric data because of its advantages compared to the other methods. At the individual level, however, although there is substantial recognition that Z-score is the most appropriate descriptor of malnutrition, health and nutrition centers (e.g. supplementary feeding programmes in refugee camps) have been in practice reluctant to adopt its use for individual assessment.

In this database, weight-for-height, height-for-age and weight-for-age are interpreted by using the Z-score classification system. The Z-score system expresses the anthropometric value as a number of standard deviations or Z-scores below or above the reference mean or median value. A fixed Z-score interval implies a fixed height or weight difference for children of a given age. For population-based uses, a major advantage is that a group of Z-scores can be subjected to summary statistics such as the mean and standard deviation. The formula for calculating the Z-score is:

**Z-score (or SD-score) = (observed value - median value of the reference population) / standard deviation value of reference population**

### **Interpreting the results in terms of Z-scores has several advantages:**

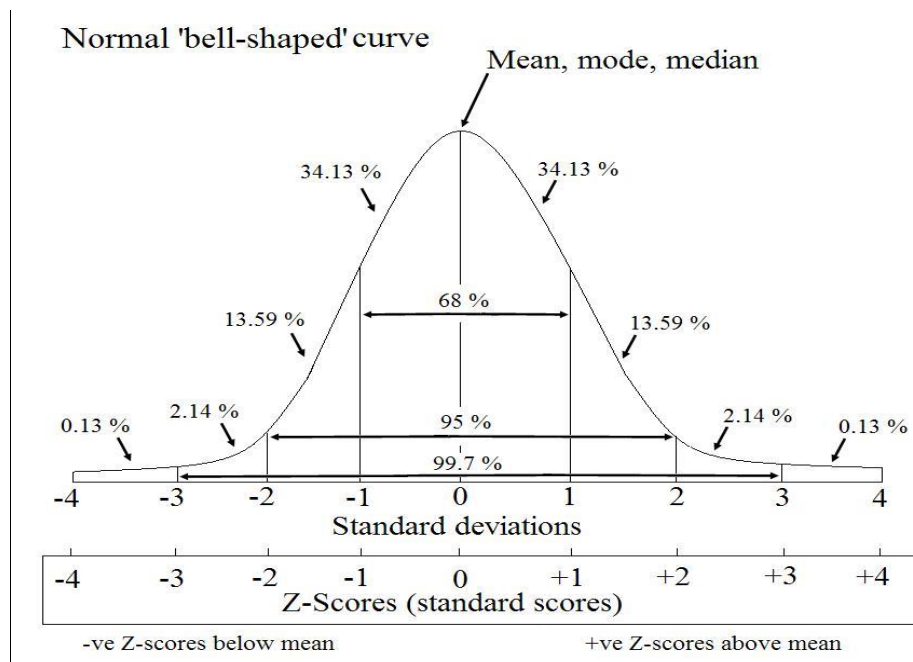
The Z-score scale is linear and therefore a fixed interval of Z-scores has a fixed height difference in cm, or weight difference in kg, for all children of the same age. For example, on the height-for-age distribution for a 36-month-old boy, the distance from a Z-score of -2 to a Z-score of -1 is 3.8 cm. The same difference is found between a Z-score of 0 and a Z-score of +1 on the same distribution. In other words, Z-scores

have the same statistical relation to the distribution of the reference around the mean at all ages, which makes results comparable across ages groups and indicators.

Z-scores are also sex-independent, thus permitting the evaluation of children's growth status by combining sex and age groups.

These characteristics of Z-scores allow further computation of summary statistics such as means, standard deviations, and standard error to classify a population's growth status.

The use of -2 Z-scores as a cut-off implies that 2.3% of the reference population will be classified as malnourished even if they are truly "healthy" individuals with no growth impairment. Hence, 2.3% can be regarded as the baseline or expected prevalence. To be precise the reported values in the surveys would need to subtract this baseline value in order to calculate the prevalence above normal. It is important to note, however, that the 2.3% figure is customarily not subtracted from the observed value. In reporting underweight and stunting rates this is not a serious problem because prevalences in deprived populations are usually much higher than 2.3%. However, for wasting, with much lower prevalence levels, not subtracting this baseline level undoubtedly affects the interpretation of findings.



## Z Scores

Z Score is a statistical measure that reflects the relative deviance form the median value/standard. It is a pure number and is measured as SD (Standard Deviation) in statistical terms. Z Scores are used in a variety of fields and not just in measuring the nutritional status of children.

Some of the other statistical options available for measuring relative score are the T Score, Standard Nine and Percentile.

The matter of a relative score becomes all important when there is no agreeable absolute measure for a certain scalar to call it standard or right. For varying measures of a scalar found in a population, we can calculate several different things like a Maximum Value, Minimum Value, Mean (Arithmetic Mean, Geometric Mean or Harmonic Mean), Median, Mode, etc. But what can we say about what it ought to be? Or which is the best? There is no clear answer to this.

This is where the concept of Standard Deviation (SD) comes in. Leaving aside the actual statistical definition of SD, let us just understand it as a measure of deviation of a particular value from the median value. When this is expressed as a positive value and a negative value depending on whether the value is greater than or less than the median, it is called a Z Score. So when the Z Score of an individual measure is 0 (zero), it means that it is equal to the median.

In the area of Child Health & Nutrition, Z Score is the positive or the negative SD of a particular child with respect to the median of a carefully selected sample or a predetermined population. Z Scores can be of various types depending upon whether the height, weight or both are taken into account.

Therefore, Z Score is a comparative and not an absolute measure in the true sense. However, some extensive studies and research carried out by authoritative bodies like WHO and NCHS/CDC on a global scale have resulted in the setting of certain standardized median values. And today these are used as a reference frame by most nations, most organizations and most researchers.

Please also note that the application of Z Score is not confined to the area of Child Growth & Nutrition and measuring the nutritional status of children. Z Scores can be, and also are used for a variety of purposes including quality control, comparison of examination scores, etc.

### **Weight for Age Z Score**

A Weight-for-Age Z Score (WAZ) should be understood as the number of standard deviations of the actual weight of a child from the median weight of the children of his/her age as determined from the standard sample. This is prefixed by a positive sign (+) or a negative sign (-) depending on whether the child's actual weight is more than the median weight or less than the median weight.

When the actual weight of a child is exactly equal to the median, the resultant WAZ is 0 (zero). As per the agreed global standards, the following categories can be formed:

1.  $-1 < WAZ < 0$       Normal (Well nourished)
2.  $-2 < WAZ < -1$       Marginally Underweight (Mildly Malnourished)
3.  $-3 < WAZ < -2$       Moderately Underweight (Moderately Malnourished)
4.  $WAZ < -3$       Severely Underweight (Severely Malnourished)



The case of having a below median WAZ is called Underweight and is an indication of malnutrition.

### **Height for Age Z Score**

A Height-for-Age Z Score (HAZ) should be understood as the number of standard deviations of the actual height of a child from the median height of the children of his/her age as determined from the standard sample. This is prefixed by a positive sign (+) or a negative sign (-) depending on whether the child's actual height is more than the median height or less than the median weight.

When the actual height of a child is exactly equal to the median, the resultant HAZ is 0 (zero). As per the agreed global standards, the following categories can be formed:

1.  $-1 < \text{HAZ} < 0$       Normal (Well nourished)
2.  $-2 < \text{HAZ} < -1$       Marginally Stunted (Mildly Malnourished)
3.  $-3 < \text{HAZ} < -2$       Moderately Stunted (Moderately Malnourished)
4.  $\text{HAZ} < -3$       Severely Stunted (Severely Malnourished)

The case of having a below median HAZ is called Stunting and is an indication of malnutrition.

### **Weight for Height Z Score**

A Weight-for-Height Z Score (WHZ) should be understood as the number of standard deviations of the actual weight of a child from the median weight of the children of his/her age as determined from the standard sample. This is prefixed by a positive sign (+) or a negative sign (-) depending on whether the child's actual weight is more than the median weight or less than the median weight for the same height.

When the actual weight of a child is exactly equal to the median weight for that height, the resultant WHZ is 0 (zero). As per the agreed global standards, the following categories can be formed:

1.  $-1 < \text{WAZ} < 0$       Normal
2.  $-2 < \text{WAZ} < -1$       Marginally Wasted
3.  $-3 < \text{WAZ} < -2$       Moderately Wasted
4.  $\text{WHZ} < -3$       Severely Wasted

The case of having a below median WAZ is called Wasting and is an indication of malnutrition.

### **Other Z Scores**

There are some other Z scores also like BMI for age Z score, HC for age Z score, etc which are related to pure BMI and HC respectively. But these are not so popular and does not mean much to nutrition specialists. They are rather comfortable with absolute BMI and HC measured in cm.

## UNIT 5

### NATIONAL PROGRAMMES AND POLICIES, ROLE OF NATIONAL AND INTERNATIONAL AGENCIES IN IMPROVING NUTRITIONAL STATUS OF THE COMMUNITY,

INTEGRATED CHILD DEVELOPMENT SERVICE (ICDS)  
SUPPLEMENTARY NUTRITION PROGRAMME (SNP)  
APPLIED NUTRITION PROGRAMME (ANP)  
MID DAY MEAL PROGRAMME (MDMP)  
VITAMIN 'A' PROPHYLAXIS PROGRAMME  
ANAEMIA PROPHYLAXIS PROGRAMME  
FOOD AND AGRICULTURAL ORGANIZATION (FAO)  
WORLD HEALTH ORGANIZATION (WHO)  
UNITED NATIONS CHILDREN'S FUND (UNICEF)  
UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP),  
COOPERATIVE AMERICAN RELIEF EVERYWHERE (CARE)  
OTHER VOLUNTARY AND GOVERNMENT AGENCIES

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#### FOOD AND AGRICULTURAL ORGANIZATION (FAO)

The Food and Agricultural Organization (FAO) is a specialized agency of the United Nations that leads international efforts to defeat hunger, serving both developed and developing countries, FAO acts as a neutral forum, where all nations meet as equals to negotiate agreements and policy. FAO is also a source of knowledge and information, and helps developing countries and countries in transition, modernize and improve agriculture, forestry and fisheries practices, ensuring good nutrition and food security for all.

FAO was founded on 16 October 1945 in Quebec City, Canada. As of 11 April, 2006, it had 190 members.

#### Objectives:

1. To raise the levels of nutrition and standard of living of the population of member countries.
2. To secure improvements in the efficiency of production and distribution of all food and agricultural products.
3. To improve the conditions of rural populations.
4. To contribute towards an expanding world economy and towards ensuring freedom from hunger for humanity.

It gives technical assistance to various Governments. Its main objective is to alleviate poverty and hunger by promoting agricultural development, improved nutrition and the pursuit of food security-the access of all people at all times to the food they need for an active and healthy life. The organization offers direct development assistance, collects, and analyses and disseminates international forum for debate on food and agricultural issues.

FAO is active in land and water development, plant and animal products, forestry, fisheries, economic and social policy, investment, nutrition food standards and commodities and trade. It also plays a major role in dealing with food and agricultural emergencies.

A specific priority of the organization is encouraging sustainable agriculture and rural development, a long term strategy for the conservation and management of natural resources.

## **WORLD HEALTH ORGANIZATION (WHO)**

The World Health Organization is a specialized agency of the United Nations (UN) that acts as a coordinating authority on international public health. It was established on 7 April 1948 and headquarters is in Geneva. WHO promotes technical co-operation for health programmes to control and eradicate disease and strives to improve the quality of human life. It has a single agenda of improving the health of the people all over the world. It monitors disease outbreaks, plans preventive measures, provides cost effective medications and combats correctively to eradicate infectious disease.

**Objectives :** To give worldwide guidance in the field of health.

1. To set global standards for health.
2. To cooperate with governments in strengthening national health programmes.
3. To encourage research and to develop methods to combat disease and make available their study and technology for all.

WHO works with UNICEF, UNESCO, World bank and other organizations.

### **Health & nutrition related functions:**

- Feeding special food: WHO has recently increased nutrition work to develop the cheap foods for babies and infants, which are rich in protein.
- It educates the people about the importance of nutritious foods specifically mothers.
- It conducts medical research programme, which includes human reproduction, drug evaluation, pollution and to improve sanitary conditions. The WHO is studying the different types of medical disorders and their treatment. The main function of WHO is to sponsor the training and research for the medical practitioners of different countries.
- WHO continuously stresses on the importance of National Health Planning and the need for each country to make best utilization of the social resources.
- The WHO is always ready to serve in case of major natural calamities like floods, famines and Quakes.
- WHO acts as a source of information regarding various health problems. A wide variety of morbidity and mortality statistics relating to health problems are published by WHO.

## **UNITED NATIONS CHILDREN'S FUND (UNICEF)**

The United Nations Children's fund was created by the United Nations General assembly on December 11, 1946, to provide emergency food and health care to children in countries that had been devastated by world war II in 1953. The headquarter is present in New York city. UNICEF provides long term humanitarian and developmental assistance to children and mothers in developing countries.

UNICEF is mandated by the UN General assembly to advocate the protection of children's rights, to help meet their basic needs and to expand their opportunities to reach their full potential. UNICEF insists that the survival, protection and development of children are universal imperatives.

UNICEF works in more than 160 countries, areas and territories on solutions to the problems plaguing poor children and their families and on ways to realize their rights. It encourages the care to offer the best possible start in life, helping prevent childhood illness and death, making pregnancy and child birth safe.

**Objectives:**

1. UNICEF works towards comprehensive child health care in the earliest years including the antenatal period before birth.
2. Basic Education and Gender Equality: To promote fund and facilitates for universal primary education for all.
3. AIDS and Children: UNICEF also works via advocacy and community outreach to help governments, communities and families support children orphaned by HIV/AIDS. UNICEF also support programmes that help prevent mother-to child transmission of HIV/AIDS.
4. Child Protection: Focus areas include raising government awareness of child protection rights and situation analysis as well as promoting laws that punish child exploiters working through advocacy and the local offices worldwide. UNICEF helps strengthen the resources of schools communities and families to care for marginalized children, including those orphaned by HIV/AIDS.

**Nutrition's Health Programmes:**

- It has maintained a vigorous programme of financial assistance to maternal and child health problems in under developed areas.
- Distribution of supplementary food to children has been accompanied increasingly by educational measures. Its activities cover immunization, Vitamin A supplementation, Fe Supplementation and education programmes.

**COOPERATIVE AMERICAN RELIEF EVERYWHERE (CARE)**

CARE is one of the world's largest private humanitarian organizations. Headquartered in Atlanta, Georgia, committed to help families in poor communities & improve their lives. Founded in 1945 to provide relief to survivors of World War II, CARE quickly became a trusted vehicle for the composition and generosity of millions.

CARE international is a body of ten autonomous member organizations based in Australia, Canada, Benmark, Deutschland, France, Japan, Norge, Osterreich, UK and USA.

CARE's mission has evolved over the decades. CARE continues to provide emergency relief during and after disasters, but the organization today focuses on addressing underlying causes of poverty. In such areas such as health, HIV/AIDs, natural resources, education and economic development, CARE works to

empower women, because experience has shown that women's gains yield dramatic benefits for families and communities.

### **CARE's campaigns in the fight against global poverty includes**

- ✓ The World Hunger Campaign
- ✓ Education (To improve quality and accessibility of basic education)
- ✓ HIV/AIDS: (Efforts to reduce spread of disease and to aid the affected one's).
- ✓ Victories over poverty: (Long term solutions to poverty)
- ✓ CARE for the child

### **Different projects undertaken by CARE in India are:**

- ✚ Integrated Nutrition and Health project (INHP)
- ✚ Promoting linkages for urban sustainable Development (PLUS) Project.
- ✚ Better Health and Nutrition Project (BHNP)
- ✚ Sustainable Tribal Empowerment project (STEP)
- ✚ Anaemia Control Project
- ✚ Credit Rotation for Empowerment and Development through Institution. Buiding and Training (CREDIT) project.
- ✚ Maternal and Infant Survival project (MISP).
- ✚ Girls Primary Education (GPE) project.
- ✚ Improving women's Health project.
- ✚ Improved Health Care for Adolescent Girls project.
- ✚ Kankan Integrated Development project.
- ✚ Child Survival (CS) project.
- ✚ Improving women's Reproductive Health and Family spacing project.

## **ROLE OF NATIONAL AGENCIES IN COMBATING MALNUTRITION**

### **INDIAN COUNCIL OF AGRICULTURAL RESEARCH (ICAR)**

Indian Council of Agricultural Research (ICAR) is an autonomous organization under the Department of Agricultural Research and Education, Ministry of Agriculture, Government of India. Formerly known as Imperial Council of Agricultural Research, it was established on 16 July 1929 as a registered society under the Societies Registration Act, 1860 in pursuance of the report of the Royal Commission on Agriculture. The ICAR has its headquarters at New Delhi.

The Council is the apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the' entire country. With over 90 ICAR institutes and 45 agricultural universities spread across the country, this is one of the largest national agricultural systems in the world.

The ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development that has enabled the country to increase the production of food grains making a visible impact on the national food and nutritional security. It has played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology development and its scientists are internationally acknowledged in their fields.

### **Objectives**

1. To plan, undertake, aid, promote and co-ordinate education, research and its application in agriculture, agroforestry, animal husbandry, fisheries, home science and allied sciences.
2. To act as clearing house of research and general information relating to agriculture, animal husbandry, home science and fisheries through its publications and information system, and instituting and promoting transfer of technology programmes.
3. To provide, undertake and promote consultancy services in the fields of education, research, training and dissemination of information in agriculture, agroforestry, animal husbandry, fisheries, home science and allied sciences.
4. To look into problems relating to broader areas of rural development concerning agriculture, including post-harvest technology, by developing co-operative programmes with other organizations such as the Indian Council of Social Sciences Research, Council of Scientific and Industrial Research, Bhabha Atomic Research Centre, and universities.

As on 9th September 2009 ICAR has following number of institutions

- 4 Deemed Universities
- 48 ICAR Institutions
- 6 National Bureaux
- 28 Project Directorates
- 17 National Research Centres
- 138 Substations of ICAR Institutes
- 61 AICRPs (All India Coordinated Research Projects)
- 10 Other Projects
- 17 Network Projects
- 8 Zonal Project Directorates
- 569 Krishi Vigyan Kendras (KVKs)

### **INDIAN COUNCIL OF MEDICAL RESEARCH (ICMR)**

The Indian Council of Medical Research (ICMR) is the premier autonomous organization of the Government of India for planning, promoting, coordinating and conducting biomedical research in India.

The objectives of the ICMR are in consonance with the national health policy and aim towards improving the health of the people of India through biomedical research.

The ICMR established in the year 1911, is one of the oldest medical research organizations in the world with a broad mandate to acquire new knowledge through the conduct and support of biomedical research in all areas of biomedical research that would have a bearing on improving the health of Indian people.

**Objectives:**

1. To make scientists aware of the need and responsibility to protect new knowledge generated through intellectual property rights, ownership of biological and other materials and data generated using ICMR funds and facilities.
2. To develop procedures at ICMR institutions to capture, assess and protect new intellectual property generated.
3. To provide ICMR scientists information demand relating to patents in their areas of interest by maintaining appropriate national and international databases.
4. To provide appropriate technological professional and legal expertise and services to assist ICMR scientists to file patents in India and abroad.
5. To encourage and provide all support to universities and other institutions for protecting and commercializing new knowledge generated with ICMR support.
6. To develop a licensing policy that ensures the maximal public health benefit and a fair return on investment from ICMR research.
7. To develop and implement a royalty policy at ICMR institutions that encourages innovative scientists and technology generators through a system of royalty sharing and reward system.
8. To serve in an advisory capacity to the Indian Government on IP related issues concerning public health.
9. To forge appropriate strategic alliances with national and international Science and Technology agencies and industry to market its new inventions and develop professional knowledge network for ICMR's technology management professionals.

**NATIONAL INSTITUTE OF NUTRITION (NIN)**

The National Institute of Nutrition located at Hyderabad is one of the esteemed research institute of the Indian Council of Medical Research.

**Objectives:**

1. To identify various dietary and nutrition problems prevalent among different segments of the population and continuously monitor diet and nutrition situation of the country.
2. To evolve suitable methods of prevention and control of nutrition problems through research, keeping the existing economic, social and administration set up in view.
3. To conduct operational research to pave the way for planning and implementation of national nutrition programmes.

4. To investigate nutritional deficiencies, nutrient interactions and food toxicities at basic level for understanding the biochemical mechanism involved.
5. To provide training and orientation in nutrition to key health professionals.
6. To disseminate authentic health and nutrition information through appropriate extension activities.
7. To integrate the institutes research programmes with other health agricultural and economic programmes as envisaged by the Government.
8. To advise governments and other organizations on problems of nutrition.

The Institutes activities can be broadly categorized under four major heads.

- ✚ **Clinical Studies:** Conducting clinical studies. The clinical aspects of the Institutes work are carried out mostly in the three major teaching hospitals in the twin cities of Hyderabad and Secunderbad.
- ✚ **Laboratory Studies:** The institute has excellent facilities for undertaking of studies in biochemistry, food chemistry, pathology, immunology, hematology, microbiology, endocrinology, physiology and toxicology. Excellent facilities exist for laboratory animal breeding and experimentation.
- ✚ **Community Studies:** Investigations in community nutrition and operational research are carried out in many state. The Institute collaborates with the state and central Governments and international agencies in planning and conducting diet and nutrition surveys evaluating ongoing nutrition programmes and conducting studies on socio-cultural aspects of nutrition.

Along with research work, teaching and training activities are also given priority. The institute has been recognized as a centre for research lending to Ph.D and M.D degrees by many Indian Universities. The Institute has been recognized by WHO as a center for advanced training in health and nutrition.

Publications are brought out on specific themes of importance to major target groups like auxiliary health workers, teachers, woman and children.

## **NATIONAL NUTRITION MONITORING BUREAU (NNMB)**

Monitoring of the nutritional status of population, is an important aspect of any nutrition intervention programme to assess the massive inputs and to determine the direction in which the community nutrition is progressing, so as to initiate appropriate corrective actions. The Indian Council of Medical Research (ICMR), established National Nutrition Monitoring Bureau (NNMB) in the year 1972, with a Central Reference Laboratory (CRL) at the National Institute Of Nutrition, Hyderabad.

### **The objectives of NNMB are**

1. To collect data on dietary intakes and nutritional status of the population on a continuous basis.
2. To evaluate the ongoing national nutrition programmes.

In addition to coordinating the activities of the State units, CRL is also responsible for sampling, training, supervision and analysis of the data collected periodically. Linkages with the National Sample Survey Organization have also been forged. At present there are 10 units of NNMB in different states of India i.e.



Andhra Pradesh, Gujarat, Orissa, Karnataka, Kerala, Madhya Pradesh, Tamil Nadu, Maharashtra, Uttar Pradesh and West Bengal.

### **FOOD AND NUTRITION BOARD (FNB)**

The Food and Nutrition Board (FNB), set up in 1964, is under the department of Women welfare and Child Development. The FNB has a technical wing at the centre, 4 regional offices at Delhi, Mumbai, Kolkata and Chennai. It is engaged in its conventional activities as well as in new initiatives undertaken as a follow up of National Nutrition Policy. Some of the areas of FNB activities are as under.

- ✚ **Nutrition Education and Orientation:** Nutrition Education of the people in rural, urban and tribal areas is one of the primary activities of the FNB. Nutrition demonstrations in rural, urban and tribal areas are organized by each of the 43 Community Food and Nutrition Extension Units (CFNEUS) in different states, 12,000 programmes benefiting about 5 lakh persons are organized annually.
- ✚ **Training in Home Scale Preservation of Fruits and Vegetable:** The CFNEUS impart education and training in home scale preservation of fruits and vegetables to housewives and adolescent girls with a view to promote preservation and consumption of fruits and vegetable which could be useful for income generation purposes.
- ✚ **Monitoring of Supplementary Feeding under ICDS:** The CFNEUS monitor the supplementary feeding component of ICDS in areas of their location.
- ✚ **Mass Media Communication:** Development of educational and training material on nutrition has been one of the important activities of FNB Headquarters. Some of the important publications include Handbook on Integrated Nutrition Education, Guidelines for Nutrition of pregnant women, posters on child's Health, Nursing mothers, complementary feeding, instant food mixes, Iodized salt, folders on mother's milk, green leafy vegetables, fruits and vegetables for vitality, stickers for school children, National plan of Action on Nutrition etc. Efforts are made to promote nutrition facts about infants, pregnant and lactating mothers.
- ✚ **Advocacy and Sensitization of Policy makers and Programme managers:** Advocacy and sensitization of policy makers for integrating nutritional concerns in developmental programmes is a key issue for promoting nutrition of the people in the country. Regional workshops are planned for this.
- ✚ **Follow Up Action on National Nutrition Policy:** A number of initiatives have been taken up since National Nutrition Policy was adopted by Government of India in 1993. A National Plan of Action on Nutrition was formulated and approved by the Inter ministerial coordination Committee and released in 1995. A task force on micronutrient deficiency like Vitamin A and Iron was constituted and details are worked to eradicate them.

The National Nutrition Mission aims at eradicating malnutrition in a time bound fashion. The three important areas for action are vigorous awareness campaign in malnutrition and its prevention, direct interventions for preventing malnutrition, nutrition monitoring, mapping and surveillance to be established in the country for reducing high levels of malnutrition.

## **NUTRITION FOUNDATION OF INDIA (NFI)**

Nutrition Foundation of India (NFI) was founded by Dr.C.Gopalan in 1980 with the active co-operation and support of a large body of scientists and leading citizens. NFI is a non-governmental, non-profit, voluntary institution dedicated to the cause of eradication of under nutrition in the country. It is recognized officially by the government of India as a “scientific research body”.

The foundation derives financial support for its activities from enlightened private donors and from National and International agencies interested in the improvement of nutritional status of populations. The government of India’s continued support and goodwill facilitated the growth of the foundation.

### **Objectives:**

1. Highlight and focus public and government attention on national problems related to malnutrition: assess their causation, magnitude and implications and offer short term as well as long term action plans for their control.
2. Institute conduct and support action oriented studies and research on these problems through existing institutes, university centers and other suitable bodies in order to evolve appropriate solutions capable of application in the current context.
3. Investigate means to offset existing deficiencies in the pattern of production and distribution of foods and to ensure wholesomeness and nutritive value of foods sold for public consumption.
4. Disseminate information on diet and nutrition, promote nutrition education in schools and through mass media, publish periodically a Bulletin in order to disseminate information on important facts of nutrition.
5. Interact with the planning commission and governmental agencies to facilitate the formation, implementation and evaluation of nutrition programmes.

The foundation has always recognized the fact that the growing knowledge regarding diet and nutrition should be widely disseminated to the public and play an important role in extension education.

Foundation has also set up a separate body which deals with dietary and nutritional management of nutrition related chronic degenerative disease.

## **NUTRITION PROGRAMME IN INDIA**

### **Introduction**

Malnutrition is one of the pressing problems in India affecting the economic development of the country. Malnutrition is rampant in all the parts of the country being more in certain areas and with certain age groups.

A hungry man is a social liability. He cannot work, cannot learn, cannot build resistance to diseases and thus retards the economic and social development of the nation.

During the mid-thirties to the present stage, four distinct phases of nutrition programmes could be identified. These are presented in figure below.

### Different phases of nutrition Programmes

In each phase, the concerned sector took the predominant role. Thus, in the first phase, nutrition programming was more or less the responsibility of the medical or health sector. In the second phase, food and agriculture sector took the leading role. In the third phase, the community development and in the present IV phase, all related sectors with social welfare as the nodal agency. The success or failures of each phase led to the strategy of the next phase.

### Nutrition programmes in India under different sectors of Indian Government

Important nutrition programmes in India today under different sectors of the Government, responsible for their implementation are described below.

S.No	Ministry responsible for implementation	Name of the programme	Target group	Services provided
1.	Ministry of health and family welfare	a)Vitamin 'A' prophylaxis programme	Children between 1-5 years	Provision of 2,00,000 I.U. of vitamin 'A' every six months to children under 6 years, for control of nutritional blindness.
2.	Ministry of Social and Women's welfare	a)Integrated child development scheme (ICDS)	Children upto 6 years. Pregnant and lactating women.	Package of services <ul style="list-style-type: none"> <li>• Immunisation</li> <li>• Health check up.</li> <li>• Referral services</li> <li>• supplementary Nutrition</li> <li>• Non-formal pre-school education</li> <li>• Nutrition and health education to women of 15-45 years age.</li> </ul>
3.	Ministry of Education & Culture	Mid-day meals scheme for school children	School children	<ol style="list-style-type: none"> <li>1. Supplementary feeding for 200 days in a year</li> <li>2. Nutrition education.</li> </ol>
4.	Ministry of rural development	Applied nutrition	Pre schoolers, pregnant &	<ol style="list-style-type: none"> <li>1. Encourages local food production through training</li> </ol>

		Programme (ANP)	lactating women.	and supply of materials for kitchen gardening and community gardens. - Fish ponds - Poultry development 2. Supplementary feeding. 3. Cooking demonstrations.
5.	Ministry of Agriculture and Cooperation.	The programmes of Food and Nutrition Board		<ul style="list-style-type: none"> <li>• Development and promotion of nutritious foods like miltone, weaning foods like Bal-ahar, and fortification of foods.</li> <li>• Nutrition education through mobile units and production of Audiovisual aids and holding exhibitions.</li> <li>• Conducting diet surveys and formulation of balanced diets.</li> </ul>

## NATIONAL NUTRITION PROGRAMMES

### NATIONAL VITAMIN A PROPHYLAXIS PROGRAMME

Nutritional blindness caused by vitamin A deficiency is one of the major nutritional problems affecting children. Dietary improvements to provide adequate amounts of vitamin A is the logical approach for prevention and control of this condition and there are relatively inexpensive sources of vitamin A precursor (carotenes) such as green leafy vegetables and fruits. Achieving this however, involves intensive nutrition education which is a long term approach. A short term measure of providing synthetic vitamin A periodically to pre-schoolers was launched in 1971 by the Ministry of Health and Family Welfare. A massive oral dose of 200,000 I.U. of vitamin A is given once in every six months to children between 1-5 years. Supplies of vitamin A for this programme are made available by the ministry of Health to State

Family Welfare Departments implementing the programme through the network of Primary Health centres and sub-centres. ANMs and other paramedical workers administer vitamin A by home visits to all the children between 1-5 years. The acceptability of this approach and administrative feasibility and efficacy of the programme are well established.

#### **VITAMIN-A PROPHYLAXIS PROGRAMME 1970**

VAD is the most common cause of preventable blindness in children(1-3yrs) 20-40 million children worldwide- estimated to have at least mild vitamin A deficiency (VAD), half reside in India. VAD causes an estimated 60,000 children in India to go blind each year.

Prevalence rates vary greatly among the states and range from less than 1% to 6%. Prevalence of Xerophthalmia 0.6% as per GBD 2000 estimates. VAD in India remains a significant public health problem.

The National Vitamin A prophylaxis programme was started in 1971

Became part of RCH programme from 1997

#### **Goal**

- To make vitamin –A deficiency no more a public health problem
- To reduce Bitot’s spot to less than 0.5%
- To bring down the prevalence of night blindness to less than 1%

**Short term measures-** Children between 1-5 years were given oral doses of 200,000 IU vitamin A every six months. Currently, vitamin A is given only to children less than three years old who are at greatest risk. The administration of the first two doses is linked with routine immunization to improve the coverage. A dose of 100,000 IU is given along with measles vaccine at nine months of age and 200,000 IU with DPT booster at fifteen months.

**Medium term measure-**Fortification of food, Vanaspati is with vitamin A and D to the extent of 2500 IU of vit-A and 175 IU of vit-D per 100grams. Fortified milk currently, 62 dairies are fortifyingFortified milk with 200 IU/100 ml with future plans for expansion. Other food considered for fortification include sugar, salt, tea, margarine, dried skimmed milk etc.

**Long term measures** - Dietary improvement is, undoubtedly, the most logical and sustainable strategy to prevent VAD. Nutrition education -A change in dietary habits and increased access to vitamin A-rich foods through education. Immunization against infectious diseases, Prompt treatment of Diarrhoeal diseases. Better feeding practices of infants and children.

## **NATIONAL ANAEMIA CONTROL PROGRAMME**

Iron deficiency is the major causative factor for anaemia in India, although folate deficiency is also responsible to some extent. High rates of prenatal mortality and premature births are some sequelae of anaemia. As a preventive measure, the Ministry of Health has undertaken a national programme of distribution of iron and folic acid tablets to pregnant women during last trimester of pregnancy and to preschool children. The existing network of Primary Health and Maternity and Child Health Centres is used for this programme. Evaluation studies revealed that the programme could be effective in raising the haemoglobin status of the beneficiaries, though not achieved anticipated success.

### **Prevalence of nutritional anemia in India**

- 65% infant and toddlers
- 60% 1-6 years of age,
- 88% adolescent girls (3.3% has hemoglobin <7 gm./dl; severe anemia)
- 85% pregnant women (9.9% having severe anemia).

The prevalence of anemia was marginally higher in lactating women as compared to pregnancy. The commonest is iron deficiency anemia.

- The programme was launched in 1970
- 1992 became part of CSSM programme
- 1997 became part of RCH programme
- All pregnant mothers get 1 tablet of IFA per day for 100 days.
- All anaemic mothers get 2 tablets of IFA per day for 100 days.
- All anaemic child get 1 tablet of IFA per day for 100 days
- All acceptors of family planning (IUD) are given one tablet of IFA for 100 days.
- All adolescent girls were given 1 tablet of IFA per week

### **Dose**

60 mg of elementary iron & 0.5 mg of folic acid and which was raised to 100 mg elementary iron from 1992 however folic acid content remained same. Children in the age group of 1-5 years are given one tablet of iron containing 20 mg elementary iron (60 mg of ferrous sulphate and 0.1 mg of folic acid) daily for a period of 100 days.

## **NATIONAL IODINE DEFICIENCY DISORDERS (IDD) CONTROL PROGRAMME**

India has one of the most severely endemic areas of goiter. It occurs all along the sub-Himalayan regions and several new foci of endemic goiter has been discovered in recent years in the country. Of the 120 million people living in the endemic region, nearly 1/3rd are estimated to be suffering from goiter. Prevention and control of this condition through distribution of Iodised salt is well known. The ministry of health and family welfare launched a National Goitre Control Programme towards the end of the Second Five Year Plan. The programme was renamed in 1992 as National Iodine deficiency disorders control

programme. Identification of pockets of goiter and supply of iodised salt to the population at risk are done under this programme. Salt is iodised with potassium iodate and distributed in endemic areas at the same prices as common salt. Iodised salt is made accessible to below poverty line population through PDS in several states of India. Various administrative and managerial bottlenecks at the implementation level appear to have contributed to the poor impact of this programme.

### **National iodine deficiency disorder control programme (NIDDCP) 1992**

- National goitre control programme was launched in 1962,
- GOI adopted policy of universal salt iodization (USI) 1984.
- Amended 1988- level of iodization of salt at manufacture level at 30ppm and consumer level 15ppm. 1990 sale and manufacture of non iodized salt was banned.
- Referred as NIDDC programme in 1992 with an aim to bring down the incidence of IDD below 10% by 2000.

### **Components of IDDC programme**

- Iodization of salt and oil
- Monitoring and surveillance
- Manpower training
- Mass communication

### **Iodized salt**

- ✓ Most economical, convenient and effective means of mass prophylaxis for IDD
- ✓ Under PFA act level of iodization is 30ppm at manufacturer level and 15ppm at consumer level
- ✓ Addition of 30 mg of iodine per Kg usually in the form of potassium iodate
- ✓ Potassium iodate is more stable in warm, damp and tropical climate.

### **Iodized oil (injection)**

- IM iodized oil ( poppy seed oil, safflower oil)
- 1ml of IM injection will provide protection for 4 years
- More expansive than iodized salt
- Less practicable as it is very difficult to reach each and every one to give injection Iodized oil (oral) or sodium iodate tablet also tried
- More costly than IM injection

### **Iodine monitoring and surveillance- components**

- Iodine excretion determination
- Determination of iodine content in soil and food
- Determination of iodine in salt at factory level, wholesale and retail level and community or consumer level.

## **Manpower training**

- Training of health worker in all approaches of IDD control
- Training on public education Mass communication through posters radio, television, news papers and other means.

## **INTEGRATED CHILD DEVELOPMENT SERVICES (ICDS) SCHEME**

A novel scheme of Integrated Child Development Services was launched in 1975-76 by the department of social welfare. It envisages an integrated package of services for children under 6 years a

nd women during pregnancy and lactation.

The concept of providing a package of services is based primarily on the premise that impact will be appreciable by converging all the needed inputs in the area of operation. The composite package of services is delivered to the community through specially trained anganwadi workers.

### **Objectives**

- ✓ To improve the nutritional and health status of pre-school children in the age-group of 0-6 years
- ✓ To improve the physical, mental and social development of the child
- ✓ To reduce the incidence of mortality, morbidity, malnutrition and school drop-out;
- ✓ To enhance the capability of the mother to look after the normal health and nutritional needs of the child through proper nutrition and health education

### **Administrative set up**

- At state level -state ICDS programme officer who report to DPH
- District level ICDS programme officer
- Block level(100 Villages) – Child Development Project Officer
- For every 20-25 ICDS center 1 supervisor (mukhya sevika)
- At ICDS centre – Anganwadi worker (every 1000 pop)
- In tribal areas 1 Anganwadi for 700 pop

**Targeted Beneficiaries** - The Scheme targets the most vulnerable groups of population include

- children upto 6 years of age,
- pregnant women and nursing mothers belonging to poorest of the poor families and living in backward rural areas, tribal areas and urban slums.

The identification of beneficiaries is done through surveying the community and identifying the families living below the poverty line.

### **Package of Services**

1. Supplementary Nutrition
2. Immunization



3. Health Check-up
4. Treatment & Referral Services
5. Non-formal Pre-school Education
6. Nutrition & Health Education

**Supplementary nutrition** - All children below 6 years of age, Adolescent girls, expectant mothers belonging to schedule caste and tribes who's monthly income less than 300 and land less agriculturist Given for 300 days ( lunch).

Recipients	Calories	Grams of Protein
Children upto 6 Years	300	8-10
Adolescent Girls	500	20-25
Pregnant and nursing mothers	500	20-25
Malnourished Children	Double the daily need provided to the other children (600 and/or special nutrients on medical recommendation)	

**Non formal education** - Children between 3-6 years are imparted pre- elementary education without formal hours of teaching without syllabus and test, Teaching is mixed with play. Locally made charts, pictures, diagrams, toys and play charts, equipments are used.

**Immunization** - Anganwadi arranges with health worker female serving her area to give immunization to her wards and pregnant mothers. Treatment & Referral services, with help of HWF get all needy children treated for minor illness like diarrhea, ARI, minor cuts, fever etc. All other cases and severe malnutrition refers to medical officer of PHC. Growth monitoring, Checks the weight of all preschool children every month and records in growth chart.

### The impact of the programme

- ✚ Evident from the remarkable improvements made in child survival and development indicators
- ✚ Decrease in Prevalence of Malnutrition among Pre-school Children
- ✚ Improved immunization Coverage in ICDS Areas
- ✚ Decrease in IMR in ICDS Areas
- ✚ Improvement in School Enrolment and Reduction in School Dropout Rate in ICDS Areas, 1992.

### MID-DAY MEAL PROGRAM

The Mid-Day Meal Scheme was launched by the Ministry of Human Resource Development (Department of Education) with effect from 15th August, 1995 for the benefit of students in primary schools. The

Scheme presently covers students of Class I-VIII in the Government Primary Schools / Upper Primary Schools/ Schools aided by Govt. and the Schools run by local bodies.

The Department of Food & Public Distribution makes allocation of annual requirement of foodgrains under the Scheme to Department of School Education & Literacy, Ministry of Human Resource Development.

It involves provision of lunch free of cost to school-children on all working days. The key objectives of the programme are:

1. protecting children from classroom hunger,
2. increasing school enrolment and attendance,
3. improved socialisation among children belonging to all castes,
4. addressing malnutrition, and
5. social empowerment through provision of employment to women.

The scheme has a long history especially in Tamil Nadu and Gujarat, and has been expanded to all parts of India after a landmark direction by the Supreme Court of India on November 28, 2001. The success of this scheme is illustrated by the tremendous increase in the school participation and completion rates.

Mid-day Meal Scheme-1962 - The mid-day meal scheme is the popular name for school meal programme in India. It involves provision of lunch free of cost to school-children on all working days. 106 million children, 8 lakh schools in 576 districts.

**Objectives of the programme are:**

- To improve the nutritional status of children
- protecting children from classroom hunger,
- increasing school enrolment and attendance,
- improved socialization among children belonging to all castes

The scheme has a long history especially in Tamil Nadu and Gujarat, Has been expanded to all parts of India after a landmark direction by the Supreme Court of India on November 28 2001. The success of this scheme is illustrated by the tremendous increase in the school participation and completion rates in TAMIL NADU.

One of the pioneers of the scheme is the Madras Corporation that started providing cooked meals to children in corporations' schools in the Madras city in 1923. The programme was introduced in a large scale in 1962 in TN. Major thrust came in 1982 decided to universalize the scheme for all children in government schools in primary classes in TN. Later the programme was expanded to cover all children up to class 12.

**Principles** - The meal should be a supplement and not a substitute to the home diet. The meal should supply at least one third of the total energy requirement and half of the protein need. The cost of the meal should be reasonably low. The meal should be such that it can be prepared easily in schools, no

complicated cooking process should be involved, as far as possible, locally available foods should be used, this will reduce the cost of the meal. The menu should be frequently changed to avoid monotony.

### Model menu

Foodstuffs	g/day/child
a. Cereals and millets	75 Pulses
b. Oils and fats	30
c. Leafy vegetables	88
d. Non – leafy vegetables	30s

**SPECIAL NUTRITION PROGRAMME** - Programme was started in 1970

### Beneficiaries

- ✓ Children below 6 years of age
- ✓ Pregnant and nursing mothers in urban slums, tribal areas and backward rural areas

Supplementary food supplies about 300 kcal and 10-12 grams of protein per child per day

Mothers receive daily 500 kcal and 25grams of protein, Supplement is provided for 300 days in year. It is gradually being merged with ICDS programme.

**BALWADI NUTRITION PROGRAMME** - Started in 1970, 6000 Balwadi centre -across the country, For children under the age group of 3-6 years. Provide pre-primary education to children, Food supplement provides 300 kcal and 10 grams of protein per child per day for 270 days.

**TAMILNADU INTEGRATED NUTRITION PROGRAMME** - Was started in the year 1981, Beneficiaries are children < 6 years, pregnant and lactating mothers. Merged with ICDS programme.

### Indirect nutrition programmes

There are programmes which have great indirect effect on prevention of malnutrition. They are as follows:

- **Family welfare programme-** Nutrition programmes and programmes for birth spacing are the “two sides of the same coin”. It is an accepted fact that without improvement in the family health, nutrition improvement of the children is impossible. Again there cannot be any family health if the mother in the family conceived year after year a large number of children to take care. The

correlation between nutrition and family size has been well documented not only in India but in various parts of the world.

- **Universal Programme of immunization** and provision of effective primary health care. It is essential to break the vicious circle between malnutrition and infection. Immunization and timely medical care are definite nutrition promoters.
- **Provision of safe drinking water and improvement in sanitation:** these are powerful nutrition promoters in indirect manner. Gastro enteritis is the commonest cause of under nutrition and mortality among children in India and to a large extent it is caused by unsafe water and poor sanitation. Provision of safe water and improved sanitation will drastically reduces the incidence of gastro-enteritis and diarrhea and thus improves the nutrition situation of child population.
- **Literacy programme-** Illiteracy is a manifestation of poverty. There are evidences to show that malnutrition is more common among the children of illiterate mothers and that in a community the incidence of malnutrition reduces with the introduction of literacy programme. Thus, the programmes which are now in operation in India for removing the massive illiteracy in India and also the functional literacy programme implemented in various parts of India acts as indirect nutrition programme.
- **The public food distribution system-** is a very powerful weapon to remove the problem of malnutrition from the weakest, economic sectors. These segments have low food purchasing power and any measure to provide adequate food and of a reasonable quality would greatly enhance their dietary consumption. The food stamps in the United States or subsidized Food programmes in many other countries, the food Rationing System in India are the examples of such programmes.
- **Income generating programmes-** as poverty is one of the main factors causing undernutrition, efforts to increase the income of families, especially the purchasing power of women was proved to have definite positive impact in decreasing hunger and undernutrition.

## UNIT 6

### NUTRITION EDUCATION – OBJECTIVES, PRINCIPLES AND IMPORTANCE OF NUTRITION EDUCATION IN A COMMUNITY

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#### Definition

Nutrition education is defined as the process by which beliefs, attitudes, environmental influences and knowledge about food and health are channelized in to practices which are sound and consistent with an individual need, purchasing power, available food sources, health and sanitary facilities and socio cultural background.

- Nutrition education is an instructional method that promotes healthy behaviors by imparting information that individuals can use to make informed decisions about food, dietary habits, and health
- The successful nutrition message has a favorable impact on the target audience and gets them to
- Examine their belief system
- Evaluate the consequences of a certain behavior
- Change their behavior

#### Importance of Nutrition Education

Nutrition is a discipline, which is closely connected with many other areas related to human existence, such as agriculture, economics, medicine, food technology, engineering, biological sciences, sociology, anthropology etc. Several factors such as low agricultural production, poverty, population explosion, ignorance and poor environmental sanitation causes and aggravates malnutrition. Ignorance is perhaps the most important single factor underlying malnutrition and malnutrition could be prevented to a considerable extent if available foods are better utilized. Hence, nutrition education is necessary at all stages.

The importance of nutrition education as a means for improving nutrition of the community in the developing countries has increased rapidly during the recent past.

- Lack of awareness about the dietary requirements and nutritive value of different food is the main cause for prevailing malnutrition among school children, pregnant women, lactating mother and other vulnerable sections of the community.
- Nutrition education should be practical and should be easily adaptable to the socioeconomic status, food habits and the available local food resources generally needed for the purpose of demonstration and feeding of the locally available audience. Nutrition education programme should become a part of the community.
- Increase awareness
- Enhancing people's motivation
- Facilitating the ability to take action
- Improving environmental supports

- Nutrition Educators can also use a growth centered educational approach.
- Nutrition educators can also work in coalitions with Other Professionals Major Organizational and Operational non-Governmental Agencies Sectors.....

### **Objective of nutrition education**

To impart knowledge that enable people to gain the understanding, knowledge, skill and attitudes necessary to act rationally in the selection, production, organization, storage, preparation, distribution, consumption and safe handling of food consistent with individual needs and available food and economic resources.

Hence, the nutrition educator should have thorough understanding of principles of good nutrition, locally available foods and their nutritive value, their purchasing capacity, customs, superstitions, food habits and values with regard to food etc.

### **The main objectives are as follows:**

- a. To develop nutrition advisory services and nutrition education programmes for the public.
- b. To participate and coordinate in community nutrition programmes with the co-operation of people working in other disciplines like social workers, village health workers and nurses, etc. and also with the help of social welfare agencies.
- c. To help in developing supplementary nutrition programme where ever necessary.
- d. To improve the nutritional levels of the community by the available means.

### **Principles of Nutrition Education - Applying Educational Principles to Program Design**

- An effective nutrition intervention program will integrate good instructional design and learning principles and use media that facilitate a high degree of individualization
- The effect of an intervention on the target populations knowledge and behavior depends on the interventions application of 6 basic educational principles...
- Consonance - the fit between program and its objectives
- Relevance - the degree to which the intervention is geared to clients
- Individualization - allows clients to have personal questions answered or instructions paced according to individual learning progress
- Feedback - helps clients learn by providing a measuring stick to determine how much progress they are making
- Reinforcement - designed to reward the desired behavior
- Facilitation - measures taken to accomplish desired actions or eliminate obstacles

### **Nutrition Education methods**

The nutrition educator has a variety of teaching methods available

These have been grouped as

### 1. Individual contacts

These include what are known as home and farm visits. Since each person's problems are different, the personal approach through such visits results in greater understanding. They help in guessing first hand information, developing good will, establishing confidence and stimulating interest. Individual contact method has its own limitations. It consumes more time, money and labour than the other methods. However, this is the best method for establishing rapport with people and to impart nutrition education.

### 2. Group contacts

These are the commonly used forms of nutrition education and are quite effective. They include the following

- ✚ **General meeting**-A heterogeneous group is collected and certain information is passed on to the group. A large number of people can be reached by this method but proper discussion is not possible.
- ✚ **Method and result Demonstrations**-Demonstration is the oldest and most effective form of education which makes two impressions one on the sense of vision and the other on the sense of hearing. Method demonstrations are useful for teaching skill. In nutrition education this can be used to teach new and better methods of cooking. Result demonstration is a method of teaching designed to show by example, the practical application of an established fact or a group of facts.
- ✚ **Balwadi feeding programmes**-These can be effectively used for educating both mother and child about good nutrition. Good food habits when inculcated in the childhood influence them all their life. A good method of teaching nutrition to the mother is to make her prepare the supplement by herself and feed the child.
- ✚ **School feeding programmes and school Gardens**-Teaching nutrition in the school years will leave significant mark on the minds of the children and influence them throughout their life. Children can be educated and helped to grow the nutrition vegetable and fruits in their garden so that along with nutrition education it improves their health status also.
- ✚ **Nutrition Rehabilitation centers and nutrition wards**-The primary objective of these rehabilitation centers is the improvement of the nutritional status of the affected groups. So, nutrition education to such groups has very important role.
- ✚ **Training to village level workers and other extension personnel** -These personnel can have a definite impact on the thinking of people. Auxillary nurse /midwives are a group who when trained can pass on the knowledge of nutrition to the women, especially pregnant and lactating mothers. Hence these personnel who are trainers should be trained well by group approach.

### 3. Mass contacts

Various studies have shown that the cost of nutrition education is comparatively cheaper, if mass media are used. A larger number of people can be reached in leisure time. The proper use and combination of

several media at the same time, on the same subject matter, within a given area has been found to be very effective in stimulating people. Today mass media is the most commonly used media to educate both literate and illiterate population. Mass media include

- ✚ **Print material:** This includes booklets, leaflets, folders, circulars, newspapers, magazines and any other printed material. While these are powerful media in the literature world, their use is limited in an illiterate population group. They involve much effort and money.
- ✚ **Radio** -Radio is a powerful medium of communication both in the rural and urban societies. Nutrition education can be effectively carried out through this media. Here, one should plan the programme in attractive way by considering the background and their way of life.
- ✚ **Exhibition**-An exhibition is a systematic display of modules, specimens, charts, and posters etc, which are more or less self-explanatory. This is a method of reaching even the illiterate population. It is very appealing to be public but requires much planning and preparation in advance.
- ✚ **Dramatizations, puppet Shows**-One can educate public more effectively by using traditional methods of communication, since public have sentimental appeal. These are more effective in teaching illiterate groups also. Puppet shows, folk songs and dances, dramatizations proved to be verify effective for nutrition education.
- ✚ **Films**-Films are a powerful media, through which education can be given, to both literate and illiterate groups.
- ✚ **T.V (Television)**-is also one of the strongest and effective media in educating the public. Popular talks and discussions on important nutritional problems of the region will form effective means of nutrition education
- ✚ **Advertisements**-The latest trend in nutrition education is to use advertising techniques to 'sell' nutrition to the masses. If information is disseminated in terms of lessons, people don't accept it easily. But by using social marketing strategies, nutrition messages can be imparted effectively. Advertising through posters, wall paintings, hoardings and films, can be effectively used. Both positive approach, where the benefits of eating a particular food and negative approach, where the dangers of not eating the food can be emphasized, in this approach.

**The various important methods of nutrition education are:**

**a. Lectures and demonstrations** - The lecture should be simple and too elaborate. It should be easily adoptable by the people attending the course. The demonstrations should be simple and these should make good use of locally available resources with the help of which it can be easily adopted by the community.

The nutrition work should discuss the prevailing nutritional problem in the community in simplest form and the solution for it. These are extremely effective mode of education. They should be practical and illustrative and easily understandable.



**b. Workshops** - The nutrition work should discuss the prevailing nutritional problem in the community in simplest form and the solution for it.

**c. Film and slide shows** - These are extremely effective mode of education. They should be practical and illustrative and easily understandable.

**d. Poster, charts and exhibition** - Posters should be simple and should immediately catch the attention of the viewers and should be written in the regional language. The letters should be clearly and easily visible at a distance too. Charts also should be in a position to stimulate the interest of the people. The charts should be well- balanced with the use appropriate colours and should not be crowded.

Exhibitions having posters and charts are the best mode for educating the community. It should be set up keeping in mind the educational level of the people the education programme is catering to.

**e. Books, pamphlets, bulletins and newspaper** - Printed matter for nutrition education is suitable for educating students, teachers and other professionals. These materials should be made available in regional languages and should give sufficient information.

**f. Radio and television** - Radio and Television programmes reach a large number of audience within no time. Jokes, stories, dramas, etc. involving the nutritional problem help to create large scale awareness.

In general, it is agreed that face-to-face strategies are more likely to be effective in changing behaviour than mass media programmes. Using the strategies synergistically seems to be best option in most situations. Table 1 summarises the complementary nature of the two approaches.

**Table 1: Some relative advantages and disadvantages of face-to-face and mass media approaches**

	<b>Advantages</b>	<b>Disadvantages</b>
Face-to-face	<ul style="list-style-type: none"> <li>· Interactive</li> <li>· Reliable</li> <li>· Provides social support</li> <li>· Allows for personalising</li> <li>· Allows for modelling</li> <li>· Appropriate sequencing easy</li> <li>· Follow-up easy</li> </ul>	<ul style="list-style-type: none"> <li>· Expensive</li> <li>· Penetration weak</li> <li>· May encourage dependency</li> <li>· May not be acceptable to many people</li> </ul>
Mass media	<ul style="list-style-type: none"> <li>· Cheap per contact</li> <li>· Large numbers reached</li> <li>· More acceptable for many people</li> <li>· May stimulate self-initiated change</li> <li>· Potential for further development through modem technology</li> </ul>	<ul style="list-style-type: none"> <li>· Weak engagement of users</li> <li>· Unreliable</li> <li>· Dilution of content</li> <li>· Follow-up difficult</li> </ul>

*Adapted from the Australian National Health and Medical Research Council's Nutrition Education Report (1989)*

## **Learning across the Life Span**

- People of any age learn best if
- They have the prerequisite knowledge
- Content is broken into small pieces.
- They have an opportunity to practice what they have learned
- The content seems relevant

## **Adult Learners**

- Adult education - the process whereby adults learn and achieve changes in knowledge, attitudes, values, and skills
- For adults, learning is an intentional, purposeful activity
- Adult learners approach learning differently than children do because they have different motivations for learning

## **Characteristics of adult learners include the following**

- They learn best when subject matter is directly tied to their own realm of experience
- Their learning is facilitated when they can make connections between their past experiences and their current concerns
- They are motivated to learn by the relevance of the topic to their lives
- They retain new information best when they are actively involved in problem-solving exercises and hands-on learning
- An effective program takes into account the learning styles and motivations of the target population

## **Recommendations for adult learners**

- Make learning problem-centered
- Make information concrete and define all abstract terms
- Make learning collaborative between the educator and the learner
- Encourage participatory approaches to learning
- Ask open-ended questions to draw out what adults already know about the topic
- Seize the teachable moments which are life transitions
- Increase the adult learners sense of self-worth by validating their experiences
- Establish a positive learning environment
- Recognize individual and cultural differences because they affect learning styles
- Target groups should be researched by
- Reviewing the literature
- Conducting formative research
- Asking representatives from the audience to help you with the planning and development of the program

## **Behaviorally Focused Nutrition Education Programs for Children**

- Behaviorally focused nutrition education addresses 3 domains of learning
  - Cognitive - presents children with the how of eating more healthfully
  - Affective - addresses factors that motivate children to change the way they eat
  - Behavioral - helps children build new eating skills and behaviors
- Strategies recommended to promote healthful eating among students in the lower elementary school grades
- Involve parents in nutrition education through homework or take-home videos
- Provide role models for healthful eating
- Use incentives to reinforce healthful eating
- Identify easy-to-prepare, tasty, and healthful snacks such as fruits and vegetable
- Increase student's confidence in their ability to make healthful eating choices

## **Developing a Nutrition Education Plan**

- The nutrition education plan outlines the strategy for disseminating the interventions keys messages to the target population
- Key nutrition messages may be designed to change consumer behavior, as in the 5 a Day for Better Health message to Eat five to stay alive
- The nutrition education plan is a written document that includes the following
  - Needs of the target population.
  - Goals and objectives for intervention activities
  - Program format
  - Lesson plans
  - Nutrition messages to be imparted to the target population
  - Marketing plan
  - Any partnerships that will support program development or delivery
  - Evaluation instruments
  - A nutrition education plan is developed for each intervention target group
  - At the systemic level, the nutritional education plan might properly be called a strategy

## **Developing Lesson Plans**

- The first step in developing a lesson plan is to know your target audience, the setting, and the content
- Consider these principles when developing lesson plans
- Focus on the learner and their interests, needs, and motivations
- Relate learning to real-life situations and give examples that relate directly to the learners lives and experiences
- Actively involve the learners in the learning process because people learn best by doing

## STEPS IN DESIGNING NUTRITION PROGRAMME

KEY STEPS - There are key steps that must be followed in planning a nutrition programme.

**Step 1.** Gather and Synthesize Information on the Nutrition Situation

**Step 2.** Determine Initial Program Goal and Objectives

**Step 3.** Review Health and Nutrition Services

**Step 4.** Preliminary Program Design: Prevention

**Step 5.** Preliminary Program Design: Recuperation

**Step 6.** Putting It All Together

**Step 1. Gather and Synthesize Information on the Nutrition Situation** provides guidance on gathering and synthesizing data to:

- 1) Determine whether implementation of a community-based nutrition program is warranted in the setting;
- 2) Identify potential causes of undernutrition and key intervention areas; and
- 3) Decide whether the program will focus on prevention-only or prevention and recuperation.

**Step 2. Determine Initial Program Goal and Objectives** Step 2 guides the user to draft initial program goals and objectives based on the conclusions in Step 1, and to note information on other issues such as:

- the funding available,
- community priorities,
- donor interests and
- organizational strengths.

### STEP 3. Review Health and Nutrition Services

- Mapping existing health and nutrition policies, programs and activities is an important part of program design.
- This information will guide to consider which activities can be strengthened or built upon, the local capacity for response, and the best use of limited available resources.

**A review of health and nutrition services is divided into the following areas:**

- National policies
- Service availability, access and uptake
- Quality of service delivery
- Availability of health and nutrition IEC materials

**STEP 4: Preliminary Program Design: Prevention** Note that prevention of undernutrition has a focus here on stunting and underweight.

- You have determined that high levels of stunting and/or underweight in children are of public health significance in your program area and that a preventive nutrition program is necessary.

- In addition, you have identified priority intervention areas.

**STEP 5. Preliminary Program Design: Recuperation** Note that recuperation programs here focus on MAM, SAM and/or underweight. You have determined that high levels of acute malnutrition (MAM or SAM) and/or underweight are of public health significance and that your community-based nutrition program will incorporate both preventive and recuperative approaches.

**STEP 6: Putting It All Together** - at this step after collecting and analyzing information on the nutrition situation and resources, determining priority intervention areas, and exploring the potential approaches.

At this point, based on discussions from Steps 1-5, you will put the various options together to prioritize and decide on the best combination of approaches to implement in the program area.

## **EVALUATION OF NUTRITION EDUCATION PROGRAMMES**

Evaluation of nutrition education programmes includes not only collection of qualitative and quantitative data, but also their analysis and interpretation for the purpose of making judgement and decisions. In this context, evaluation is seen to have two main functions: formative and summative. Formative evaluation is used to improve and develop programme activities as they are carried out, and is therefore continuous. Summative evaluation measures the outcome of an activity or set of activities (Oshaug, 1992).

### **Figure 1: Reasons for evaluating nutrition education programmes**

#### **To assess:**

1. impact or effect,
2. how programmes are planned and executed,
3. how programme personnel perform,
4. how effectiveness can be improved,
5. the utility of a programme, and
6. to satisfy the programme sponsors.

### **Figure 2: Functions of evaluation**

1. Improve and develop activities of programmes as they are carried out
2. Measure outcome
3. Accountability
4. Provide feedback to or involve beneficiaries in evaluation activities
5. Create or increase the awareness of educational activities
6. Promote public relations
7. Evaluate programme personnel
8. Facilitate supervision

## Potential Evaluation Methods:

### **Test**

- ✓ Pre and Post Test
- ✓ Test Against Control Groups

### **Participation**

- ✓ Attendance
- ✓ Completion
- ✓ Certificates
- ✓ Follow-On Tracking

### **Data Collection**

- ✓ Surveys
- ✓ Questionnaires
- ✓ Interviews
- ✓ Checklists
- ✓ Feedback forms

### **Financial Reports**

- ✓ Cost to budget
- ✓ Cost per unit of service
- ✓ On time on budget

### **Performance**

- ✓ Grades
- ✓ Graduation
- ✓ Drop in recidivism
- ✓ Job placement
- ✓ Permits, inspections, certifications

### **Subjective (Qualitative)**

- ✓ Journals
- ✓ Testimonials
- ✓ Observations
- ✓ Photographs
- ✓ Clippings

## UNIT 7

### REFERENCES:

1. <https://www.encyclopedia.com/caregiving/encyclopedias-almanacs-transcripts-and-maps/community-nutrition>
2. <https://climb.pcc.edu/blog/the-role-nutritionists-are-playing-in-improving-health#:~:text=A%20nutritionist%20can%20help%20a,on%20individual%20needs%20and%20goals>.
3. <https://www.slideshare.net/mlogaraj/community-nutrition-programme>
4. <https://www.slideshare.net/mlogaraj/community-nutrition-programme>
5. Bamji M. S, Prahlad Rao N. & Vinodini reddy (2003). Text book of Human Nutrition (p-p 197-201), New Delhi. Oxford & IBH Publishing Co. PVT. LTD.
6. Srilakshmi.B (2005). Nutrition Science (pp 3-14), New Delhi. New Age International (P) Limited.
7. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=19054>
8. <https://www.who.int/nutgrowthdb/about/introduction/en/index4.html>
9. [https://www.powershow.com/view/267f8Mjg5O/Principles\\_of\\_Nutrition\\_Education\\_powerpoint\\_ppt\\_presentation](https://www.powershow.com/view/267f8Mjg5O/Principles_of_Nutrition_Education_powerpoint_ppt_presentation)
10. [http://www.fao.org/3/w3733e06.htm#:~:text=There%20are%20many%20sources%20of,\(in%20households\)%20and%20For](http://www.fao.org/3/w3733e06.htm#:~:text=There%20are%20many%20sources%20of,(in%20households)%20and%20For)
11. <https://fundingforgood.org/what-are-evaluation-methods/>