UNIT 1 INTRODUCTION TO NUTRITION AND NUTRITIONAL ASSESSMENT

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1.0 INTRODUCTION

As a student of this programme in community health for nurses, we would like to build on your previous knowledge about nutrition and dietetics. This unit aims to give you more awareness about nutritional assessment. It will strengthen your primary health care skills to work at health and wellness centre in community health settings.

This unit focuses on concepts of nutrition. It emphasises various facts about nutrition like concepts and classification of nutrients, common source of various nutrients, special nutritional requirements according to age, sex, activity and physiological condition. This will enable you to help your target population to prevent nutrition related diseases and you will be able to promote positive health among them.

You may think that my job is to take care of people, mainly the health of women and children. So why should I be worried about (or even working for) improvement in their nutrition? Many of the diseases we suffer from are due to some problems with nutrition, yet it is usually a neglected area. Whether it is a doctor of PHC or a nurse, we are all working for improving the health status of people in our
assigned areas. Foundation of much of whatever good health we attain is rooted in our nutrition. Indian culture has always given due importance to nutrition.

1.1 OBJECTIVES

After completing this unit, you should be able to:

- define nutrition and nutrients;
- classify nutrients;
- identify common sources of various nutrients;
- explain nutritional requirements (as per age, gender, activity and physical condition);
- describe nutritional assessment of individual, families and the community;
- plan and recommend a suitable diet for individuals, families and the community;
- discuss important nutrition programmes including convergence with ICDS; and
- describe nutrition education and rehabilitation.

1.2 CONCEPT OF NUTRITION

Food refers to anything which nourishes the body. Food includes solids, semi-solids and liquids which can be consumed to keep us healthy. Food helps us in the production of heat and energy for our daily activities. It helps us in the growth, repair and maintenance of our body tissues.

Nutrition is the science of food and its relationship to health. Following three processes are involved in the utilisation of food in our body.

i) Ingestion: It implies intake of food (by mouth)

ii) Digestion: After ingestion food is digested to make it absorbable. It is achieved by enzymes present in our mouth (saliva), stomach and intestines.

iii) Absorption: Digested food gets absorbed and passes from our intestines into the blood circulation and lymphatic system for distribution all over the body.

iv) Metabolism of food is the set of life sustaining chemical changes which undertake within the cells of living organisms and its utilisation for the purpose of providing fuel to run the cellular processes.

Food has major physiological functions as follows:

- Provides energy for body functions.
- Nutrients build and maintain body tissues.
- Safeguarding body against diseases.
- Regulating body functions.

Food has social function also, as mentioned below:

- Creates atmosphere for joyful eating.
- Used as offering to God in religious festivals and in fasts.
- Main component in any gathering or party.
- Means of communication and relationship.
- Means of social prestige.
Psychological function of food includes the following:

- Satisfying hunger and taste buds.
- Providing enjoyment.
- Provides comfort in depressive mood.
- Used as a reward or punishment e.g. good or bad food.

### 1.3 Types of Nutrients

Nutrients are chemical substances contained in food. There are a variety of nutrients which are supplied through the foods. Nutrients play a critical role in health and disease. Each nutrient performs specific function in the body. Absence of a particular nutrient can cause specific deficiency disorder. Most natural foods you eat contain more than one nutrient.

**Functions of nutrients:**

- Energy production for physical activity.
- Growth, development and repair.
- Resistance to infection and protection from disease.
- Control of temperature, blood pressure, metabolism and waste disposal.
- Structural integrity of bones, muscles and other tissues.

There are two types of nutrients required to have proper growth and development in human beings. These are macronutrient and micronutrient. The macronutrients are protein, fat and carbohydrate. The micronutrients are Vitamins and Minerals.

#### 1.3.1 Macronutrients

These are organic nutrients required in large quantity. These are proteins, fats and carbohydrates. These form the main bulk of food in the Indian diet.

1) **Proteins**

These are of the greatest importance in human nutrition. Proteins are composed of carbon, hydrogen, oxygen, nitrogen and sulphur, phosphorus, iron and other elements in varying amounts. Proteins differ from carbohydrates and fats in that they contain nitrogen, amounting to about 16%. One fifth of the body weight of an individual is constituted by proteins. These are built of amino acids. Human body requires 22 amino acids. Of these 8 are called “essential” because the body cannot synthesise them in sufficient quantity. These must be obtained from the food we eat. The essential amino acids are as follows:

1) Isoleucine
2) Leucine
3) Lysine
4) Sulphur containing amino acids (methionine + cysteine)
5) Phenylalanine Tyrosine
6) Threonine
7) Tryptophan, and
8) Valine.

**Functions of Proteins:**

1) For growth and development: since they provide the building material i.e. the amino acids
2) For repair of body tissues and their maintenance

3) For synthesis of antibodies, enzymes and hormones. The body requires protein to produce antibodies. Protein also can furnish energy to the body in shortage of fats or carbohydrates in diet. But generally the body depends on carbohydrates and fats rather than proteins.

Sources of proteins:

1) **Animal Source**: Proteins of animal origin are found in milk, meat, eggs, cheese, fish and fowl. These contain all the essential amino acids in adequate amounts. Egg protein is considered to be the best among food proteins because of their high biological value and digestibility.

2) **Plant Source**: Plant or vegetable proteins are found in pulses (legumes) cereals, beans, nuts, oil-seed cakes, etc. They are poor in essential amino acids. In India, cereals and pulses are the main sources of dietary protein because they are consumed in bulk. (Table 1.1)

<table>
<thead>
<tr>
<th>Food</th>
<th>Protein (gm per 100 g. of food)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANIMAL FOODS</strong></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>3.2-4.3</td>
</tr>
<tr>
<td>Meat</td>
<td>18.0-26.0</td>
</tr>
<tr>
<td>Egg</td>
<td>13.0</td>
</tr>
<tr>
<td>Fish</td>
<td>15.0-23.0</td>
</tr>
<tr>
<td><strong>PLANT FOODS</strong></td>
<td></td>
</tr>
<tr>
<td>Cereals</td>
<td>6.0-13.0</td>
</tr>
<tr>
<td>Pulses</td>
<td>21.0-28.0</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1-4</td>
</tr>
<tr>
<td>Fruits</td>
<td>1-3</td>
</tr>
<tr>
<td>Nuts</td>
<td>4.5-29.0</td>
</tr>
<tr>
<td>Soyabean</td>
<td>43.2</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td></td>
</tr>
<tr>
<td>Oils and fats / Sugar and Jaggery</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Protein Requirements:

Protein requirements vary as per age, sex and other physiological variables, factors like infection, worm infestation, emotional disturbances and stress situation. Usually 1.0 gm protein/ kg body weight is needed for an Indian adult.

2) **Fats**

Fats are composed of carbon, hydrogen and oxygen. They are composed of fatty acids. Some fats such as groundnut oil, gingely oil are liquid at room temperature; some fats such as ghee and butter are solid at room temperature. Fats are again classified into saturated and unsaturated fats. In general, animal fats are “saturated” fats; vegetable oils and fats are “unsaturated” fats. Excessive intake of saturated fats (i.e. animal fats) is harmful to the body. Cardiovascular (heart) disease is attributed to excessive
consumption of saturated fats. The essential fatty acids are linoleic and linolenic acids. These are unsaturated in nature and are not synthesised by the body. (Table 1.2)

**Functions of Fats:**

1) Dietary fat is concentrated source of energy. One gram of fat supplies 9 calories of energy. This is almost twice the number of calories derived weight for weight, from carbohydrate or protein.

2) Fats are carriers of fat-soluble vitamins, e.g. vitamins A, D, E and K.

3) Dietary fat supplies “essential fatty acids”, e.g. Linoleic acid, prevents scaly skin formation. In general, essential fatty acids are needed for growth and maintenance of the integrity of the skin.

4) The fat layer below the skin helps in maintaining our body temperature.

5) Fats provide cushioning for many organs in the body (heart, kidney, intestine etc.)

6) Foods containing fats are tasty.

**Sources of Fats:**

1) Animal sources: These are ghee, butter, fat of meat, fish oil, etc.

2) Vegetables sources: these are various vegetable oils such as groundnut, gingely, mustard, cottonseed, safflower (kardi) and coconut oil.

**Visible and invisible fats:**

Visible fats are used during cooking i.e., ghee, vegetable oils. The invisible fats are those which we generally do not take notice of, such as the fat in milk, eggs, meat and nuts.

**Fat requirements:** In developed countries, dietary fats provide 30–40% of total energy intake. Ideally only 20–30% of total dietary energy should be provided by fats. At least 50% of fat intake should consist of vegetable oils rich in essential fatty acids. Fats help to absorb and transport soluble vitamins to body parts.

**Table 1.2: Dietary Sources of Essential Fatty Linoleic Acids**

<table>
<thead>
<tr>
<th>Essential Fatty Acids</th>
<th>Dietary Sources</th>
<th>Per cent Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linoleic</td>
<td>Safflower</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Corn oil</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Sunflower oil</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Soya bean oil</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Sesame oil</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Groundnut Oil</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Mustard oil</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Palm oil</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Coconut oil</td>
<td>2</td>
</tr>
<tr>
<td>Arachidonic acid</td>
<td>Meat, eggs,</td>
<td>0.5-0.3</td>
</tr>
<tr>
<td></td>
<td>Milk (fat)</td>
<td>0.4-0.6</td>
</tr>
<tr>
<td>Linolenic acid</td>
<td>Soyabeans oil</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Leafy greens</td>
<td>varied</td>
</tr>
<tr>
<td>Eichosapentaenoic acid</td>
<td>Fish oil</td>
<td>10</td>
</tr>
</tbody>
</table>
3) **Carbohydrates**

These are the main source of energy, providing 4 kcals per gram. Carbohydrate is also essential for the oxidation of fats and for the synthesis of certain non-essential amino acids. There are 3 main sources of carbohydrate, viz., starches, sugar and cellulose. Starch is basic to the human diet. It is found in abundance in cereals, roots and tubers. Sugars comprise monosaccharides (glucose, fructose, galactose) and disaccharides (sucrose, lactose and maltose). These free sugars are highly water soluble and are easily assimilated. Free sugars along with starches constitute a key source of energy. Cellulose, an indigestible component with no nutritive value, contributes to dietary fibre.

**Dietary Fibre:**

It has many functions. It absorbs water, and increases the bulk of the stool which helps reduce the tendency of constipation by encouraging the bowel movements. It is known to be associated with reduced incidence of coronary heart disease. A daily intake of about 40 grms of dietary fibre is desirable. Indian diet provides 50-100 grams per day of fiber with whole grain, cereals, pulses and vegetables, consumed daily.

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### Check Your Progress 1

1) List any three functions of Nutrients.

2) List the type of Nutrients.

3) Enlist the macronutrients we require to have normal growth and development.

4) How much of body weight of an individual is constituted by proteins?

5) Ideally ………………..of total dietary energy should be provided by fats.

6) Three main sources of carbohydrate are…………………..

7) List any two functions of protein.

8) ………………..are the fat soluble vitamins.

9) List any two animal sources of fat.
1.3.2 Micronutrients

Micronutrients are needed only in minuscule amounts, these substances enable the body to produce enzymes, hormones and other substances essential for proper growth and development. There are two types of Micronutrients, these are Vitamins and minerals. Let’s now discuss these in detail.

I) Vitamins

Vitamins and minerals are called micronutrients since these are required by the body in much smaller amounts. They do not yield energy like fats and carbohydrates. But they are vital for the survival of man as catalysts in various body processes. They protect the body against infection and disease. Some 13 vitamins are stated to be needed by the body. Since the body cannot manufacture vitamins in sufficient quantity, they must be supplied through the diet. A balanced diet meets the daily requirement of vitamins.

Classification:

1) Fat soluble vitamins: Vitamins A, D, E, and K are fat soluble vitamins.
   a) Vitamin A or retinol
   b) Vitamin D (Caliciferol-D2, cholecalciferol D3)
   c) Vitamin E (Tocopherol)
   d) Vitamin K

2) Water soluble vitamins: The following are water soluble vitamins:
   a) Thiamine (vitamin B1)
   b) Riboflavin (vitamin B2)
   c) Nicotinic acid
   d) Pyridoxine (vitamin B6)
   e) Pantothenic acid
   f) Folic acid
   g) Vitamin B12
   h) Ascorbic acid (vitamin C)

1) Vitamin A (Retinol)

Vitamin A is a fat-soluble vitamin. Its chemical name is “retinol”. In India 8% of children aged 6 months–6 years have vitamin A deficiency. It is a major cause of preventable blindness.

Function of Vitamin A: It is needed for:

1) Normal vision and health of the eyes.
2) Health of the skin and mucous membrane.
3) Skeletal growth.
4) Protection of body against infection.

Sources of Vitamin A:

Animal Sources: Butter, ghee, egg, milk, liver and fish are good sources.

Plant Sources: The cheapest source of vitamin A is green leafy vegetables such as spinach, amaranth, coriander, drum-stick leaves. (Table 1.3)
A daily intake of 100 grams of leafy vegetables provides the daily requirement of vitamin A. Other vegetables (carrots, pumpkin), and ripe fruits (e.g. mangoes, papaya) are also rich sources. In vegetables and fruits, it occurs in a different form (precursor form) known as carotene. It is converted into vitamin A in small intestine, and then stored in liver. Carotenes are the main source of vitamin A for Indians. Average absorption of carotenes from Indian diet is about 50%.

Table 1.3 : Dietary Sources of vitamin A

<table>
<thead>
<tr>
<th>Dietary Sources</th>
<th>International Units (I.U) of vitamin A per 100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk, whole</td>
<td>180</td>
</tr>
<tr>
<td>Fish</td>
<td>100</td>
</tr>
<tr>
<td>Egg</td>
<td>2,200</td>
</tr>
<tr>
<td>Ghee, Fresh</td>
<td>2,500</td>
</tr>
<tr>
<td>Spinach</td>
<td>5,500</td>
</tr>
<tr>
<td>Amaranth</td>
<td>2,500 to 11,000</td>
</tr>
<tr>
<td>Cabbage</td>
<td>2,000</td>
</tr>
<tr>
<td>Carrots</td>
<td>2,000 to 4,300</td>
</tr>
<tr>
<td>Mango, ripe</td>
<td>4,800</td>
</tr>
<tr>
<td>Papaya, ripe</td>
<td>2,020</td>
</tr>
<tr>
<td>Cod liver oil</td>
<td>6,000</td>
</tr>
<tr>
<td>Shark liver oil</td>
<td>9,000 to 60,000</td>
</tr>
</tbody>
</table>

**Daily requirement**: (1 I.U. of vitamin A = 0.3 µg retinol)

Recommended allowances: See Table 1.4

Table 1.4 : Daily required intake of vitamin A

<table>
<thead>
<tr>
<th>Group</th>
<th>Retinol mcg</th>
<th>Or B carotene mcg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man</td>
<td>600</td>
<td>2,400</td>
</tr>
<tr>
<td>Woman</td>
<td>600</td>
<td>2,400</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>600</td>
<td>2,400</td>
</tr>
<tr>
<td>Lactation</td>
<td>950</td>
<td>3,800</td>
</tr>
<tr>
<td>Infants (0 to 12 months)</td>
<td>350</td>
<td>1,200</td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 to 3 years</td>
<td>400</td>
<td>1,600</td>
</tr>
<tr>
<td>4 to 6 years</td>
<td>400</td>
<td>1,600</td>
</tr>
<tr>
<td>7 to 9 years</td>
<td>600</td>
<td>2,400</td>
</tr>
<tr>
<td>10 to 12 years</td>
<td>600</td>
<td>2,400</td>
</tr>
<tr>
<td>Adolescent 13 to 19 years</td>
<td>600</td>
<td>2,400</td>
</tr>
</tbody>
</table>
Effects of deficiency:

1) **Night blindness**: It is inability to see in dim light. It is the earliest symptom of vitamin A deficiency.

2) **Xerophthalmia**: It is the dryness of the eye. The white portion of the eye (conjunctiva) becomes “dry” when the eye lids are kept open for half a minute or so. This is an early clinical sign of vitamin A deficiency. In addition, the conjunctiva appears muddy and wrinkled.

3) **Bitot’s spots**: These are brownish, triangular raised, foamy patches seen on the white portion (sclerolconjunctiva) of the eye.

4) **Keratomalacia**: The cornea (black portion) of the eye becomes soft and loses its transparency. It may affect a part or whole of the cornea. If not promptly treated, it leads to complete collapse or destruction of the eye ball, resulting in blindness. Once this stage is reached, no amount of rich food rich in vitamins A or treatment can bring back the eye-sight.

2) **Vitamin D**

   It occurs in mainly 2 forms.

   1) Vitamin D2 or ergocalciferol (does not occur in nature)
   2) Vitamin D3 or cholecalciferol (occurs widely in animal fats and fish oils)

**Functions:**

1) Vitamin D is required for the formation of the healthy bones and teeth. It has a direct action on the mineralisation of the bones.

2) It promotes the intestinal absorption and utilisation of calcium and phosphorus.

**Sources:**

1) **Sunlight**: This is an important natural source of vitamin D. Provitamin, 7-dehydrocholesterol, which is normally present in the skin is converted into vitamin D3 by the action of the ultraviolet rays of the sunlight. The rate at which vitamin D3 is synthesised in the skin depends upon the exposure of the body to the sun.

2) **Foods**: These include egg (yolk), liver and fish. Fish liver oil is the richest source. Milk is generally a poor source. Vitamin D is not found in foods of vegetable origin. (Table 1.5)

<table>
<thead>
<tr>
<th>Source</th>
<th>Microgram per 100 grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td>1.5</td>
</tr>
<tr>
<td>Butter</td>
<td>0.5-1.5</td>
</tr>
<tr>
<td>Liver</td>
<td>30-40</td>
</tr>
<tr>
<td>Milk</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Daily requirement:**

a) **Adults**: They need 2.5 micrograms (100 i.u.) per day. In most climatic conditions, normal adults obtain vitamin D in enough amounts through sunlight.
b) **Pregnancy, lactation and growing children:** The need for vitamin D considerably increases during pregnancy, lactation and childhood. This may be up to 10 micrograms (400 i.u.) per day. Vitamin D is stored in the body. So if taken in excessive amount. It can produce toxic symptoms (hyper-vitaminosis D). It may manifest itself in such symptoms as nausea, vomiting, loss of appetite, excessive urination, etc. In cases of extreme toxicity, soft tissues like kidneys, lungs and heart can be calcified leading to death.

Deficiency of Vitamin D: It leads to (1) rickets in children, and (2) osteomalacia in adults. In these two conditions, the essential abnormality is that bones contain less calcium than normal. Rickets is a common disease in children who do not have access to direct sunlight and who are not eating animal foods like eggs to meet their daily requirement. Osteomalacia (which means softening of the bones) is a disease of adults.

3) **Vitamin E**

It is widely distributed in foods. It is available in small quantities in meats, fruits and vegetables. By far the richest sources are vegetable oils (e.g., oils of sunflower seeds). Humans on balanced diet do not easily suffer from its deficiency.

4) **Vitamin K**

It is also synthesised to some extent by intestinal bacteria. It is necessary for proper clotting of blood. It is used therefore, for the prevention and treatment of bleeding. Its deficiency rarely occurs in adults who consume normal balanced diets. Its requirement is met by dietary intake and synthesis in the gut. Its daily requirement is about 0.03 mg/kg for the adult. Soon after birth, all infant or those at increased risk should receive a single intramuscular dose of a vitamin K for prophylaxis.

5) **Thiamine**

It is a water-soluble vitamin. It is relatively stable to heat, but is destroyed in neutral or alkaline solution. It plays an important part in carbohydrate metabolism. In thiamine deficiency, there is accumulation of pyruvic and lactic acids in the tissues and body fluids. It is also essential for the proper functioning of the nervous system.

**Sources:** Thiamine is widely distributed in small amounts in all natural foods. The richest sources are unmilled cereals, pulses and nuts especially groundnut. The main source is cereals (e.g., wheat, rice contributing 60–85 % of total supply). Meat, fish, eggs, vegetables and fruits are relatively poor in vitamin B1. (Table 1.6)

<table>
<thead>
<tr>
<th>Food</th>
<th>Mg per 100 grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat whole</td>
<td>0.54</td>
</tr>
<tr>
<td>Rice, raw home pounded</td>
<td>0.21</td>
</tr>
<tr>
<td>Rice, milled</td>
<td>0.06</td>
</tr>
<tr>
<td>Bengal gram dal</td>
<td>0.48</td>
</tr>
<tr>
<td>Almonds</td>
<td>0.24</td>
</tr>
</tbody>
</table>
**Introduction to Nutrition and Nutritional Assessment**

<table>
<thead>
<tr>
<th>Food</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gingely seeds</td>
<td>1.01</td>
</tr>
<tr>
<td>Groundnut</td>
<td>0.90</td>
</tr>
<tr>
<td>Milk, whole</td>
<td>0.05</td>
</tr>
<tr>
<td>Egg, (Hen)</td>
<td>0.13</td>
</tr>
<tr>
<td>Liver</td>
<td>0.36</td>
</tr>
</tbody>
</table>

**Losses:** Thiamine is readily lost from cereals during the process of washing and cooking. The milling of rice results in considerable loss of thiamine. Parboiled and home-pounded rice are better sources. Thiamine in fruits and vegetables is partly lost during storage.

**Daily requirements:** It is 0.5 mg per 100 kcals of energy intake. The body content of thiamine is placed at 30 mg, and if more than this is given it is merely lost in the urine.

**Deficiency of Thiamine:** It results in Beriberi (fatigue, neuritis, poor memory, anorexia).

Wernicke’s encephalopathy may also occur – encephalopathy with memory deficit, ocular palsy, delirium associated with B1 deficiency. Moderate deficiency manifests itself in the form of loss of ankle and knee jerks and in the presence of calf tenderness.

6) **Riboflavin**

**Function:** It is involved in protein, fat and carbohydrate metabolism.

**Sources:** Good sources are milk and milk products, eggs, liver and green leafy vegetables. Wheat, millets, and pulses are fair sources, but rice is a poor source. Germinating pulses also furnish riboflavin. It’s also synthesised by bacteria in the large intestine.

**Daily requirement:** 0.6 mg per 1,000 calories.

**Deficiency:** The signs are: angular stomatitis (inflammation of mouth), cheilosis (red lips, with fissured angle of mouth), soreness of the tongue, redness and burning sensation in the eyes, dermatitis.

7) **Niacin**

**Function:** It is required by the body for the utilisation of carbohydrate and tissue respiration.

**Sources:** Food rich in niacin are whole grain cereals, pulses, nuts, meat, liver and chicken. Maize is a poor source but groundnut is particularly rich in this vitamin.

**Requirement:** The daily requirement is 6.6 mg per 1,000 calories.

**Deficiency:** It may lead to pellagra, characterised by soreness of the tongue, pigmented scaly skin, dementic and diarrhoea. The skin becomes pigmented and scaly on parts of the body exposed to sunlight e.g., hands and feet, face and neck; and the pigmentation has a symmetrical distribution. In severe cases, the deficiency of nicotinic acid may result in mental disturbances. Pellagra is found in areas where maize is the staple cereal. In India where jowar (sorghum...
vulgare) is eaten, pellagra has also been observed. This is attributed to the excessive amount of the amino acid, leucine in jowar.

8) Pyridoxine (Vitamin B6):

It plays an important role in the metabolism of amino acids, fats and carbohydrate. Food rich in pyridoxine are liver, meat, fish, whole cereals and legumes. Pyridoxine deficiency is associated with skin lesions, cheilosis, glossitis and convulsions in children. Requirement for pyridoxine have not been definitely established. Adults probably require 2.0 mg per day. Ordinary diet consumed by man generally contains enough pyridoxine.

9) Pantothenic acid

It is widely distributed in animal and vegetable foodstuffs. No deficiency symptoms have been reported in man. The human requirement for this vitamin has not been clearly defined.

10) Folic acid

It is essential for the synthesis of DNA (deoxyribonucleic acid).

**Sources:** It is present in green leaves. Liver is one of the richest sources. It is also found in pulses, nuts and whole grains. Deficiency results in anaemia which is common among poor people and also among pregnant women. There is a national programme in India, under which anaemia among pregnant women and young children is being combated through the supply of iron and folic acid tablets.

**Requirement:** For healthy adults it is 100 micrograms and during pregnancy 400 micrograms; children need, 100 micrograms.

11) Vitamin B12

It is also necessary for the synthesis of DNA and also in carbohydrate, fat and protein metabolism.

**Source:** Liver, eggs, fish and milk contain vitamin B12. Foods of vegetable origin do not contain this vitamin. Therefore B12 deficiency is seen in diets of strict vegetarians who do not even take milk.

**Deficiency:** It leads to pernicious anaemia. It can also affect the nervous system, including the spinal cord.

**Requirement:** About 1 microgram for adults. For proper utilisation of vitamin B12 intestinal secretion should be normal.

12) Vitamin C

It is a water soluble vitamin. It is the most unstable of all the vitamins. It gets rapidly destroyed by high temperature, oxidation, drying or storage.

**Functions:** It is required to form collagen, the protein substance that binds the cells together, if this substance is not formed, healing of the wounds will be delayed. Bleeding phenomena appear on vitamin C deficiency. It helps in absorption of iron. It helps in increasing the general resistance of the body to fight infection.

**Sources:** All fresh fruits contain vitamin C. Amla is one of the richest sources, in the fresh as well as in the dry condition. Guavas are cheap but rich source. Green leafy vegetables are rich in vitamin C. Roots and tubers (potatoes) contain very small amounts. Sprouting pulses are yet another source. Meat and milk contain very small amounts. (Table 1.7)
### Table 1.7: Dietary sources of vitamin C

<table>
<thead>
<tr>
<th>Sources</th>
<th>mg per 100 g</th>
<th>Sources</th>
<th>Mg per 100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td></td>
<td>Vegetables</td>
<td></td>
</tr>
<tr>
<td>Amla</td>
<td>600</td>
<td>Amaranth</td>
<td>99</td>
</tr>
<tr>
<td>Guava</td>
<td>212</td>
<td>Cabbage</td>
<td>124</td>
</tr>
<tr>
<td>Lime</td>
<td>63</td>
<td>Spinach</td>
<td>28</td>
</tr>
<tr>
<td>Orange</td>
<td>30</td>
<td>Brinjal</td>
<td>12</td>
</tr>
<tr>
<td>Tomato</td>
<td>27</td>
<td>Cauliflower</td>
<td>56</td>
</tr>
<tr>
<td>Bengal gram</td>
<td>15</td>
<td>Potatoes</td>
<td>17</td>
</tr>
<tr>
<td>Green gram</td>
<td>16</td>
<td>Onion</td>
<td>11</td>
</tr>
<tr>
<td>Reddish</td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

**Deficiency:** It results in a bleeding disease called scurvy seen in infants on artificial feeds. Scars of previous wounds may break down and becomes open wounds again in severe cases of scurvy. Minor bleeding and delayed wound healing are attributed to partial deficiency.

**Requirement:** Recommended values of Vitamin C are as follows:
- Adults: 40 mg per day
- Pregnancy: 40 mg per day
- Lactation: 80 mg per day
- Infants and children: 40 mg per day

## II) Minerals

These are divided into two major groups:

- **Major minerals:** Calcium, phosphorus, sodium, potassium, and magnesium.
- **Trace elements:** These are required by the body in less than few milligrams per day e.g. iron, iodine, fluorine, zinc, copper, cobalt, chromium, manganese, molybdenum, selenium, nickel, tin, silicon and vanadium.

Major functions of these minerals are tabulated in Table 1.8 as given below.

### Table 1.8: Function of Minerals

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Development of bones and teeth with phosphorus.</td>
</tr>
<tr>
<td></td>
<td>Regulation of contraction and relaxation of muscles e.g. heart muscles.</td>
</tr>
<tr>
<td></td>
<td>Regulation of passage of substances across cell membrane.</td>
</tr>
<tr>
<td></td>
<td>Facilitation of impulses from one nerve cell or neuron to another.</td>
</tr>
<tr>
<td></td>
<td>Clotting of blood.</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>Development of bones and teeth (with calcium).</td>
</tr>
<tr>
<td></td>
<td>Formation of phospholipids</td>
</tr>
</tbody>
</table>
## Minerals

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Function</th>
</tr>
</thead>
</table>
| Iron     | • Oxygen transport through haemoglobin, an iron-containing compound.  
• Fueling muscle contraction through the action of myoglobin which stores oxygen for the immediate needs of muscle cells.  
• Completing the oxidation of carbohydrates, fats and proteins.  
• Maintenance of higher order brain functions including learning.  
• Metabolism reactions of various types as a part of enzymes or other substances maintaining the functions of the body’s immune system. |
| Iodine   | • Synthesis of the hormone thyroxine secreted by the thyroid gland. (which plays an important role in the regulation of oxidation in cells) |
| Sodium   | • Regulation of balance between extracellular and intracellular fluids.  
• Regulations of pH of body fluids.  
• Facilitation of passage of nerve impulses from neuron to neuron.  
• Regulation of muscle contraction.  
• Regulation of movement of substances across cell membranes. |
| Potassium| • Regulation of balance of intracellular and extracellular fluid.  
• Regulation of pH of body fluids.  
• Role in muscle contraction.  
• Role in transmission of nerve impulses. |
| Chloride | • Regulation of pH of body fluids with sodium and potassium. |
| Magnesium| • Regulation of transport of substances across cell membranes.  
• Maintenance of enzyme activity as a coenzyme.  
• Role in bone mineralisation (deposition of minerals in bones).  
• Maintenance of transmission of nerve impulses.  
• Synthesis of protein.  
• Facilitation of smooth muscle action. |

### 1.4 MEAL PLANNING

It involves applying the knowledge of food, nutrient requirements and individual preferences to plan adequate and acceptable meals. Suitable diet for the individuals and families shall be as per the local food items available, individual dietary habits and as per economic status of families. The diet should also satisfy hunger and taste.
Balanced diet includes the foods from at least 3 to 5 food groups in a meal in adequate amounts and proportions. It should provide all the required nutrients for the given person.

It provides 50–60% energy from carbohydrates (preferably complex carbohydrates), 10–15% from protein and 20–30% from oils and fat. This includes visible fat/oil used in cooking and butter applied to bread; ghee applied to chapatti/Roti and invisible fat that is inherently present in foods like meat, nuts and oil seeds, etc. Besides this, a balanced diet will supply the micronutrients and other constituents in food like dietary fibre, antioxidants and other phyto chemicals that protect the body and are important for maintaining optimal health.

Following issues need to be thought about or addressed for a good meal plan.

- What to serve?
- How much to serve?
- How much the family can spend?
- How to prepare food?
- How to serve meals, at what time?

### 1.4.1 Aims of Meal Planning

- Fulfill the nutrition needs of an individual or members of a group.
- Use money’s worth to make appropriate food choices and get the best nutritional value vis-à-vis cost.
- Invest on nutrient dense food items rather than energy dense foods.
- Help in the purchase, preparation and service of appropriate food items.
- Help to economise on time, labour and fuel.
- Provide variety in the diet through proper selection of foods.
- Make meals appealing and palatable by proper selection of food in terms of colour, texture and flavour.
- Cater to individual preferences and yet provide adequate nutrients in meals.
- Minimise wastage and at the same time utilise leftovers.

### 1.4.2 Steps of Meal Planning

1) It starts with considering a person’s or the group’s age, sex and physical activity for one full day from morning to night.

2) Three major meals (breakfast, lunch and dinner) and 1–3 small meals snacks (mid-morning evening tea/snack and bedtime) can be planned for one full day. Details depend on the age, work schedule and physiological status.

3) A gap of 2–3 hours should be kept between main and small meals and of 4–6 hours between two main/major meals.

4) Schedule breakfast at 8–10 am, lunch at 2–3 pm, and dinner at 8–9 pm.

5) Use the food pyramid/food groups for selection of groups.
6) Each main meal should contain one to two items from each food group like energy providing, body building and protective food groups. The fourth food group of fat/sugar should be included in moderation.

7) If the individual has a 3 meal pattern (major meals), each meal should contribute approximately one-third of the nutritional requirements, if person has more than 3 meals per day, one-third of the requirement should be consumed in the breakfast. The rest of the day’s requirement is to be distributed among the different meals.

8) For a minor/small meal, even a single food preparation, cooked or raw like fruit is sufficient. Care should be taken that none of the meals especially minor meals or snack are not calorie-rich/energy-dense, which is often the case. Here preference should to be given to nutrient-dense foods.

9) Consider the monthly income and money spent on food, availability of food in season and food preferences of the individuals while selecting the food items.

10) Write the menu plan for each meal giving the name of the food preparation along with quantity in house-hold measures.

11) Make a table for representation of food preparation in each meal, main food ingredients used in each food preparation, amount of each food ingredient. Columns can be further added for calories and other nutrients to be calculated.

12) For calculation of nutritive value for selected nutrients, refer to the book on Nutritive value of Indian foods published by the National Institute of Nutrition, Hyderabad.

13) Food selection should be done in a way that the food preparation/meal gives variety in colour, flavour and taste, and texture. It should also suit the daily routine/pattern of the individual and occasion.

14) Basic meal plan guidelines given herein do not include infants and persons who have any health problem or disease.

1.4.3 Diet Plan for Different Age Groups

As you know that diet is not required in equal quantity by all age groups, it requires as per the requirements of particular age group, stage of life, gender and level of energy consumption. You may please refer Unit 3 of for readings in detail. However, we have discussed here in brief to keep the flow of reading.

**Diet Plan for a Toddler:** Children aged 1–4 years can eat the same foods as an adult, about half the amount. This stage in life is vital to development both physically and mentally. Therefore, optimum nutrition is vital, not only for the child’s health, but also reduction in risk of disease later in life. These few years can shape eating patterns for their whole life. Healthy foods are good to include. But do not forget to remind the parents to ensure that their children drink plenty of fluids throughout the day. Try also to make foods fun and easy to eat. All kids are different. Any meal plan should account for their likes and dislikes.

**Diet Plan for Children aged 5–12 yrs:** They are still developing both physically and mentally. They also need good nutrition. However, this age is notorious for
finicky diet habits, irregular eating and grazing. This needs to be regulated. During these years eating habits for life are still being shaped. Try to steer your child away from processed foods and confectionary. It is better to choose more traditional ‘healthy’ alternatives. However, don’t let them feel left out from the other kids at school. Occasional treats are fine. If child is really into sports or other physical activities then he will needs lots of energy-packed foods throughout the day. Don’t forget to encourage him / her to drink plenty of fluids. Calcium rich foods, sources of essential fats; high protein foods and slow released carbohydrate sources need particular attention.

They should be encouraged to eat the same meal as the whole family. Sitting down together is also important to help behavioural development and for the re-enforcement of family values. Encourage the child to eat at similar times of the day, to steer them away from snacking and binging, however encourage them to drink fluids whenever they’re thirsty.

**Diet Plan for Adolescents:** Adolescence ranges from 10–19 years of age. Boys generally require more food than girls. If they are into sports or heavy physical activities, they need to eat more. A good calcium and iron intake is important in girls. They should avoid junk foods.

**Diet Plan for an Elderly Person:** One particular concern in the elderly is obtaining sufficient fluid intake. Some old people also have difficulty in passing stools; therefore a good fibre intake is encouraged. It’s even more important that elderly people try to stick to meal and snack times, as sometimes motivation to prepare food can be low, especially if you are only preparing meals for one. With increased age and the onset of disease, some assistance may be required with preparation and feeding.

---

**Check Your Progress 2**

1) Name any three sources of vitamin A.
   - 
   - 
   - 

2) Daily requirement of vitamin D is ......................

3) Deficiency of Vitamin D causes ...................... in children and ...................... in adults.

4) ................. are essential for synthesis of DNA.

5) Classify the minerals.
   - 
   - 
   - 

6) Enlist any three aims of meal planning.
   - 
   - 
   - 

7) Enlist three major meals and their ideal timings to take.
   - 
   - 
   -
1.5 GENERAL DIETARY ADVICE

Let us now discuss general dietary advices at different meal timings age as given below:

**Breakfast**

Breakfast is the first meal of the day and is very important from the nutritional point of view. Literally, it means breaking the fast, because it is eaten after a gap of 8–10 hours after the night meal on the previous day, i.e. dinner. It is said to be adequate if it contains the main food groups namely, energy giving, body building protective foods approximately one-third of the day’s need. It will boost the energy level and help to maintain energy level throughout the day and prevent physical and mental fatigue.

Traditional breakfast preparations eaten in India are healthy and should be consumed. Breakfast food preparations: plain paratha, stuffed paratha, chapatti, bhakri or rotla, porridge/Dalia (salted, with vegetable, milk), lassi, idli/dosa, dhokla, muthia, upma, uttapam, poha, cheela/puda, thepla, vermicelli (with vegetable, milk) bread, sandwiches.

**Beverages:** Milk plain, tea/coffee/fruit juice/lassi;

**Accompaniments:** Raw fruits or chutneys;

**For non-vegetarians:** Egg preparations may be used

**Lunch**

It is the second major meal and includes staple foods. It needs to provide one-third of the diet for the individual. It is most influenced by the work schedule of the person and the availability of the arrangement of the meal service. Some people consume lunch at home; some eat lunch in canteens of their organisation/place of work. Some carry packed lunch or some eat in restaurants. Most people like to have a complete meal at lunch time. It is usually consumed between 1–3 pm. The type of food preparations are also governed by the individual preferences and the types of preparations and meal services available. If not eaten, work performance and behaviour may be affected. Technically this meal should contain all food groups and provide variety, on a daily basis. The following food items can be included:

**Cereals:** Chapatti/phulka/bhakri (in Maharashtra)/paratha/rice/khichdi/pulao/biryani/bread/thepla (in Gujarat).

**Pulses:** Dal/sambar/chole/rajma/usal/other pulse preparations.

**Cooked vegetables:** Preparations based on a single selected vegetable (bhindi bhaji/sabji) or a combination of two vegetables (methi aloo/aloo matar or more than 2 vegetables (mixed vegetables (mixed vegetable, e.g. vegetable korma) or vegetables with pulses. These vegetables can be prepared dry or in a curry from using variety of preparation methods.

**Raw vegetables/fruits:** Salads only with one or more vegetables, e.g. tomato and cucumber slices, onion, with pulses like sprouted moong/chana. Fruits are used as such.

**Milk products:** Plain curd/yoghurt, butter milk, rauts, custard, kheer, ice cream, other milk preparations.

**Egg/meat/fish preparations:** One portion of this can be eaten instead of one portion of a pulse preparation, e.g. fish curry, mutton curry, chicken curry, prawn pulao.
Sweet preparations or dessert can also be included occasionally but should not be eaten daily.

**Accompaniments:** Some people prefer to have raw onion and green chilli, some prefer papad and pickle. Those who include pickle and papad should consume only small amounts as both items are rich in sodium. Also it is better to have roasted papad than fried papad.

Many people go out to work and carry packed lunch.

**Packed lunch:** It has certain limitations, which necessitates modification in food preparation and serving style. The following points should be considered for designing a packed food. It is better to have dry food. Gravy preparations or beverages may spill during travel and may require special containers.

- It may not be possible to have a large variety of foods as it may require additional preparation in the morning, or additional or many containers. There may not be enough time or a proper place to eat all the different varieties.
- Temperature of the food preparation needs to be considered. Very hot food or foods, which require refrigeration if packed, may spoil if it is eaten much later in the day. Certain hot preparations may not be palatable or may become soggy, e.g. noodles, dosa.
- It should preferably contain food preparations, which are attractive, palatable or can be shared within the peer group.
- Age of the person should be considered.
- Portion size is important.
- It is important not to include biscuits, chips, noodles.
- It should consist of a cereal preparation, vegetables, and a pulse preparation.

**Snacks**

After a hard day’s work, a person feels exhausted and may need replenishment of energy for rest of the day. Snacks are usually eaten for relaxation or enjoyment. Many a times, they may be eaten because the person, is attracted, although he/she may not be hungry and has the appetite to consume such foods.

A snack should be nutritious and should not replace a meal. Many popular snacks provide empty calories or are energy-dense. Such snacks should be avoided. Snack often lead to overeating and over consumption, which may lead to obesity. Snacks can be eaten at any time of the day, such as midmorning, these energise the person. These also have a “feel good” factor. Following preparations can be used as snacks:

- Freshly prepared snacks, such as sandwiches, pakodas, bhajia, cutlets, kachoris, samosa, batata wada, wada pav, some of the breakfast items, chat items (aloo chat, bhel puri, pani puri, sev puri ragda pattice) dabeli, tikki, chole bhature, fruit chat, pav bhaji, noodles, dhokla, khandvi, dal wada, medu wada, dahi wada, appams.
- Snacks with long shelf life can be stored, such as dal moth, mathri, chakli, chivda, sev, gathia, khakhra, shakkarpura.
- Beverages: Tea/ coffee/fruit juice/lassi/milk shake/ nimbu pani/jal jeera/ mocktails/soft drinks/thandai/kanjee.
- Indian sweets: Eaten along with major meal or as such and as per occasion, e.g. gulab jamun, halwa of different kinds, ras gulla, barfi, laddoos of different types, gujiya/karanji, malpuas, rabdi, basundi, kheer/payasam, ghevar, jalebi, kulfi, imarti.

**Note:** All fried, salty and sweet foods should be eaten in small amounts and only occasionally. It is preferable to consume steamed and shallow fried preparations. Fruits with milk can also be consumed during snack time rather than choosing fried preparations.

**Dinner**

Nutritionally, it is similar to lunch and similar food preparations included in this meal are generally more appetising since dinner is generally eaten at home with the family, in a relaxed manner. Those who consume packed lunch need to pay adequate attention to the nutritional quality of their dinner. However, one must guard against consuming heavy, deep fried and rich food items. Dinner should provide the remaining 1/3rd of the day’s energy and nutrient requirement.

It is important not to eat dinner after 9 p.m. It is better that there is a gap of 2–3 hours between dinner and going to bed. Some people consume some food late at night. These foods should preferably contain some protein and some carbohydrate like milk, so that will help the person to relax and sleep well. Chocolates, biscuits, dessert and ice creams should be avoided late at night. The menu chosen for the different meals, depends upon the culture in various regions of India.

### Table 1.9: Sample menu providing approximately 2000 kcal

<table>
<thead>
<tr>
<th>Meal</th>
<th>Food Preparation</th>
<th>Quantity Consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast (8-9 am)</td>
<td>Milk</td>
<td>1 large glass</td>
</tr>
<tr>
<td></td>
<td>Vegetable poha*</td>
<td>1 bowl</td>
</tr>
<tr>
<td></td>
<td>Mint coriander chutney</td>
<td>1 teaspoon</td>
</tr>
<tr>
<td></td>
<td>Chapatti</td>
<td>3</td>
</tr>
<tr>
<td>Lunch (1-2pm)</td>
<td>Rice</td>
<td>½ bowl</td>
</tr>
<tr>
<td></td>
<td>Chana dal with lauki</td>
<td>1 bowl</td>
</tr>
<tr>
<td></td>
<td>Vegetable stir fry</td>
<td>1 bowl</td>
</tr>
<tr>
<td></td>
<td>Plain curd</td>
<td>1 bowl</td>
</tr>
<tr>
<td>Evening snack (5-6pm)</td>
<td>Idli*</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Sambhar*</td>
<td>1 bowl</td>
</tr>
<tr>
<td>Dinner</td>
<td>Chapatti</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Pea potato curry</td>
<td>1 bowl</td>
</tr>
<tr>
<td></td>
<td>Cucumber curd salad</td>
<td>1 bowl</td>
</tr>
</tbody>
</table>

* In north India Parantha in Breakfast, Pakoda/samosa as evening snack may replace these.

The example given below is a calculation of percent energy obtained from the three macronutrients:
• Protein: \(70\text{g} \times 4\text{ kcal} = 280\text{ kcal}\) divided by \(2000 = 0.14\) multiplied by 100 = 14%.

• Carbohydrate: \(317.5\text{ g} \times 4\text{ kcal} = 1270\) divided by \(2000 = 0.635\) multiplied by 100 = 63.5%.

• Fat: \(50\text{g} \times 9\text{ kcal} = 450\) divided by \(2000 = 0.225\) multiplied by 100 = 22.5%.

### 1.6 NUTRITIONAL ASSESSMENT

The nutritional status of an individual is the result of many interrelated factors. It is influenced by the adequacy of food intake both in terms of quality and quantity and also by the physical health of the individual.

#### 1.6.1 Objectives of Nutritional Assessment

- To obtain information on the extent of nutritional problems of a community.
- To identify the population group ‘at risk’ or in greatest need of assistance.
- To develop a nutrition programme that meets the needs defined by the assessment.
- To evaluate the failure or success of nutrition programme.
- To assess the degree of malnutrition of preschool and school going children.

In nutritional surveys it is not necessary to examine all the persons in a given community. Examination of a representative sample of the population covering all ages and both sexes in different socio-economic groups is sufficient.

#### 1.6.2 Methods of Assessment

This involves various techniques and methods. Proper evaluation demands a many angled approach, covering all the different stages in the natural history of nutritional diseases. The assessment method includes:

**Clinical Examination:** It is an essential feature of all nutritional surveys. It is also the most practical method of ascertaining the nutritional status of a group of individuals. There are a number of physical signs, some specific and many non-specific. When two or more clinical signs/characteristics of a deficiency disease are present simultaneously, their diagnostic significance is greatly enhanced.

Signs used in nutritional survey:

- Not related to nutrition, e.g. alopecia, pyorrhoea, pterygium.
- That need further investigation (molar pigmentation, coined vascularisation, geographic tongue)
- Known to be of value, e.g. angular stomatitis, Bitot’s spot, calf tenderness, absence of knee or ankle jerks (beriberi), enlargement of the thyroid gland (endemic goiter), etc.

However, clinical signs have the following characters:

- Malnutrition cannot be quantified on the basis of clinical signs
- Many deficiencies are unaccompanied by physical signs, and
- Lack of specificity and subjective nature of most of the physical signs.
To minimise subjective and objective errors in clinical examination, standard surveys forms or schedules have been devised covering all areas of the body.

**Anthropometry:** It involves physical measurement of an individual and relating them to growth and development standards, e.g., height, weight, head circumference, skin fold thickness, arm circumference, waist circumference, etc. Growth of the children can be monitored by mapping height for age and weight or length curves. Infantometer is used to measure the length of small children measuring rod or stadiometer are used for adults. Road to health card is useful for grading degree of PEM for preschool children. Refer Course 3, Block 1, Unit 2 on nutrition assessment for details about practical aspects.

The fat fold or skin fold thickness measurement is a means of assessing the amount of fat in an individual. This is practiced in clinical settings. Skin fold calipers are used to measure this subcutaneous fat in millimeters.

Waist circumference is obtained by measuring the air confidence around the smallest area below the rib cage and above the umbilicus with use of a non-stretchable tape. It assesses the abdominal fat content. Measurements of above 40 inches for men and 35 inches for women are considered as risk factor of disease.

Mid-Arm circumference (MAC) is measured midway between the shoulder and tip of the elbow. It is important in growing children and in PEM children. Head circumference measurements are useful in children below 3 years of age and indicate non-nutritional abnormalities.

**Laboratory and Biochemical Assessment:**

**Haemoglobin estimations:** It is the most important laboratory test that is carried out in nutritional surveys. It is a useful index of the overall state of nutrition. Stools and urine be examined for intestinal parasites. History of parasitic infestation, chronic dysentery, and diarrhoea provide useful information about the nutritional status. Urine should also be examined for albumin and sugar.

**Biochemical test:** These may be applied to measure individual nutrient concentration in body fluids (e.g. serum retinol, serum iron) or to detect abnormal amounts of metabolites in urine (iodine). Biochemical tests are time-consuming and expensive. They cannot be applied on a large scale, e.g. in the nutritional assessment for whole community.

**Assessment of Dietary Intake:** Direct assessment of food consumption involves dietary surveys which may be household inquiries on individual food consumption surveys. A diet survey may be carried out by one of the following methods:

- Weighment of raw foods
- Weighment of cooked foods
- Oral questionnaire method

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**Check Your Progress 3**

1) Explain the importance of breakfast in our dietary pattern.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

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2) Enlist the objectives of nutritional assessment.
................................................................................................................
................................................................................................................
................................................................................................................

3) What you will measure during Anthropometric assessment of nutrition?
................................................................................................................
................................................................................................................
................................................................................................................

4) Mid-Arm circumference is measured between………………

5) The most important laboratory test that is carried out in nutritional survey is………………

1.7 NUTRITION EDUCATION

It aims to guide people to choose optimum balanced diets and promote good dietary habits. Nutritional problems such as ignorance about the value of breastfeeding, traditional food allocation pattern in the families, etc. can be solved by nutrition education.

In recent years the link between dietary habits and certain chronic disease such as obesity, diabetes and cardiovascular disease has been established. Nutrition education is a major intervention in the hands of nurses for the prevention of malnutrition, promotion of health and improving the quality of life.

Nutrition is an important aspects of treatment of certain diseases. So this is the prime responsibility of a nurse to teach about good nutrition to the patients in the hospital and to the families in the community. This helps the people to select right kinds of foods to eat, safe methods of cooking, hygienic practices in handling and preservation of food.

1.7.1 Purpose of Nutrition Education

Let us go through this purpose of nutrition education as given belows :

1) To educate the individual, the family and the community about the food sources, nutritive values, proper method of cooking, balanced diet and requirements of energy.

2) To educate them about the food selection, preparation, purchase and storage.

3) To provide information about food substitutes, changes and modification in diet.

4) To educate the effects of various cooking methods on the nutrients.

5) To inform about the importance of various nutrients and their required amount.

6) To inform about signs and symptoms of nutritional deficiencies.

7) To explain about the importance of food hygiene.

8) To underline the nutritional requirements of the vulnerable group (children, pregnancy, location, and old age).
9) To educate to avoid bad habits, prejudices, idiosyncrasies and wrong notions on diet.

10) To educate on methods of prevention and control of nutritional deficiencies.

1.7.2 Principles of Nutrition Education

1) Nutrition education should include all family members.

2) Help the family to understand the importance and objectives of nutrition.

3) Advice should be made according to the individuals, practice, religion and culture.

4) The individual should be given sufficient time to adopt new ideas and habits.

5) They should be encouraged to ask questions (to satisfy their queries).

1.7.3 Methods for Imparting Nutrition Education

Community health educated you can use various methods of imparting health education to the people including various audio visual aids.

- **Personal talks:** One to one casual or informal talk with people will yield better results when counselling them on nutrition. First their existing diet and routine life should be analysed against the family background. This will help menu planning, budgeting the foods and exchange list, etc.

- **Group Discussion:** It is organised by a nurse, dietician or any other expert. Group should include the persons with same characteristics.

- **Exhibition and Kitchen Garden:** These are the real aids which can show the practical means of using fresh vegetables and fruits. There is also visual demonstration which helps and motivates people to adopt healthy nutritional preparations.

- **Cooking Demonstration:** Cooking demonstration helps the people to change their menu as per their taste. They can learn various methods of cooking.

- **Posters and Charts:** These can be used to highlight specific features in nutrition. Posters should be comprehensive, colourful and self-explanatory.

- **Practical Methods:** These include short menu planning, budgeting of food, calculating the caloric and other nutrient intake per menu intake. During home visits to the families nurse can guide them as per their family size, income, age group and their food habits.

Following techniques can be used to make nutrition education more effective, e.g. role playing nutrition drama. Puppet show, music and flock dance, posters, pictures, tape recorder, computer, television, films about nutrition.

Nutrition education can be organised during:

1) Home visit.

2) School health programmes

3) During special clinics, e.g. ante/ post-natal clinic and preschool clinic

4) Special community health programmes and health camps

5) Indoor and outdoor clinics with patients and their attendants.
1.8 NATIONAL NUTRITION PROGRAMMES

In India many nutritional programmes are in operation since 1st five year plan period. Many International agencies such as WHO, UNICEF, FAO, CARE are assisting the Govt. of India to implement these programmes to improve the nutritional status of the people with emphasis on women and children. Here we will discuss some of the important nutritional programmes for your improved knowledge and active involvement at grassroot level.

1) Vitamin A prophylaxis programme

This was launched in 1970 by Ministry of Health and Family Welfare. Vitamin A deficiency is considered a public health problem in India. First strategy is the improvement of people’s diet so as to ensure a regular and adequate intake of food rich in vitamin A. Regular consumption of dark green leafy vegetables or yellow fruits and vegetables prevent vitamin A deficiency. Breastfeeding protects against vitamin A deficiency. Colostrum is rich in vitamin A. It is a long term measure involving intensive nutrition education of the public and community participation. Second strategy is to administer a single dose of 2,00,000 IU of vitamin A in oil (retinal palmitate) orally every 6 month to preschool children, i.e., 1 to 6 years. 1st dose (1,00,000 IU) is given at 9 months.

Treatment of vitamin A deficient cases

Single oral dose of 2,00,000 IU of vitamin A immediately at diagnosis. Follow-up dose of 2,00,000 IU one to four weeks later.

A community health nurse should make assessment of that particular community for vitamin A deficiency diseases. If she knows the magnitude of the problem, she can make plan accordingly. She should assess the children while they come to attend baby clinic, in Anganwadis and in schools. It is her responsibility to organise immunisation clinics and camps in which she administers the vitamin A drops as a part of Immunisation. She maintains the required temperature of vitamin A drops at the time of consumption. She should maintain record of these programmes in stock register, and immunisation cards. She should make and send the regular report for vitamin A drops to medical officer.

She can teach the community to take diet containing Vit. A. She should explain the cheap and locally available foods rich in vitamin A. She should also make aware them about deficiency diseases of vitamin A. Time to time evaluation is very important to watch the progress of the programme. If there is any failure she should inform to the authority. She plays an important role in teaching AWW and other health professionals.

2) Iodine deficiency disorders control programme (IDDCP)

The National Goiter Control Programme was launched by the Govt of India in 1962. The objective was identification of the goiter endemic areas to supply iodised salt in place of common salt and to assess the impact of goiter control measures. Prevalence of disease still remains high. Now it is clear that the problem is not restricted to hills, as was thought earlier, but is extremely prevalent in other parts of India. As a result IDD control programme has been initiated in which use of iodised salt is being promoted nationwide. It was decided to fortify all edible salt. Latest results of evaluation have shown that the prevalence of goiter has declined.
Components of IDDCP programme: Components of IDDCP are as given belows:

**Iodised salt:** In India, the level of iodisation is fixed under the FSSR 2011 and is not less than 30 PPM at the production point and not less than 15 PPM of iodine at the consumer level. It is the most economical convenient and effective means of mass prophylaxis. Iodised oil: Injection of iodised oil (1 ml) provides protection for about 4 years.

- **Oral Iodised oil:** The oral administration of iodine as iodised oil or as sodium iodate tablets is technically simpler than the injection method.
- **Iodine Monitoring:** A network of laboratories is available for this.
- **Man Power Training:** Health workers and other engaged in the programme are trained in all aspects of goiter control including legal enforcement and public education.
- **Mass Communication:** It’s a powerful tool for nutrition education. It should be fully used in goiter control, work. Creation of public awareness is a key to success of the programme.
- **Hazards of Iodisation:** Amid increase in incidence of thyrotoxicosis has now been described following iodised salt programme.
- **Role of nurse:** A complete assessment is necessary to know the magnitude of the iodine deficiency disorders. It will help in planning and administration of IDD programme. A nurse is direct care provider to the families in community and to the patients in hospitals. You can assess the problem while working in your area. You can help the laboratory workers in iodine monitoring when required.

You would works as mediator between community and health authorities. You can promote following activities:

- motivate better to use iodised salt and oil.
- arrange campaign in schools, at clinics to create awareness among people.
- make use of compulsory law regarding iodised salt.
- make the paramedical staff fully trained.
- provide knowledge and give training to them about IDD programme.
- provide training to your subordinates to evaluate the programme.
- collect information from shopkeepers about selling the iodised salt.
- maintain relevant records.

Health education is the main tool to minimise the problem of iodine deficiency disorder (IDD). You can also motivate them to use iodised salt. You can collect the data from community people and market people. You should organise special health education campaign in the schools, health centers and make special announcement for this disease and the ways to control IDD.

3) **Mid-Day Meal Programme**

In order to combat malnutrition and improve the health of school children, it is now an accepted procedure in all advanced countries to provide a good nourishing meal to school children. In view of the limited finances in India, it is recommended that the school meal should provide atleast one-third of daily calories requirement and about half of the daily protein requirement of child. Mid-day Meal Programme was initiated in 1962. Following broad principles should be kept in mind for this meal:
• It should be a supplement and not a substitute to the home diet.
• It should supply at least one-third of the total energy requirement and half of the protein need.
• Its cost should be reasonably low.
• 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.

### Table 1.10: Model Menu

<table>
<thead>
<tr>
<th>Food Stuffs</th>
<th>g/day/child</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals and millets</td>
<td>75</td>
</tr>
<tr>
<td>Pulses</td>
<td>30</td>
</tr>
<tr>
<td>Oils and fats</td>
<td>8</td>
</tr>
<tr>
<td>Leafy vegetables</td>
<td>30</td>
</tr>
<tr>
<td>Non leafy vegetables</td>
<td>30</td>
</tr>
<tr>
<td>Milk/ substitute</td>
<td>150-200 ml</td>
</tr>
</tbody>
</table>

• Minimum number of feeding days in a year should be 250 to have the desired impact on children.
• School feeding should not be considered as an end in itself. National Programme of Mid Day Meal in Schools (MDMS) is also discussed in Unit 3 under Sub Section 3.7.2.

The important goals to be accomplished are:

i) Reorientation of eating habits,

ii) Incorporation nutrition education into the curriculum.

iii) Encouraging the use of local commodities.

iv) Improving school attendance as well as educational performance of the pupils.

The central assistance provided to state under the programme is by way of free supply of food grain from nearest Food Corporation of India at the rate of 100 g per student per day and subsidy for transport of food grain. To achieve the objective a cooked mid-day meal with minimum 300 calories and 8 to 12 grams of protein content will be provided to all the children in class 1 to 5.

Some suggestions for preparation of mid-day meal are as under:

• Food grains must be stored in a place away from moisture, in airtight containers/bins to avoid infestation. Special precaution should be taken to avoid contamination with pesticides (do not store these in food store area)

• Use whole wheat and broken wheat (dalia) for preparing mid-day meals.

• Rice should preferably be parboiled or unpolished.

• ‘Single Dish Meals’ using broken wheat or rice and incorporating some amount of a pulse or soya beans and some seasonal vegetable, green leafy vegetables and some amount of edible oil will save both time and fuel besides being nutritious (e.g. Broken wheat pulao, leafy khichari, upma, dal-vegetable bhaat)
Nutrition

• Cereal pulse combination is necessary to have good quality protein. The cereal pulse ratio could range from 3:1 to 5:1.
• Sprouted pulses have more nutrients and should be incorporated in single dish meal.
• Leafy vegetables when added to any preparation should be thoroughly washed before cutting and should not be subjected to wash after cutting.
• Soaking of rice, dal, Bengal gram, etc. reduces cooking time. Wash the grains thoroughly and soak in just sufficient amount of water required for cooking.
• Rice water if left after cooking should be mixed with dal. If these are cooked separately, should never be thrown away.
• Fermentation improves nutritive value.
• Locally popular food items (khichri, kadhi, idli, dosa, dhokla,) may be encouraged.
• Cooking must be done with the lid on to void loss of nutrients.
• Over cooking should be avoided.
• Reheating of oil used for frying is harmful and should be avoided.
• Leafy tops of carrots, radish, turnips, etc. should not be thrown.
• Only ‘iodised salt’ should be used for cooking mid-day meal.

Why School Meals are given?
• In India, the school children form one-third of total population.
• Childhood is a period of rapid growth and development and also of physical activity. Hence nutritional care is needed.
• School meal provides best opportunity for nutrition education for removing prejudices and imparting good dietary habits.
• School meal also provides best opportunity to learn and share feeding pattern within the group.

Role of Nurse in Mid-Day Meal Programme:

(Please refer Unit 5 of this block to identify the role of nurses in food safety.)

This can be well described through nursing process, i.e. Assessment, Planning, Implementation and Evaluation.

a) **Assessment/Health Appraisal:** Before planning the mid-day school meal, it is very important to assess the nutritional status of school children. This includes measurement of height, weight and arm circumference (anthropometric measurement). You carry head to foot exam, i.e. colour of eyes, nails for anaemia and dental check-up for dental carries and other dental diseases. So, nurse is a key person and active member of multidisciplinary team consist of school physician counsellor, psychologist, social worker, teachers and parents. You may act as a coordinate or advocate conveying information about nutrition and health to the teachers, parents and school children. Please refer Course 3, Block 1, Unit 2 for practical details.

b) **Planning and Implementation:** After assessment, you should also participate in planning and implementation of mid-day school meal. You
should observe whether the meal is providing one-third of the daily energy required and about half of the daily protein required. You should also provide this information to the school teachers who are the main persons to plan and prepare mid-day school meal.

c) **Evaluation:** The purpose of evaluation is to assess the failure or success of the programme implemented. This includes comparison between pre-assessment and post-assessment of the programme to see the difference or progress, recording and reporting. School health nurse is responsible to maintain the health records of the school children regularly and of the mid-day school meals also. You should report to school teachers and the parents of children if there is any malnourished.

d) **Nutrition Education:** It has an important role in prevention and control of nutritional deficiency diseases. Nurse should teach the school children, their parents and even school teachers regarding preparation and serving of mid-day school meal. You should explain about cheap and locally available foods and their food values. You can also teach them regarding dental care, healthy food habits and balanced diet.

4) **ICDS (Integrated Child Development Services Scheme)**

It was started in 1975 by the Ministry of Social Welfare. It provides following integrated package for child welfare:

- Supplementary nutrition
- Immunisation
- Growth monitoring
- Health check-up
- Medical referral services
- Nutrition and health education for women
- Non-formal education of children up to the age of 6 years and of pregnant and nursing mothers in rural, urban and tribal areas.

**Objectives of ICDS**

1) To improve the nutritional and health status of children in the age group of 0 to 6 years.

2) To lay foundations for proper psychological, physical and social development of the child.

3) To reduce mortality and morbidity, malnutrition and school dropout.

4) To achieve an effective coordination of policy an implementation among the various departments working for the promotion of child development.

5) To enhance the capabilities of the mother and nutritional needs of the child through proper nutrition and health education.
Table 1.11: Package of Services under ICDS

The delivery of services to the beneficiaries are as follows:

<table>
<thead>
<tr>
<th>Services</th>
<th>Target Group</th>
<th>Service Provided By</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Supplementary Nutrition</td>
<td>Children below 6 years, Pregnant &amp; Lactating Mothers (P&amp;LM)</td>
<td>Anganwadi Worker and Anganwadi Helper [MWCD]</td>
</tr>
<tr>
<td>ii) Immunisation*</td>
<td>Children below 6 years, Pregnant &amp; Lactating Mothers (P&amp;LM)</td>
<td>ANM/MO [Health system, MHFW]</td>
</tr>
<tr>
<td>iii) Health Check-up*</td>
<td>Children below 6 years, Pregnant &amp; Lactating Mothers (P&amp;LM)</td>
<td>ANM/MO/AWW [Health system, MHFW]</td>
</tr>
<tr>
<td>iv) Referral Services</td>
<td>Children below 6 years, Pregnant &amp; Lactating Mothers (P&amp;LM)</td>
<td>AWW/ANM/MO [Health system, MHFW]</td>
</tr>
<tr>
<td>v) Pre-School Education</td>
<td>Children 3-6 years</td>
<td>AWW [MWCD]</td>
</tr>
<tr>
<td>vi) Nutrition &amp; Health Education</td>
<td>Women (15-45 years)</td>
<td>AWW/ANM/MO [Health system, MHFW &amp; MWCD]</td>
</tr>
</tbody>
</table>

Source: http://icds-wcd.nic.in/icds/icds.aspx (MoWCD, GoI) * AWW assists ANM in identifying the target group

The administrative unit of an ICDS project is the community development block under the charge of Child Development Project Officer (CDPO). The urban or rural project has a population of 100,000 and a tribal project about 35000. The focal point for the delivery of services under the ICDS scheme is the Anganwadi Worker (AWW) selected from the local community. A supervisor (Mukhya sevika) is responsible for 20–25 AWW.

Table 1.12: Revised Nutrition Norms in ICDS (since February, 2009)

<table>
<thead>
<tr>
<th>Beneficiaries</th>
<th>Calories</th>
<th>Protein (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children(6 months to 72 months)</td>
<td>500</td>
<td>12-15</td>
</tr>
<tr>
<td>Severely malnourished Children (SAM) (6 months- 72 months)</td>
<td>800</td>
<td>20-25</td>
</tr>
<tr>
<td>Pregnant women and lactating mothers</td>
<td>600</td>
<td>18-20</td>
</tr>
</tbody>
</table>

Source: http://icds-wcd.nic.in/icds/icds.aspx (MoWCD, GoI)

Functions of Angan Wadi Worker (AWW)

- Survey of community and beneficiaries.
- Assesses their growth/development & health status.
- Organises Non-formal education activities for mothers and children.
- Assists PHC staff in providing health services.
- Maintains records of immunisation, feeding and preschool attendance.
- Works for other community based activities, e.g. family planning.
- Mediation between administrator, local school, health staff and community.
Delivery of Services: Let us now go through various activities delivered under ICDS scheme as given below:

a) **Supplementary Nutrition**: It is given to degree 2 and 3 PEM children below 6 years and to nursing and expectant mothers from low income group. The type of food depends upon local availability. It is given in 300 days a year. Children are weighed every month and recorded on road-to health card. Nutrition education is also given to mothers.

b) **Nutrition and Health Education**: It is given to women (15–45 yrs) nursing and expectant mothers.

c) **Immunisation**: Against various diseases is being done.

d) **Health Check-up**: This includes antenatal & postnatal care of mothers, care of newborn, infants and of under-fives. Expectant mothers are given iron and folic acid tablet. High risk mothers/children are referred to hospitals. The health care of children under six consists of record of weight and height at periodical intervals; Watch over mile stones; immunisation. General check-up is done every 3–6 months to detect disease and malnutrition. Treatment of disease like diarrhoea and respiratory infection & deworming is also done. Prophylaxis against vitamin A deficiency and anaemia is also done. Health records of children, antenatal care, delivery card, etc are maintained.

a) **Non-formal Preschool Education**: Children between the ages 3 to 6 years are imparted Non-formal education in the Anganwadis to provide opportunities to develop desirable attitude, values and behaviour patterns. Local inexpensive toys and materials are used.

Role of Nurse in ICDS: As community health educator you need to take the following activities:-

- **Training, Supervision & Evaluation**: You can make a supervisory round in Anganwadi in your area to check their health records, attendance and functions they perform. You should guide whenever they need. Nurse should check growth monitoring cards and match with head to foot inspection to identify under nourished children.

- **Health Education**: This must include the diet during pregnancy and lactation, immunisation, treatment of diarrhoea with ORS. Mothers should be encouraged to attend Anganwadis by making them aware about different services of ICDS.

Check Your Progress 4

1) List any three purposes of Nutritional Education.
   
   ................................................................................................................
   ................................................................................................................

2) Explain the principles of Nutritional education.
   
   ................................................................................................................
   ................................................................................................................
3) Enlist methods of imparting Nutritional Education.

4) Enlist the National Nutritional Programmes.

5) List the services being provided under ICDS.

6) Enlist the functions of AWW.

1.9 LET US SUM UP

Several programmes within the field of health, seemingly unrelated to nutrition, may have a profound impact on the nutritional status. Since malnutrition is closely related to infection, all programmes of immunisation and improvement of environment sanitation will inevitably have a beneficial effect on nutrition. The FAO/WHO Expert Committee on Nutrition stressed that food and nutrition planning must be integral part of the overall socioeconomic development.

1.10 MODEL ANSWERS

Check Your Progress 1

1) i) Structural integrity of bones, muscles and other tissues
   ii) Energy production for physical activity
   iii) Growth, development and repair.

2) Macronutrient and Micronutrient

3) Proteins, fats and carbohydrates

4) About 16%

5) Ideally only 20–30% of total dietary energy should be provided by fats.

6) There are 3 main sources of carbohydrate, viz., starches, sugar and cellulose.

7) i) For growth and development: they furnish the building material i.e. the amino acids
   ii) For repair of body tissues and their maintenance

8) Vitamins A, D, E and K

9) Ghee and Meat
Check Your Progress 2

1) Carrots, mangoes and papaya
2) 2.5 micrograms (100 i.u.) per day
3) Rickets, Osteomalacia
4) Folic Acid and Vitamin B12
5) • Major minerals: Calcium, phosphorus, sodium, potassium, and magnesium.
   • Trace elements: These are required by the body in less than few milligrams per day e.g. iron, iodine, fluorine, zinc, copper, cobalt, chromium, manganese, molybdenum, selenium, nickel, tin, silicon and vanadium.
6) i) Help in the purchase, preparation and service of appropriate food items.
   ii) Help to economise on time, labour and fuel.
   iii) Provide variety in the diet through proper selection of foods.
7) Breakfast at 8–10 am, lunch at 2–3 pm, and dinner at 8–9 pm.

Check Your Progress 3

1) Breakfast is the first meal of the day and is very important from the nutritional point of view.
   Literally, it means breaking the fast, because it is eaten after a gap of 8–10 hours after the night meal on the previous day, i.e. dinner. It will boost the energy level and help to maintain energy level throughout the day and prevent physical and mental fatigue.
2) • To obtain information on the extent of nutritional problems of a community.
   • To identify the population group ‘at risk’ or in greatest need of assistance.
   • To develop a nutrition programme that meets the needs defined by the assessment.
   • To evaluate the failure or success of nutrition programme.
   • To assess the degree of malnutrition of preschool and school going children.
3) Height, weight, head circumference, skin fold thickness, mid arm circumference, waist circumference.
4) Shoulder and tip of the elbow
5) Haemoglobin estimation

Check Your Progress 4

1) To educate them about the food selection, preparation, purchase and storage.
   To inform about the importance of various nutrients and their required amount.
   To inform about signs and symptoms of nutritional deficiencies
2) • Nutritional education should include all family members.
   • Help the family should understand the importance and objectives of nutrition.
   • Advice should be made according to the individuals, practice, religion and culture.
Nutrition

- The individual should be given sufficient time to adopt new ideas and habits.
- They should be encouraged to ask questions (to satisfy their queries).

3) Personal talks, Group Discussion, Exhibition and Kitchen Garden, Cooking Demonstration, Posters/Charts and practical method.

4) National Programme for Control of Blindness or Vitamin A prophylaxis programme
- Iodine Deficiency Disorders Control Programme (IDDCP)
- Mid-Day school Meal Programme
- ICDS (Integrated Child Development Scheme)

5) Supplementary nutrition
- Immunisation
- Health check-up
- Growth monitoring
- Medical referral services
- Nutrition and health education for women
- Non-formal education of children upto the age of 6 years and of pregnant and nursing mothers in rural, urban and tribal areas.

6) Survey of community and beneficiaries.
- Assesses their growth/development & health status
- Organises Non-formal education activities for mothers & children
- Assists PHC staff in providing health services.
- Maintains records of immunisation, feeding and preschool attendance.
- Works for other community based activities, e.g. family planning.
- Mediation between administrator, local school, health staff and community.