NUTRITION
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UNIT 1
(NUTRION AND DIETITICS)

Basic Nutrition Concepts

Nutrition

Nutrition (also called nourishment or aliment) is the provision, to cells and organisms, of the materials necessary (in the form of food) to support life or The study of nutrients in food, how the body uses nutrients, and the relationship between diet, health and disease or

Nutrition is the science that deals with all the various factors of which food is composed and the way in which proper nourishment is brought about.

In hospitals, nutrition may refer to the food requirements of patients, including nutritional solutions delivered via an IV (intravenous) or IG (intragastric) tube.

Dietetics

The interpretation and communication of the science of nutrition so that people can make practical choices about food and lifestyle, in both health and disease.

Nutritionist

A nutritionist focuses firstly on food, and then looks at its effects on people.

Dietitian

A dietitian looks at the human, and then how that human's health is influenced by food.

Foods

The products derived from plants or animals that can be taken into the body to yield energy and nutrients for the maintenance of life and the growth and repair of tissues.

Diet

The foods and beverages a person eats and drinks.

Energy

The capacity to do work. The energy in food is chemical energy. The body can convert this chemical energy to mechanical, electrical, or heat energy.

Nutrients

The chemical substances obtained from food and used in the body to provide energy, structural materials, and regulating agents to support growth, maintenance, and repair of the body's tissues. Nutrients may also reduce the risk of some diseases.

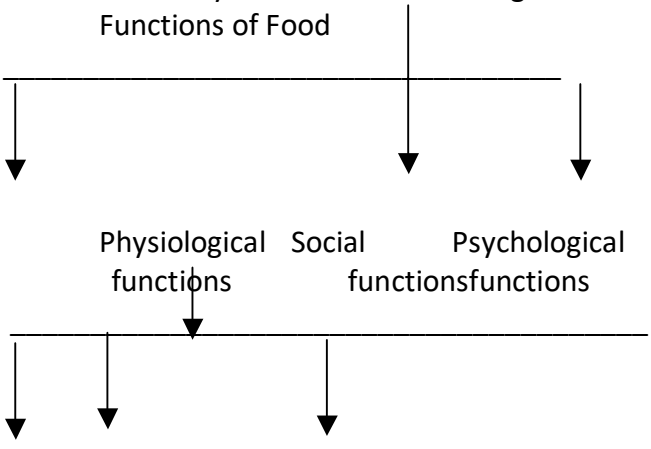
FOOD GROUPS – A GUIDE IN MENU PLANNING

Food is the basic necessity of man. It is a mixture of different nutrients such as carbohydrate, protein, fat, vitamins and minerals. These nutrients are essential for growth, development and maintenance of good health throughout life. They also play a vital role in meeting the special needs of pregnant and lactating women and patients recovering from illness.

FUNCTIONS OF FOOD

Food may be classified according to their functions in the body.

Functions of Food



Energy yielding Body building foods Protective foods
Foods (Protein) (Vitamins and (Carbohydrate, minerals)
Physiologicalfunctionfood:

1. Energy yielding foods:

Foods rich in carbohydrates and fats are called energy yielding foods. They provide energy to sustain the involuntary processes essential for continuance of life, to carry out various professional, household and recreational activities and to convert food ingested into usable nutrients in the body.

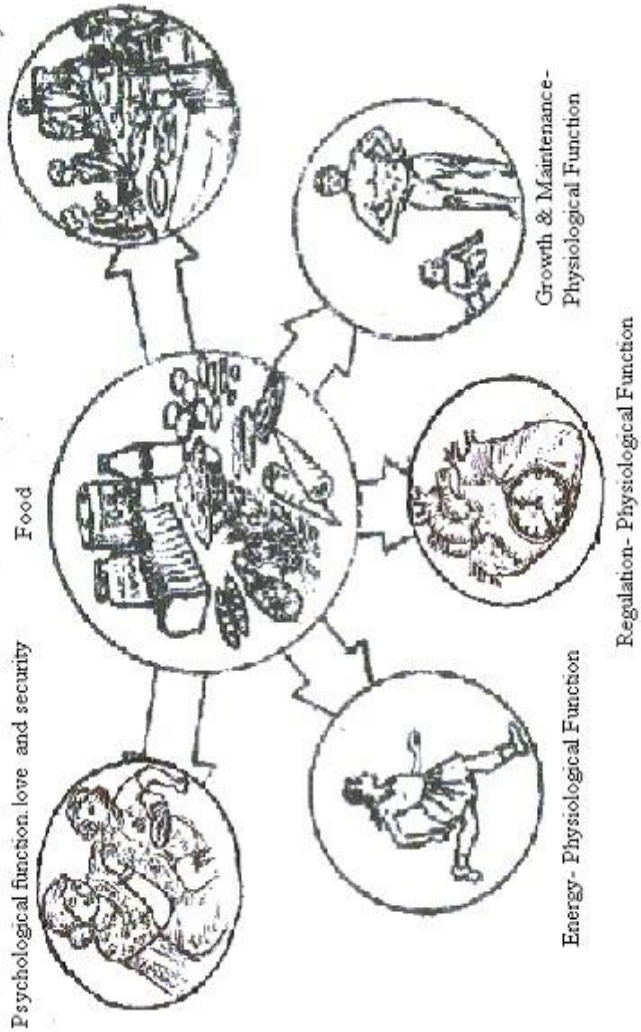
The energy needed is supplied by the oxidation of foods consumed. Cereals, roots and tubers, dried fruits, oils, butter and ghee are all good sources of energy.

Body building foods:

Foods rich in protein are called body building foods. Milk, meat, eggs and fish are rich in proteins of high quality. Pulses and nuts are good sources of protein but the protein is not of high quality. These foods help to maintain life and promote growth. They also supply energy.

Protective and Regulatory foods:

Foods rich in protein, minerals and vitamins are known as protective and regulatory foods. They are essential for health and regulate activities such as maintenance of body temperature, muscle contraction, control of water balance, clotting of blood, removal of waste products from the body and maintaining heartbeat. Milk, egg, liver, fruits and vegetables are protective foods.



Functions of food Fig.1.2

1.2 ICMR FIVE FOOD GROUPS

TABLE – 1.A

Five Food Group System

Food Group	Main Nutrients
I. Cereals, Grains and Products : Rice, Wheat, Ragi, Bajra, Maize, Jowar, Barley, Rice flakes, Wheat flour.	Energy, protein, Invisible fat Vitamin – B_1, Vitamin – B_2, Folic Acid, Iron, Fibre.
II. Pulses and Legumes : Bengal gram, Black gram, Green gram, Red gram, Lentil (whole as well as dhals) Cowpea, Peas, Rajmah, Soyabeans, Beans.	Energy, Protein, Invisible fat, Vitamin – B_1, Vitamin – B_2, Folic Acid, Calcium, Iron, Fibre.
III. Milk and Meat Products : Milk : Milk, Curd, Skimmed milk, Cheese Meat : Chicken, Liver, Fish, Egg, Meat.	Protein, Fat, Vitamin – B_{12}, Calcium. Protein, Fat, Vitamin – B_2
IV. Fruits and Vegetables : Fruits : Mango, Guava, Tomato Ripe, Papaya, Orange. Sweet Lime, Watermelon. Vegetables (Green Leafy) : Amaranth, Spinach, Drumstick leaves, Coriander leaves, Mustard leaves, fenugreek leaves . Other Vegetables : Carrots, Brinjal, Ladies fingers, Capsicum, Beans, Onion, Drumstick, Cauliflower.	Carotenoids, Vitamin – C, Fibre. Invisible Fats, Carotenoids, Vitamin – B_2. Folic Acid, Calcium, Iron, Fibre. Carotenoids, Folic Acid, Calcium, Fibre
Food Group	Main Nutrients
V. Fats and Sugars : Fats : Butter, Ghee, Hydrogenated oils, Cooking oils like Groundnut, Mustard, Coconut. Sugars : Sugar, Jaggery	Energy, Fat, Essential Fatty Acids Energy

Significance of the five-food group system

The five food group system can be used for the following purposes :

Planning wholesome balanced menus toachieve nutritional adequacy.

Assessing nutritional status – a brief diet history of an individual can disclose inadequacies of food and nutrients from any of the five groups.

Based on the assessment, nutrition education can be imparted to the individual.

FOOD PYRAMID :

The food guide pyramid was introduced in 1992 by USDA (United States Department of Agriculture) as a general plan of what to eat each day. The food guide pyramid is a valuable tool for planning a health promoting diet.

By incorporating the principle of balance, variety and moderation, an individual can still eat their favourite foods while following the food guide pyramid.

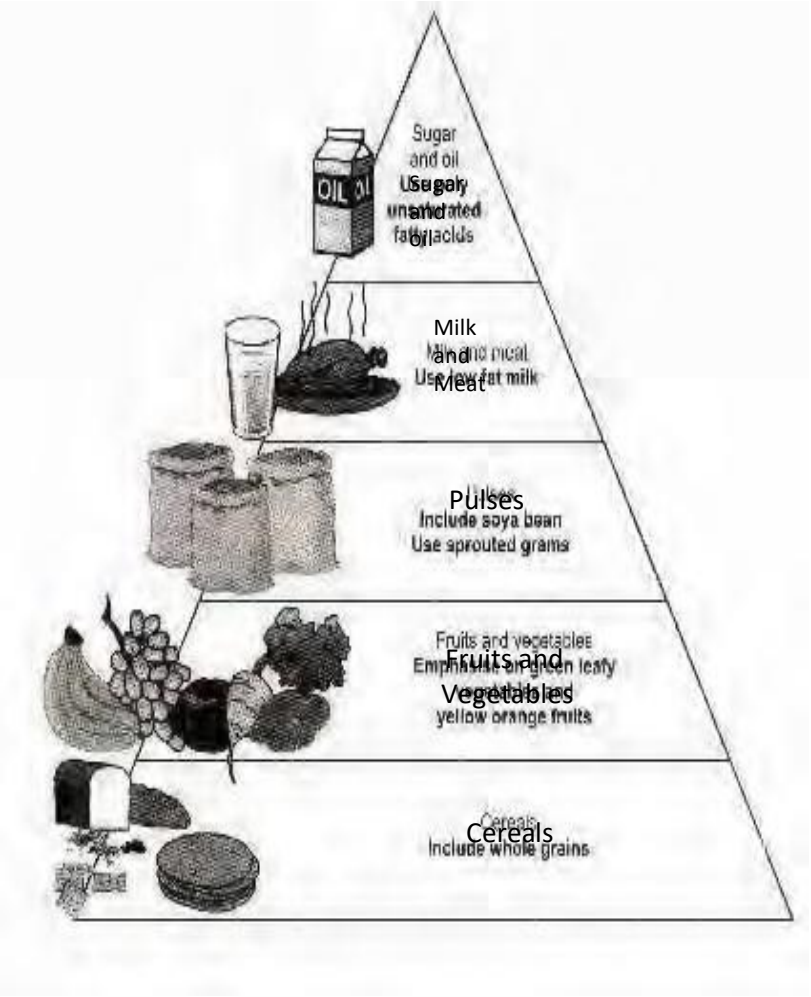


Fig.1.3 -Food guide pyramid Source:

Balance:

It means choosing food from different food groups.

Variety:

This means including different foods within each food group. For eg. consuming a variety of fruits.

Moderation:

This means keeping serving sizes reasonable. This involves self control.

The food guide pyramid provides recommendation for the number of daily servings that should be consumed from each of the food groups.

The diagram Fig. 1.3, clearly represents that cereals should form the major bulk of the diet followed by fruits and vegetables, pulses, milk and meat products and sugars and oil. The portion size of foods for adolescents (13-18 years) is given below.

TABLE 1.B
Portion size of foods for adolescents

Food Groups	Portion Size	Number of Portions for Adolescents	
		Girls	Boys
Cereals and millets	30 g	10	14
Pulses	30 g	2	2
Milk	100 ml	5	5
Roots and tubers	100 g	1	2
Green leafy Vegetables	100 g	1	1
Other vegetables	100 g	1	1
Fruits	100 g	1	1
Sugar	5 g	6	7
Fats and oils	5 g	5	5

There are six classes of nutrients:
Carbohydrates
Lipids (fats)
Proteins
Vitamins
Minerals &
Water

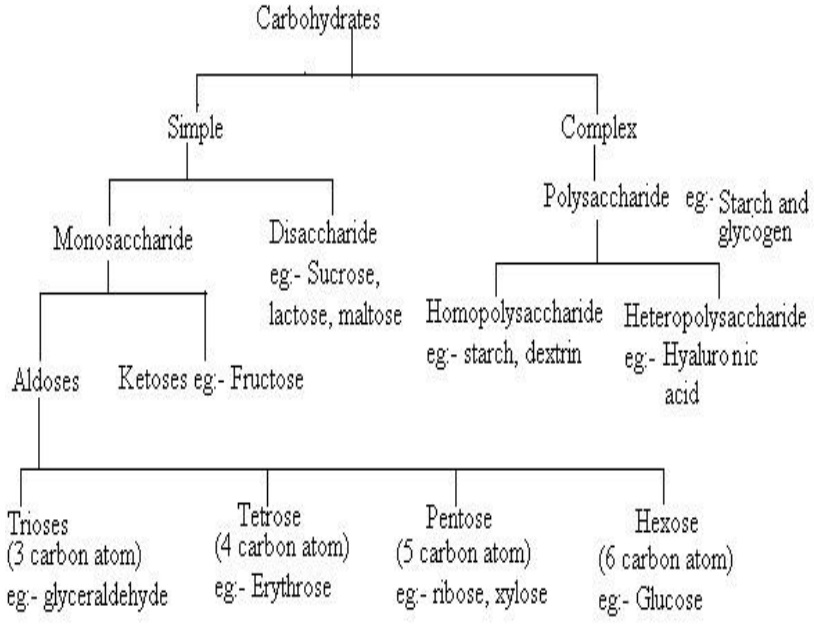
CARBOHYDRATES

Energy that is needed to move, perform work and live is chiefly consumed in the form of carbohydrates. Carbohydrates, primarily starches, are least expensive, easily obtained and readily digested form of fuel.

COMPOSITION

Carbohydrates are organic compounds composed of carbon, hydrogen and oxygen, with the later elements in the ratio of 2:1. The general formula is $C_nH_{2n}O_n$. They are viewed as hydrated carbon atoms.

CLASSIFICATION – SIMPLE AND COMPLEX :



Carbohydrates are classified, depending on the number of sugar units they contain, as simple carbohydrate and complex carbohydrates.

Monosaccharides and disaccharides make up simple carbohydrates, called simple sugars containing one and two sugar units respectively. Polysaccharides called complex carbohydrates are structurally larger and more complex than simple sugars. They include starch, dietary fibre and glycogen.

There are two main classes of monosaccharides based on the carbonyl group present in them. They are aldoses and ketoses, aldoses (eg; glucose) containing the aldehyde group (CHO) and ketoses, (eg;- fructose) containing the ketone group (C=O).

Aldoses are further divided into trioses, tetroses, pentoses and hexoses based on the number of carbon atoms.

The common disaccharides are Maltose, Lactose and Sucrose which on hydrolysis yield two monosaccharide units.

Maltose ▶ hydrolysis Glucose + Glucose

Lactose hydrolysis ▶ Glucose + Galactose

Sucrose hydrolysis ▶ Glucose + Fructose

FUNCTIONS AND FOOD SOURCES

Carbohydrates perform the following functions.

Energy :The principle function of carbohydrates is to serve as a major source of energy for the body. Each gram of carbohydrate yields 4Kcal of energy regardless of its source. In Indian diets 60 – 80 % of energy is derived from carbohydrate.

Glucose:

Glucose is indispensable for the maintenance of the functional integrity of the nervous tissue and is the sole source of energy for the proper functioning of the brain.Prolonged lack of glucose may cause irreversible damage to the brain.

Protein Sparing Action :

Carbohydrates exert a protein sparing action. If sufficient amounts of carbohydrates are not available in the diet, the body will convert protein to glucose in order to supply energy.

Fat Metabolism :

Carbohydrates are essential to maintain normal fat metabolism.Insufficient carbohydrates in the diet results in larger amounts of fat being used for energy than the body is equipped to handle. This leads to accumulation of acidic intermediate products called ketone bodies.

Synthesis of Body Substances

Carbohydrates aid in the synthesis of nonessential aminoacids, glycoproteins (which function as antibodies) and glycolipids (which form a part of cell membrane in body tissues especially brain and nervous system).

Precursors of Nucleic Acid :

Carbohydrates and products derived from them, serve as precursors of compounds like nucleic acids, connective tissue matrix and galactosides of nervous tissue.

Detoxification Function :

Glucuronic acid, a metabolite of glucose serves as a detoxifying agent.It combines with harmful substances containing alcohol or phenolic group converting them to harmless compounds which are later excreted.

Roughage of the Diet :

Insoluble fibres known as composite carbohydrates can absorb water and give bulk to the intestinal contents which aids in the elimination of waste products by stimulating peristaltic movements of the gastrointestinal tract.

Food Sources of Carbohydrates

Cereal grains, roots and tubers are the major sources of starch. Fruits and vegetables contain varying amounts of monosaccharides and dissaccharides.

Sugar is obtained from sugarcane.

Types and sources of Carbohydrates are given in the table-17A.

Table 17A

Types and Sources of Carbohydrates

Carbohydrate	Food Source

1. Monosaccharides Glucose Fructose Galactose, Maltose	 Fruits, honey, corn-syrup. Fruits, honey. These do not occur in free form in foods.
2. Dissaccharides Sucrose Lactose Maltose	 Cane and beet sugar. Milk and milk products. Malt and Cereal products.
3. Polysaccharides Digestible: Starch &Dextin Glycogen Indigestible: Cellulose Pectins, Gums	 Grains, vegetables especially roots& tubers and legumes Meat products and seafoods Stalks and leaves of vegetables, outer coat of seeds Fruits, Plant secretions and seeds.

DIGESTION, ABSORPTION AND UTILIZATION

Digestion :

The first stage of digestion of carbohydrate takes place in the mouth. Chewing breaks up food and exposes starch and sugars to the action of enzymes.

Saliva contains salivary amylase (ptyalin). It converts starch to maltose but time limits the action of salivary amylase, because as food enters the stomach, the acid present in the stomach blocks the action of salivary amylase.

In the stomach the acid causes hydrolysis of sucrose. In the small intestine pancreatic amylase and intestinal amylase digest starch up to the stage of maltose.

Starch —salivary, pancreatic & intestinal amylase→ maltose + Isomaltose

Glycogen is also broken by these enzymes to dissacharides. Enzymes maltase, sucrase and lactase present in the brush borders of the columnar cells of small intestine convert dissacharides to monosaccharides.

Maltose —Maltase→ Glucose + Glucose

Lactose —Lactase→ Glucose + Galactose

Sucrose —Sucrase→ Glucose + Fructose

Cellulose and other polysaccharides are not digested by enzymes, so undigested material passes to large intestine forming bulk which contributes to faeces.

The end products of carbohydrate digestion are monosaccharides – glucose, galactose and fructose.

They are absorbed by process of active absorption by the mucosa of the small intestine.

Metabolism:

Metabolism occurs inside the various cells of the body. There are two types of metabolism; anabolism (building up) and catabolism (breaking down).

The major carbohydrate anabolic path ways are conversion of glucose into glycogen (glycogenesis) in the liver and muscles. The conversion of glucose into fat (lipogenesis) in the liver and adipose tissue.

Carbohydrates follow two major catabolic pathways:

The breakdown of glucose releasing energy (glycolysis) and converting it into usable energy (ATP) and the conversion of glycogen to glucose (glycogenolysis).

After digestion and absorption of glucose into the blood stream it is utilized directly by the tissues for energy.

When the absorbed glucose exceeds the body's need for energy it is stored as glycogen in the liver and muscle and excess glucose is converted to triglycerides and stored as fat in adipose tissue.

REQUIREMENTS

As carbohydrate is utilized as main source of energy, at least 40 percent of the total energy in the food should come from Carbohydrates.

In our country 60 – 80 percent of a day's energy needs are met from carbohydrates in the form of starch furnished by cereals and pulses.

In developed countries only 30 – 40 percent of days energy needs are met from carbohydrates.

DIETARY FIBRE

Dietary fibre is defined as that portion of plant material ingested in the diet that is resistant to digestion by gastro intestinal secretions. It consists of hemicellulose, cellulose, lignins, oligosaccharides, pectins, gums and waxes.

Some bacteria in the large intestine can degrade some components of fibre releasing products, that can be absorbed into the body and used as energy source.

Two categories of fibre are found in food. Crude fibre is defined as the residue remaining after the treatment with hot sulphuric acid, alkali and alcohol.

The major component of crude fibre is a polysaccharide called cellulose. Crude fibre is a component of dietary fibre. Several other carbohydrate and related compounds called pectins, hemicellulose and lignins are the second category found in plant foods and are also resistant to digestion.

These together with cellulose are collectively known as dietary fibre.

Types of fibre:

There are two types of fibre – soluble and insoluble fibres. The food source and action of these in the body is given in the table-17B.

Table 17 B

Types and Sources of fibre.

Types of fibre	Major food sources	Action in the body
Soluble fibres Gums, pectins, mucilages	Citrus fruits, apple, oats, barley, legumes	Delay gastro intestinal transit Delay glucose absorption Lower blood cholesterol
Insoluble fibres Cellulose hemicellulose Lignin	Whole wheat products, wheat bran, whole grain breads, cereals and vegetables like green peas, beans cabbage. Skin of vegetable and fruits, grains	•Accelerate Gastro intestinal transit Increase fecal-weight Slow starchhydrolysis Delay glucoseabsorption

PROTEIN

One fifth of an adults total body weight is protein. Protein is found in every cell of our body.

All the tissues in our body such as muscle, blood, bone, skin and hair are made up of proteins.

Many hormones and enzymes are either protein or protein derivatives. The nucleic acids in the cell nucleus occur in combination with proteins as nucleoproteins.

Protein is thus essential to maintain cellular integrity and function and for health and reproduction.

COMPOSITION

Proteins contain carbon, hydrogen, oxygen and nitrogen. They are distinguished from carbohydrates and fats by the presence of nitrogen.Protein is synthesized from basic units called amino acids. Protein molecules, which contain up to hundred amino acids are much larger than carbohydrates or lipid molecule.Chemically amino acids are composed of a carbon atom to which is attached a carboxyl (COOH) group, a hydrogen atom (H), an amino group (NH_2) and an amino acid radical (R) as shown below.

Structure of an Amino acid.

COOH
H C R
NH_2 |

The carboxyl group, the amino group and the hydrogen atom are the same for all amino acids.
The R group however distinguishes one amino acid from another.
R varies from a single hydrogen atom as found in glycine, to longer chain of up to 7 carbon atoms.
A protein molecule is made upon of chains of amino acids joined to each other by a peptide linkage. The amino group of one amino acid is linked to the carboxyl group of another amino acid by removal of water.
Thus two amino acids form di-peptide and three form a tri-peptide. Proteins consist of hundreds of such linkages hence called Polypeptides.

ESSENTIAL AND NON-ESSENTIAL AMINO ACIDS

Amino acids are classified into two groups – essential (indispensable) and non-essential (dispensable).
An essential amino acid is one that cannot be synthesized by the body to meet the physiological needs and hence should be supplied by the diet. The essential amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine threonine, tryptophan and valine. Non-essential amino acids are those that the body can synthesize. They are alanine, arginine, aspargine, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine and tyrosine.

Comparison of complete protein with incomplete protein

The protein of animal foods like milk, meat, and fish generally compare well with egg

Table 18 A
Biological value of food proteins.

	Food Stuff	Biological Value
I	Animal Protein	
	Egg	96
	Milk	90
	Meat	74
	Fish	80
II	Vegetable Protein	
	Cereals	
	Rice	80
	Wheat	66
	Maize	50
III	Pulses	
	Bengal gram	74
	Red gram	72
IV	Oil Seeds	
	Ground nut	55
	Gingelly	62

Source: Gopalan.C, B.V.RamaSastri and Balasubramaniam. S.C.1996 (reprinted) Nutritive Value of Indian foods, NIN.
Hyderabad.

The limitation in cereals can be overcome by a judicious combination with pulses, which are rich in lysine. The resulting mixture of cereals and pulse will have an amino acid pattern better than either of the constituents. Thus a combination of cereal and pulse has a supplementary effect. For (eg) recipes like, Pongal, Idli, dhokla are based on cereal pulse combination.

Thus the habitual diets in India based on cereal and pulse have indeed a rational basis. The biological value of some important food proteins is given in table-18A.

FOOD SOURCES

All foods except refined sugar, oils and fats contain protein to varying degree.

Table 18 B

Food Sources of Dietary Protein

Food Stuff	Protein %
Rich Sources :	
Meat, fish and liver	18 – 20
Eggs	14
Milk powder, full fat	26
Milk powder, skimmed	33
Cheese	18 – 20
Pulses	18 – 24
Nuts and oilseeds	18 – 26
Soyabean	35 – 40
Good Sources :	
Cereals and millets	6 – 12
Tender legumes, green peas, cow peas	7 – 8
Fair Sources :	
Potato	2
Green leafy vegetables	2 – 6

Animal foods like meat, fish, egg and plant foods like pulses oilseeds and nuts contain high amounts of proteins and are classified as rich sources of proteins.

Cereals and millets and tender legumes such as green peas are moderate sources of protein.

However cereals are consumed in large amounts daily and contribute a considerable amount of protein to the daily intake.

Leafy vegetables, roots and tubers are poor sources of protein as they contain less than two percent proteins

FUNCTIONS OF PROTEIN

Proteins form a major part of total body structures and they participate in many activities in our body. The major functions of protein in our body can be listed as in the table-18C.

Table 18 C

Functions of Protein

1.	Build and repair body tissues	Proteins form integral parts of most body structure such as skin, tendon, membranes, muscles, organs and bones. They support the growth and repair of body tissues.
2.	Enzymes	(eg) Lipase helps to breakdown fat and sucrase breaks down sug-

		ar.
3.	Hormones	Regulate body process.
4.	Antibodies	Inactivate foreign invaders thus protecting the body against disease.
5.	Fluid & electrolyte balance	Proteins help to maintain the volume and composition of body fluids.
6.	Acid-base balance	Proteins help maintain the acid-base balance of the body fluids by acting as buffers.
7.	Energy	Proteins provide fuel for the body's energy needs [4 KCal/gm].
8.	Storage	Proteins help to store iron and copper.
9.	Homeostasis	Proteins maintain normal osmotic balance among body fluids.
10.	Transport proteins (eg) Haemoglobin, lipoprotein	These type of proteins carry nutrients to the tissues. eg lipoprotein carry lipids, haemoglobin transports oxygen.
11.	Contribute to sensory & physical properties of food	Proteins impart colour , flavour, odour and texture to foods.

DIGESTION, ABSORPTION AND UTILIZATION OF PROTEINS:

Proteins taken in the diet are digested to amino acids in the stomach and small intestine. Gastric juice contains enzymes pepsin which digests protein in acid medium. It hydrolyses proteins to polypeptides.

Dietary Protein $\xrightarrow{\text{Pepsin}}$ Polypeptides

In the small intestine, pancreatic and intestinal juices contain proteolytic enzymes. Pancreatic juice contains trypsin, chymotrypsin and carboxyl peptidase.

They hydrolyse large protein molecule to smaller polypeptide.

Proteins $\xrightarrow{\text{Trypsin and Chymotrypsin}}$ Peptides + Amino acids

Peptides $\xrightarrow{\text{Carboxy peptidase Amino Peptidase}}$ Aminoacids

Intestinal juices contains polypeptidases&dipeptidases which hydrolyse polypeptide & dipeptide to individual amino acids. There are several peptidases acting on different proteins. When undigested protein enter large intestines, bacteria causes nitrification of proteins leading to foul smelling flatus.

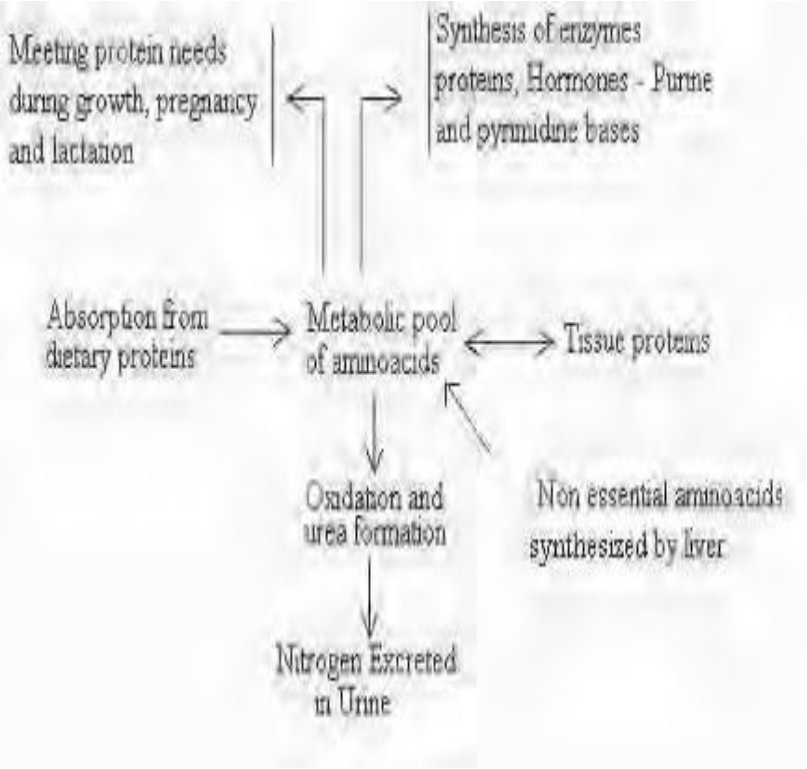
Dipeptides $\xrightarrow{\text{Dipeptidase}}$ Amino acids

Tripeptides $\xrightarrow{\text{Tripeptidase}}$ Amino acids

Proteins are mainly absorbed in the form of amino acids. Amino acids are absorbed by active transport mechanism in the intestinal cells. Sometimes whole protein may be absorbed by the mechanism of pinocytosis. Absorbed amino acids pass into the portal blood and reach liver where they are converted to proteins. Other amino acids are transported through general circulation and are utilized for protein synthesis in the tissues.

Utilization of proteins in the body :

The amino acids from digested proteins are absorbed rapidly into the blood and passed onto different tissues to meet their needs.Some non-essential amino acids are synthesized in the liver and also released into the circulation.



REQUIREMENTS

The Indian Council of Medical Research recommends 1.0 g/kg/day as the safe level of intake in terms of dietary protein for Indians.

During pregnancy and lactation additional allowances are recommended. Protein requirements for children vary depending on body weight and expected weight gain.

The ICMR recommended dietary allowances for proteins is given in table-18D.

Table 18 D

ICMR Recommended Dietary Allowances for Proteins

Group	Protein g/day
Man	60
Woman	50
Pregnant woman	50 + 15
LACTATION	
0-6 months	50 + 25
6-12 months	50 + 18
INFANCY	
0-6 months	2.05 /kg
6-12 months	1.65 /kg
CHILDREN	
1-3 Yrs	22
4-6 Yrs	30
7-9 Yrs	41
BOYS	
10-12 Yrs	54
13-15 Yrs	70
16-18 Yrs	78
GIRLS	

10-12 Yrs	57
13-15 Yrs	65
16-18 Yrs	63

LIPID

Lipids more commonly known as fats and oil, are integral part of our food. They are insoluble in water but soluble in organic solvents. They occur in both plant and animals. Lipids are a concentrated source of energy.

CLASSIFICATION

Lipids are classified into simple, compound and derived lipids which are further subdivided as follows.

Lipids

Simple	Compound	Derived
Fats and oils	(a) Phospho lipids	(a)Sterols
Waxes	(b) Glyco lipids	(b)Fatty acids
	(c) Lipo proteins	

Simple lipids

Fats and Oils are included in this type. At room temperature, oils are liquids and fats are solids. Fats and oils contain esters of fatty acid and glycerol, a form in which lipids are present in food.

Compound lipids

They are esters of fatty acids containing phosphorous carbohydrate or protein. Phospholipids contain a phosphoric acid in addition to the alcohol and fatty acids.Glycolipids contain a fatty acid, carbohydrate and a nitrogenous base. Phospholipids and glycolipids form part of the cell membrane and the nervous system.Lipoproteins are macromolecular complex of lipids with proteins.

Derived lipids

These are substances liberated during hydrolysis of simple and compound lipids which still retain the properties of lipids. The important members of this group are sterols, fatty acids and alcohol.

Sterols

Sterols are solid alcohols and form esters with fatty acids. In nature they occur in the free state in the form of esters. Based on their origin sterols are classified as cholesterol (animal origin) and phytosterol (in plants).Cholesterol is a complex type of lipid that is regularly synthesised by and stored in the liver. It is present in all animal products. Fatty acids

Fatty acids are the main building blocks of fat. They have a methyl group (CH_3) at one end and a carboxyl group (COOH) at the other end with a chain of carbon and hydrogen atom in the middle. They have a basic formula $CH_3(CH_2)n$ COOH. Where 'n' denotes the number of carbon atoms which may vary from 2 to 2l.Fatty acids can be classified into Saturated FattyAcids(SFA) & Unsaturated Fatty Acids (UFA)

Saturated Fatty Acids

Saturated fatty acids are those that are unable to absorb more hydrogen. They are usually stiff and hard fats. Eg. Ghee, Butter.

Unsaturated fatty acids

Unsaturated fatty acids have one or more double bond in their molecule and are thus not saturated with hydrogen. They are liquid at room temperature. Eg. Sunflower oil.Unsaturated fatty acids may be monounsaturated or polyunsaturated depending on the number of double bonds.

Monounsaturated fatty acids (MUFA)

MUFA have only one double bond in their molecule. Eg. oleic acid found in olive oil, peanut oil.

Polyunsaturated fatty acids(PUFA)

PUFA have 2 or more double bonds in their molecule. Eg. linoleic acid, linolenic acid. They are present in corn, safflower, soyabean, sunflower oils and fishoils.Monounsaturated and polyunsaturated fats are usually soft or liquid at room temperature.

Triglycerides

Fatty acids combine with glycerol to form a glyceride, When only one fatty acid combines with glycerol, it forms a monoglyceride, diglycerides have 2 fatty acids and triglycerides have three fatty acids attached to glycerol.Most of the fatty acids present in the body and absorbed from foods occur in the form of triglycerides.During digestion triglycerides are hydrolysed to form free fatty acid, monoglycerides and glycerol which are absorbed by the intestinal wall and the majority of these are rebuilt as triglycerides.

Long and short chain fatty acid

The number of carbon atom in fatty acids decides the chain length. Thus short chain fatty acids contain 4 to 6 carbon atoms, medium chain 8 to 12 carbon atoms and long chain fatty acid have 14 to 18 carbon atom.

Essential and Non – Essential fatty acid

Essential fatty acid (EFA) are those which cannot be synthesized by the body and need to be supplied through diet.Linolenic acid, linoleic acid and arachidonic acid are essential fatty acids.

Non -essential fatty acids

Non-essential fatty acids are those which can be synthesized by the body and which need not be supplied through the diet. Palmitic acid, oleic acid and butyric acid are examples of non – essential fatty acids.

FUNCTIONS OF LIPIDS

Lipids perform several important functions:
They are the concentrated fuel reserve of the body
Lipids are the constituents of cell membrane structure and regulate the membrane permeability.
They are essential for the digestion, absorption and utilization of fat soluble vitamins like Vitamin A, D, E and K.
Lipids are important as cellular metabolic regulators (Steroid hormones and prostaglandin).
Lipids protect the internal organs serving as insulating materials.
As compounds of the mitochondria membranes, lipids (phospholipids) participate in electron transport chain.
Fat imparts palatability to the diet and slows stomach emptying time, thus giving a feeling of fullness. This delay of onset of hunger is called 'satiety value' of fats.
The calories in fat spare the proteins from being oxidized for energy.
Fat deposited in the adipose tissue serve as reserve source of energy during starvation. It acts as an insulator conserving the body heat.
Essential fatty acids which are derived lipids, perform important functions in our body.
Functions of essential fatty acids:
Maintenance of the function and integrity of cellular and subcellular membrane.
Regulation of cholesterol metabolism by transporting it between the blood and body tissues.
Acts as precursor of hormone like – prostaglandin which aid in regulating vascular function and help relieving pain and inflammation.
Delays blood clotting time.

DIGESTION ABSORPTION AND UTILIZATION

Digestion

In the mouth:
tarts in the mouth with hard fats beginning to melt when they reach body temperature. The salivary glands at the base of the tongue release a lipase enzyme which digest fat to a less extent in adults.
In the stomach:
In the stomach fat floats as a layer above the others components of swallowed food. As a result little fat digestion takes place.
In the small Intestine:
When fat enters the small intestine, the hormone cholescystokinin signals the gall bladder to release bile. Bile emulsifies fat and also provides an alkaline medium for the action of pancreatic lipase and intestinal lipase.
The triglycerides are acted upon by these lipases and hydrolyzed to monolycerides and fatty acids.
The cholesterol esters are hydrolyzed to give cholesterol and fatty acids.
Triglycerides Monoglyceride + fatty acids

Cholesterol esters ▶ ▶ Cholesterol + fatty acids

Absorption and Utilisation

Small molecules of digested triglycerides (glycerol, short & medium chain fatty acids) can diffuse into intestinal cells and are absorbed directly into the blood stream.Larger molecules(Monoglycerides, long chain fatty acids) merge into spherical complexes known as miscelles. The lipid contents of the miscelles diffuse into the intestinal cells. Once inside the monoglycerides and long chain fatty acids are reassembled to new triglycerides.Within the intestinal cells the new triglycerides and larger lipids like cholesterol and phospholipids are placed into transport vehicle called chylomicrons.

The intestinal cells then release chylomicrons into the lymphatic system. The lymph circulation empties into the thoracic duct which inturn enter the subclavian vein and subsequently into the blood stream.The blood transport lipids to the rest of the body and cells absorb them and utilize for energy. This breakdown of fat to yield energy is called lipolysis.

Majority of lipids enter via the lymph to the liver where the protein and lipid (cholesterol, triglycerides) are bound together to form lipoproteins.

There are four types of lipoproteins, they are:

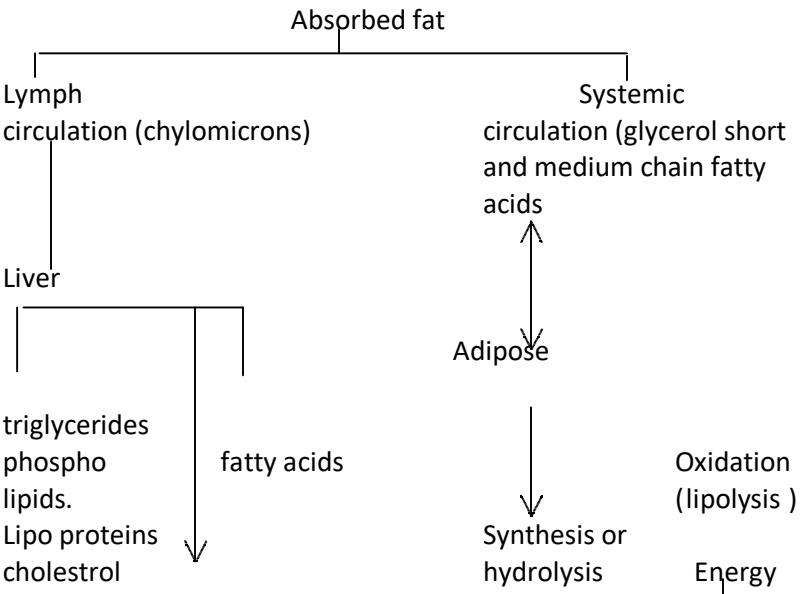
chylomicrons,

very low density lipo protein (VLDL)

low density lipo protein (LDL) and

high density lipo proteins (HDL).

Chylomicrons, VLDL and LDL serve to transport and deposit lipids from the intestine and liver to the tissues for absorption. Low-density lipoprotein, which has the highest cholesterol fraction favours lipid deposition in tissues including blood vessels and hence termed 'bad' cholesterol. HDL cholesterol removes the lipids from the tissues and transports it back to liver for disposal, hence it is termed as 'good cholesterol'. High levels of LDL cholesterol indicates a high risk of cardiovascular disease.



Apart from lipoproteins, triglycerides, cholesterol and phospholipids are synthesized in the liver. This is called lipogenesis.It can be represented as follows:

Muscle

Synthesis Modification Tissue of Short chain

Oxidation $+CO_2+H_2O$

Acetoacetate

FOOD SOURCES

Foods in general contain two types of fat namely "visible fats" and "invisible" or "hidden" fats.

Visible fats

Visible fats are fats extracted from the following sources.

Oil seeds : coconut, corn, cornseed, groundnut, mustard, palm, rice bran, safflower, seasame, soyabean, sunflower and hydrogenated vegetable oils (vanaspathi).

Animal fats: Butter and Ghee.

Fish oils: Shark and cod liver oils.

Invisible or hidden fats:

Invisible or hidden fats are those which form an integral part of foods and are therefore not visible. It includes the fats present in the cells and cell walls and cell membranes of both plant and animal tissues.

Almost everything we eat as listed below carries some invisible fats.

Plant food – Cereals, millets, vegetables, spices, nuts and oil seeds, coconut, avacado.

Animal food – Milk and milk products (curd, cream, cheese), flesh foods, (mutton, beef, pork, chicken) organ meats (brain, liver, kidney), fish, shrimp, prawn.

Sources of Saturated Fat:

Saturated fat is resistant to oxidation even at frying temperatures. Examples are

Plants – coconut oil. Hydrogenated vegetable oils. Palm kernel oil.

Animals – Butter, ghee, fats from flesh foods and organ meats.

Sources of Unsaturated Fat:

Unsaturated fats and oils include mono unsaturated fatty acids and PUFA in various proportions.Important sources of unsaturated fats are as follows:

Plant sources:

All common vegetable oils with the exception of coconut oils are predominantly unsaturated. The invisible fats present in nuts and oilseeds, cereals, pulses and legumes, roots and tubers, vegetables, spices and fruits.

In most plant foods and vegetable oils linoleic acid is the predominant PUFA, but mustard and soyabean oils, legumes/pulses. Fenugreek leaves, and green leafy vegetables are good sources of alpha linolenic acid.

Animal sources:

The muscles (lean meat) of flesh foods, unlike the depot fat surrounding the tissues is mainly composed of cholesterol esters and phospholipids, both of which have a high proportion of long chain n-6 PUFA which are otherwise formed in the body from linolenic acid.

Arachidonic acid is found in animal and human cells.

Fish and fish oils provide long chain n – 3 PUFA.

Hydrogenation:

Hydrogenation (addition of hydrogen at double bonds) converts liquid oils into semisolid or solid fats. During hydrogenation, linoleic and alpha linolenic acid present in the oils are converted to trans fatty acids and saturated fatty acids. Also, the monounsaturated fatty acids are converted to saturated fatty acids.

Hydrogenated fats were designed to imitate ghee. It is used to prepare processed foods like biscuits and cakes.

Vanaspathi is produced in India by hydrogenation of vegetables oils.

Cholesterol:

Cholesterol is a constituent of animal foods but is absent in plants. Vegetable oils do not have cholesterol. In human diets, cholesterol is obtained from ghee, butter, cheese, milk, curd, egg, flesh foods, organ meats, fish and prawns. Most animal foods are good sources of both cholesterol and fatty acids.

Requirements

The ICMR recommended allowances for fat for Indians is given in table 19A.

Table 19 A

The ICMR recommended allowances for fat.

Group	Fat g/day
Adult man	20
Adult woman	20
Pregnant woman	30
Lactating woman	45
Children (1–9 yrs)	25
Children (10–18 yrs)	22

Effects of Deficiency:

Deficiency of fat in the diet causes the deficiency of essential fatty acids. Deficiency of essential fatty acids leads to cessation of growth.

It also results in flaky skin, development of itchy sores on the scalp. The common disorder in adults and children in India is phrynoderma or toad skin.

The condition is characterized by the presence of horny eruptions on the posterior and lateral aspects of the limbs on the back and buttocks.

Phrynoderma is cured rapidly by the administration of linseed or safflower seed oil rich in EFA.

Infants fed on a EFA deficient diet develop irritation and changes in the skin with in a few weeks. The skin changes appear as dryness and desquamation with oozing in the folds.

Diarrhoea may also occur, supplementation of the diet with linoleic acid helps to restore the skin to normal condition.

ENERGY

Energy is the capacity to do work. The energy to perform work is derived from the carbohydrate, fat and protein in the diet. The source of energy in diets varies depending on agricultural, cultural, social and economic factors.The body needs energy for maintaining body temperature, metabolic activity, supporting growth, for physical work, to maintain constant body weight and good health.The body's storage energy or potential energy is continuously available in the body from the glycogen in muscle and liver. This stored energy is transformed to other forms to accomplish the work of the body. Examples are

Osmotic Energy – Maintain transport of nutrients.

Electrical Energy – Transmission of nerve impulse.

Chemical Energy – Synthesis of new compounds.

Thermal Energy – Heat regulation.

Whenever one form of energy is produced another form is reduced by exactly the same amount as stated by the Law of Conservation of Energy.This law states that energy can neither be created or destroyed it can only be transformed from one form to another.

UNITS OF ENERGY – CALORIE AND JOULE

The unit of energy, kilocalorie (Kcal) was used for a long time. Recently the International Union of Sciences and International Union of Nutritional Science (IUNS) have adopted 'Joule' as the unit of energy in place of Kcal. These units are defined as follows.

A joule is defined as the energy required to move 1kg mass by 1 metre by a force of 1 Newton acting on it. One Newton is the force needed to accelerate 1 kg mass by less than a second.

Kcal is defined as the heat required to raise the temperature of 1kg of water by 1° C. (From 14.5°C to 15.5°C)

1Kcal = 4.184 KJ (Kilo Joules) 1000 Kcal = 4184 = 4.18 MJ (mega joules)

1 KJ = 0.239 Kcal.

ENERGY VALUE OF FOODS

The energy in various foods is measured by calorimetry. Calorimetry is the measurement of heat loss.

An instrument for measuring heat output of the body or the energy value of foods is called a Calorimeter. In measuring the calorie value of foods, Bomb calorimeter is used. The maximum amount of energy that the sample is capable of yielding when it is completely burnt or oxidized is the energy value of that food, also known as heat of combustion.

The energy measured using a Bomb Calorimeter is as follows

1g of Carbohydrate - 4.1 kcal

1g of fat - 9.45 kcal

1g of protein - 5.65 kcal

When samples of Carbohydrate, Fat, Protein are
burned, the amount of heat produced is always the same for each of these nutrients.

In the bomb calorimeter carbohydrates, fats and
proteins are completely oxidized whereas in the human body the process of digestion and absorption does not proceed with 100 percent efficiency. The extent of digestion varies from one nutrient to another.

The Coefficient of digestibility is used to express the proportion of an ingested nutrient that ultimately becomes available to the body cells.

The coefficient of digestibility for carbohydrate, fat and protein are 0.98, 0.95 and 0.92 respectively. It is observed that carbohydrate and fat are metabolized almost completely, Whereas protein metabolism is incomplete due to the presence of nitrogen. The physiological energy value of carbohydrate, fat and protein are 4, 9 and 4.

These values are known as Atwater Bryant factors or physiological fuel values as given in table-20A.

Table 20 A

Physiological fuel value of Carbohydrate, Fat, Protein

	Heat of Combustion Kcal	Coefficient of digestibility	Digestibility per cent	Physiological fuel value Kcal
Carbohydrate	4.1	0.98	98	4.0
Fat	9.45	0.95	95	9.0
Protein	5.65	0.92	92	4.0

Source : Robinson C. H., Marilyn R. and Lawler. 1982. Normal and Therapeutic Nutrition.

BASAL METABOLISM

Basal Metabolism is the minimum amount of energy needed by the body for maintenance of life when the person is at post absorptive state, physical and emotional rest.

Basal Metabolic Rate (BMR) is a measure of the energy required by the activities of resting tissue.

The Basal Metabolic rate can be measured directly from the heat produced (using a Respiration Calorimeter and Metabolic Chamber) or indirectly from O_2 intake and CO_2 expenditure when the subject is at rest.

Factors affecting Basal Metabolic Rate (BMR)

The factors affecting Basal Metabolic Rate are listed in table-20B.

Table 20 B

Factors affecting Basal Metabolic Rate (BMR)

Factor	Effect on BMR
Body Compositon	The more lean body mass higher is the BMR. This is due to greater metabolic activity in these tissues when compared to bones and fat. Men with a high proportion of muscle mass or lean body mass have a higher BMR than women.
Fever	Fever raises the BMR. There is a 7% increase in BMR for each degree rise in temperature in Fahrenheit.
Stress	Stress raises BMR.
Smoking & Caffeine	Increases the BMR
Hyperthyroidism (Oversecretion of thyroxin)	The basal metabolic rate is elevated as much as 50-70%.
Growth	In children and pregnant women the BMR is higher.

Pregnancy	During the last trimester of pregnancy Basal Metabolic rate is increased by 1525% as there is a increase in muscle mass of uterus, size of mammary gland, foetal mass and placenta, cardiac work and respiratory rate.
Fasting/Starvation	Lowers BMR
Hypothyroidism (under secretion of thyroxin)	The basal metabolic rate is decreased by 30%
Age	Lean body mass diminishes with age slowing the BMR. In tall people the BMR is higher.
Undernutrition	Prolonged undernutrition lowers the BMR.

ENERGY COST OF PHYSICAL ACTIVITIES

Next to Basal Metabolism it is the physical activity, which accounts for the largest energy expenditure.There is a wide variation from individual to individual in occupational activity.The energy required for the actual physical activity varies depending on the type of occupation of an individual.For computing energy requirements, the occupations have been classified as sedentary, moderate and heavy.

The ICMR classification of activities based on occupation is given in table-20C.

Table 20 C

Classification of activities based on occupation

Sex	Sedentary (80-180 Kcal / hr)	Moderate (170-240 Kcal / hr)	Heavy (250-350 Kcal / hr)
Male	Teacher Tailor Executive	Fisherman, Potter	Stone Cutter, Mine Worker. Wood Cutter.
Female	Teacher Executive Nurse	Servant maid. Weaver	1) Stone Cutter

The energy cost of physical activities is expressed in terms of BMR units.

BMR Unit:

The energy cost of rest and physical activity is expressed as multiples of BMR which is called the physical activity ratio (PAR).

The physical activity ratio expresses the energy cost of an individual activity per minute as ratio of the cost of BMR per minute. Hence it is advantageous to express the energy expenditure in terms of BMR units.

Energy cost of some common activities in terms of BMR Units.

Activity	Energy cost of activities in BMR Units

Sitting quietly	1.2
Standing quietly	1.4
Sitting at desk	1.3
Walking (3MPH)	3.7

Energy requirements of Indian Adults in terms of BMR Units.

Activity	Duration (hrs)	Rate of energy expenditure in terms of BMR Units		
		Sedentary	Moderate	Heavy
Sleep	8	1.0	1.0	1.0
Occupational activity	8	1.7	2.8	4.5
Non-Occupational Activity	8	2.2	2	-
Average for 24 hr		1.6	1.9	2.5

ESTIMATION OF TOTAL ENERGY NEEDS

The energy requirement of an individual is the level of energy intake from food that will balance energy expenditure when the individual has a body size and composition and level of physical activity, consistent with long term good health, and that will allow for maintenance of economically necessary and socially desirable activity. In children and pregnant and lactating women, the energy requirement includes the energy needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health. (WHO)Energy requirements are best determined by measurements of energy expenditure.

Energy expenditure from a physiological point of view is made up of three major components:

(i) BMR (ii) Dietary Thermogenesis (iii) Physical activity

For all practical purposes, the component of energy expenditure related to regulatory energy output or dietary thermogenesis are known to merge into measurements related to the cost of physical activity. Hence energy expenditure has only two principal component i) BMR & ii) Physical activity.

Calculation of energy requirements.

1) Predicting BMR.

Equations for predicting BMR (K.cal / 24 hrs) as proposed by the ICMR expert committee for Indians is given in table-20E.

Table 20 F

Equations for predicting BMR (Kcal / 24 hr)

Sex	Age (yrs)	Prediction Equation
Male	18 – 30	14.5 x B.W (kg) + 645
	30 – 60	10.9 x B.W (kg) + 833
	> 60	12.8 x B.W (kg) + 463
Female	18 – 30	14.0 x B.W (kg) + 471
	30 – 60	8.3 x B.W (kg) + 788
	> 60	x B.W (kg) + 565

2 . Calculating Daily energy requirement:

Using the computed BMR from body weights and recommended BMR factor for Indians for different levels of physical activity (which is 1.6, 1.9 & 2.5 for sedentary, moderate & heavy activity respectively) the energy requirements are arrived at.

For example:

For an Indian adult man 29 yrs of age, weighing 60kg and doing moderate activity, the energy requirement is calculated as follows.

BMR = 14.5 x 60 + 645 = 1515 k.cal / 24 hr

Energy requirement = predicted BMR x BMR units for activity = 1515 x 1.9

= 2878.5

2878 k.cal / day.

ENERGY BALANCE

To maintain daily energy balance the total energy requirement of an individual is the number of K cal necessary to replace daily basal metabolic loss in addition to loss from exercise and other physical activities.

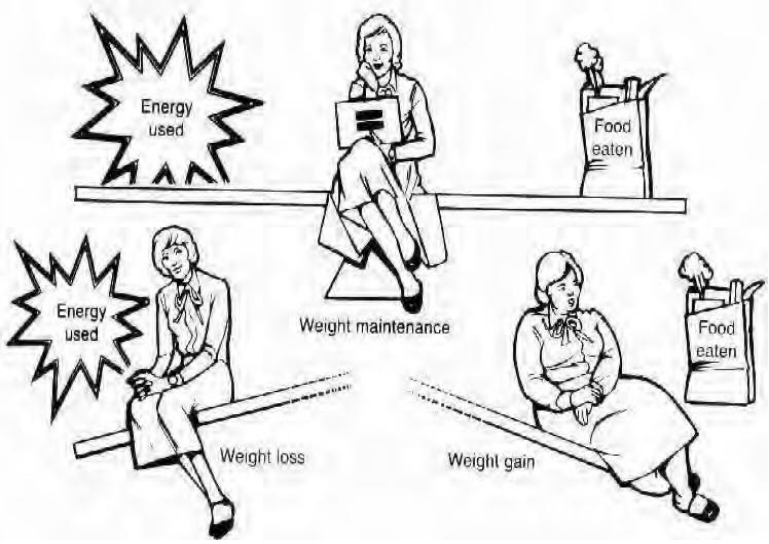


Fig 20.1 Energy Balance

Source : Susan. R. Holman, 1987. Essential of Nutrition for the Health Professionals.

Obesity represents an energy imbalance resulting from an excess of energy input over energy output (expenditure). Extreme weight loss is a state of energy imbalance resulting from a deficit energy input over energy output

VITAMINS

No caloric, organic nutrients found in a wide variety of foods that are essential in small quantities to regulate body processes, maintain the body, and allow growth and reproduction.

There are 13 different vitamins in food.

Instead of being burned to provide energy for the body, vitamins work as helpers. They assist in the processes of the body that keep you healthy.

For example, vitamin A is needed by the eyes for vision in dim light.

Vitamins are found in fruits, vegetables, grains, meat, dairy products, and other foods.

Unlike other nutrients, many vitamins are susceptible to being destroyed by heat, light, and other agents.

Table 28.4 Vitamins : their functions, sources and deficiency diseases.

Vitamin	Daily requirement	Function	Best food sources	Deficiency diseases	Symptoms
		1. Water Soluble Vitamins			
Vitamin B_1 (Thiamine)	1.3 mg (boys) 1.2 mg (girls)	Carbohydrate metabolism; sharpens appetite; functioning of heart, nerve and muscles	Yeast; liver; milk; cheese; leafy vegetables; meat; whole grain cereals	Beri-beri	Pain in hands and feet. Swelling of body. Paralysis of limbs. Oedema.
Vitamin B_2 (Riboflavin)	1.6 mg (boys) 1.4 mg (girls)	Carbohydrate and protein metabolism; keeps skin healthy;	Milk; liver meat; eggs peas; yeast; whole grains; green leafy vegetables.	Riboflavinosis; photophobia	Retarded growth and mental disorder. Cracking of skin at corners of mouth. Lesions of eyes.
Vitamin B_3 (Niacin)	1.8 mg (boys) 1.5 mg (girls)	Coenzyme for protein, fat and carbohydrate metabolism. Keeps the skin healthy.	Fish; eggs; meat; legumes; whole grains; leafy vegetables; peanuts; bean; tomato; potato.	Pellagra	Dermatitis (bad skin), diarrhoea (loose motions) dementia (mental disorder).
Vitamin B_{12} (Cyanocobalamine)	0.2-100 mg	Blood formation, Nervous tissue metabolism, Nucleic acid synthesis.	Liver; fish; cheese; milk; eggs; meat.	Pernicious anaemia.	Paleness of skin; breath lessness; retarded growth.
Vitamin C (Ascorbic Acid)	40 mg	Resistance to infections; keeping teeth, gums and joints healthy; healing of cuts and wounds; maintenance of connective tissue.	Amla, cabbage; tomatoes, lemon; orange; mangoes; chillies, guava, pineapple; sprouted grams.	Scurvy	Bleeding gums; pain in joints; general weakness.
		2. Fat Soluble Vitamins			
Vitamin A (Retinol)	750 mg	Maintenance of vision and skin; Essential for synthesis of visual pigment	Milk, cheese, butter, eggs codliver oil, carrots mangoes papaya, yellow pumpkin spinach, sweet	Night blindness. Xerophthalmia or keratinol acid. Dry skin	Cannot see in dimlight, (night blindness); Retarded keratinization of epithelia
Vitamin D (Calaciferol)	200 IU	Keeps teeth and bones healthy, absorption of calcium and phosphorus	Milk; cheese; egg yolk; cod liver oil, fish; butter; expo sure to sunlight.	Rickets in children; (Fig. 28.1) Osteomalacia in adults	Failure of growing bones to calcify; bow legs pigeon chest; softening of bones Painful bones; spontaneous fracture.
Vitamin E (Tocopherol)	Trace	antioxidant; ageing vitamin	Grains vegetable oil, green leafy vegetables, nuts, liver	reproduction failure in males and females	Sterlity in males, miscarriage, or death of embryos during pregnancy in females.
Vitamin K (Phylloquinone)	Trace amount	Clotting of blood	Green leafy vegetables; soyabean; tomatoes.	Faulty blood clotting; haemorrhage.	Delayed blood clotting.

No caloric, inorganic chemical substances found in a wide variety of foods; needed to regulate body processes, maintain the body, and allow growth and reproduction.
They are also required by the body in small amounts and do not provide energy.
Like vitamins, they work as helpers in the body and are found in a variety of foods.
Some minerals, such as calcium and phosphorus, become part of the body's structure by building bones and teeth.

Table 28.5 Minerals required by and in our body, their sources and functions

	Minerals	Functions	Food sources	Deficiency diseases	Symptoms
1.	Calcium	Formation of bones and teeth, necessary for nerve, teeth and muscles	Milk and milk products; fish; meat; beans; green leafy vegetables; brocolli, tapioca; cereals.	Rickets; Oesteomalacia loss of teeth	Softening of bones; deformities; pain in bones; enamel.
2.	Iron	Formation of haemoglobin; acts as carrier of oxygen.	Liver; green leafy vegetables; eggs, spinach; groundnuts; cereals; jaggery.	Anaemia.	Loss of weight; pale appearance; tiredness; loses of appetite.
3.	Phosphorus	Formation of bones and teeth	Milk; cereals; green leafy vegetables; nuts, bajra meat.	Rickets and Oesteomalacia;	Softening of bones; bowlegs; pigeon chest.

Unlike vitamins, minerals are indestructible and inorganic.

Water

Water plays a vital role in all bodily processes and makes up just over half the body's weight.
It supplies the medium in which various chemical changes of the body occur and aids digestion and absorption, circulation, and lubrication of body joints.
For example, as a major component of blood, water helps deliver nutrients to body cells and removes waste to the kidneys for excretion.
Water is the most plentiful nutrient in the body, accounting for about 60 percent of your body weight.
Experts rank water second only to oxygen as essential to life. ϖ In short without water there is no life.
BALANCED DIET AND FACTORS ON WHICH IT DEPEND AND REVIEW OF MACRO AND MICRO NUTRIENT

Balanced diet

DIet which contains different types of food possesing the nutrients- Carbohy-drate,protein,fats,vitamins,minerals and water –in a proportion to meet the requirement of the body. 3
Balanced diet achieved by eating variety of food.
There is no single food with correct amount of all essential nutrients.
Eating a balanced diet requires a certain amount of knowledge and planning.
The basic composition of balanced diet is highly variable as it differs from country to country depending on the availability of food.
Social &cultural habits, economic status, age,sex&physical activity of the individual largely influence the in take of diet
Nutrion Expert Group from ICMR has recommended the composition of balanced diet for Indian.
They recommended cereals(rice,wheat,jowar) pulses,vegetables, roots & tubers, fruits,milk&milkproducts,fats&oils ,sugar & ground nuts. A
Additional intake of Meats,fish&egg for non vegetarian.for vegetarian milk &pulses.
FOOD GUIDE
Development of a Food Guide
Several factors have to be considered in developing a food guide for a large country like India.
Some of the relevant factors are:

- Foods plentifully available and normally used in the dietary.
- Normal meal pattern.

- Recommended dietary intakes of nutrients for Indians.
- Need to emphasise some foods because of prevailing nutritional deficiencies in the country.

As you know, food availability and meal patterns vary from one country to another. Therefore, a food guide for one country, such as the Basic Four used in the USA, is not suitable for use in India, where meal pattern, food availability and cost are different. This is one of the reasons for developing a food guide for India.

In developing a food guide, the foods are classified on the basis of their use and the major nutrients which they provide. Such a classification can serve as a guide for the selection and use of foods. For example, cereals, dals, and leafy and other vegetables are such classes. Most preparations use oils and fats as a seasoning, and jaggery or sugar as a sweetener. These foods, which enhance food acceptability, can be one of the food groups. This is how the food guide is developed.

The five food groups suggested by ICMR and their nutritional contribution is presented in Table

Food Group	*Foods Included*	*Main Nutrients*
1.	Cereals and their products – Rice, wheat, jowar, bajra, ragi, maize, other millets and their products	Energy, protein, iron, thiamin, niacin, fibre
2.	Protein foods – Dals, legumes, milk, eggs, fish, poultry, meat and their products	Proteins, energy, calcium, iron, B-complex vitamins, invisible fat, fibre
3.	Protective vegetables and fruits – (*a*) All green leafy vegetables, orange-yellow fruits and vegetables	Carotenoids, vitamin C, iron, calcium, folic acid, fibre
	(*b*) Vit. C-rich fruits and vegetables	Vitamin C, carotene, fibre
4.	Other vegetables and fruits – All gourds, beans, peas, potatoes, onions, etc., all other fruits — banana, apple, melons, grapes, etc.	Supplementary sources of minerals, vitamins and fibre
5.	Oils, fats, sugars and their products – Oils, ghee, butter, vanaspati, sugar, jaggery, jams, syrups	Energy, fat, essential fatty acids Energy

Food Guide for Selecting an Adequate Diet

All the foods we use in our daily meals are divided into five groups in the food guide for India.This is presented in

Table 14.1. The food groups are chosen because of the specific nutrients contributedby each to the total diet.

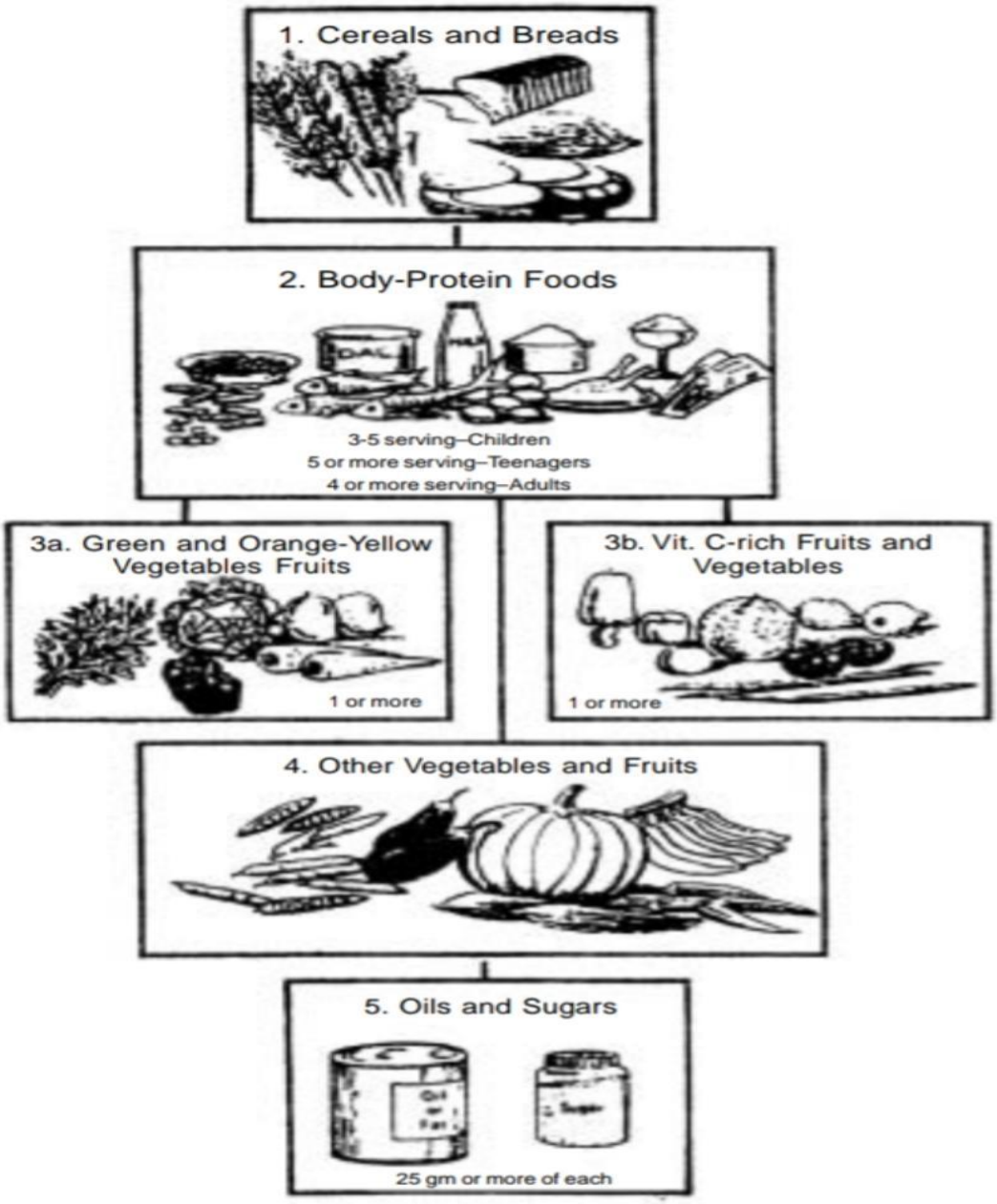
Food Group	*Foods Included*	*Size of Serving*	*Suggested No. of Servings*
1.	**Cereals and Breads** The staples, rice, wheat, *bajra, jowar,* maize, ragi and their preparations	25 g	9–16
2.	**Protein Foods**		
	Dals, legumes, nuts and oilseeds	25 g	
	Milk and milk products	150 g	3–5
	Eggs	1 No.	
	Fish, poultry, meat	30 g	
3.	(*a*) **Protective Vegetables and Fruits** All green leafy vegetables, orange, yellow vegetables and fruits	50–75 g	1–2
	(*b*) **Vit. C Rich Vegetables and Fruits:** Amla[4], guava, drumstick, orange, papaya, mausambi, etc.	50–75 g	1–2
4.	**Other Vegetables and Fruits** All the remaining vegetables such as fruit vegetables, gourds, immature beans and peas, potatoes, onions, etc. Fruits such as bananas, melons, sapota, grapes, apples, etc.	50–75 g	3 or more
5.	**Oils, Fats, Sugars**		
	Oils, ghee, butter, *vanaspati*	5 g	5 or more
	Sugar, jaggery, murabbas, syrups	5 g	5 or more

Foods have been assigned to the groups on the basis of their composition. Thefood guide is designed to direct selection of foods and quantities consumed to provide by RDA, thusforming the foundation of our adequate diet.As you may observe, the first column in the table indicates the food group, the third columnspecifies the amount in one serving, and the last column indicates the minimum number of servings tobe taken to meet your nutritional needs. If sufficient amounts of foods from each of the five groups areincluded in the day's diet, the nutrient requirements of the body will be met. Such a diet is a balanceddiet, as it meets the person's nutritional needs.Let us study each food group in details, so that we can use the food guide as a practical tool. Thefood guide is presented pictorially in Figure

Group 1: Cereals and Breads

The first food group includes preparations of cereals and millets, which are the staple foods in India. These foods

provide more than half our body's daily need for energy and proteins. In addition,if the whole grain or its flour is used



in the preparation, these foods can be a valuable source of thiamin(one of the B vitamins) and iron.The foods in the group include rice, wheat, jowar, bajra, makka (maize or corn), ragi or nachani,and cereal products such as rawa (suji or semolina), rice flakes (pohe, aval), senvaya (vermicelli), etc

Group 2: Protein Foods

This group includes the major sources of proteins in our dietary, such as dals, whole pulses, milk,eggs, fish, poultry and meat (Figures 14.3 & 14.4). A third or more of our protein requirement is metby these foods. These foods are not only good sources of proteins, but also of minerals and vitamins.Dals, eggs, and meat are good sources of iron. In addition, milk is a very good source of calcium andriboflavin. Milk, eggs and liver are rich in vitamin A. These foods also supply part of our requirementof the B vitamins. The foods in this group are varied in their composition. Therefore, the serving sizeof these foods varies as given below:Dals and whole legumes or pulses 25 gMilk and milk preparations 1 medium cup or 150 mlEgg (medium size 50–52g) 1 No.Fish, meat and poultry 25 to 30 g

Group 3: Protective Vegetables and Fruits

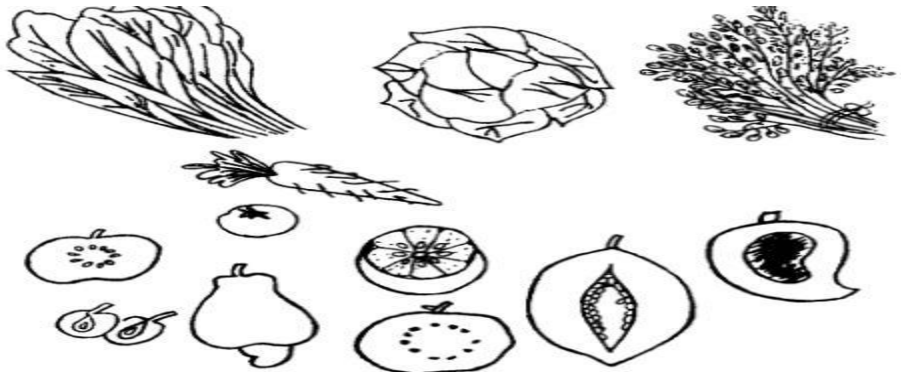
The protective vegetables and fruits are rich sources of beta-carotene or provitamin A and ascorbicacid or vitamin C. To emphasise these sources, the group is divided into group 3(a) and group 3(b).

Group 3(a) — Vitamin A Rich Green and Yellow Vegetables and Fruits

This group is a rich source of pro-vitamin A, and includes all dark green leafy vegetables such asmath (amaranth), palak (spinach), methi (fenugreek), radish leaves, colocasia leaves, etc. It also includeslight green leafy vegetables such as cabbage, onion tops, and lettuce, and yellow-orange vegetables andfruits such as carrots, pumpkin, mangoes, papaya, oranges, cantaloupe (turbuz), apricots, etc.(Figure 14.5).All of these vegetables and fruits share one common component, which brings them together inone group. This component is the yellow plant pigment beta-carotene, which is a precursor of vitaminA. One serving of this group provides 75–120 per cent of our day's need of vitamin A. In addition, thedark green leafy vegetables provide about 50 per cent need for vitamin C.

Serving size: One serving is 50 g of the vegetables or fruit, or half a katori of cut vegetables orfruit.

Suggested number of servings: It is suggested that one or more servings a day be includedfrom this group. In



practice, you can include dark green leafy vegetables three times a week, yellow —orange vegetables two times a week, and light green vegetables two times a week

Group 3(b) — Vitamin C Rich Vegetables and Fruits

In this group we have rich sources of ascorbic acid, which is also known as vitamin C. A tropicalcountry such as India has a number of rich sources of vitamin C, which are not found in temperateregions, and hence are not mentioned in the Western food guides. For example, the richest source ofvitamin C in the tropics is amla (Indian gooseberry), which contains ten times as much vitamin C asany citrus fruit. Guavas, cashew apples, bor, cabbage, and drumsticks (both leaves and pods) areexcellent sources of vitamin C, and contain 3 to 6 times the amount provided by citrus fruits.Besides these, we have a variety of citrus fruits such as oranges, mausambis, pummelo, grapefruits,etc., and other fruits such as papaya, mangoes, pineapples and tomatoes, which are also good sourcesof vitamin C (Figure 14.5).

Serving size: Generally, one serving is a 50 g portion or half a katori of cut vegetable or fruit.

There are some exceptions to this serving size, when we choose a very concentrated source. Forexample, you need only one amla, or 25 g of guava or cashew apple to comprise a serving.

Suggested number of servings: One or more servings a day is suggested. One serving provideshalf or more of our day's need for vitamin C. Please remember that some vegetables and fruits are goodsources of both beta-carotene and vitamin C. Some examples of these are cabbage, drumstick leaves,amaranth, oranges, mangoes and papaya. If you choose one of these, you will take care of the servingsfrom both group 3(a) and group 3(b).

Group 4: Other Vegetables and Fruits

All the vegetables and fruits not mentioned as part of Group 3(a and b) are included in this group.The members of this group are:

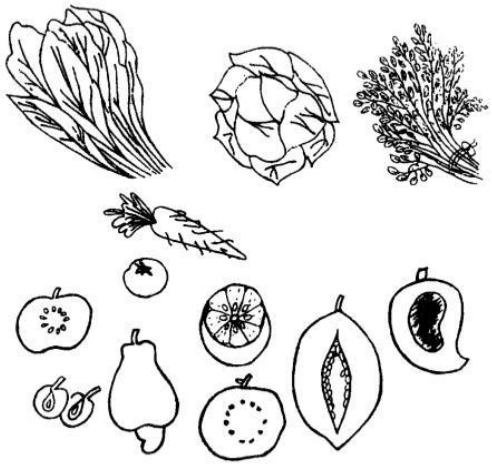
Fruit and flower vegetables — cucumber, cauliflower, brinjal, capsicum, ladies finger, etc.

Gourds — ash gourd, bottle-, snake-, bitter-, ridge-, sponge gourd and others.

Immature beansand peas — french beans, cluster beans, chawli, red gram (tender), walpapdi, etc.

Roots and tubers — beetroot, radish, potatoes, yams, onion, etc.

Other Fruits — bananas, melons, grapes, apples, jackfruit, plums, berries, chikus (sapota),pears, plantain, litchis, seetaphal, ramphal, pomegranate, etc



Group 5: Oils, Fats and Sugars

There are two major classes of foods included in this group: oils and fats including oils, ghee,butter and vanaspati, used as a spread, seasoning or shortening and sugars. Sugar, jaggeryandpreparations such as jams, syrups, etc., are included as sugar serving These foods enhance the taste and acceptability of any preparation. All these foods provideenergy. Sugars are a readily available energy source, while oils and fats are a concentrated energysource.In contrast to sugars, which are not a good source of any essential nutrients, oils and fats haveother functions besides providing energy. Oils and fats are necessary to transport and utilise fat-solublevitamins in the body. Vegetable oils contain essential fatty acids, which are necessary for growth in theyoung and to maintain the health of our skin.

Serving size: A typical serving size for oils, fats and sugars is 5 g, or about a teaspoon, since weuse a teaspoon to add sugar to beverages and also to serve oil or ghee.

Suggested number of servings: Since it is not an essential component in nutritional

Nutrient Density

Several investigators are individually studying ways to develop an easy-to-use index of nutritive quality of individual foods. One of these is nutrient density. It is the ratio of the percentage of the recommended allowance of the nutrient to the percentage of the energy requirement in a serving of the food. For example, a serving of cow's milk (150 ml) provides 100 kcal, 180 mg calcium and 2.9 mg of riboflavin. The nutrient density is calculated as given in Table

	Energy Kcal	*Calcium mg*	*Riboflavin mg*
RDA (Man)	2400	400	1.40
Milk — 1 serving	100	180	0.30
Percentage of RDA from milk	5	45	21
Nutrient Density		9.0	4.2

Practical Aspects of Food Selection

While you select foods from each food group, pay attention to the practical aspects of so that youget the most nutrients for each rupee spent for food.In Group 1, the cereals and breads group, the amount of iron and thiamin in the food preparationsvaries with how refined the grain or flour is. The chapatis made from whole wheat flour contain sixtimes as much thiamin as bread made from the same amount of refined wheat flour. Parboiled rice andrice flakes contains more iron and thiamin than milled polished rice. This knowledge can help yourselection of foods from this group.In the protein foods group, there is a wide choice of foods. Group 2 includes all types of dalssuch as tur, chana, mung, urad, masur and whole pulses or legumes such as chawli, rajma, wal, matki,chana, etc. As you may know, oilseeds such as groundnuts and til (sesame) also belong to the legumefamily and are included in this group. You can choose those dals and pulses, which are available at the-

most reasonable cost. Though all dals and legumes are good sources of B-vitamins, mung containsmore thiamin than others. Groundnuts are a very rich source of niacin.Milk is another important part of Group 2. Milk is used in a number of preparations, such as tea,coffee, butter-milk, curds, basundi, etc.

Use of the Food Guide in Meal Planning and Evaluation

The food guide is a practical tool to use in meal planning and evaluation. Please note the following important points when using the food guide in meal planning:

1. Select foods from each of the five broad food groups.
2. Choose at least the minimum number of servings from each of the food groups.
3. Make choices within each group. Please remember that foods in each group are similar butnot identical in food values.
4. Try to include at least one food from Group 2 in each meal.
5. Use seasonal vegetables and fruits to ensure good nutrition at low cost.

The nutritive value of menus planned, using the food guide, for an adult woman and an adult manare given in Tables 14.3 and 14.4. On scrutiny of these tables, it is evident that the nutrient content ofthe menu is equal to or greater than the recommended dietary allowances (RDA) for an adult womanand man.

Table 14.3: Nutrient Content of Menu for an Adult Woman

Food Group	*Foods and Servings*	*Amount g*	*Energy Kcal*	*Protein g*	*Vit. A value mcg*	*Iron mg*
1.	Rice (4)	100	340	7		3.0
	Chapati (5)	125	425	15		14.4
	Bread (2)	40	98	3		0.2
2.	*Dal* (2)	50	170	11		2.9
	Milk (1)	150	100	5	240	0.3
	Egg (1)	50	86	7	300	1.0
3.	(*a*) Amaranth (1)	50	22	2	2760	13.0
	(*b*) Guava (1)	50	24	–		1.0
4.	Brinjal (1)	50	15	1		0.4
	French beans (1	50	12	1	65	0.9
	Potato (1)	75	73	1		0.5
5.	Jaggery	15	57	–	–	1.7
	Sugar	25	100	–	–	–
	Oil	20	180	–	–	–
	Vanaspati	15	135	–	112	–
	Ghee/Butter	10	90	–	73	
	Total intake		1927	53	3,550	39.3
	RDI		1900	45	3,000	32.0
	Excess or deficit		+27	+8	+550	+7.3

Foods and Servings		Amount g	Energy Kcal	Protein g	Vit. A mcg	Iron mg
Rice	(4)	100	340	7		3.0
Chapatis	(6)	150	510	18		17.2
Bread	(2)	4 slices	196	6		0.4
Dal	(2)	50	170	11		2.9
Milk	(2)	300	200	10	480	0.6
Eggs	(2)	100	170	13	600	2.1
(a) *Palak*	(1)	50	13	1	2,790	5.5
(b) Orange	(1)	50	24	–	0–550	0.1
Brinjal	(1)	50	12	1		0.4
Cauliflower	(1)	50	15	1		0.7
Potato	(1)	75	75	1		0.5
Jaggery		20 g	76	–		2.2
Sugar		20 g	205	–	–	–
Oil		25 g	225	–	–	–
Vanaspati Ghee/Butter		20 g	180	–	150	–
Total intake			2,406	69	4,570	35.6
RDI			2,400	55	3,000	24.0
Excess or Deficit			+6	+14	+1,570	+11.6

Table 14.5: Dietary Score Card

	Food Group	Points Per Serving	Maximum Score
1.	Breads and Cereals	5	45
2.	Protein Foods	5	15
3.	Protective Vegetables and Fruits	10	20
4.	Other Vegetables and Fruits	5	10
5.	Fats, Oils and Sugars	5	10

Plans for Food Budget

In practice, one must make daily menus for a week and base the food purchase. This step isessential whether the plan is for a single person, a family or an institution. The food purchase is guidedby nutrient needs and also the food budget. Planning helps to make the best use of the available moneyto meet the needs of the family members. The food choices within a group can be guided by one's food budget. The steps, which help toget the best returns for the food money include:

- Buying the staple foods, dals and pulses in bulk, when the prices are competitive, just afterthe harvest.
- Buying milk and milk products from government dairy outlets.
- Buying fruits and vegetables from main markets at competitive rates.
- Buying seasonal vegetables and fruits.
- Buy sugar, jaggery in bulk from wholesale dealers.
- Buy oil from wholesale depots in bulk.
- Make butter and ghee at home.
- Buy spices in bulk and prepare the spice mix at home.

There are several government programmers, which subsidise foods for the various socio-economics tratas. These include rationed food grains, foods given to children in grade schools to ensure attendance, school lunch programmers and supplementary feeding of expectant and nursing mothers.

FOOD SANITATION

implies cleanliness in the producing, preparing, storing and serving offood and water. Food sanitation is an essential aspect of food preparation. It needs to be emphasised atevery stage of food handling and preparation. Some of the items which need particular attention are:

(i) a safe and potable water supply,
(ii) selection of wholesome ingredients and
(iii) hygienic handling, during preparation and serving.

These steps prevent entry of spoilage and pathogenic organisms in the food.

In addition, all the equipment coming in contact with food should be scrupulously clean; thesurroundings should be clean and there should be a proper and safe method for the disposal of waste.Inculcation of hygienic habits would help in preventing foods from being contaminated during handling.

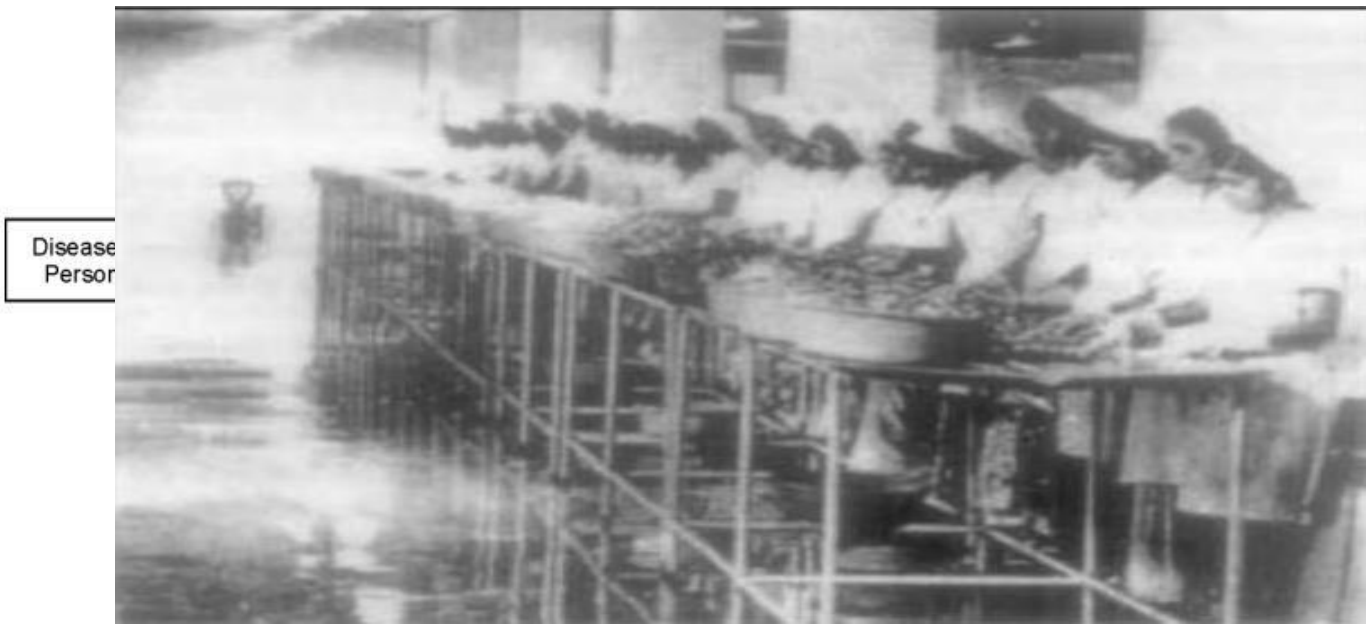
Food Handling

Food comes into contact with human hands during harvesting, storage, preparation and service.

It is important that food handlers be free from any communicable diseases—colds, any other respiratoryailment, cuts or boils, as they may be responsible for transferring these to the food thereby spreadingthe infection to persons consuming the food.Human hair, nasal discharge, skin can also be source of microorganisms. Therefore, personshandling food, must wash hands with soap before starting preparation, and refrain from touching hairor wiping nose during food preparation.

Food sanitation is a way of life. It can never be overemphasised. A number of gastrointestinaldisorders, such as diarrhoea, cholera and communicable diseases such as typhoid, septic sore throat,diphtheria, dysentery, etc., are communicated by use of contaminated water or food (Figure 22.3).

Therefore, it is very important that sanitary handling of food and water is religiously adhered to (Figure22.4).



Food Contamination

Food may be contaminated if the:

1. Water used for washing or cleaning is not potable.
2. Soil adhering to foods grown close to ground is not completely removed.
3. Containers or utensils used for storage and preparation are not clean.
4. Personnel handling food have unhygienic habits.
5. Personnel handling food suffer from communicable diseases.

Equipment

It is necessary that all equipment coming in contact with food be kept clean. This includes knives,meat mincers, blenders, rolling pins, wooden boards, metal and porcelain dishes, utensils, etc. Theyshould be scrubbed, cleaned with detergent and water and then rinsed with potable water. It is a goodpractice to see that such equipment are dipped in hot water at 80°C for at least 30 seconds or more andthen allowed to drain dry. This sanitary step is especially important during epidemics such as infectivehepatitis (infective jaundice), cholera, etc. Parts of blenders, mixers, etc., should be inspected aftercleaning to ensure that there is no food material left over. If allowed to remain they could allow harmfulmicroorganisms to grow and spoil the food. Equipment made of plastic and other such material whichcannot withstand high temperatures need not be given the dip in hot water but should be given othertreatments and then allowed to drain dry.In villages it is a common practice to scrub utensils and dishes with ash and then rinse them withwater. The utensils and dishes are then allowed to dry in the sun.

Control of Insects and Rodents

One of the common insects contaminating foods is the housefly. These have minute hair on theirlegs and thus can be the carriers of harmful bacteria depending on where they come from. It is possiblethat they may carry faecal matter or other such sources of pathogenic bacteria and deposit it on thefood.

Another insect which can also be a source of contamination in the same way as the housefly isthe cockroach. These insects, which usually prefer darkness, have been known to cause diarrhoea anddysentery.

Apart from these two common ones, there are innumerable insects ranging from the larvae foundin wheat and rice to locusts, which can cause serious damage to food.Rodents, which include rats, mice and bandicoots, not only consume large quantities of food,thus contributing to the overall shortage of food in the country, but may also be the carriers of diseases

This can be done by:

(i) Keeping the prepared food in cupboards with wire-netting.

(ii) Filling cracks, fissures in the walls and flooring which are usually the places where insects breed and multiply.

(iii) Covering drains, holes, etc., with wire gauze so as to prevent the entry of rodents

Practical Rules for Good Sanitation

1. Tie hair neatly before starting food preparation. Use hair net or cap if necessary. Wash handsthoroughly with soap and water before starting preparation.
2. Wash fruits, vegetables, cereals and beans thoroughly before preparation with potable water.Boil milk in a clean container as soon as possible after receipt and keep covered. Bottles ofmilk need to be rinsed thoroughly with water and then washed with soap and water.
3. Use potable water in food preparation.
4. Boil water used for drinking or for preparation of cold beverages, if the purity of water is notguaranteed.
5. Utensils and equipment used for preparation should be scrupulously cleaned.
6. Cooked food should be stored covered, preferably in the container in which it is cooked.
7. Left over foods such as rice, vegetables, should be stored either in a refrigerator kept in apan of cold water. Re-heating before use is advisable.

STORAGE

MAINLY THEIR ARE THREE TYPES OF STORAGE IS WIDELY USE

DRY STORAGE: A lot of food is preserved by drying under the sun. Drying removes most water from food. Most bacteria die or become inactive when the food is dried. Anchovies and dried chilies are examples of dried food

COLD STORAGE ¬Cooling slows down the action of microorganisms, thus it takes longer to spoil. It allows fruit from different parts of the world to appear on our supermarket shelves. ¬Cold storage is for foods that must be kept in the refrigerator or cool room below 5degree centigrade

FROZEN STORAGE The frozen storage is used to store foods which need to be kept frozen solid at -15 degree centigrade .e.g.. meat, fish, seafood , veggies like green peas etc. At frozening temperature, microorganisms become inactive, thus food cannot spoil when it is frozen.

FOOD PRESERVATION

Food preservation is the process of treating and handling food to stop or slow down Food spoilage, loss of quality, edibility or nutritional value and thus allow for longer food storage.

PRINCIPLES OF FOOD PRESERVATION:

Keeping out micro-organism or removing the micro-organism already present .
By killing the micro-organisms by radiation or by heat .
By preventing or slowing the decomposition of food through destruction or inactive of food enzymes, e.g. blanching or adding antioxidant

TYPES OF FOOD PRESERVATION

1. TRADITIONAL METHOD
2. MODERN INDUSTERIAL TECHNIQUE

Traditional method

COOLING - Cooling preserves food by slowing down the growth and reproduction of microorganisms and the action of enzymes that causes the food to rot. e.g. food such as fresh fruit, salads and dairy products to be stored safely for longer periods.

Freezing- Freezing is also one of the most commonly used processes, both commercially and domestically, for preserving a very wide range of foods. Keep your freezer at zero degrees (0°F) or below to maintain the quality of frozen foods. Most foods will maintain good quality longer if the freezer temperature is -10°F to -20°F.

Boiling

Heating

Sugaring - Sugar tends to draw water from the microbes (plasmolysis). This process leaves the microbial cells dehydrated, thus killing them. In this way, the food will remain safe from microbial spoilage.

Pickling

Canning- canning involves cooking food, sealing it in sterilized cans or jars, and boiling the containers to kill or weaken any remaining bacteria as a form of sterilization.

Jellying - Food may be preserved by cooking in a material that solidifies to form a gel. Such materials include gelatine, agar, maize flour, and arrowroot flour. Some foods naturally

Jugging- Jugging is the process of stewing the meat (commonly game or fish) in a covered earthenware jug or casserole.

Burial- foods can be preserved in soil that is very dry and salty (thus a desiccant) such as sand, or soil that is frozen

Fermentation in Some food by using specific micro-organisms that combat spoilage from other micro- organisms. These micro-organisms keep pathogens in check by creating an environment toxic for themselves and other micro-organisms by producing acid or alcohol

Modern industrial technique:

Pasteurization- Pasteurizations of milk is done to kill disease- producing micro-organism and to destroy lipase and other natural milk enzyme .there are two methods of pasteurization. □ 1.Batch or holding method □ 2. High temperature short time(HTST)

Batch or holding method:□ milk is heated to 63 degree centigrade and it held at this temperature for 30 minutes than it cooled to prevent multiplication of serving bacteria

High temperature short time(HTST)□ High temperature short time method involves heating every particle of milk to 72 degree centigrade and holding at that temperature for 15 seconds .

Vacuum packing - Vacuum-packing stores food in a vacuum environment, usually in an air-tight bag or bottle.

Artificial food additives □ Preservative food additives can be antimicrobial— which inhibit the growth of bacteria or fungi, including mold

Irradiation- Irradiation of food is the exposure of food to ionizing radiation for killing the micro- organism

Pulsed electric field electro oration

Modified atmosphere - Modifying atmosphere is a way to preserve food by operating on the atmosphere around it

High-pressure food preservation - Pressed inside a vessel exerting 70,000 pounds per square inch or more

Bio-preservation- Is the use of natural or controlled microbiota or antimicrobials as a way of preserving food and extending its shelf life.

HURDLE TECHNOLOGY- Hurdle technology is a method of ensuring that pathogens in food products can be eliminated or controlled by combining more than one approach.

FOOD PREPARATION

In cooking there is a transfer of energy from a heat source to food and this energy alters the food molecules, ♣ Heat brings about chemical, physical and microbiological changes. ♣ In kitchen, mainly 3 types of devices are used to cook food: i. Stovetop ii. Conventional oven iii. Microwave oven

1) CONDUCTION METHOD: θ Heat transfer through direct contact. θ When cooking on the stovetop, the heat from the flame or electric grill is applied directly to the fry pan to cook food. θ Most pans are made up of cooper and aluminum, that conduct heat very efficiently and do not melt on stovetop.
2) CONVECTION METHOD: θ In this method, heat transfer through a fluid. θ The fluid can be liquid or gas and even in case convection oven it may be air. θ An oven is a confined area that gets hot by flames or electric coils. θ The air inside is warmed to a desired temperature and, as a result, cooks the food from all directions. θ This method of heat transfer is responsible for pizza, cakes, and other baked foods.
3) RADIATION: θ In this heat is transferred using electromagnetic radiations. θ A microwave oven uses strong radio waves which are very weak and not hot. θ Microwave ovens work by spinning water, fat, sugars and oil inside the food. θ This causes friction, which then heats the food and cooks it from the inside.
3) ELECTRONIC HEAT TRANSFER:θ Microwave ovens have magnetron fitted in it which converts electric currents to microwaves that are similar to light or radio waves . θ This energy is focused towards the food to be cooked.

PURPOSES OF COOKING FOOD

- θ Make its maximum valuable in palatable form.
- θ Make it easily digestible.
- θ Improve its flavor, texture and appearance.
- θ Develop and enhance flavors.
- θ Destroy pathogenic organism acid substance found in raw food.
- θ Make the food tasty and nutritious.
- θ Variety of dishes can be prepared from the same item of food.

METHODS OF FOOD PREPARATION –

MOIST HEAT METHOD: i. Boiling ii. Stewing iii. Simmering iv. Steaming v. Pouch vi. Blanch

DRY HEAT METHOD

COMBINED METHOD

MOIST HEAT METHOD-

In this method the heat is conducted to the food product by water (liquid) or steam.

I. BOILING: ♣ Boiling means cooking food in a rapidly bubbling liquid. ♣ Some vegetables such as roots and tubers, pulses, cereals are cooked by boiling. ♣ The high temperature would cause protein to toughen and rapid bubbling would break up delicate products.

ADVANTAGES: • It is an easy method of cooking. • It saves time and fuel. • Boiled food is easily digestible. ¬

DISADVANTAGES: • The high temperature would cause protein foods and toughen and the rapid boiling would break up duplicate products. • Rapid boiling does not cook the food faster. • It may effects the flavor, color and appearance of food. • Some valuable nutrients may be lost when the cooking water is discarded.

2) SIMMERING: ♣ It means to cook in a small amount of liquid that is bubbling very gently. ♣ Most foods are meat, pulses and dried vegetables are cooked by this method. ♣ They are cooked for a longer period to make them tender and digestible.

ADVANTAGES: • Stewed foods are nourishing because nutrients and soluble vitamins pass in to water that served as gravy. • It enhance the taste and flavor of food.

DISADVANTAGES: ♣ It is slow process. ♣ Vitamin C is destroyed by slow process.

3) STEWING: ♣ Simmering and stewing are almost one and the same. ♣ Solid food is cooked is liquid and served with gravy. ♣ Carrot, potatoes and meat can be cooked by stewing. ♣ Food is cut into even size pieces and the heavy based sauce pan with a suitable lid is used. ¬ ADVANTAGE: • Food is nourishing since it is cooked in covered pan. • Almost all nutrients are retained as gravy which is served also.

4) POACH: ♣ It means to cook in a small amount of hot liquid that is not actually boiling. ♣ Undesired odors and flavors are eliminated by this method. ♣ Soft foods are cooked by this method, e.g. fish, egg etc. 5) BLANCH: ♣ Green beans, broccoli, fruits, and other green vegetables are cooked by blanching. ♣ It is the process where the food items are plunged into boiling water for a short period of time and then removed and placed under cold running water to stop the process of cooking. ♣ It maintains the nutritive value of the food and the natural color of the food item.

6) STEAMING: } By this method food is cooked by directly exposing to steam. } In quantity cooking, this usually done in special steam cooker and also can be done on rack above boiling water. 7) COOKING BY PRESSURE COOKERS: } Pressure cooker holds steam under process. } Cooking time must be carefully controlled to avoid overcooking. ¬ ADVANTAGES: } The food gets cooked faster than otherwise. } It saves time and fuel. } Prepared food is nutritious. } The food retain its nutrients and flavor.

DRY HEAT METHOD 1. Roasting and baking 2. Broiling 3. Grilling 4. Sauté 5. Frying • Pan frying • Deep frying

1) ROASTING AND BAKING: } In this method heat is transferred by convection method. } Cakes, cookies, biscuits etc. are cooked by this method. } Roasting usually applies to meat and poultry. } Baking applies to bread, pastries and cakes and cookies. Fish could also be baked. } Cooking uncovered is essential to roasting. Covering holds in steam, which changes the process from dry to heat cooking. } Roasting can be done in 3 different equipments: 1. Spit roasting 2. Oven roasting 3. Pot roasting.

2) BROILING: ♣ In broiling radiant heat comes from above. ♣ Food is placed on a pre heated metal grate. ♣ Harder meat, poultry fish and few vegetable items are cooked by broiling. θ RULES FOR BROILING: } Turn the heat on full. cooking temperature is controlled by moving the rack nearer and further from the heat source. } Preheat the broiler. } Dip the food item in oil to prevent sticking and minimize drying. } Turn the food only once to cook from both sides and to avoid over handling. } Use lower heat for larger and thicker items and higher heat for thinner pieces.

3) Grilling: } Heat is used from below. } It is done on an open grid over heat sources which may be charcoal, an electric element or gas method. } Meat kebab & cheese are cooked by grilling method.

4) SAUTE: } In this small amount of oil is used. } High heat is applied. } Vegetable oil such as olive oil is used. } Butter is not used due to its smoke point.

5) FRYING: } It is a dry heat cooking method as water is not used in this method. } It involves cooking of food item in oil or other edible fats such as vegetable oil, olive oil, ghee etc. } The items are cooked faster and get browned. θ Pan frying: } Frying means to cook in moderate amount of fat in a pan over a moderate heat. } The amount of fat used depends on the food being cooked. } It is done over low heat than sauteing, because larger pieces are being cooked.

θ Deep frying: } it means to cook food submerged in hot fat. } Many foods are dipped in a butter before frying. } This forms a protective coating between food and fat and helps give the product crispness, color, flavor.

COMBINED METHOD

BRAISING: } This method is a combination of dry heat and moist heat. } Firstly an item is cooked by dry heat to ensure proper caramelization. } Then liquid is added and simmer it until it becomes soft and tender. } It is useful for tougher pieces of meat.

UNIT – 2
DIET THERAPY
Introduction

The best doctors in the world are:

"*Doctor Diet, Doctor Quiet and Doctor Merryman" – Jonathan Swift.*

Diet Therapy is use of appropriate foods as a tool in the recovery from illness. In most illnesses, the patient's diet complements the medical or surgical treatment. The rate of recovery thus is determined by the patient's acceptance and intake of the diet prescribed. In certain ailments such as obesity and diabetes mellitus modified diet is the most important input to help the patient's recovery All therawpeutic diets are modifications of the normal diet made in order to meet the altered needs resulting from disease. As you may have noted in Chapter 14, the normal diet is planned to meet the recommended dietary allowances (RDA), using the basic five food groups. Therapeutic diet is planned to meet or exceed the dietary allowances of a normal person as the aim of diet therapy is to maintain health and help the patient to regain nutritional wellbeing.

In certain ailments it may be necessary to restrict intake of calories (as in weight reduction diets) or sodium (as in heart ailment).

Food Acceptance in Illness

Illness leads to poor food acceptance due to:

(i) Reduced desire or interest in food due to lack of appetite, gastrointestinal disturbances or discomfort after eating.

(ii) Reduced appetite due to inactivity.

(iii) Reduced appetite due to some drugs.

In addition a patient in hospital faces a number of stressors. These include:

(i) Altered time of eating and rest as compared to home.

(ii) A lot of questions are asked; some of these are very personal.

(iii) Movements to various laboratories for investigations or tests.

(iv) A lot of waiting for tests to be done.

(v) Fear of tests and their results.

(vi) Hospital staff, who monitor the patient, may intrude on privacy.

(vii) Other patients in the ward or room may cause anxiety.

To counteract these stressors, a relative, a nurse or a case manager is needed to monitor the patient's care. In this stressful situation, the only comfort for the patient may be food.

Illness Affects Nutrition

The nutrient needs and their use in the body may be affected by illness. The patient does not haveappetite, may have pain and/or vomiting. This may result in insufficient food intake. Nutrient absorptionmay be poor due to severe diarrhoea, which may lead to loss of weight, malnutrition and even dehydration. The patient may face problems such as poor appetite, too much or too little food served etc.Therapeutic diets may be bland, less salty, poor in texture and choice. Food acceptance of modifieddiets can be a problem. These problems need to be anticipated and resolved by discussion with thepatient.

The patient may feel relief if the appetite is satisfied, meals are attractive, colourful and include some well-prepared favourite foods. In fever, the metabolic rate is increased and so the need for all nutrients (calories, proteins, vitamins) is increased. Nutrient utilization is adversely affected in metabolic diseases. The patient's lack of movement (due to confinement to bed or wheelchair) for many days increases loss of nitrogen and calcium from the body. These are some of the problems that need attention andsolution.

Planning of Therapeutic Diets

The energy and protein needs need to be determined to ensure proper nutritional care of a malnourished patient.

Energy Needs : The energy intake has to meet the basal plus activity needs of the patient, taking into account the patient's need for – repletion, maintenance or weight loss. The resting energy expenditure (REE) can be measured with a portable equipment, which measures volumes of oxygen (VO_2) consumed and carbon dioxide expired (VCO_2). The REE is increased in patient suffering from burns, fevers, infection, fractures, trauma etc.

and lowered in malnutrition. The resting energy expenditure (REE) can also be determined using the classic Harris-Benedict equation derived from indirect calorimetry measurements, using the weight, height and age of the patient.

Harris-Benedict Equation

Women: REE (kcal) = 655.1 + 9.56W + 1.85H - 4.68A

Men: REE (kcal) = 66.5 + 13.75W + 5.0H - 6.78A

where A = Age in years, W = Weight in kgs, H = Height in cms

Protein Needs: Loss of nitrogen is increased by stress. If the losses in urine are measured, the protein intake can be increased to make up for the loss. When the loss is unknown, protein intake can be proportional to energy intake, as indicated below:

Calorie : Nitrogen ratio in Severe stress is — 150 : 1 to 100 : 1

For example, if a stressed patient needs 2400 kcalories, his N-need is–

2400 kcal = N(g) × 150 = 16.0 g N per day

Protein Needs = 16.0 × 6.25 = 100g per day

Therapeutic Diets

Food is an integral part of patient care and is a major contributor in his/her recovery. Therefore, careful selection of foods, their preparation and ensuring that these are consumed by the patient is an important part of the therapy. The medical personnel are responsible for diagnosis and indicating the kind of modifications to be made in the normal diet in view of the condition of the patient. The diet section staff use this information to plan the patient's diet. There are three aspects of the diets prescribed. The first refers to the composition of the diet. Thus it indicates modification in the components of the diet. For example, low calorie diet, indicates that the energy content of the diet is reduced. However, it is important to include a specific amount intended to guide the user (such as 1200 or 1500 calorie diet). Second aspect refers to the consistency of the diet. Thus you have normal diet, liquid diet (further classified into clear–liquid, full-liquid diet), soft diet, soft fiber-restricted diet, pureed diet, etc. Thirdly, it is important to indicate the manner and route of feeding the diet, such as by mouth, by nasogastric tube, gastrostomy tube etc., depending on the condition of the patient.

Types of Diets

Normal Hospital Diet

Normal diet is the most commonly used diet in the hospitals. It plays a very important part in the patient's recovery. It aims to meet the recommended dietary allowances of nutrients through a planned diet. There are no restrictions involved in food planning, but the food plan is balanced to avoid over- or under-nutrition. In the hospitals, there is choice of menu based on normal food acceptance patterns of the patients. Thus in India, the hospitals serve vegetarian and non-vegetarian diet. There may be some choice of foods in the menu, which helps to retain a feeling of control in the patient. Table 23.1 gives foods included in the normal diet.

Modifications of Normal DIET

The normal diet may be modified to:

1. Provide change in consistency, e.g., soft and fluid diets;
2. Provide foods bland in flavour;
3. Modify intervals of feeding;
4. Increase or decrease energy content;
5. Increase or decrease other nutrients, e.g., protein;
6. Increase or decrease fibre.

Liquid and Soft Diets

The type of modification relates to the condition and need of the individual concerned. The selection of foods is made on the same principles as the normal diet, using the daily food guide.

Mechanical Soft Diet:

Many people, including infants, need soft diet because they have no teeth. Therefore, the only change made is in the consistency of the foods served. No restriction is placed on food selection. This diet is sometimes described as mechanically soft diet. The normal diet is modified to form various diets according to the needs of the patient. These include various liquid and soft diets. Liquid Diets are further divided into Clear-liquid Diet and Full-liquid Diet.

Clear-liquid Diet or Clear-fluid Diet

includes drinks such as tea, coffee, clear fruit juices, coconut water, sherbets, extracts of dal, rice, popped cereals, fat-free broth, carbonated drinks. Milk is not included, as it is not a clear liquid. Feeds are offered in small portions of about 20-25 ml every hour or two and the volume is increased gradually as the condition of the patient improves.

Full-liquid Diet:

In full liquid diet, foods included are –liquids and foods which are liquid at body temperature. It can provide adequate nutrition, with the exception of iron. As the nutrient-density is not high, six or more feedings are given. Skim milk powder is added to increase the protein content of the diet. This increases the lactose content of the diet and therefore, it should not be given to persons with low lactase activity. This diet has high calcium and fat content and is low in fiber

Soft Diet:

Soft diet is used after full-liquid diet and before moving on to a normal diet. It is nutritionally adequate. Foods included are those, which are easy to mix with saliva, swallow and digest. Exclude foods, which contain harsh fiber, strong flavours and too much fat. Food allowances for soft diet are given in Table 24.5. The calories and protein content of soft (low fiber) diet is given in Table 24.6. Soft diets include several variations such as mechanically soft diet, pureed diet and fiber-restricted soft diet

Mechanically Soft Diet: In this diet the modification of normal diet is in texture only. The method of preparation or the seasonings used are not restricted. This is also called Dental Soft Diet, as it is prescribed for those who cannot chew, due to absence or removal of teeth or ill-fitting dentures.

Pureed Diets:Pureed diets include foods, which are smooth, soft and need hardly any chewing. These are good for patients who have difficulty in swallowing. All foods (except those that are already soft or smooth) are blended or pureed in a mixer. Liquids are added to get the consistency needed by the patient. To increase calories, fat and/or sugars are added.

Soft Fiber-Restricted Diet: Indigestible carbohydrates are excluded from this diet. Indigestible fibers include those which make up cell wall of plants (such as cellulose, hemicellulose, lignin, pectic substances, gums and mucin). The amount of indigestible carbohydrates in the diet can be reduced

Parenteral Nutrition

In parenteral feeding, the nutrient preparations are given directly into a vein. When a patient is likely to be dehydrated and needs quick reversal of the condition, a 5% dextrose solution in water (DSW) is usually given by a peripheral vein (also known as IV drip) to provide fluids and some energy (calories). Electrolyte solutions can also be given by this mode. In some conditions the higher dextrose concentrations with amino acids and lipids are given.

Total Parenteral Nutrition (TPN)

TPN is used only when it is not possible to use enteral route and the patient is hypermetabolic or debilitated. Before giving TPN, a thorough nutritional and metabolic assessment of the patient is done. The blood levels of various nutrients are monitored frequently during TPN and the solution adjusted, if needed. Composition of Solutions: Crystalline amino acids are used to meet protein needs, so that the composition can be controlled to meet patient's needs. Dextrose solutions (hypertonic) provide

carbohydrates as energy source and ensure amino acid sparing action. For patients with lung problems, high dextrose load causes difficulty in breathing. For such patients part of the carbohydrate is replaced with fat, to prevent this problem. Emulsions of safflower or soy oil are given separately, to meet part of the energy needs and to provide essential fatty acids.. As lipid emulsions are isotonic, these are given by central or peripheral vein. Other nutrients (vitamins, minerals and other electrolytes) are given in solution or by injection. TPN solutions being hypertonic are introduced into a large central vein where the solution gets diluted quickly in the high rate of blood flow. The patient should be helped to return to oral feeding as soon as feasible, as TPN is expensive and can lead to a number of complications, if not given properly

THERAPEUTIC DIET UNDER EACH UNIT

DIET IN FEVER, INFECTION AND LUNG DISEASES

Infections

Infection occurs when a pathogen gains entry into the body in sufficient numbers or multiplies inthe body and causes injury at a particular site. Depending on where the pathogen attacks, differenttypes of illnesses develop. If a pathogen enters through the nose or mouth, and multiplies in that region,ailments of throat or bronchi occur. If pathogens enter the lungs, it can injure them. If pathogens areswallowed with water, milk or food, gastrointestinal symptoms such as nausea, vomiting, cramps anddiarrhea frequently result. If the pathogens enter through cut skin, infections such as boils, skin ulcersor other inflammations occur.

Fever

Fever often accompanies infection. The patient may have chills due to fever and may complain offeeling cold. But all fevers are not a result of infection. All elevations in body temperature are not fever.For example, there is elevation of body temperature in heat stroke, as the body is unable to eliminate
heat.

Infection affects protein catabolism (breakdown), often decreases food intake and increasesnutrient loss through vomiting and/or diarrhea. Enteric(intestinal) infections, as in typhoid, interferewith absorption and reduce nutrient utilization. Fever, which often accompanies infection, increasesenergy needs of the body (about 7% per degree Fahrenheit) above normal temperature.Fever may be acute and of short duration as in colds, intermittent as in malaria or chronic as in TB

Diet: The dietary treatment varies with the kind of fever and its duration. When fever is acute andof short duration, the most important aspect is to feed sufficient fluids and electrolytes to make up forthe losses from the body. As appetite is usually poor, frequent small feeds of liquid and soft foods needto be given to ensure adequate intake. As the condition improves, the size of the feed is increased tomeet nutritional needs.The critical problem is protein breakdown, which occurs in infection. A high protein, high caloriediet is prescribed . Liquid and soft foods need to be fed often to ensure sufficient foodintake as appetite is poor. The drugs given (antipyretics) help to bring the temperature to normal. Most of the drugs containingredients to relieve pain also. The medication is taken with food to minimise gastric irritation.

Tuberculosis

In India, tuberculosis is a major cause of illness and death. According to one estimate, one fourIndians is infect-

Table 25.1 High Protein High Calorie Diet

Protein 75g; Kcal 2,500				*Protein 110g; Kcal 3,000*			
Food	*Amt/Serving*	*Protein*	*Kcal*	*Food*	*Amt/Serving*	*Protein*	*Kcal*
Milk,toned	800ml	26	535	Milk,toned	1000ml	32	670
Egg	1 no	6	75	Egg	1 no	6	75
Cheese/ Paneer/meat	2 S	9	133	Cheese/ Paneer/meat	4 S	18	265
Dal	2 S	11	170	Dal	3 S	17	255
Cereals, Breads	6 S	15	510	Cereals, Breads	12 S	30	1,020
Vegetables	3-4 S	5	100	Vegetables	3-4 S	5	100
Fruits	3 S	1	180	Fruits	3 S	1	100
Ghee Butter/oil	9 S	0	405	Ghee Butter/oil	5S	0	225
Sugar	10 S	0	200	Sugar	5 S	0	100
Jam etc.				Jam etc			
Total		75	2,508	Total		110	2,990

ed by T.B.

Tuberculosis is caused by the bacteria Mycobacterium tuberculosis. It is transmitted through thecough or

Table 25.2 Food Allowances for High Calorie, High Protein Diet

Protein – 75 to 110g and Kcal 2,500 to 3,100

Group	*Foods*	*No. of Servings, amount*
I	Cereals, breads	6 – 12 S (150 – 300g)
II.	Milk, toned/cow's Egg SMP/Cheese/Paneer/Meat Dal	800 – 1000ml 1 no 50 – 100g 2 – 3 S (50 – 75g)
III and IV	Vegetables Fruits	3 – 4 S 1 S leafy vegetable 1 S raw (salad) 2 S other + root vegetable 3 – one of these citrus
V	Ghee, Butter, Oil Sugar, jam, murabbas, Desserts such as kheer, pudding, Custard, shreekhand etc.	5 – 10 S 10 S

Table 25.3 A Sample Menu– Foods Included in 80-100g Protein Diet

Breakfast	**Lunch**
Orange	Rice
Eggs, scrambled	Chapati
Milk toned – 1 C	Dal
Bread/toast	Usal
Butter	Vegetable, beans
Murabba	" potato
Tea with milk, sugar	Salad – tomato
	Dahi ½ C
Mid morning	**Dinner**
1 C lassi & banana	Bhakari
Afternoon pm Snack	Rice
Milk 1 C	Dal
Egg sandwich	L. vegetable
Tea	Papad
	Fruit Salad

sneeze of an infected person, when it gets sprayed into the air. Most people who breathe inthe bacteria do not get infected. In those who do not get infected even after inhaling the bacteria, themicroorganisms may remain dormant as their immune system triggers activation of macrophages,which engulf the bacteria. About 10 per cent of those infected develop tuberculosis some time in theirlife, when the natural immunity is lowered.In tuberculosis, lungs are the most frequently affected part, but other organs may be attackedsometimes. Tuberculosis (T.B.) is accompanied by cough, sneezing, fever and tissue wastage. Inacute form, the fever is high and the symptoms are similar to pneumonia. Low grade fever is typical ofthe chronic form.

Body's Metabolic Response: Ability to utilise fat is reduced, hence muscle protein losses areincreased. As available nitrogen is used to synthesize immune bodies, considerable protein wastingoccurs with loss of body weight.

Diet: A high protein, high calorie diet is prescribed. It must provide sufficient energy i.e. about2500-3000 calories and 75-100g protein (Table 25.2).

Asthma, Chronic Bronchitis and Emphysema

Asthma, chronic bronchitis and emphysema are grouped together as Chronic ObstructivePulmonary Disease (COPD). The group has a common characteristic, which is air-flow reduction or obstruction. A lot of attention is given to its pathophysiology, but the nutrition aspect of treatment doesnot receive adequate attention.

There are about 300 million air-sacs (alveoli) in the lungs. The symptoms of injury are noticedonly after 60 per cent of these air sacs are affected. The symptoms and possible causes of COPDare given in Table 25.4.

A very large number of Indians suffer from these ailments. A large percentage of annual deathsfrom chronic bronchitis and emphysema are due to excessive smoking cigarettes or bidis.

Nutritional Status: Nutritional status is poor and weight loss is noted. Breathing difficulties donot permit normal eating. The sputum formed affects tastes adversely. Due to insufficient oxygensupply, peristalsis is reduced resulting in poor appetite. In addition the drugs given to improve breathingcause gastric irritation. In severe cases, the low oxygen supply and side effects of drugs may lead toulcer formation in the stomach in about 20-25% of the patients.

Table 25.4 Characteristics of COPD

Disease	*Symptoms*
Asthma	increased response of trachea and bronchi to stimuli, airways reduced, swelling of airway wall, excess mucus, wheezing, coughing, difficulty in breathing.
Chronic bronchitis	excess mucus, inflamed airways, hyperactive bronchi, difficulty in breathing out
Emphysema	reduced lung surface area, destruction of air sacs and air spaces in lungs, wheezing, chronic cough, chest shape distorted to barrel shape due to overwork and over-inflation of muscles

Treatment: Avoidance of predisposing factors is an important part of cure. Dust allergy is oneof the most common causes of asthma. The mites present in dust which have been found to be the cause, have to be removed by frequent washing of bed sheets and pillow covers, wet wiping of floorsand fans and vacuum cleaning the books, papers and other articles, which the patient has to handle indaily life.

Diet Therapy: The first aim in diet therapy is to prevent malnutrition or correct it if it hasoccurred. The energy needs increase many fold in comparison to normal needs of a person ofcomparable age and size. In extreme COPD cases, the energy used for breathing can be 10 times thatof the normal rate.

Energy: Energy needs need to be met; but intake must be monitored to match the oxygenavailable. Thus one can avoid production of excess carbon dioxide which may cause acidosis. Thesepatients have limited ability to excrete carbon dioxide, so diet must contain foods with low respiratoryquotient (RQ). RQ of fats is 0.7, proteins 0.8 and carbohydrates 1.0. So non-protein calories can beprovided by high fat to carbohydrate ratio, which will decrease carbon dioxide production. Suchformulas are available to treat severe cases.

Plan of Meal Times: Rest before meals helps to improve intake of food. Slow, deep breathingand relaxation practice helps eating. It also helps to avoid swallowing air, which can disrupt flow offood. Eating small meals slowly, wearing loose garments, not lying down, bending over or exercisingsoon after meals are helpful. Small

frequent meals helps to reduce anorexia and decrease pressure onstomach due to fullness. It permits free movement of diaphragm and decreases fatigue.

Some drugs used to dilate bronchi have caffeine – like side effects, so caffeine should be avoidedby patients on such days. To avoid undesirable side effects, it is advisable to take medicines with food.

DIET IN GASTROINTESTINAL PROBLEMS

Introduction

The gastrointestinal tract is involved in transforming the food eaten into energy to meet thebody's needs for its sustenance and function. Anything that affects its function disturbs this processand leads to disease.

The gastrointestinal tract consists of esophagus (food tube), stomach (mixes food and formschyme) , small intestine (small diameter tube 20 ft. long, consisting of the duodenum, the jejunumand the ileum) and large intestine (large diameter tube which includes cecum, colon, rectum andanal canal).The food is ground in the stomach into tiny particles. The stomach secretes mucous to protectthe lining of the gastrointestinal tract. In addition it also secretes hydrochloric acid and several enzymesand readies the food for digestion by changing it into semifluid chyme. The pancreas secrete pancreaticjuice into the duodenum to facilitate the digestion of the food in the small intestine. Food productscarried by blood vessels from the walls of the digestive tube are delivered to the liver, the largest organin the digestive system

The dietary factors associated with ailments of the gastrointestinal tract (G.I.) are:

(i) Acidity, (ii) inadequate fiber, (iii) fat, (iv) substances such as gluten in wheat and (v) lactose.One more substance - alcohol – does affect the health of the G.I. tract adversely. But it is not afood, nor is it a dietary essential.

Constipation

According to a research survey in Mumbai, over 70 per cent of the persons studied complainedof constipation.Persons, who have little or no exercise especially elderly persons, suffer from atonic constipation.They limit their food selection to soft, low-fiber foods; they limit fluid intake to prevent urination,especially at night. They become dependent on laxatives and yet find no relief, as the causative factorsare not eliminated.

Treatment: The following changes in routine and diet help to get rid of the constipation:

(i) Increase fluid intake to 1200 to 1500ml. i.e., 5 to 6 glasses of water in addition to other beverages and liquid foods (soups, buttermilk, etc.)

(ii) Include 200 to 250g of vegetables and fruits in the diet and

(iii) Exercise regularly e.g., walking ¾ to 1 hour daily,

(iv) Do fitness exercises, and/or

(v) Suryanamasksars or yoga daily.

Diet: Their diet needs to be modified gradually to high fiber diet as listed below :

1. Eat whole wheat chapati and bhakari as major part of the meal and reduce intake of whitebread and polished rice
2. Include cooked preparations of germinated pulses in the diet.
3. Take two or more servings of cooked vegetables such as cluster and other beans, gourds (snake, ridge, bitter, sponge, etc.)
4. Eat raw vegetables such as cabbage, carrot, cucumber, tomatoes, radish etc.
5. Include two or more servings of fruits such as amla, banana, papaya, chiku, guava, melons,jackfruit, berries, apples, etc.
6. Take beverages such as buttermilk, lemon squash, mango panhe, kokum drink, to increasefluid intake.
7. Drink 5 to 6 glasses of water, as a drink to ensure movement of food in the digestive tract and smooth elimination of waste products.

The changes in the diet must be introduced gradually to avoid feeling of bloating or cramping dueto the changes.

Diarrhoea

Diarrhoea is one of the most common G.I. tract ailments. It is still the second most commoncause of death in childhood, killing over 1.5 million children in India alone.

The occurrence of diarrhoea indicates that there is contamination of food and water with virusand bacteria from human faeces. In diarrhoea, the stools are liquid or semisolid and large volumes ofthese are passed frequently. There is also vomiting, cramps and abdominal pain. The food passes through the gastrointestinal tract so rapidly that its digestion and absorption is reduced. The fecalmatter moves through the colon so fast that water and electrolytes are not reabsorbed.Frequent and/or prolonged attacks result in loss of fluids, electrolytes, minerals, vitamins, proteins,fats, carbohydrates and as a result there is loss of body weight. This leads to dehydration.

Therapy: The first step is to identify the cause and remove it. If diarrhoea is severe and dehydrationhas set in (eyes sunken, skin loose and inelastic, passing reduced amounts of dark urine), fluids andelectrolytes may be first given intravenously to let the gastrointestinal tract to rest. This is followed byfeeding fluids, with gradual move to oral rehydration therapy and later to a very low residue diet.

Table 26.1 WHO Formula for Oral Rehydration Solution (ORS)

Sodium chloride	3.5g	Dissolve in one liter
Sodium bicarbonate	2.5g	boiled, cooled water. **Do not boil after dissolving**
Potassium chloride	1.5g	**these ingredients in water**
Glucose	20.0g	

Directions for use of ORS:

1. Use a clean cup and spoon
2. For infants, use a dropper. Babies who are breastfed, should continue to be breastfed in addition to **ORS**
3. Let the patient **sip the liquid** from the spoon, **not drink it.**
4. Feed one cup for each stool passed
5. Even if the patient vomits, in the first couple of hours continue to feed ORS in small sips

If oral rehydration mixture is not available, use a home-made one containing sugar (40g), and salt (3.5 g) per liter supplemented with potassium rich foods such as coconut water, lemon juice, banana, mashed papaya, mashed plantains etc.

Low Residue Diet

Oral rehydration therapy is followed by a very low residue diet in cases of severe diarrhoea. Thelow residue diet of less than 10g of fiber a day reduces the normal work of the intestines by restrictingthe amount of dietary fiber and reducing food residue. Food residue is the bulk in colon that includesundigested food, intestinal secretions, bacteria and cells shed from the intestinal lining. The foodsallowed and foods avoided in low residue soft diet are listed in Table 26.2. It consists mainly of liquidssuch as buttermilk, dal soup, broth, vegetable and fruit juices, coconut water, etc. some soft foodssuch as soft cooked dal, cooked eggs, pureed mild-flavoured vegetables, apple sauce, fruit pulsp ,refined breads, soft cooked rice, custards, kheers, etc. can gradually be added to improve the nutrientcontent, as the condition of the patient improves and appetite slowly recovers. The patient needs to progress from liquid diet, soft diet to normal diet gradually. Contaminationof food must be prevented to avoid recurrence of diarrhoea.

Table 26.2 Foods Allowed and Avoided in Low Residue Diet

Foods Allowed	*Foods Avoided*
Buttermilk, (2 C only)	Whole milk
Dal soup and soft cooked dal	
Eggs (all but fried)	Legumes, nuts, fried foods,
Soups and soup broth	Fibrous meat
Vegetable juices and cooked or pureed mild-flavoured vegetables, dudhi, pumpkin	Vegetable and fruit fiber
Fruit juices, banana, apple sauce, Fruit pulp (papaya, melons etc.)	Pickles, preserves
Coconut water	
Refined breads, soft cooked rice, noodles, chapatti, etc.	Coarse cereals and breads Whole grain breads
Kheer, jelly, custard, biscuits, plain cakes	
Tea, coffee if allowed	

Food Tolerance

Food tolerance is highly an individual reaction to intake of various foods. Some persons sufferfrom heartburn, flatulence and distention of abdomen, when they consume certain foods. Tolerance tosuch foods is highly an individual reaction and needs to be treated as such. The foods mentioned ascause of the discomfort include dry beans and split dals of redgram, bengal gram and sometimes blackgram. Among the vegetables, strong flavoured ones containing sulfur compounds such as cabbage,cauliflower, leeks, onions, radishes and turnips are mentioned. Some persons cannot tolerate evencucumbers and watermelon. It is important to record the diet history of the patients, including theirperceived food tolerance, before preparing a diet plan for treating them. Persons, who are nervous, tense, too worried, insecure, feeling neglected and/or anxious, tend tosuffer from gastrointestinal ailments. Their emotions affect the function of the digestive tract adversely.

Other factors noted are:

(i) irregular eating hours,
(ii) quick gulping down of food and hence poor mastication,
(iii) lack of rest and
(iv) lack of rational schedule.

Luckily there is a wide choice of foods available in each food group and it is possible to plan anutritionally adequate diet, using foods, which are well tolerated by the patient.

In view of the above, in treating patients suffering from gastrointestinal ailments, diet plan needsto be individualized.

DIET IN CARDIOVASCULAR DISORDERS

Introduction

Cardio means of heart and vascular means of blood vessels. Thus cardiovascular diseasesinclude ailments of heart (CHD) and of blood vessels (atherosclerosis).

The heart is the strongest and toughest muscle in the body. As the arteries carry blood fromtheheart to the lungs and other tissues, any damage to the artery results in a variety of heart diseases.Cardiovascular diseases include hypertension, ischemic heart disease, leading to angina pectorisand lastly myocardial infarction. Hypertension is increased blood pressure or high BP in short. Inischemic heart disease, there is lack of blood to the heart muscle resulting in a heart attack. In anginapectoris, there is reduction of blood supply to the heart muscle due to narrowing of the artery wall.

Myocardial infarction is caused by thrombosis, which is coagulation of blood in blood vessel ororgan.

Cardiovascular diseases develop in three stages:

(a) In the first stage, arterial damage begins due to fat oxidation products, hypertension and/orsmoking.

(b) As it progresses, there is deposition of fatty material in the arterial wall, increasing its thickness,making it narrow and rigid. The movement of oxygen and nutrients is made more difficult asthe arterial passage is narrowed. The heart must pump harder driving blood pressure up(high B.P. or hypertension).

(c) Lastly there is heart attack, which is also known as coronary occlusion, coronarythrombosis or myocardial infarction. It is virtually like a traffic jam, causing insufficientsupply of blood to the tissues of the body beyond the point of blockage. If the blockage is inthe artery connecting to the brain, it leads to stroke. As blood supply is crucial to thesustenance of life, it is crucial that the patient gets immediate medical aid to minimise thedamage and save life.

Ailments of the heart are on the rise and even young persons succumb to these ailments. Henceit is important to understand the contributing factors, to prevent these as far as possible and arrest theirprogress to minimize the damage.

Risk Factors

The major risk factors are:

(i) elevated serum cholesterol

(ii) emotional stress

(iii) hypertension

(iv) lack of activity leading to obesity and

(v) smoking

Heredity is an additional risk factor, for one inherits the food habits and often the life style ofone's parents. All researchers in this field uniformly agree that high blood lipids levels are a primary cause whichcontribute to most serious heart disorders. High sodium intake may be involved in hypertension.

Basic Nutritional Plan to Monitor Serum Lipid Levels

The diet changes which have proved to be effective in preventing or reversing heart disease havethe following nutritional goals:

- Reduce the total amount of fat, mainly the saturated fat in the diet.
- Use polyunsaturated fat in place of saturated fat in the diet
- Decrease the intake of the amount of dietary cholesterol
- Increase physical activity to alter cholesterol components in the blood.
- Attain ideal body weight and maintain it.

To accomplish these goals, the diet must have high carbohydrate (50 –70% of total calories),adequate protein (12-20% of total calories) and reduced fat (20 to 30 % of total calories). The fatcomponent must be such that it contains a third to half of polyunsaturated fat, a third monounsaturatedfat sources and the remaining part may consist of saturated fat sources. The composition of food fatsis given in Table 29.2. It can help to modify one's diet in the right direction.

In a 2000 calorie diet, the calories from fat would thus be 400 to 600, which amounts to about 45to 65 grammes of fat in the diet, a third of it is taken in hidden form. Hidden fat as we have seen inchapter 5, occurs in foods such as milk, dahi, nuts, oilseeds, eggs and meat. Hidden fats content of dietvaries, but is estimated to provide about a third or more of the total fat in the diet. Thus the visible fatintake in the diet as butter, ghee and oil used in food preparation can be 30 to 40 grammes. In order tocontrol the saturated fat intake, the amounts of animal foods such as ghee, butter, cheese, eggs andmeats must be monitored to provide less than 15 grammes of the total fat intake.

Meal Planning and Food Exchange Lists

Food selection guide (table 29.3) and food exchange lists for meal planning (Appendix B) can bea valuable tool in choosing foods to be used in the diet.

Cereals and Their Products: It is advisable to include whole cereal products such as chapatti,bhakri, for most of the servings from this group.Parboiled rice may be used in fermented preparations such as idli. The intake of refined cerealproducts such as bread, nan, bhature etc. must be reduced. The number of servings from this

Table 29.3 Food Selection Guide

Foods – Include As per Prescription	*Foods Include Liberally*	*Foods to Avoid*
Cereals – rice, wheat	Green leafy vegetables	A. Fatty sweets– mithais, laddus, chocolates, shreekhand, basundi, rabdi, cakes, pastries, cream biscuits, pies, doughnuts etc.
Jowar, bajra, nachni etc.	Salad vegetables- All gourds, Fruit vegetables, Fruits – melons, amla *	B. Fatty fried foods– Shev, chivada, farsan, wafers, chaklis, Fried papad, kurdais, khari biscuits etc. bhajias, wadas, samosas, cutlets, etc.
Dals and legumes		
Milk without cream	Thin buttermilk	C. Nuts (esp. dried ones) cashews, groundnuts, coconut, almonds, walnuts etc.
Lean meat	Coconut water	D. Salty sauces and oily dressings
Fish and egg white	Clear soups condiments-lime juice	E. Sodium rich foods– pickles, papad, sandage, baked products made with baking powder
Vegetable oils	Tamarind, cocum, vinegar etc.	
Sugar, jaggery		F. Soft drinks and alcoholic drinks– beer, scotch etc.
Salt	Spices and spice mix to flavour food and garlic	

Whole milk cow's	64	29	4
Human milk	46	38	8
Cheddar cheese	65	28	3
Egg	10	13	2
Poultry	30-40	40-44	14-20
Fish (low fat)	2-5	2-3	4
Lamb, pork, beef	45-50	44	2-6
C. Nuts			
Groundnuts	9	25	14
Walnuts	4	10	40

groupvaries from 7 – 12 and depends on the person's total energy needs, but must provide 55 to 70 per centof the total calories.

Dals and Legumes: are important sources of protein, iron and B complex vitamins in the vegetarianIndian diet. It is advisable to use whole legumes which provide additional fibre. Cooked germinatedpulses provide some vitamin C also. The number of servings may vary from two to four, depending onthe age and the type of dietary (vegetarian or non-vegetarian)

Both fresh and germinated beans will help control cholesterol. The dry ones can be soaked andgerminated to add variety. The fibre helps to excrete CHOL and thus reduce its concentration in theblood.

`Milk and Its Products: Only toned milk or doubletoned milk, its curd, buttermilk and skim milkproducts can be used liberally. But limited amounts of whole milk, especially buffalo milk needs to beused after removing the fat layer after cooling. Similarly, ghee and butter, need to be used in verysmall amounts (only a teaspoon) as these are high in cholesterol and saturated fats.

Eggs, Fish, Poultry and Meat: Egg yolk is a concentrated source of cholesterol (275 mg/eachegg yolk). Whole egg intake is suggested to be a maximum of two per week, including those used inpreparations such as egg curry, cakes, custards, etc.Meat intake is suggested to be limited to one to two servings of lean cuts with all visible fatremoved. Fish (low fat ones) and chicken (with skin removed) may be used in these servings tocontrol fat intake.

Vegetables and Fruits: Vegetables and fruits are good sources of minerals, vitamins and fibre.The number of servings suggested are five to six, one of which should be a seasonal one rich in betacarotene.(leafy vegetables such as amaranth, fenugreek, spinach, radish leaves etc.) and anothervitamin C rich one. (amla, guava, orange, musumbi, papaya tomato, drumstick leaves etc.). The remainingthree servings may be selected from any of

seasonal beans and fruit vegetables.Fruits and vegetables are the best dietary source of antioxidants in the diet. The lycopene fromtomatoes has been shown to be particularly effective at stopping LDLs from oxidizing.

Vegetable Preparation: A variety of vegetable salads can be prepared. Dahi, lemon juice, herbs(coriander, mint, curry leaves) and spices (cumin seeds, mustard, fenugreek, asofoetida etc.) can beused to season these. Raw as well as cooked vegetables (pumpkin, gourds) are used to prepare saladsand raitas. Vegetables can be seasoned with a little oil and spices (whole and powdered) to enhance theflavour and acceptability according to the family pattern.

Sugars, Sweets and Low-fat Desserts: These must be used in limited amounts not exceeding three teaspoons of sugar, honey or jam; half a cup of kheer made with toned milk, 2-3 mints or 1/3 cupgelatin dessert.

Oils and Fats: Butter, ghee and animal organ fats (such as liver) are rich sources of vitamin A.But as these contain cholesterol (about 300 mg/100g) their intake must be restricted suitably to fit in thetotal dietary intake of 300 mg cholesterol per day

Meal Preparation Guidelines

A 1200 calories low fat vegetarian diet food exchanges are given in Table 29.5. The calories,protein, fat and cholesterol content of the diet is also included. Please note that when eggs and fleshfoods are excluded, the cholesterol content of the diet is reduced to 45mg by using toned milk and onlyone teaspoon of ghee or butter. The menu plan based on the foods indicated in Table 29.5 is presented after the table. A numberof variations of this menu can be made using the food selection guide given in Table 29.3 and foodexchanges in Appendix B. The food exchanges can be increased gradually to maintain one's ideal bodyweight, when the desired weight loss has occurred.

Alterations in Knowledge and Habits: It is important to know food composition (from authenticsources), learn to develop healthy eating habits, make wise choices while eating out. For sedentarypersons, increased physical activity will improve both physical fitness and food utilisation.Some clinicians prefer that the patients adhere to the dietary and life style changes, which havebeen found to reduce the serum cholesterol in a number of studies. A low fat, 1600 calorie diet tomaintain one's ideal body weight has been presented in table 29.6. The possibility exists that themedications used to alter the blood lipids may cause long-term negative effects

Table 29.5 Low Fat Diet – Vegetarian (1200 Calories)

Food	*Exchanges*	*Calories*	*Protein*	*Fat*	*Cholesterol*
Cereals	7	595	18	—	—
Dal	2	170	11	—	—
Milk (toned)	2	200	10	9	30
Egg/Flesh foods	—	—	—	—	—
Vegetable A	2	—	2	—	
Vegetable B	2	70	4–6	—	—
Fruits	2	40	—	—	—
Fat (half ghee)	2	90	—	10	16
Sugar	2	40	—	—	—
Total		1205	45 – 47	19	46

Total Calories: 1205, Protein: 45g, Fat: 19g

Calories from Protein	= 15%
Calories from fat	= 14%
Calories from carbohydrate	= 71%
Cholesterol	= 46 mg/day

Menu Plan

Morning –	Tea 1C (+ 1 tsp sugar)		
Breakfast	Milk 1C	**Tea + Snacks**	
	Bread 2 slices	Tea 1C (+ 1 tsp sugar)	
	Banana ½ big or 1 small	Dhokla – 4 pieces (no oil)	
Lunch	Chapati 1	**Supper**	
	Rice ½ C	Bhakari ½	
	Dal 1C	Rice ½ C	
	Palak Bhaji ½ C	Dal 1 C	
	Tomato Salad	French beans ½ C	
	Dahi ½ C	Cucumber Salad	
		Dahi ½ C	

Therapy in ailments of heart and blood vessels involves nutritional care.

Hypertension is the most common problem in humans in India, though almost seventy-five percent of the cases are mild. If unchecked, it can be a major risk factor for other serious heart conditions.Normal blood pressure is less than 140mm Hg Systolic and less than 85mm Hg diastolic.Hypertension has many causative factors though in 90 per cent of cases, the cause is unknown.

Atherosclerosis (narrowing of the arterial walls due to deposits of fatty material) causes resistanceto blood flow, making the heart to pump harder, thus increasing the blood pressure. The increase inblood pressure injures the arteries further, thus worsening the atherosclerosis.

Diet Therapy:

Hypertension may be often due to obesity, because the increased weight meansincreasing work of the heart to supply blood to the extra tissue formed. For many overweight hypertensivepeople, dietary changes which result in weight loss will lead to reduction in blood pressure. This maybe adequate therapy in mild cases. But there are normal and underweight persons who suffer fromhypertension.

The second possibility is excessive sodium intake, which draws more water into circulation, thusincreasing blood volume, leading to increased blood pressure. There are about 20 per cent people whoare sensitive to sodium and may be affected by excess sodium intake; other 80 per cent appear to berelatively free from the adverse effects of excessive sodium intake. Research studies have shown thatincrease in potassium intake can lower blood pressure. Increase in intake of alcohol in excess of 2 ozs.daily has a hypertensive effect, which increases with the amount consumed.

It is important to remember that blood pressure control is one of the most effective ways todecrease mortality in adults.In patients, whose only problem is mild hypertension (diastolc pressure of 90-94 mm Hg),therapy without use of drugs is used to achieve control. This includes:

(a) *Moderate sodium restriction* (1000-1500 mg/day): No salt in cooking or at the table. Noprocessed foods (pickles, papads, canned foods etc. containing salt). Four servings ofregular bread can be taken.

(b) *Adequate potassium intake*: Plant foods are rich sources of potassium, especially fruitsand vegetables. Potassium is present in higher concentration than sodium in fruits andvegetables by a factor of 5 to 50 fold. Hence intake of three to four servings of fruits, whichneed no preparation (hence no addition of salt), can ensure adequate potassium intake.

(c) *Regular exercise tailored to the individual is a must* – walking 5 kilometres daily has beenfound to be an ideal way to keep fit. It needs no equipment and can be undertaken in allweather.

(d) *Stress management*: is a very important aspect of therapy. It involves regular planning ofone's activities allowing realistic scheduling of work, relaxation, physical activity, mealtimes,prayer/meditation and rest. This removes the stress from one's days, as there is time availablefor each aspect of the day. Thus one does not rush from one activity to the other, gulp downfood on the run or skip meals. People under stress are unable to function effectively. Theyare worried and tense all through the day, because so many tasks are unfinished due to noplanning or poor planning. A planned, enjoyable routine of each day is the most importantpart of therapy to stress management.

(e) *Abstaining from alcohol consumption* is the most desirable part of the therapy. If one cannotfollow it, alcohol intake must be restricted to occasional 2 oz limit.

Sodium Restricted Diets

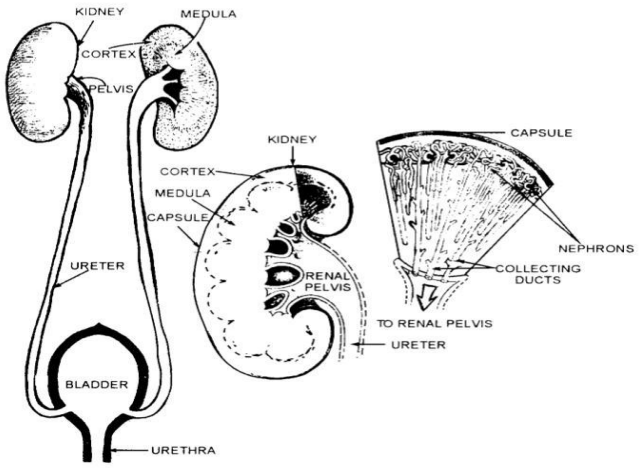
Most people's daily intake of salt is 3-7 g (3,000-7,000 mg). Levels of sodium restriction commonlyprescribed are:

500-700 mg is severe restriction. No sodium is used in cooking or at the table. Processed foods (pickles, papads, kurdais, wafers etc.) or canned vegetables containing salt are avoided.

Low sodium bread, if available, should be used. Vegetables which have naturally high sodium content are omitted.

(b) 1000 –1500 mg is moderate restriction. It is described above.

(c) 2000-3000 mg is mild restriction. Small measured amount of salt is used in cooking. A small plastic spoon (given with ice cream cups at stores) could be used to add salt in cooking, instead of a teaspoon to avoid excess sodium.



DIET IN KIDNEY DISEASES

Introduction

Like the liver, kidneys play a vital role in maintaining the body's normal state (homeostasis).There are two kidneys in the human body. The nephron is the basic functional unit of the kidney. Eachkidney has about a million nephrons. Each nephron has two main parts. Bowman's capsule (a cupshaped top of the nephron) with a network of capillaries called the glomeruli (plural of the wordglomerulus) in it, and the renal tubule. The tubule is a long winding tube, the first part of whichsurrounds the glomerulus. The fluid is driven by a pressure gradient from glomerulus into the tubuleand the filtration begins. As the filtrate moves along, the materials needed are returned to the blood andwaste material is carried to the bladder for storage and discharge at normal intervals.

Functions of Kidneys

The kidneys help to regulate the internal harmony by performing the following functions:

Filtration: The kidneys are the filters through which all dissolved substances pass and selectively absorb those to be retained. Figure 30.1 depicts the urinary system. The end products of protein metabolism (urea, creatinine, uric acid and urates) are removed from blood by filtration to be discarded in urine. Excess of chloride, potassium, sodium and hydrogen ions are also filtered out from the blood. By being selective filters, kidneys try to maintain a constant blood composition and volume.

Maintenance of Fluid, Electrolyte and Acid-base Balance. Ions from the blood are secreted into the urine to maintain acid-base balance In this process they monitor the composition and volume of blood and other body fluids. Kidneys maintain fluid electrolyte and acid-base balance as they carry out selective filtration.

Excretion: The kidneys excrete dissolved unwanted substances filtered out of the blood as urine.

The kidneys help regulate the blood pressure.

Kidneys produce erythropoietin (a hormone), which stimulates maturation of red blood cells in the bone marrow.

The conversion of vitamin D to its most active form calcitriol occurs in the kidneys. Activated vitamin D regulates the absorption of calcium and phosphorus and thus helps regulate calcium and phosphorus levels in the blood. When kidney function is disturbed due to disease or trauma, all the above functions are affected adversely.

Causes of Kidney Disease

Several ailments may cause kidney disorders. These include infection, degenerative changes,chronic diseases (e.g., diabetes mellitus, cardiovascular disorders such as atherosclerosis, hypertension),medications, toxic metal consumption, cysts, renal stones or trauma. Surgery, burns and poisons aresome traumas, which may cause kidney damage.

Obesity increases the risk of renal disease. Habitual intake of high protein diet may increase thework of kidneys and cause damage. Reducing weight, decreasing protein intake to normal level candecrease the risk of kidney disease.

Kidney Ailments

Any disease that affects the function of the glomerulus or tubule disturbs the body's ability toutilise food and can cause havoc

Glomerulonephritis

Nephritis is a general term used to indicate inflammation of the kidneys. When capillaries inglomeruli are inflamed, it is called glomerulonephritis.An acute form of glomerulonephritis often follows a streptococcal infection of the respiratorytract, tonsillitis, pneumonia or scarlet fever. It occurs mostly in children and young adults. If theinfection is very mild, it may not be detected and treated, resulting in permanent damage to the system,which may be detected after many years. The symptoms include nausea, vomiting, fever, rise in bloodpressure, albumin (proteinuria) and small amounts of blood in the urine (hemanuria) and edema.Usually recovery is complete.

Diet Therapy: When there is nausea and vomiting in the acute stage, sweetened fruit juices,sweetened tea, ginger-lemon sherbet, high carbohydrate, low electrolyte supplements are given. Thesehelp to reduce tissue breakdown. Fluid intake is monitored in proportion to the urine output.As soon as the patient is able to eat, a diet to maintain weight containing sufficient calories isgiven. If urine volume is decreased (as in oliguria) fluid is limited. Protein is also restricted to 40g. Theproteins included must be of high biological value. Sodium is limited to 1g/day. Table 30.1 presents dietand a menu plan for such a patient.

Chronic Glomerulonephritis

It can either be an untreated acute glomerulonephritis or an immunological cause of unknownorigin. In the early stages, abnormal urine analysis results such as protein, red and white blood cells areobserved in the urine. As the ailment advances, the patient may suffer from tiredness, edema, increasein blood pressure and blurred vision. As the kidneys cannot concentrate urine, there is frequent urinationand need to urinate often in the night, thus disturbing sleep. If not checked by treatment, it can lead tochronic renal failure.

Diet Modification: The diet must be planned to suit the patient's kidney capacity.Normal intake of protein is planned when kidneys are able to excrete wastes. If proteins areexcreted in the urine, the protein losses must be covered by appropriate increase in the diet of proteinsof high biological value.When the blood urea nitrogen rises with the worsening of kidney function, the protein in the dietmust be reduced to 30-40 g or less. At the same time, the energy intake through carbohydrate and fatmust be enough to prevent tissue breakdown.If

Table 30.1 Diet in Glomerulonephritis

Calories – 1800, Protein – 40 g, Na – 800 mg

Food Groups	*No. of Exchanges*	*Protein (g)*	*Calories (kcal)*	*Na (mg)*
Cereals	9	18	900	45
Legumes and Pulses	2	11	200	20
Milk, toned	2	10	200	48
Egg / chicken / fish	½	3	40	10 - 65
Vegetables A	2	—	—	20
Vegetables B	2	2	60	20
Fruit	2	—	100	20
Fat	2	—	180	—
Sugar	5	—	100	—
	Total	43	1780	183–238

Meal Plan

Meal	*Menu Items*	*Drink*
Breakfast	1 Egg, 2 toasts, orange/mosumbi	tea/coffee
Lunch	1c rice, 1 chapati, 1s french beans, 1s dal, ½ s dahi	
Tea	1s upma/pohe, 1 banana	tea
Supper	1c rice, 2 phulkas, 1c dal, 1s ridge gourd bhaji, ½c dahi	

there is edema, sodium intake needs to be restricted. Due to poor reabsorption of the nutrients,loss of iron can lead to anemia. Hence iron supplements are needed.

Nephrotic Syndrome

This includes lipoid nephrosis, a rare condition, which affects children. It may also be due toprogression of chronic glomerulonephritis or be related to toxins of streptococci.There is a degeneration of kidney tissue, which permits protein loss through the filtrate. Largeamounts of proteins (albumins) are thus lost through the urine from the body.In the beginning, there is swelling of eyelids and legs due to fluid retention in the body. Loss ofalbumin in urine leads to low serum albumin values, at the same time, cholesterol level in the blood-increases. In this rare disease, mortality is high.

Diet Modifications: Diet treatments must rectify edema, excessive protein loss and malnutrition(anemia, etc.)

- Protein allowance is increased to 2-3g/kg for children and 75-100g for adults, providedthrough high quality proteins (Table 30.2). High protein intake may sometimes hastenworsening of renal condition. Hence some authorities recommend 1.6 to 1.8g/kg of proteinof high biological value. High protein supplements with low sodium content are useful.
- Energy allowance must be adequate to permit use of protein from the diet for tissue synthesis.About 50-60 calories/kg body weight need to be given.

  Sodium level needs to be kept at about 500 mg to prevent edema. Low sodium sources ofvegetables and fruits are given in table 30.3.
- Dietary fat and cholesterol may be limited to control hyperlipidemias

Table 30.2 Diet for a Patient with Nephrotic Syndrome

Wt. of the patient – 45 kg Calories 50 – 60/kg
Calories – 2400, Protein 85 g, Na – 500 mg/day

Food Groups	*No. of Exchanges*	*Proteins (g)*	*Calories (kcal)*	*Na (mg)*
Cereals	10	20	1000	50
Legumes and Pulses	2	11	200	20
Milk, toned	4	20	400	96
SMP	50g	19	180	260
Fish/chicken/duck	2	10	100	30 – 60
Vegetables A	2	—	—	20
Vegetables B	2	4	60	10
Fruits	2	—	100	10
Sugar	6	—	120	—
Oils, fats	2	—	180	—
	Total	84	2,340	496–516

Acute Kidney Failure

Acute kidney failure is sudden, often reversible in a patient who had limited function earlier. Whenkidneys are not able to carry out their normal function of maintaining the internal chemical environmentof the body by filtering out the wastes and excreting them, it is known as renal failure. It often developsdue to gradual destruction of renal tissue by the disease or may occur suddenly as in nephrosis orobstruction of the tract.

When the glomerular filtration rate rapidly drops to less than 20 ml/minute, there is a fast rise inthe serum urea and creatinine. When the rate drops further to 10 ml/minute or less, an excess of ureaand other nitrogenous wastes appear in the blood, which are symptoms of uremia. Simultaneously,there is inability to urinate, with urine output decreasing to less than 100 ml/day. At this stage, thepatients may suffer from drowsiness, weakness, fatigue or may have headache, itching or blurredvision. Acute renal failure leads to death in one-fourth of the cases. The percentage increases to half, ifthe patient is over 75 years or there is associated trauma.

Dialysis has proved to be a boon for such patients. It is instituted until kidney function is regained.

Table 30.3 Low Sodium sources of Vegetables and Fruits

Sodium Content	*Vegetables*
1. Less than 5 mg/100 g EP	Bitter gourd (green), bottle gourd. brinjal, french beans, onion stalks, parwar, ridge gourd, onions
2. 5 to 11 mg/100 g EP	Pumpkin, ladies finger (bhendi), peas, cucumber, colocasia, potato, sweet potato, tapioca (dried chips), yam, brussel sprouts
3. 12 – 15 mg/100 g EP	Cabbage, green plantain.
	Fruits
4. Less than 6 mg/100 g EP	Amla, guava, orange, papaya, peaches, plums, chiku, pomegranates, tree tomato, phalsa.
5. 7 to 13 mg/100 g EP	Pears, ripe tomato.

Dietary Modifications: In the first 24-48 hours, food and liquid intake by mouth are restricted.Glucose is given intravenously as oral intake is limited due to nausea, vomiting and lack of appetite.Sometimes tube feeding or total parenteral nutrition (TPN) is used. Dialysis is essential when TPN isused.

A protein free diet may be given before a patient is put on dialysis. Another approach is to giveglucose with essential amino acids orally, by tube feeding.The fluid allowance is 500 ml to make up for insensible water losses plus the urine output. Morefluid is provided if there is vomiting, diarrhea, fever, etc. to prevent dehydration.Energy intake should be enough to prevent catabolism. 20-40g protein is given with gradualincrease to normal levels with improvement in kidney function. The serum electrolytes and urineoutput are constantly monitored so that appropriate diet and fluid intake adjustments can be made.Diet is modified as the patient regains normal kidney function, in the recovery phase of theailment.

Chronic Renal Failure

Gradual loss of kidney function is the beginning, but if it silently continues, the glomerular filtrationrate begins to reduce leading to chronic renal failure. Kidneys have a vast reserve capacity, whichallows them to support life through much of this progressive deterioration. When the glomerular filtrationrate (GFR) drops from normal 125 ml/minute to less than 30 ml/minute, dietary modification is initiatedWhen the GFR reduces to 3 ml/minute, dietary control is not sufficient and dialysis or kidneytransplant is necessary to save the life of the patient.

Dietary Modifications: The diet planning takes into account the stage of the disease, its causes,blood levels of urea and electrolytes, nutritional status, other diseases occurring and if the patient is ondialysis. The patients awaiting dialysis have a more severely restricted diet compared to those who areon dialysis.

Energy: To prevent tissue breakdown and release of nitrogen and potassium into circulation, anintake of 1900-2000 cal/day is indicated. Main sources of energy are carbohydrates and fats. Theirmetabolic end products do not pose a problem for the excreted through lungs(CO_2), sweat glands (water) and bowel (semisolid residue)Protein: Protein intake is reduced to reduce work of kidneys of excreting end products ofprotein metabolism (namely, urea, creatinine, uric acid, sulfate and organic acids) in the urine. Most ofthe protein (65 to 75 per cent) in the diet should be of high biologic value

Table 30.4 Diet for a Patient with Chronic Renal Failure

30–40 protein, 1900 calories, 500 mg Na per day

Food	*No. of Exchanges*	*Proteins (g)*	*Calories (kcal)*	*Na (mg)*
Cereals	8	16	800	40
Dals & Pulses	1	6	100	10
Milk, toned	1	5	100	24
Fish/chicken	½	5	40	10–37
Vegetables A	2	—	—	30
Vegetables B	3	3*	150	20
Fruits	2	—	100	15
Sugar	10	—	200	—
Oils, fats	4	—	360	—
	Total	35	1850	176

Meal Plan**

Meal	*Items*	*Drink*
Breakfast	1 parantha / chapati-bhaji. banana	Tea/coffee
Lunch	1 ½ chapati, thick dal, rice (½ c), ½ c buttermilk	
Tea	1 s upma, orange/musumbi	Tea
Supper	Rice (2s), Phulkas (2), cabbage, bhaji, egg curry	

UNIT – 3
NUTRITION FOR INFANTS

INFANCY (BIRTH TO 1 YEAR)

Excluding fetal growth, growth in the fi rst year of life is more rapid than at any other time in the life cycle. Birth weight doubles by 4 to 6 months of age and triples by the fi rst birthday. Length increases by approximately 10 in during the fi rst year. Adequate calories and nutrients are needed to support the unprecedented rate of growth.

Recommendations for the amount of calories, macronutrients, vitamins, and minerals infants should consume are based on the average intakes of healthy full-term newborns who are exclusively breastfed by well-nourished mothers. Although the total amount of calories and nutrients are generally far less than what adults need, the infant's needs are much higher per kilogram of body weight. Proportionately, infants use large amounts of energy and nutrients to fuel their body processes and growth.

Breast Milk

Breast milk is specifically designed to support optimal growth and development in the newborn, and its composition makes it uniquely superior for infant feeding (Box 12.1) (American Academy of Pediatrics [AAP], 2012a). Breastfeeding is credited with numerous potential health benefits for the infant, including lower risks of otitis media, upper respiratory tract infection, lower respiratory tract infection, asthma, atopic dermatitis, gastroenteritis, obesity, celiac disease, type 1 and type 2 diabetes, certain types of leukemia, and sudden infant death syndrome (AAP, 2012a). Although many of these benefits are linked to breastfeeding for 3 months of more, some benefi ts occur with any duration of breastfeeding, such as the reduced risk of obesity and type 2 diabetes.

Box 12.1 Composition of Breast Milk

- The protein content of breast milk is adequate to support growth and development without contributing to an excessive renal solute load.
- The majority of the protein is easy-to-digest whey.
- Breast milk contains small amounts of amino acids that may be harmful in large amounts (e.g., phenylalanine) and high levels of amino acids that infants cannot synthesize well (e.g., taurine).
- The fat in breast milk is easily digested because of fat-digesting enzymes contained in the milk.
- The content of linoleic acid (an essential fatty acid) is high.
- The high level of cholesterol is believed to help infants develop enzyme systems capable of handling cholesterol later in life.
- Breast milk contains amylase (a starch-digesting enzyme), which may promote starch digestion in early infancy when pancreatic amylase is low or absent.
- Breast milk contains enough minerals to support adequate growth and development but not excessive amounts that would burden immature kidneys with a high renal solute load.
- The minerals are mostly protein bound and balanced to enhance bioavailability. For instance, the rate of iron absorption from breast milk is approximately 50% compared with about 4% for iron-fortified formulas. Zinc absorption is better from breast milk than from either cow's milk or formula.
- All vitamins needed for growth and health are supplied in breast milk, but the vitamin content of breast milk varies with the mother's diet.
- The renal solute load of breast milk is approximately one-half that of commercial formulas. The low renal solute load is suited to the immature kidneys' inability to concentrate urine.
- Athough they are more abundant in colostrum, antibodies and anti-infective factors are present in mature breast milk. Bifidus factor promotes the growth of normal gastrointestinal (GI) flora (e.g., *Lactobacillus bifidus*) that protect the infant against harmful GI bacteria.

Infant Formula

Infant formulas may be used in place of breastfeeding, as an occasional supplement to breastfeeding, or when exclusively breastfed infants are weaned before 12 months of age. Term formulas contain cow's milk protein and lactose and are made to resemble human milk. The Infant Formula Act regulates the levels of nutrients in formulas, specifying both minimum and maximum amounts of each essential nutrient. Almost all formula used in the United States is iron fortified, a practice that has greatly reduced the risk of iron deficiency in older infants (Krebs and Hambidge, 2007). Because the minimum recommended amount of each nutrient is more than the amount provided in breast milk, nutrient supplements are unnecessary. There are no data to support the use of one term formula over another; they are all nutritionally interchangeable (O'Connor, 2009).

Box 12.3 Teaching Points for Breastfeeding

- The infant should be allowed to nurse for 5 minutes on each breast on the first day to achieve letdown and milk ejection. By the end of the first week, the infant should be nursing up to 15 minutes per breast.
- In the first few weeks of breastfeeding, the infant may nurse 8 to 12 times every 24 hours. Mothers should offer the breast whenever the infant shows early signs of hunger, such as increased alertness, physical activity, mouthing, or rooting. After breastfeeding is well established, eight feedings every 24 hours may be appropriate.
- The first breast offered should be alternated with every feeding so both breasts receive equal stimulation and draining.
- Even though the infant will be able to virtually empty the breast within 5 to 10 minutes once the milk supply is established, the infant needs to nurse beyond that point to satisfy the need to suck and to receive emotional and physical comfort.
- The supply of milk is equal to the demand—the more the infant sucks, the more milk is produced. Infants age 6 weeks or 12 weeks who suck more are probably experiencing a growth spurt and so need more milk.
- Water and juice are unnecessary for breastfed infants in the first 6 months of life, even in hot climates.
- Early substitution of formula or introduction of solid foods may decrease the chance of maintaining lactation.
- Infants weaned before 12 months of age should be given iron-fortified formula, not cow's milk.
- Both feeding the infant more frequently and manually expressing milk will help to increase the milk supply.
- Breast milk can be pumped, placed in a sanitary bottle, and immediately refrigerated or frozen for later use. Milk should be used within 24 hours if refrigerated or within 3 months if stored in the freezer compartment of the refrigerator.

Box 12.4 Teaching Points for Formula Feeding

One of the greatest hazards of formula feeding is overfeeding. Never force the infant to finish a bottle or to take more than he or she wants. Signs that an infant is finished include biting the nipple, puckering the face, and turning away from the bottle. Discourage the misconception that "a fat baby = a healthy baby = good parents."
Each feeding should last 20 to 30 minutes.
Formula may be given at room temperature, slightly warmed, or directly from the refrigerator; however, always give formula at approximately the same temperature.
Spitting up of a small amount of formula during or after a feeding is normal. Feed the infant more slowly and burp more frequently to help alleviate spitting up.
Hold the infant closely and securely. Position the infant so that the head is higher than the rest of the body.
Avoid jiggling the bottle and making extra movements that could distract the infant from feeding.
Check the flow of formula by holding the bottle upside down. A steady drip from the nipple should be observed. If the flow is too rapid because of a too large nipple opening, the infant may overfeed and develop indigestion. If the flow rate is too slow because of a too small nipple opening, the infant may tire and fall asleep without taking enough formula. Discard any nipples with holes that are too large, and enlarge holes that are too small with a sterilized needle.
Reassure caregivers that there is no danger of "spoiling" an infant by feeding him or her when the infant cries for a feeding.
Burp the infant halfway through the feeding, at the end of the feeding, and more often if necessary to help get rid of air swallowed during feeding. Burping can be accomplished by gently rubbing or patting the infant's back as he or she is held on the shoulder, lies on his or her stomach over the caregiver's lap, or sits in an upright position.
After the teeth erupt, the baby should be given only plain water for a bedtime bottle-feeding. Never prop the bottle or put the infant to bed with a bottle.

Recently, formulas with long-chain polyunsaturated fatty acids (arachidonic acid and docosahexaenoic acid [DHA], an omega-3 fatty acid) have been marketed to promote eye and brain development (O'Connor, 2009). They are more costly than routine formulas, and most well-conducted randomized trials show no benefit to using them.A variety of other formulas are available (Table 12.1):

- Preterm formula is intended for infants born before 34 weeks of gestation. Designed to promote "catch-up" growth, these formulas are higher in calories, protein, calcium, magnesium, and phosphorus than routine formulas. Hospital discharge before 34 weeks of gestational age is rare, so these formulas are typically only used in the hospital.
- Enriched formula for infants 34 to 36 weeks of gestation—these formulas contain more calories than term formula but less than preterm formula.

- Soy formula that is intended to be used only for infants with galactosemia or congenital lactase deficiency or from strict vegan families.

However, soy formula accounts for almost 25% of formulas sales in the United States (Bhatia and Greer, 2008). Recently, an expert panel was convened to evaluate the safety of soy formula on infant and child development arising from laboratory animal studies that showed the isoflavones found in soy formulas had an adverse effect on development (National Institute of Environmental Health Sciences, National Institutes of Health, U.S. Department of Health and Human Services [USDHHS], 2010).
The National Toxicology Program concurred with the opinion of the expert panel that there is minimal concern for adverse effects on development in infants who consume soy formula.

- Lactose-free formula that contains a corn-based carbohydrate for infants with congenital or primary lactase deficiency, galactosemia, or gastroenteritis in at-risk infants
- Hypoallergenic and nonallergenic formulas for infant with an allergy to milk protein
- Antireflux formulas for infants with gastroesophageal reflux
- Specialty formulas for infants with inborn errors of metabolism, such as phenylketonuria (PKU) or maple syrup urine disease. These specialized formulas are intentionally lacking or deficient in one or more nutrients, so they do not supply adequate nutrition for normal infants. They must be supplemented with small amounts of regular formula.The amount of formula provided per feeding and the frequency of feeding depend on the infant's age and individual needs. General parameters are provided in Table 12.2. Overfeeding is one of the biggest

Table 12.1 Infant Formulas

Category	Carbohydrate Source	Protein Source	Indications
Formulas providing 20 cal/oz			
Term formula (e.g., Enfamil with iron, Similac with iron)	Lactose	Cow's milk	Routine
Term formula with added long-chain fatty acids (e.g., Enfamil Lipid, Similac Advance)	Lactose	Cows' milk	Claims to promote eye and brain development
Soy formula (e.g., Enfamil ProSobee, Similac Isomil)	Corn based	Soy	Congenital lactase deficiency, galactosemia
Lactose-free formula (e.g., Enfamil Lactofree, Similac Sensitive)	Corn based	Cow's milk	Congenital and primary lactase deficiency, galactosemia; gastroenteritis in at-risk infants
Hypoallergenic formula (e.g., Enfamil Nutramigen, Similac Alimentum)	Corn or sucrose	Extensively hydrolyzed protein	Milk protein allergy
Antireflux formula (e.g., Similac Sensitive RS)	Lactose thickened with rice starch	Cow's milk	Gastroesophageal reflux
Formulas providing 24 cal/oz			
Preterm formula (e.g., Enfamil 24 Premature, Similac 24 Special Care)	Lactose	Cow's milk	Less than 34 weeks of gestation; weight less than 3 pounds 15 oz
Formulas providing 22 cal/oz			
Enriched formula (e.g., Enfacare, Similac Neosure)	Lactose	Cow's milk	34–36 weeks of gestation; weight of 3 pounds 15 oz or greater

Source: O'Connor, N. (2009). Infant formula. *American Family Physician, 79,* 565–570.

hazards of formula feeding. Caregivers should recognize

Infant Feeding and Obesity

Many overweight infants remain overweight as children; childhood obesity has long been known as a strong predictor of adult obesity (Whitaker, Wright, Pepe, Seidel, and Dietz, 1997). Research suggests that the critical period for establishing dietary intake patterns, eating habits, and food preferences begins in infancy and, although inconsistent, may be set as early as 2 years of age (Cashdan, 1994). Strategies to reduce rates of overweight in very young children are gaining greater attention, particularly parental feeding practices that may promote obesity, such as inattention to hunger and satiety cues or using controlling, rewarding, or restrictive feeding (Dattilo et al., 2012).

Breastfeeding duration and/or exclusivity has been inversely related to the rate of weight gain during infancy and with weight and risk of overweight and obesity in toddlers and preschoolers (Gillman, 2008; Griffiths, Smeeth, Hawkins, Cole, and Dezateux, 2009; Gunnarsdottir, Schack-Neilsen, Michaelsen, Sørensen, and Thorsdottir, 2010; USDHHS, 2011).

Complementary Foods: Introducing Solids

Introducing complementary foods earlier than 4 months of age is associated with early or excessive weight in infants, toddlers, and preschoolers (Hawkins, Cole, and Law, 2009; Huh, Rifas-Shiman, Taveras, Oken, and Gillman, 2011; Sloan, Gildea, Stewart, Sneddon, and Iwaniec, 2008). Parents are urged to delay introducing solid foods until the infant exhibits developmental readiness.Physiologically, complementary foods become a necessary source of nutrients at around 6 months of age because neonatal nutrient reserves become depleted and the concentrations of some nutrients in breast milk, such as zinc, decline over time (Krebs and Hambidge, 2007). Developmentally, most infants exhibit readiness to spoon-feed around 4 to 6 months of age as refl exes disappear, head control develops, and the infant is able to sit. Over time, control of the head, neck, jaw, and tongue; hand–eye coordination; and the ability to sit, grasp, chew, drink, and self-feed evolve. The eruption of teeth indicates readiness to progress from strained to mashed to chopped fi ne to regular consistency foods. Guidelines for introducing solids on the basis of developmental readiness appear in Table 12.3.For both breast-fed and formula-fed infants, iron-fortified infant cereal is traditionally the first solid food introduced. To increase the likelihood of acceptance, parents are urged to give a small amount of formula or breast milk to take the edge off hunger before beginning the cereal. Iron-fortified infant cereals are recommended until the infant is 12 to 18 months old because the iron in these cereals is absorbed more readily than that from other cereals

WEANING

Early feeding of foods other than milk may lead to allergies

Solid foods should not be introduced before 4 to 6 months of age and should be done gradually.

Solids should be started with iron- fortified rice cereal.

Cooked and pureed vegetables, then pureed fruits, egg yolk, and finally, finely ground meats.

Honey should never be given to an infant because it could be contaminated with Clostridium botulinum bacteria.

When the infant learns to drink from a cup, juice can be introduced.

Juice should never be given from a bottle because babies will fill up on it and not get enough calories from other sources.

Avoid foods on which the child can choke such as hot dogs, nuts, grapes, popcorn, small candies and tough pieces of meat or vegetables

By age one year most babies can eat foods from all food groups.

Avoid excess sugar and salt.

Help children develop an active lifestyle and healthy eating habits.

Box 12.5 Tips to Create a Positive Eating Environment

- Keep in mind that it is not important if a child refuses to eat a particular food (e.g., spinach), so long as the child has a reasonable intake from each major food group.
- Offer a variety of foods, not just the ones you like. Repeated exposures may be needed before a child accepts a new food.
- Fat and cholesterol should not be limited in the diets of very young children, who need fat and cholesterol for their developing brains and nervous systems.
- Never force a child to eat; if a healthy child is hungry, he or she will eat.
- Do not use food to reward, punish, bribe, or convey love.
- Let toddlers explore and enjoy food, even if it means eating with their fingers.
- Space meals further apart and limit snacking so the child will be hungry at mealtimes.
- Keep mealtime relaxed, pleasant, and unhurried, allowing 20 to 30 minutes per meal.
- Eat with the child.
- Children may refuse to eat because they are (1) too excited or distracted, (2) seeking attention, (3) expressing independence, (4) too tired, or (5) simply not hungry. When any of these instances occur, remove the child's plate without comment. If the child wants a snack later, make it nutritious.

Table 12.3 Sequence of Infant Development and Feeding Skills in Normal, Healthy, Full-Term Infants*

Developmental Skills			
Baby's Approximate Age	**Mouth Patterns**	**Hand and Body Skills**	**Feeding Skills or Abilities**
Birth through 5 months 	▪ Suck/swallow reflex ▪ Tongue thrust reflex ▪ Rooting reflex ▪ Gag reflex	▪ Poor control of head, neck, trunk ▪ Brings hands to mouth around 3 months	▪ Swallows liquids but pushes most solid objects from the mouth
4 months through 6 months 	▪ Draws in upper or lower lip as spoon is removed from mouth ▪ Up-and-down munching movement ▪ Can transfer food from front to back of tongue to swallow ▪ Tongue thrust and rooting reflexes begin to disappear ▪ Gag reflex diminishes ▪ Opens mouth when sees spoon approaching	▪ Sits with support ▪ Good head control ▪ Uses whole hand to grasp objects (palmar grasp)	▪ Takes in a spoonful of pureed or strained food and swallows it without choking ▪ Drinks small amounts from cup when held by another person, with spilling
5 months through 9 months 	▪ Begins to control the position of food in the mouth ▪ Up-and-down munching movement ▪ Positions food between jaws for chewing	▪ Begins to sit alone unsupported ▪ Follows food with eyes ▪ Begins to use thumb and index finger to pick up objects (pincer grasp)	▪ Begins to eat mashed foods ▪ Eats from a spoon easily ▪ Drinks from a cup with some spilling ▪ Begins to feed self with hands
8 months through 11 months 	▪ Moves food from side-to-side in mouth ▪ Begins to curve lips around rim of cup ▪ Begins to chew in rotary pattern (diagonal movement of the jaw as food is moved to the side or center of the mouth)	▪ Sits alone easily ▪ Transfers objects from hand to mouth	▪ Begins to eat ground or finely chopped food and small pieces of soft food ▪ Begins to experiment with spoon but prefers to feed self with hands ▪ Drinks from a cup with less spilling
10 months through 12 months 	▪ Rotary chewing (diagonal movement of the jaw as food is moved to the side or center of the mouth)	▪ Begins to put spoon in mouth ▪ Begins to hold cup ▪ Good eye-hand-mouth coordination	▪ Eats chopped food and small pieces of soft, cooked table food ▪ Begins self-spoon feeding with help

*Developmental stages may vary with individual babies.

Source: U.S. Department of Agriculture Food Nutrition Service. (n.d.). *Feeding infants. A guide for use in child nutrition programs.* Available at www.fns.usda.gov/tn/Resources/feedinginfants-ch2.pdf. Accessed on 11/13/12.

Advantages of Brest feeding:

Provides infant with temporary immunity to many infectious diseases
It is economical, nutritionally perfect, and sterile.
Breast milk is easily digested.
Breastfed infants have fewer infections.
Breastfeeding promotes oral motor development.

Colostrum:

Is thin yellow fluid first secreted by the mammary gland a few days before and after childbirth.
Contains up to 20% more protein, more minerals and less lactose and fat than mature milk
Contains immunoglobulin's representing the antibodies found in maternal blood 6
Indications of adequate nutrition include:
The infant has six or more wet diapers per day.
The infant has normal growth.
The infant has 1–2 bowel movements per day.
The breast becomes less full during nursing.
Bottle Feeding
Formulas are made from modified cow's milk to resemble breast milk in value.

Synthetic formula made from soybeans may be used for allergic infants.
Formula must be prepared with the correct amount of water to prevent health complications.
Cow's milk can cause gastrointestinal blood loss in infants and should not be used.
Use consistent temperature for formula.
The infant should be held in a semi upright position.
Nutritional Requirements of the Infant
Base of infants' diet is breast milk or formula.
Except for Vit D, breast milk provides all the nutrients an infant needs for the first 4- 6 months of life
Essential vitamins and minerals can be supplied in breast milk, formula, and food
Infants are born with a 3-6 month supply of iron
A vitamin K supplement is routinely given at birth.
Nutritional needs depend on a child's growth rate.
Feeding Schedules Babies should be fed on demand, in other words whenever the baby is crying. This is about every 2 hours in early weeks extends to 4 hours after about 2-3 weeks
Infants with special nutritional needs:
Premature infants
Children with cystic fibrosis
Failure to thrive
Metabolic disorders such as (Galactosemia and Phenylketonuria)

Premature Infants:

An infant born before 37 weeks of gestation
The sucking reflex is not developed until 34 weeks of gestation.
Infants born earlier will require total parenteral nutrition, tube feedings, or bolus feedings.

Cystic Fibrosis

An inherited disease in which the body secretes abnormally thick mucus and decreased production of digestive enzymes and malabsorption of fat.
Recommendation: 35%–40% of diet should be from fat and digestive enzymes can be taken in pill form - Digestive enzymes and fat-soluble vitamin supplementation at meal times

Galactosemia

A condition in which there is a lack of the liver enzyme transferase.
Transferase normally converts galactose to glucose.
The amount of galactose in the blood becomes toxic.
Results in diarrhea, vomiting, edema, and abnormal liver function.
Cataracts may develop, galactosuria occurs, and mental retardation occurs.

Diet therapy:

- Exclusion of anything containing milk from any mammal
- Nutritional supplements of calcium, vitamin D, and riboflavin
- Infant receives lactose-free, commercially prepared formula
- Lifelong elimin^{0}ation of lactose in diet

Phenylketonuria (PKU)

Infants lack the liver enzyme phenylalanine hydroxylase, which is necessary for the metabolism of the amino acid phenylalanine. - Infants are normal at birth, but if untreated become hyperactive, suffer seizures, and become mentally retarded between 6 and 18 months old.

Diet therapy: - Commercial formula Lofenalac - Regular blood tests - Synthetic milk for older children - Avoidance of phenylalanine - Lifelong diet therapy - Hospitals are required to screen newborns for PKU before discharge. 27

Foods allowed for PKU: fats, sugars, jellies, fruits, vegetables, cereals, special phenylalanine-free synthetic milk
Foods not allowed for PKU: meats, fish, poultry, eggs, milk, cheese, nuts, dried beans and peas, commercially prepared products made from regular flour 28

UNIT – 4
Nutritional Requirements in Different Age Groups

NUTRITION FOR TODDLERS AND PRESCHOOLERS

Evidence suggests that dietary habits acquired in early childhood persist through to adulthood (Kelder, Perry, Klepp, and Lytle, 1994). Parents are the primary gatekeepers and role models for their young children's food intake and habits; their feeding practices and style have been shown to affect children's eating behavior and their weight status (de LauzonGuillain et al., 2012). Parents should decide what foods the child is offered, when the child eats, and where eating takes place; the child should decide whether he or she wants to eat. Although it is commonly assumed that children who are allowed to self-serve consume fewer calories, results of a recent study showed that this is not necessarily true (Savage, Haisfi, Fisher, Marini, and Birch, 2012). Some children need guidance and rules to learn how to self-select appropriate portion sizes. Tips for getting children on the path to healthy eating appear inFigure12.2.Calories and Nutrients.There is very little research on the best ways to achieve optimal nutritional intakes from
1 to 2 years of age, the transition period betweeninfancy and childhood. The dramatic decrease in growth rate is reflected in a disinterest in food, a "physiologic anorexia" due to lower calorie needs per kilogram of body weight. Two-year-olds should eat approximately 1000 calories per day in three meals with one to two snacks.
The Dietary Guidelines for Americans, 2010 are intended for people who are age 2 years and older; thus, the content of childhood diets should be similar to that of adult diets. The basic messages are to choose whole grains for at least half the total grain intake; eat plenty of colorful fruit and vegetables; choose low-fat or nonfat milk; choose lean proteins; and limit solid fats, added sugars, and sodium (U.S. Department of Agriculture [USDA], USDHHS 2010

Meal and Snack Pattern

These patterns show one way a 1000 and 1600 calorie Daily Food Plan can be divided into meals and snacks for a preschooler. Sample food choices are shown for each meal or snack.

1000 Calorie Plan

Breakfast	
1 ounce grains 1/2 cup fruit 1/2 cup dairy*	Cereal and banana *1 cup crispy rice cereal* *1/2 cup sliced banana* 1/2 cup milk*

Morning Snack	
1/2 ounce grains 1/2 cup fruit	1/2 slice cinnamon bread 1/2 large orange

Lunch	
1 ounce grains 1/4 cup vegetables 1/2 cup dairy* 1 ounce protein foods	Open-faced chicken sandwich and salad *1 slice whole wheat bread* *1 slice American cheese** *1 ounce sliced chicken* *1/4 cup baby spinach (raw)* *2 Tbsp. grated carrots*

Afternoon Snack	
1/4 cup vegetables 1/2 cup dairy*	1/4 cup sugar snap peas 1/2 cup yogurt*

Dinner	
1/2 ounce grains 1/2 cup vegetables 1/2 cup dairy* 1 ounce protein foods	Chicken & potatoes *1 ounce chicken breast* *1/4 cup mashed potato* 1/4 cup green peas 1/2 small whole wheat roll 1/2 cup milk*

1600 Calorie Plan

Breakfast	
1 ounce grains 1/2 cup fruit 1/2 cup dairy*	Cereal and banana *1 cup crispy rice cereal* *1/2 cup sliced banana* 1/2 cup milk*

Morning Snack	
1 ounce grains 1/2 cup fruit 1 ounce protein foods	Egg sandwich *1 slice bread* *1 hard cooked egg* 1/2 large orange

Lunch	
1 ounce grains 1/2 cup vegetables 1/2 cup fruit 1/2 cup dairy* 1 ounce protein foods	Open-faced chicken sandwich and salad *1 slice whole wheat bread* *1 slice American cheese** *1 ounce sliced chicken* *1/2 cup baby spinach (raw)* *1/4 cup grated carrots* *1 small frozen banana*

Afternoon Snack	
1/2 cup vegetables 1/2 cup dairy*	1/2 cup sugar snap peas 1/2 cup yogurt*

Dinner	
2 ounce grains 1 cup vegetables 1 cup dairy* 3 ounces protein foods	Chicken & potatoes *3 ounces chicken breast* *1/2 cup mashed potato* 1/2 cup green peas 2 small whole wheat rolls 1 cup milk*

*Offer your child fat-free or low-fat milk, yogurt, and cheese.
Source: choosemyplate.gov

FIGURE 12.4 Meal and snack pattern. (Available at www.choosemyplate.gov)

NUTRITION FOR CHILDREN

Childhood represents a more latent period of growth compared to infancy and adolescence. Before puberty, children annually grow 2 to 3 in in height and gain about 5 pounds on average. Although there are individual differences, usually a larger child eats more than a smaller one; an active child eats more than a quiet one; and a happy, content child eats more than an anxious one. School-age children maintain a relatively constant intake in relation to their age group; children who are considered big eaters in second grade are also big eaters in sixth grade.

Calories and Nutrients

Total calorie needs steadily increase during childhood, although calorie needs per kilogram of body weight progressively fall. The challenge in childhood is to meet nutrient requirements without exceeding calorie needs. My Plate food and calorie level guidelines for ages 6 to 18 years are shown in Table 12.4.

Table 12.4 MyPlate Food and Calorie Intake Levels Recommended for 6- to 18-Year-Olds

Daily Amount of Calories and Food Recommended by Age and Gender for Moderately Active Individuals*							
Age							
Males	6–8	9–10	11	12–13	14	15	16–18
Females	7–9	10–11	12–18				
Calorie Level	**1600**	**1800**	**2000**	**2200**	**2400**	**2600**	**2800**
Daily amount of food							
Fruits (cups)	1.5	1.5	2	2	2	2	2.5
Vegetables (cups)	2	2.5	2.5	3	3	3.5	3.5
Grains (oz-eq)	5	6	6	7	8	9	10
Protein Foods (oz-eq)	5	5	5.5	6	6.5	6.5	7
Dairy (cups)	3	3	3	3	3	3	3
Oils (tsp)	5	5	6	6	7	8	8
Empty calorie allowance	120	160	260	270	330	360	400

*Calorie needs generally increase by 200/day at each age for active individuals and decrease by 200/day for people who are sedentary.

Source: www.choosemyplate.gov

Eating Practices

As children get older, they consume more foods from nonhome sources and have more outside influences on their food choices. School, friends' houses, childcare centers, and social events present opportunities for children to make their own choices beyond parental supervision. Children who are home alone after school prepare their own snacks and, possibly, meals.

The "ideal" of children eating breakfast, dinner, and a snack at home, with a nutritious brownbag or healthy cafeteria lunch at school, is not representative of what most children are eating.

Children who eat dinner with their families at home tend to have higher intakes of fruits, vegetables, vitamins, and minerals and lower intakes of saturated and trans fatty acids, soft drinks, and fried foods (ADA, 2008). Family meals promote social interaction and allow children to learn food-related behaviors. Parents should provide and consume healthy meals and snacks and avoid or limit empty-calorie foods (Fig. 12.5). Snacks, especially sweetened beverages, should be limited during sedentary activities. Healthy snack ideas are listed in Box 12.6. Forbidding the intake of certain foods and pressuring children to eat are

counterproductive in that they may lead to overeating, dislikes, and an interest in eating forbidden foods (Fisher and Birch, 1999). The food groups most likely to be consumed in inadequate amounts are fruits, vegetables, and whole grains.

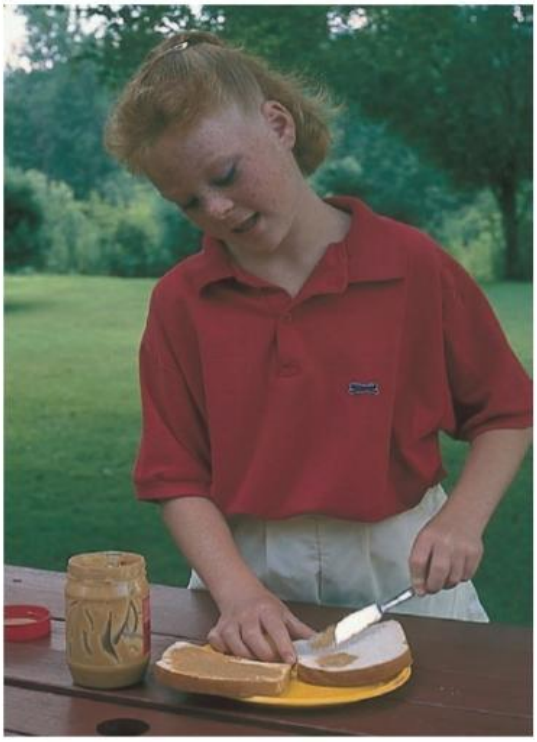


FIGURE 12.5 Good nutritional habits, such as eating healthy snacks, develop early in life. (© Bob Kramer)

Box 12.6 Healthy Snacks

Unsweetened cereal with or without milk
Meat or cheese on whole-grain bread or crackers
Graham crackers, fig bars
Whole-grain cookies or muffins made with oatmeal, dried fruit, or iron-fortified cereal
Quick breads such as banana, date, pumpkin bread
Raw vegetables, vegetable juices
Fresh, dried, or canned fruits without sugar
Pure fruit juice as a drink or frozen on a stick
Low-fat yogurt with or without fresh fruit added
Air-popped popcorn (not before age 4 years)
Peanut butter on bread, crackers, celery, apple slices
Pretzels
Milk shakes made with fruit and low-fat ice cream or frozen yogurt
Low-fat ice cream, frozen yogurt, sherbet, sorbet, fruit ice
Animal crackers, ginger snaps
Skim or 1% milk (after age 2 years)
Low-fat cheese, low-fat cottage cheese
Rice cakes or popcorn cakes

NUTRITION FOR ADOLESCENTS (12–18 YEARS)

The slow growth of childhood abruptly and dramatically increases with pubescence until the rate is as rapid as that of early infancy. Adolescence is a period of physical, emotional, social, and sexual maturation. Approximately 15% to 20% of adult height and 50% of adult weight are gained during adolescence. Fat distribution shifts and sexual maturation occurs. D Subsequently, calorie and nutrient needs increase, as does appetite, but exactly when those increases occur depends on the timing and duration of the growth spurt. Because there are wide variations in the timing of the growth spurt among individuals, chronological age is a poor indicator of physiologic maturity and nutritional needs.

Gender differences are obvious. For instance, girls generally experience increases in growth between 10 and 11 years of age and peak at 12 years. Because peak weight occurs before peak height, many girls and parents become concerned about what appears to be excess weight. In contrast, boys usually begin the growth spurt at about 12 years of age and peak at 14 years. Stature growth ceases at a median age of approximately 21 years. Nutritional needs increase later for boys than for girls.

Calories and Nutrients

Table 12.4 lists My Platerecommended calorie intakes for adolescents, which are based on DRI estimated energy expenditure calculations that account for age, gender, weight, height, physical activity level, and energy deposition. Generally, nutrient requirements are higher during adolescence than at any other time in the life cycle, with the exception of pregnancy and lactation. Notice that the calories suggested for moderately active females aged 12 to 18 years is 2000, whereas for males, the need ranges from 2200 to 2800 calories.

Females require fewer calories than males because they have proportionally more fat tissue and less muscle mass from the effects of estrogen. Girls also experience less bone growth than boys.

Eating Practices

In early adolescence, peer pressure overtakes parental influence on food choices. As the adolescent becomes increasingly independent, more self-selected meals and snacks are purchased and eaten outside the home. A natural increase in appetite combined with fast-food marketing practices geared toward adolescents and a decrease in physical activity increase the risk of overeating. Few adolescents consume recommended amounts of fruits, vegetables, dairy foods, and whole grains (Bruening et al., 2012). A study by Bowman (2002) found that from the mid-1970s to the mid-1990s, milk intake in adolescents decreased by 36% and the intake of sodas and fruit drinks almost doubled.

Nutrients of Concern

Adolescents are at risk of consuming inadequate amounts of several nutrients, such as calcium, potassium, magnesium, vitamin A, and fi ber, because they are underconsuming several food groups.

NUTRITION CONCERNS DURING CHILDHOOD AND ADOLESCENCE

Indicators of nutrition risk for children and adolescents appear in Box 12.7. Nutrition concerns discussed next include overweight and obesity, breakfast skipping, and adolescent pregnancy. Eating disorders are discussed in Chapter 14.

Overweight and Obesity

More than 23 million children and adolescents are overweight or obese in the United States (Ogden et al., 2010). Weight gain occurs when calorie intake exceeds calorie expenditure over time. Factors that contribute to an excessive calorie intake include large portion sizes, snacking, away-from-home meals, and sugar-sweetened beverage consumption (Brownell,

Schwartz, Puhl, Henderson, and Harris, 2009)

Box 12.7 Indicators of Nutrition Risk in Children and Adolescents

- Meal skipping three or more times per week
- Frequent breakfast skipping
- Eating fast food more than three times per week
- Eating from only one food group
- Poor appetite
- Frequently eating without family supervision

Source: Melanson, K. (2008). Lifestyle approaches to promoting healthy eating for children. *American Journal of Lifestyle Medicine, 2,* 26–36.

Healthy Lifestyles and Obesity Prevention

Prevention of obesity is critical because data on long-term successful treatment is limited (AAP, 2003). Parental support for a more healthful lifestyle is vital to initiating and sustaining changes in eating and exercise behaviors

Box 12.8 Healthy Behaviors That May Help Prevent Excessive Weight Gain

Limit intake of sugar-sweetened beverages.
Encourage the intake of more fruits and vegetables to the levels recommended in MyPlate.
Limit TV viewing and screen time to a maximum of 2 hours/day after the age of 2 years. TV viewing is not appropriate for children younger than 2 years.
Eat breakfast daily.
Limit eating out at restaurants, especially fast-food restaurants.
Encourage family meals.
Limit portion size.
Consume adequate calcium and fiber and a balance of carbohydrates, protein, and fat.
Encourage exclusive breastfeeding until 6 months of age and continue breastfeeding after complementary foods are introduced to 12 months and beyond.
Engage in moderate to vigorous physical activity for at least 60 minutes daily.
Limit the intake of calorie-dense foods.

Source: Barlow, S., & the Expert Committee. (2007). Expert Committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics, 120,* S164–S192.

Breakfast Skipping

Among children age 6 to 13 years, an estimated 8% to 15% skip breakfast (Affenito, 2007). Adolescent females are more likely to skip breakfast than males of similar age, and African American adolescents (24%) are more likely to skip breakfast than White adolescents (13%) (Nicklas, O'Neil, and Myers, 2004). Breakfast is missed more than any other meal (Utter, Scragg, Mhurchu, and Schaaf, 2007). Overall, breakfast skipping tends to increase with age and seems to be associated with other lifestyle factors that may be detrimental to health, such as dieting and infrequent exercise (Rampersaud, Pereira, Girard, Adams, and Metzl,

2005). Children who regularly skip breakfast have lower intakes of vitamins and minerals than those who routinely eat breakfast, and those nutrients are not made up for at other meals.

Adolescent Pregnancy

Adolescent pregnancy is associated with physiologic, socioeconomic, and behavioral factors that increase health risks to both infant and mother. Infants born to adolescent mothers are at higher risk of low birth weight (LBW) and preterm birth and are more likely to die within the fi rst year of life than infants whose mothers are in their 20s or 30s

Nutrition for Older Adults

Aging is a gradual, inevitable, complex process of progressive physiologic, cellular, cultural, and psychosocial changes that begin at conception and end at death. As cells age, they undergodegenerative changes in structure and function that eventually lead to impairment of organs, tissues, and body functioning. Box 13.1 outlines the changes in physiology, income, health, and psychosocial well-being associated with aging that have nutritional implications

Box 13.1 Changes That May Occur with Aging

Composition and Energy Expenditure Changes
- Decrease in lean body mass
- Increase in fat tissue
- Decrease in basal metabolic rate
- Decrease in physical activity

Oral and Gastrointestinal (GI) Changes
- Difficulty in chewing related to loss of teeth and periodontal disease
- Constipation is more common and may be related to decreased peristalsis from loss of abdominal muscle tone, inadequate fluid and fiber intake, secondary reaction to drug therapy, or a decrease in physical activity.
- Digestive disorders may occur from a decreased secretion of HCl in the stomach and digestive enzymes, decreased GI motility, and decreased organ function.
- Prevalence of atrophic gastritis increases.
- Nutrient absorption may decrease because of decreased mucosal mass and decreased blood flow to and from the mucosal villi.

Metabolic Changes
- Altered glucose tolerance; the underlying reason may be a decrease in insulin secretion or a decrease in tissue sensitivity to insulin.
- Synthesis of vitamin D in the skin decreases with age.

Central Nervous System Changes
- Tremors, slowed reaction time, short-term memory deficits, personality changes, and depression may occur secondary to a decrease in the number of brain cells or the decrease in blood flow to the brain.

Renal Changes
- Ability to concentrate urine decreases

Sensory Losses
- Hearing loss, loss of visual acuity, decreased sense of smell, decreased number of taste buds, and decreased sensation of thirst

Other Changes
- Change in income related to retirement
- Reliance on medications
- Social isolation related to death of spouse, living alone, impaired mobility
- Poor self-esteem related to change in body image, lack of productivity, feelings of aimlessness

Nutritional Needs of Older Adults

Knowledge of the nutritional needs of older adults is growing. However, health status, physiologic functioning, physical activity, and nutritional status vary more among older

adults (especially people older than 70 years) than among individuals in any other age group, so nutrient recommendations may not be appropriate for all elderly individuals at all times. In general, calorie needs decrease, yet vitamin and mineral requirements stay the same or increase. Two Dietary Reference Intake (DRI) groupings exist for mature adults, one for people age 51 to 70 years and another for adults over the age of 70 years. Calories and selected nutrients are discussed in the following sections.

Calories

Calorie needs decrease with age, attributed in large part to progressive decreases in physical activity (Table 13.1) (Bernstein and Munoz, 2012). A decrease in physical activity directly lowers calorie expenditure. Indirectly, a decrease in physical activity leads to a loss of lean body mass. It is changes in body composition—namely, a decrease in muscle and bone mass and an increase in percentage of body fat—that account for the decrease in metabolic rate of approximately 2% per decade beginning around the age of 30 years (Elmadfa and Meyer, 2008). Taken together, the decrease in physical activity and lower metabolic rate lead to an estimated 5% decrease in total calorie needs each decade. However, neither the changes in body composition nor the decrease in physical activity is inevitable (Rivlin, 2007). Studies show that with appropriate weight training exercises, muscle loss can be prevented and reversed, even among 90-year-old frail institutionalized men and women (Fiatarone et al., 1990; Kerksick et al., 2007; Kryger and Andersen, 2007; Pratley et al., 1994).

Protein

The Recommended Dietary Allowance (RDA) for protein remains constant at 0.8 g/kg for both men and women from the age of 19 years on (National Research Council, 2005a).

Table 13.1 MyPlate Calorie Levels Based on Sex, Age, and Activity Level

MyPlate assigns individuals to a calorie level based on their sex, age, and activity level.

Males				Females			
Activity Level	Sedentary*	Moderately Active*	Active*	Activity Level	Sedentary*	Moderately Active*	Active*
Age (Years)				Age (Years)			
51–55	2200	2400	2800	51–55	1600	1800	2200
56–60	2200	2400	2600	56–60	1600	1800	2200
61–65	2000	2400	2600	61–65	1600	1800	2000
66–70	2000	2200	2600	66–70	1600	1800	2000
71–75	2000	2200	2600	71–75	1600	1800	2000
76 and up	2000	2200	2400	76 and up	1600	1800	2000

*Calorie levels are based on the Estimated Energy Requirements (EER) and activity levels from the Institute of Medicine Dietary Reference Intakes Macronutrients Report, 2002.

Sedentary = less than 30 minutes a day of moderate physical activity in addition to daily activities.

Moderately Active = at least 30 minutes but up to 60 minutes a day of moderate physical activity in addition to daily activities.

Active = 60 or more minutes a day of moderate physical activity in addition to daily activities.

Water

The Adequate Intake (AI) for water, which includes total water from drinking water, other beverages, and water in solid foods, is constant from 19 years of age through more than 70 years old, with 3.7 L/day of total water recommended for men and 2.7 L/day for women (Institute of Medicine, 2005). Both of these fi gures represent a level of intake necessary to replace normal daily losses and prevent the effects of dehydration (National

Research Council, 2005b). Like younger adults, the elderly are able to maintain fluid balance over a wide range of intakes.Most older adults do not meet the recommended intake for water (Bernstein and Munoz, 2012). A number of physiologic changes and other factors increase the risk of dehydration in the elderly, including an impaired sensation of thirst, alterations in mental status and cognition, adverse effects of medications, impaired mobility, and an age-related decrease in the ability to concentrate urine. Fear of incontinence and pain from arthritis may cause voluntary restriction in fluid intake. Dehydration can contribute to constipation, cognitive impairment, functional decline, and death (Bernstein and Munoz, 2012).

Fiber

For all age groups, the AI for fi ber is based on median intake levels observed to protect against coronary heart disease (CHD) (National Research Council, 2005a). From the age of 1 year on and for both genders, the AI for fi ber is set at 14 g/1000 cal of intake. Based on median calorie intakes, the AI for fi ber is 38 g/day for men through age 50 years and 30 g/day thereafter. A similar decrease occurs in women, whose AI is 25 g/day from 19 to 50 years and 21 g/day thereafter.

Vitamins and Minerals

Most recommended levels of intake for vitamins and minerals do not change with aging. Signifi cant exceptions to this generalization are calcium and vitamin D and, for women,

Table 13.2 Important Nutrients Whose RDAs Change with Aging*

Nutrient	Age 31–50 Years	Age 51–70 Years	Age 71+ Years	Rationale for Change
Calcium (mg/day)	1000	1200 (female) 1000 (male)	1200	The efficiency of calcium absorption decreases with age.
Vitamin D (IU/day)	600	600	800	The ability to synthesize vitamin D on the skin from sunlight decreases with age.
Iron (mg/day) Females only	18	8	8	Cessation of menstruation

*Values are for both males and females unless otherwise indicated.

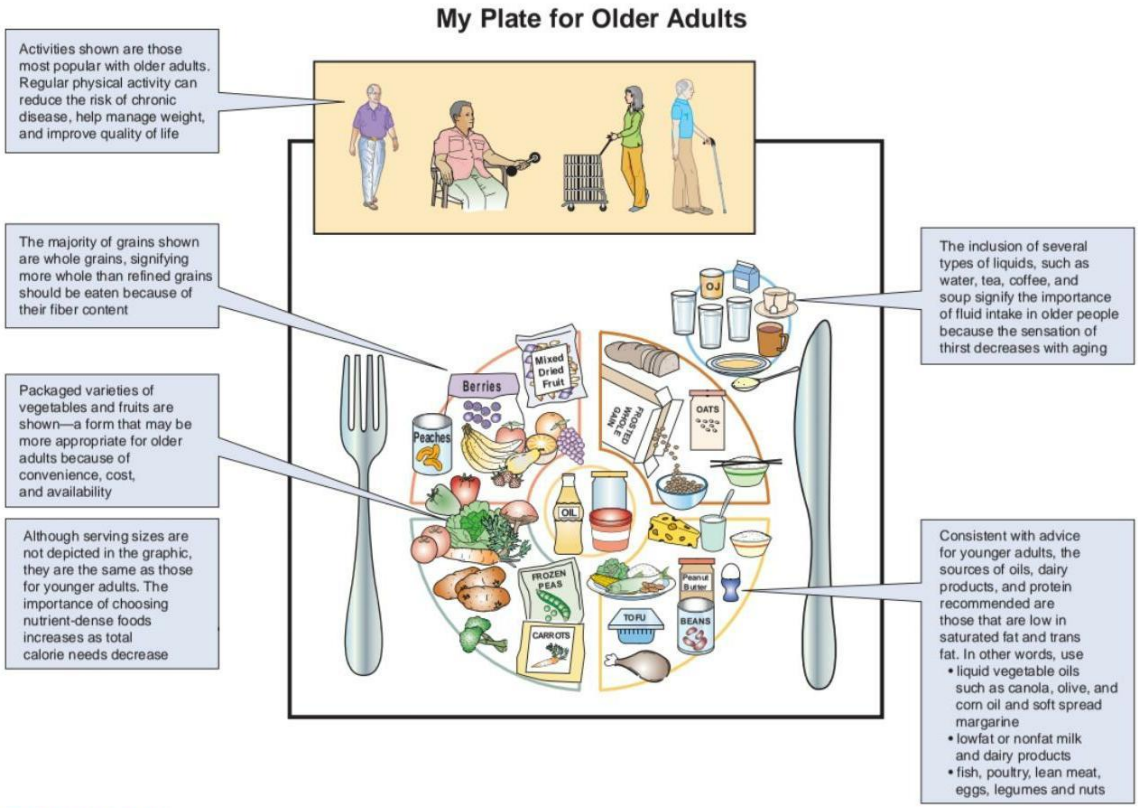
Source: Institute of Medicine. (2010). *Dietary Reference Intakes for calcium and vitamin D.* Available at http://www.iom.edu/Reports/2010/Dietary-Reference-Intakes-for-Calcium-and-Vitamin-D.aspx. Accessed 2/1/13.

Food Intake of Older Adults

Like younger adults, older Americans consume less fruit and vegetables than recommended, and starchy vegetables account for about 80% of total vegetable intake on any given day (USDA, Center for Nutrition Policy and Promotion, 2007). Major improvements in the nutritional health of older adults could be realized if older adults increased their intakes of whole grains, dark green and orange vegetables and legumes, and fat-free or low-fat milk products (Federal Interagency Forum on Aging-Related Statistics, 2012). Notice in Table 13.3 that for the nutrients most likely to be consumed in inadequate amounts by older adults, whole grains, vegetables (especially green leafy vegetables), legumes, and milk are listed as sources for three or more of these nutrients. Other changes to improve the quality of older adults' intake are to incorporate foods and beverages that are lower in sodium and to consume fewer calories from solid fats,

alcoholic beverages, and added sugars. Frequently, food choices of older adults are based on considerations other than food preferences, such as income; the client's physical ability to shop, prepare, chew, and swallow food; and the occurrence of food intolerances related to chronic disease or side effects of medication. Box 13.3 features tips for eating well as you get older.

While snacking may contribute to an excess calorie intake and obesity in other age groups, snacking in older adults may help ensure an adequate intake. A study by Zizza, Tayie, and Lino (2007) found that as older adults' frequency of snacking increased, their daily intakes of vitamins A, C, and E; beta-carotene; magnesium; copper; and potassium improved. For older adults at risk of inadequate intake, encouraging snacking between meals may be more effective than urging them to eat more at each meal.



■ **FIGURE 13.2** MyPlate for Older Adults. (***Source:*** Copyright 2011 Tufts University. For details about the MyPlate for Older Adults, please see http://nutrition.tufts.edu/research/myplate-older-adults)

Table 13.3 **Sources of Food Components That May Be Lacking in the Diets of Older Adults**

Food Component	Sources
Vitamin A	Green and orange vegetables, especially **green leafy vegetables**; orange fruits, liver, **milk**
Vitamin D	**Milk**, fortified soy milk, fatty fish, some fortified ready-to-eat cereals
Vitamin E	Vegetable oils, margarine, salad dressing made with vegetable oil, nuts, seeds, **whole grains**, **green leafy vegetables**, fortified cereals
Calcium	**Milk**, yogurt, cheese, fortified orange juice, **green leafy vegetables**, **legumes**
Magnesium	**Green leafy vegetables**, nuts, **legumes**, **whole grains**, seafood, chocolate, **milk**
Potassium	Fruit and **vegetables**, **legumes**, **whole grains**, **milk**, meats
Fiber	**Whole grains**; **legumes**; fruit and **vegetables**, especially the skin and seeds

Note: **Bold** type used to illustrate the commonality of sources among these nutrients.

Box 13.3 Tips for Eating Well as You Get Older

Enjoy Your Meals

Eating is one of life's pleasures, but some people lose interest in eating and cooking as they get older. They may find that food no longer tastes good. They may find it harder to shop for food or cook, or they don't enjoy meals because they often eat alone. Others may have problems chewing or digesting the food they eat.

Why Not Eating Can Be Harmful

If you don't feel like eating because of problems with chewing, digestion, or gas, talk with your doctor or a registered dietitian. Avoiding some foods could mean you miss out on needed vitamins, minerals, fiber, or protein. Not eating enough could mean that you don't consume enough nutrients and calories.

Problems with Taste or Smell?

One reason people lose interest in eating is that their senses of taste and smell change with age. Foods you once enjoyed might seem to have less flavor when you get older. Some medicines can change your sense of taste or make you feel less hungry. Talk with your health care provider if you have no appetite, or if you find that food tastes bad or has no flavor.

If you don't feel like eating because food no longer tastes good, you can enhance the flavor of food by cooking meals in new ways or adding different herbs and spices.

Problems Chewing?

If you have trouble chewing, you might have a problem with your teeth or gums. If you wear dentures, not being able to chew well could also mean that your dentures need to be adjusted. Talk to your health care provider or dentist if you're finding it hard to chew food.

Chewing problems can sometimes be resolved by eating softer foods. For instance, you could replace raw vegetables and fresh fruits with cooked vegetables or juices. Also choose foods like applesauce and canned peaches or other fruits.

Meat can also be hard to chew. Instead, try eating ground or shredded meat, eggs, or dairy products like fat-free or low-fat milk, cheese, and yogurt. You could also replace meat with soft foods like cooked beans and peas, eggs, tofu, tuna fish, etc.

Problems with Digestion?

If you experience a lot of digestive problems, such as gas or bloating, try to avoid foods that cause gas or other digestive problems. If you have stomach problems that don't go away, talk with your health care provider. If you do not have an appetite or seem to be losing weight without trying, talk to your health care provider or ask to see a registered dietitian.

Try New Dishes

Making small changes in the way you prepare your food can often help overcome challenges to eating well. These changes can help you to enjoy meals more. They can also help make sure that you get the nutrients and energy you need for healthy, active living.

- Look for ways to combine foods from the different food groups in creative ways. You can do this while continuing to eat familiar foods that reflect your cultural, ethnic, or family traditions.

(continues on page 330)

Box 13.3 Tips for Eating Well as You Get Older (continued)

- Experiment with ethnic foods, regional dishes, or vegetarian recipes.
- Try out different kinds of fruits, vegetables, and grains that add color to your meals.
- Try new recipes from friends, newspapers, magazines, television cooking shows, or cooking websites.
- Take a cooking class to learn new ways to prepare meals and snacks that are good for you. Grocery stores, culinary schools, community centers, and adult education programs offer these classes.

Eat with Others

Eating with others is another way to enjoy meals more. For instance, you could share meals with neighbors at home or dine out with friends or family members. You could also join or start a breakfast, lunch, or dinner club.

Many senior centers and places of worship host group meals. You might also arrange to have meals brought to your home.

When Eating Out

When you eat out, you can still eat well if you choose carefully, know how your food is prepared, and watch portion sizes. Here are some tips.

- Eat reasonable amounts of food and stay within your calorie needs for the day.
- Select main dishes that include vegetables, such as salads, vegetable stir fries, or kebobs.
- Order your food baked, broiled, or grilled instead of fried.
- Make sure it is thoroughly cooked, especially dishes with meat, poultry, seafood, or eggs.
- Choose dishes without gravies or creamy sauces.
- Ask for salad dressing on the side so you can control the amount you eat.
- Ordering half portions or splitting a dish with a friend can help keep calorie intake down.

Ask for Substitutions

Also, don't be afraid to ask for substitutions. Many restaurants and eating establishments not only offer healthful choices but let you substitute healthier foods. For example, you might substitute fat-free yogurt for sour cream on your baked potato. Instead of a side order of onion rings or French fries, you could have the mixed vegetables. Ask for brown rice instead of white rice. Try having fruit for dessert.

Meals are an important part of our lives. They give us nourishment and a chance to spend time with friends, family members, and others. If physical problems keep you from eating well or enjoying meals, talk with a health care professional. If you need help shopping or preparing meals or want to find ways to share meals with others, look for services in your community. Your area Agency on Aging can tell you about these services. To contact your area Agency on Aging, call the Eldercare Locator toll-free at 1-800-677-1116.

Source: National Institute on Aging, National Institutes of Health, U.S. Department of Health and Human Services. (n.d.). Available at http://nihseniorhealth.gov/eatingwellasyougetolder/enjoyyourmeals/01.html

NUTRITION-RELATED CONCERNS IN OLDER ADULTS

Arthritis

An estimated 50 million American adults have some form of doctor-diagnosed arthritis (Cheng, Hootman, Murphy, and Helmick, 2010). Osteoarthritis (OA), the most common form of arthritis, can lead to joint degeneration, chronic pain, muscle atrophy, impaired mobility, and poor balance. Arthritis is the leading cause of disability (Centers for Disease Control and Prevention

Osteoporosis

Throughout life, bone tissue is constantly being destroyed and rebuilt, a process known as remodeling. In the fi rst few decades of life, net gain exceeds net loss as bone mass and density are accrued. Around the age of 30 years, peak bone mass is attained (USDHHS, 2012). Thereafter, more bone is lost than is gained. During the fi rst 5 years or so after onset of menopause, women experience rapid bone loss related to estrogendeficiency. After that, bone loss continues at a slower rate.

Sarcopenia

Age-related loss of lean body mass is a normal part of aging; sarcopenia occurs when age-related loss of skeletal muscle mass is accompanied by loss of muscle strength and function. Advanced sarcopenia is characterized by physical frailty, increased likelihood of falls, impaired ability to perform ADL, and diminished quality of life (Paddon-Jones et al., 2008). Sarcopenia is estimated to affect 8% to 40% of adults over the age of 60 years and approximately 50% of those over the age of 75 years (Berger and Doherty, 2010). Sarcopenia should be considered in all older adults with observed declines in physical function, strength, or overall health and especially in older adults who are bedridden, who cannot rise independently from a chair, or who have a slow gait

Obesity

Dietary excesses and physical inactivity have led to an increase in overweight and obesity among older adults in the past two decades. In 2009–2010, 38% of people age 65 years and over were obese; in the 75 years and older category, 30% of women and 27% of men were obese (Federal Interagency Forum on Aging-Related Statistics, 2012).

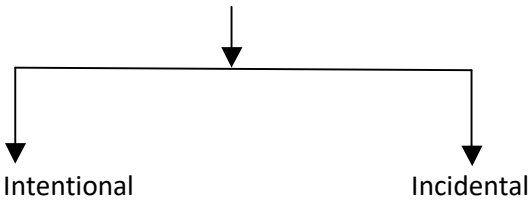
Alzheimer Disease

Alzheimer disease (AD) is the most common form of dementia among older adults, affecting an estimated 5.1 million Americans (National Institute on Aging [NIA], National Institutes of Health, 2012). Although not a normal consequence of aging, the risk of AD increases with age, and symptoms usually appear after the age of 60 years

UNIT -5
FOOD ADULTERATION
DEFINITION

Adulteration is defined as the process by which the quality or the nature of a given substance is reduced through the addition of a foreign or an inferior substance and the removal of a vital element.

TYPES OF ADULTERANTS



Intentional :

Intentional adulterants are those substances that are added as a deliberate act on the part of the adulterer with the intention to increase the margin of profit. Eg. sand, marble chips, stones, mud, chalk powder, water, dyes, etc., These adulterants cause harmful effects on the body.

Incidental :

These adulterants are found in food substances due to ignorance, negligence or lack of proper facilities. It is not a willful act on the part of the adulterer. Eg. pesticides, droppings of rodents, larvae in food.

TESTS FOR DETECTING ADULTERANTS

Simple tests for the detection of adulterants present in foods are given in the following table :

TABLE 14.A

Tests for determining common adulterants present in food

Sl. No.	Substance	Adulterant	Test
1.	Asafoetida (Hing)	Resin or gum scented and coloured	Pure asafoetida dissolves in water to form a milkwhite solution. Pure asafoetida burns with a bright flame on being ignited (burning)
2.	Sugar	Chalk Powder	Dissolve in a glass of water. Chalk will settle down in the bottom.
3.	Cardamom	Oil is removed and pods are coated with talcum powder.	On rubbing, talcum will stick to the fingers. On testing, if there is hardly any aromatic flavour, it indicates removal of essential oil.

4.	Turmeric (Haldi)	Metanil Yellow colouring	When concentrated hydrochloric acid is added to a solution of turmeric powder, it turns magenta if metanil yellow is present.
5.	Chilli powder	Sawdust and colour	Sprinkle on the surface of water, sawdust floats. Added colour will make the water coloured.

6.	Coffee	Chicory	Shake a small portion in cold water. Coffee will float while chicory will sink, making the water brown.
7.	Coriander powder	Horse dung powdered	Soak in water. Horse dung will float which can be easily detected.
8.	Cloves(Lavang)	Oil may be removed	If so, cloves may be shrunken in appearance.
9.	Cumin seeds (Jeera)	May contain grass seeds coloured with charcoal dust	If rubbed in hand, fingers will turn black.
10.	Ghee	Vanaspathi	Dissolve one teaspoon of sugar in 10 ccs of hydrochloric acid and 10 ccs of the melted ghee and shake thoroughly for one minute. Allow it to stand for 10 minutes. If vanaspathi has been added, the

			aqueous layer will be red in colour.
11.	Jaggery	Metanil yellow	Hydrochloric acid added to a solution of jaggery will turn its colour to magenta.

12.	Rawa	Iron filing to add weight	Pass magnet through the rawa. Iron filings will cling to it.
13.	Betelnut powder (Supari)	Sawdust and artificial colour	Sprinkle in water. Sawdust will float and the added colour will dissolve in water.
14.	Milk	a. Mashed potato, other starches b. Water	Add a drop of tincture of iodine. Iodine, which is brown turns blue if starch is present Put a drop of milk on a polished vertical surface and allow to flow. Pure milk flows slowly leaving a white trail. Adulterated milk will flow immediately without leaving a mark.
15.	Tea dust	Used tea leaves dried, powdered and artificially coloured.	Sprinkle the dust on a wet white filter paper. Spots of yellow, pink and red appearing on the paper indicates that tea is artificially coloured.

16.	Edible oil	Argemone	A reddish-brown precipitate is formed when oil and hydrochloric acid are gently mixed with ferric chloride solution, if argemone is present.
17.	Saffron	Maize	a) Genuine saffron is
		fibres dried, coloured and scented	tough. Spurious saffron is brittle and breaks easily. b) Dissolves easily in water, giving aroma of saffron.
18.	Sago	Sand and talcum	Gritty feel in mouth. Pure sago swells on burning and leaves hardly any ash.
19.	Black pepper	Dried seeds of papaya fruit	Papaya seeds are shrunken oval in shape and greenish brown in colour and has a repulsive flavour distinct from the bite of black pepper.
20.	Coconut oil	Any other oil	Place a small bottle of oil in refrigerator. Coconut oil solidifies leaving the adulterant as a separate layer.
21.	Bajra	Fungus (Ergot infested)	Immerse in salt water. Fungi will float to the top.
22.	Cinnamon (Dalchini)	Cassia bark	Added colour comes off in water.
23.	Common salt	White powdered stone, chalk	Stir a spoonful of simple salt in a glass of water. The presence of chalk will make the solution white
24.	Honey	Molasses (sugar and	A cotton wick dipped in pure honey when

		water)	lighted with a match stick burns, if adulterated it will not burn and will produce a cracking sound.
25.	Peanut oil	Cottonseed oil	Mix 2.5 ml of oil or fat with 2.5 ml Halphen's reagent. Lightly screw cap and heat in boiling water for 30 minutes. The test is positive if a rose colour is obtained.

PACKAGING MATERIALS AND HAZARDS

Materials used for packing

The conventional methods of packing which are prevalent even now to a large extent are tin or aluminium containers, glass bottles and jars, paper and waxed paper wrappings, paper cartons, cardboard and certain plastic containers. Tin and aluminium containers have become costly and glass bottles though very good in many respects have problems associated with breakage and heavy transportation charges on account of weight. Continued use of paper in increased volume dwindles the natural resources.

Against the conventional materials there has emerged increased usage of newer materials derived synthetically. Some polymeric plastic materials are polystyrene, polyvinyls, polyvinydines and derivatives, vinyl acetate, poly ethylene, polypropylene and polyesters.

Folding cartons and paper board boxes are used extensively in the food industry. Tin plate containers—the cylindrical open-top variety are mostly used for processed foods. Aluminium is used principally as foil e.g., chocolates. It is also used as bottle caps and closures and easy open tops for cans.

Polystyrene is principally made into tubs for ice creams, packs for eggs, sausages and small packages for butter, jam and cheese. Bags made from the simplest of all plastic polymers, namely, polyethylene or 'polythene' as commonly known have relatively low preserving qualities. Material such as polyesters vinyl acetate derivatives and multilayer films made out of a combination of different materials have good preserving characteristics for food products.

Timber crates are used extensively for packing weights above 100 kg. Plastic crates are well established in the dairy industry and for the transportation of bottled beer, mineral water and soft drinks. High density polythene is used for milk crates.

Shrink wrap packaging is a system where heat shrinkable thermoplastic film is wrapped around an article or a group of articles. The film is made to shrink around it by the application of heat to achieve a skin light package. Canned food products, bottles and jars of all types can be shrink wrapped.

Now-a-days it is expected that packaging material be environment friendly or ecofriendly, that is, it should not pose many problems for mankind and hazards to the environment. For example, corrugated boxes are ecofriendly and are preferred for exporting. They can be effectively replaced for conventional wooden boxes which need to destroy the trees. Recyclability of packaging is desirable so as to preserve the resources of the packaging material for future generations.

Packaging Hazards:

Plastics such as cellulose acetate, polyamide polyethylene polypropylene and polyvinyl chloride are often used as packing materials because they are light in weight and are resistant to diffusion due to solvents and high temperatures.

However care should be taken that only food grade plastic packing materials should be used for packaging foods to prevent the following packaging hazards.
Production of noxious thermal breakdown products which are injurious to health.
Formation of toxic residues that result when subjected to heat treatment for sterilisation of the contents.
Unfavourable reactions between acid and oil content of the food and the packaging material.

FOOD LAWS AND STANDARDS

Prevention of Food Adulteration Act.

The prevention of Food Adulteration Act, (PFA) 1954 operated by the Directorate General of Health Services, Ministry of Health was designed for the following purposes :
It formulates and monitors the standard of quality and purity of foods with emphasis on prevention of adulteration of foods.
It is the basic structure intended to protect the common consumer against the supply of adulterated foods.
It makes provision for prevention of adulteration of food and lays down the rule that no person shall manufacture for sale, store, sell or distribute any adulterated or misbranded food or food which contravenes the provision of act or rules.
It has set the yardstick to ascertain adulteration. According to this act, a food is deemed to be adulterated – if:
It is not of the nature, substance and quality, which the food ought to be.
It contains any other substance which affects, or if the article is so processed so as to affect injuriously the nature, substance and quality of the food.
It contains added inferior or cheaper substance that affects the nature and quality of the food.
Any constituent of the food is removed so as to affect injuriously the nature, quality and substance of the food.
It is prepared, packed and stored under unsanitary conditions.
It contains any filthy, disgusting, rotten, decomposed substance of a diseased animal or vegetable substance or is insect-infested or otherwise unfit for human consumption.
The article is obtained from a diseased animal.
The article contains a poisonous ingredient or any other ingredient injurious to health.
The container renders the food injurious to health.
It contains excessive or prohibited colours.
It contains excessive or prohibited preservatives.
It does not satisfy the standards prescribed by the authorities. Under the provision of the PFA Act, the Government of India has promulgated PFA rules which specifies the following details:
Qualification, duties and functions of food analysts, food inspectors and central food laboratory.
Procedure for drawing test samples and sending them to the analyst and laboratory.
Specification for the identity and purity of food.
Tolerance for contaminants, preservatives, emulsifiers and other additives.

Agmark Standard:

The word Agmark is derived from the words'Agricultural Marketing'. It is a standard of quality based on the physical and chemical characteristics of food, both the natural and those acquired during processing.
Products graded under AGMARK include vegetable oils, ghee, butter, rice, groundnut, pulses and spices. These standards ensure accurate weight and correct selling price.

Bureau of Indian Standards :

The Bureau of Indian Standards lays down criteria for standardisation of vegetables and fruit products, spices and condiments, animal products and processed food.Manufacturers are allowed to use the BIS label on each unit of their product, if their products conform with the standards laid down by BIS. The products are checked for quality by laboratories certified by BIS. BIS is also known as ISI (Indian Standard Institution).Some of the items which require compulsory BIS certification under PFA Act include artificial food colours, natural food colours, food additives, infant formula, milk-cereal based weaning foods, milk powder and condensed milk.

UNIT -6
NUTRIONAL PROGRAMMES

Various policies have been launched by the Indian government to eradicate this problem like-
Integrated Child Development Services Scheme
Midday Meal Programme
Special Nutrition Programme (SNP)
National Nutritional Anemia Prophylaxis Programme
National Iodine Deficiency Disorders Control Programme
National Goitre Control Programme
Mid Day meal programme
Applied Nutrition Programme AkshayaPatraProgramme.
And most recently Prime Minister launched a 'POSHAN Abhiyan' from Jhunjhunu in Rajasthan, on 8th March 2018. These are government's response to the malnutrition in the children and others. Many national health and nutrition surveys reported that there have been steady but slow decrement have been found under and malnutrition, nutrient deficiency, mortality and morbidity.

National Nutrition Policy (NNP)

National Nutrition Policy (NNP) has been launched in 1993 by the Government of India under the aegis of the (effect of nutrition agriculture, food production, food supply education, information, health care, social justice, rural and urban development, tribal welfare, women and child development) Department of Women and Child Development. The strategy of NNP was a multi-sectoral strategy for eradicating malnutrition and to achieve proper nutrition for all. The main approach was taken under NNP is to overcome the problem of nutrition through direct Nutrition interventions for susceptible groups through various development policies. The implementation strategy involves.
Nutrition interventions for in particularly vulnerable group who are below 6 yrs, adolescent girls and pregnant and lactating women, getting higher the safety nets.
Improve essential food item nutritional quality by Fortification that facilitates of low price nutritious foods.
Prevention of micronutrient deficiencies among susceptible groups. iv)Land reforms measures for reducing vulnerabilities of landless and landed poorly.
Strengthen health and family welfare programme.
Provide basic health and nutrition knowledge, avoid food adulteration.
Enhancement in nutrition surveillance and Monitor the progress of nutrition programmes, and check all the various aspects of nutrition. viii)Communication of information to people through traditional media.
Minimum wage administration to ensure its strict enforcement and timely revision and linking it with price rise through a suitable nutrition formula and provide a special support to women labourers during her pregnancy.
Community participation in generating awareness on various nutrition and health programmes.
Education and literacy.
Improvement in the status of women and Equal compensation for women.
In the next National Plan of Action on Nutrition (NPAN) 1995 government focused on reducing undernutrition by Multi-sectoral approach for accelerated action on determinants of malnutrition. To attain the objective of a comprehensive approach was advocated, which included improvements in individual health care, public health, sanitation, clean drinking water, access to food and knowledge of hygiene and feeding practices XII Plan has been given that mainly based on various problems which are:
Reduction of Infant Mortality Rate (IMR) to 25 by 2017.
Reduction of Maternal Mortality Ratio (MMR) to 100 in2017.
Reduction of Total Fertility Rate (TFR) to 2.1: India is on track for the achievement of a TFR target of 2.1 by 2017.
Prevention and reduction of underweight children under 3 years to 23% in raising child sex ratio in the 0-6 year age group from 914 to 935.

and reduction of the burden of Communicable and NonCommunicable diseases (including mental illnesses) and injuries:

National Health Goals for Communicable Disease

Disease	12th Plan Goal
Tuberculosis	Reduce annual incidence and mortality by half
Leprosy	Reduce prevalence to < 1/10,000 pop. and incidence to zero in all districts,
Malaria	Annual Malaria Incidence of < 1/1000
Filariasis	<1% microfilaria prevalence in all districts
Dengue	Sustaining case fatality rate of <1%
Chikungunya	Containment of outbreaks
Japanese Encephalitis	Reduction in JE mortality by 30%
Kala-azar	<1% microfilaria prevalence in all districts
HIV/AIDS	Reduce new infections to zero and provide comprehensive care and support to all persons living with HIV/AIDS and treatment services for all those who require it.

Integrated Childhood Development Services

The Integrated Child Development Service (ICDS) Scheme was launched on October 2nd, 1975. It was brought for providing supplementary nutrition, immunization and pre-school education to the children is a popular flagship programme of the government. It is one of the world's largest programmes to provide an integrated package of services for the entire development of a child. It is a centrally funded scheme executed by state governments and union territories. Main beneficiaries of this programme werechildren in the age group of 0-6 years; pregnant women and lactating mothers.

Objectives of this programme were as follows

To improve the nutritional and health status of children in the agegroup 0-6 years.

To lay the foundation for proper psychological, physical and social development of the child.

To reduce the incidence of mortality, morbidity, malnutrition and school dropout.

To achieve effective coordination of policy and implementation amongst the various departments to promote child development; and.

To enhances the capability of the mother to look after the normal health and nutritional needs of the child through proper nutrition and health education.

ICDS Provides Certain Services under their Scheme are as Follows

Supplementary Nutrition; Pre-school non-formal education; Nutrition & health education Immunization; Health check-up and Referral services. In which three services viz. immunization, health check-up and referral services are related to health and are provided through National Health Mission and

Public Health Infrastructure. And it was done by various centres Anganwadi

Centres through Anganwadi Workers (AWWs) and Anganwadi Helpers (AWHS) at a basic level.

The delivery of services to the beneficiaries is as follows:

Services	Target Group	Service provided by
(i) Supplementary Nutrition	Children below 6 years, Pregnant & Lactating Mothers (P&LM)	Anganwadi Worker and Anganwadi Helper (Ministry of Women and Child Development (MWCD)

(ii) Immunization*	Children below 6 years, Pregnant & Lactating Mothers (P&LM)	ANM /MO Health system, Ministry of Health and Family Welfare (MoHFW)
iii) Health Check-up*	Children below 6 years, Pregnant & Lactating Mothers (P&LM)	ANM/MO/AWW (Health system, MHFW)
(iv) Referral Services	Children below 6 years, Pregnant & Lactating Mothers (P&LM)	AWW/ANM/MO (Health system, MoHFW)
v) Pre-School Education	Children 3-6 years	AWW (MWCD)
(vi) Nutrition & Health Education	Women (15-45 years)	AWW/ANM/MO (Health system, MoHFW& MWCD)

*AWW assists ANM in identifying the target group.

Funding Pattern and Population Norms for Setting up of AWCs/MiniAWCs

All components of ICDS except Supplementary Nutrition Programme (SNP) are financed through 60:40 ratios (central: state). The Supplementary Nutrition Programme component was funded through 50:50 ratios. The North East states have 90:10 ratios. Beneficiaries of SNP are given hot meals along with take-home rations. For children, the number of rations and meals received depends on their malnutrition levels. SNP is provided for 300 days at the rate of Rs 8 per day for children and Rs 9.50 for pregnant and lactating mothers. Severely malnourished children are allocated Rs 12 per day. Adolescent Girls (11-14 years out of school) are allocated Rs 9.50 per day.

There will be 1 Anganwadi centre (AWC) for a population of 400-800; 2 AWCs for 800-1600; 3 AWCs for 1600-2400 and thereafter in multiples of 800 -1 AWC. The norms for one AWC for Tribal/Riverine/Desert, Hilly and other difficult areas will be 300-800 Norms for one Mini AWC will be 150400. Norms for Anganwadi on Demand (AOD) - Where a settlement has at least 40 children less than 6 years of age but no AWC.

ICDS Systems imparts a project to strengthen and improver earlier programme was Strengthening and Nutrition Improvement Project (ISSNIP). The aim of this project was to improve nutritional and early childhood development outcomes of children in India. Their main objectives of Phase 1 are to support the GoI and the selected States to strengthen the ICDS policy framework, systems and capacities, and facilitate community engagement, to ensure greater focus on children less than three years of age in the project districts; and strengthen convergent actions for improved nutrition outcomes in the stipulated districts.

The project will be implemented in identified 162 districts having a higher proportion of child under nutrition across eight States, like Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Andhra Pradesh. Besides, urban pilots will be undertaken in and around NCR of Delhi and convergent nutrition actions pilots in some selected districts in two non - project States like Odisha and Uttarakhand.

Kishori Shakti Yojana

The scheme for adolescent girls was put into operation W.E.F. 1st November 1991. Now the scheme has been renamed as Kishori Shakti Yojna. As no separate budget is available and nutrition is to be provided from the State Sector, the beneficiaries are provided supplementary nutrition through ICDS under the Supplementary Nutrition Programme.

Scheme for Adolescent Girls was sanctioned in the year 2010 and is implemented in 205 districts across the country. The target group of this scheme was adolescent girls (AGs) in the age group of 11 to 14 years. Kishori Shakti Yojana (KSY) aims to provide a facility to adolescent girls so that they may become responsible citizens. The broad objective of the scheme was to advance the nutritional, health and development status of adolescent girls, support increasing knowledge of health, hygiene, nutrition and family care, and to integrate them with opportunities for learning life skills, going back to school, helping girls grow to understand their society and become prolific members of the society.

This scheme works as the existing ICDS infrastructure. Under this scheme, adolescent girls are offered non-formal education in life education aspects including physical, developmental and sex education at Anganwadi centres. Girls can also be given basic health supplements such as IFA and de-worming tablets. Girls can also be

given vocational training at the centres. Adolescence is a crucial phase in the life of the woman. At this stage, she stands at the threshold of adulthood. This stage is intermediary between childhood and womanhood and it is the most eventful for the mental, emotional and psychological well being. The life-cycle approach for holistic child development remains unaddressed if adolescent girls are excluded from the developmental programmes aimed at human resource development.

The Adolescent Girls (AG) Scheme, put into practice by the Ministry of
Women and Child Development under Integrated Child Development Services (ICDS), primarily aims at breaking the inter-generational life-cycle of nutritional and gender disadvantage and providing a supportive environment for self-development. The government has approved expansion and universalization of the Scheme for Adolescent Girls in a phased manner i.e. in additional 303 districts in 2017-18 and the remaining districts in 201819 with the simultaneous phasing out of Kishori Shakti Yojana (KSY). Thus at present, 508 districts in the country are covered under Scheme for Adolescent Girls. In the identified areas of remaining districts, KSY is implemented.

There is two main part of this Scheme-Nutrition and Non-Nutrition Part.

In Nutrition part Home Ration or Hot Cooked Meal for 11 - 14 years Out of school girls - Nutrition Provision was Rs. 9.50 per day (600 calories; 18-20 gram of protein and recommended daily intake of micronutrients per day). While in Non Nutrition part for school going Adolescent Girls: (2 – 3 times a week) of 11 - 14 years, IFA supplementation, Health check-up and Referral services, Nutrition & Health Education (NHE), Counselling/ Guidance on family welfare, ARSH, child care practices, Life Skill Education and accessing public services should be provided. It was decided to involve Panchayati raj institutions, NGOs and other institutions for implementation of the Scheme.

Girl To Girl Approach (For Girls in the Age Group of 11–15 Years)

In each selected Anganwadi area 2 girls in the age group of 11–15 years are selected. These adolescent girls provided with a meal on the same scale as the pregnant women or nursing mother namely one that would provide 500 calories of energy and 20 g of protein. The 2 girls so identified are to receive in-service training at the Anganwadi from the worker and supervisor over a period of six months to become fully equipped individuals, capable of managing the centre on their own, so as to fully realize the objectives in all aspects, of the Anganwadi worker, including management of stores, the organization of the feeding programme, immunization schedules, to take weight of children, home visits, preschool activities etc.

Balika Mandal (For Girls in the Age Group 15-18 Years)

This scheme has more focus on the social and mental development of girls at age group 15–18 years. Special focus was laid to motivate and involve the uneducated groups belonging to this age group in non–formal education and improvement and up gradation of home-based skills.

Vitamin A Prophylaxis Programme

The programme was launched in 1970 by the ministry of health and family welfare with one objective to reduce the disease and preventing blindness due to Vitamin A deficiency. It was started with seven states with severe problems later it was extended country. Under this programme, children aged 6 months to 6 years were to be administered a mega dose of vitamin A at 6 monthly intervals. To prioritize Vitamin A administration, the programme was revised to give 5 mega doses at 6 months intervals to children 9 months to 3 years of age. In view of adequate supplies of Vitamin A, the target group has been revised to cover children 9 months- 5 years, since 2007. The main objective of this programme was to decrease the commonness of Vitamin A deficiency from current 0.6% to ≤ 0.5%. The Main strategy was given to provide health and nutrition education to encourage colostrums feeding, exclusive breastfeeding for the first six months, the introduction of complementary feeding thereafter and adequate intake of Vitamin A rich foods.

Prophylactic Vitamin A as per the following dosage schedule:

100000 IU at 9 months with measles immunisation

200000 IU at 16-18 months, with DPT booster

200000 IU every 6 months, up to the age of 5 years.

Thus a total of 9 mega doses are to be given from 9 months of age up to 5 years. All children those are suffered from xerophthalmia are to be treated at health facilities, given 1 dose of Vitamin A if they have not received it in the previous month.

National Nutritional Anaemia Prophylaxis Programme

This programme was launched during 4th 5-year plan in 1970 by Ministry of health and family welfare for the prevention of nutritional anaemia in mothers and children. Recently, the National Nutritional Anaemia Prophylaxis Programme is operated as part of the RCH programme under the revised policy, the target group has been expanded to include infants 6-12 months, school children 6-10 years and adolescents 11-18 years of age, clinically found to be anaemic. For infants and children, a liquid formulation having 20 mg elemental iron and 100 ugs folic acid per ml, will be made available. Dosage for various age groups are as follows:

Children 6-59 months: 20 mg elemental iron + 100 ug folic acid for 100 days if the child is clinically found to be anaemic.

School going children; 6-10 years 30 mg elemental iron + 0.250 mg folic acid for 100 days.

Adolescents and adults, 100 mg elemental iron + 0.500 mg folic acid for 100 days, girls are given greater priority in the programme.

Pregnant women: one tablet of 100 mg elemental iron + 0.500 mg folic acid prophylactically daily and if clinically anaemic, 2 such tablets to be given daily for 100 days.

Lactating mothers and acceptors of family planning; one tablet containing 100 mg elemental iron + 0.500 mg folic acid daily for 100 days.

The programme also aimed to include health and nutrition education to improve overall dietary intakes and encourage the use of iron and folic acid rich foods as well as food items that help iron absorption.

National Iodine Deficiency Disorders Control Programme (NIDDCP)

Ministry of Health & Family Welfare is the nodal Ministry for implementation of National Iodine Deficiency Disorders Control Programme (NIDDCP). Iodine is an essential micronutrient required daily at 100-150 micrograms for normal human growth and development. Deficiency of iodine can cause physical and mental retardation, abortions, cretinism, stillbirth, deaf-mutism, squint & various types of goitre. As per the surveys conducted by the Directorate General of Health Services, Indian Council of Medical Research, Health Institutions and the State Health Directorates, it has been found that out of 414 districts surveyed in all the 29 States and 7 UTs, 337 districts are endemic i.e where the occurrence of Iodine Deficiency Disorders (IDDs) is more than 5%. The main of this programme was to minimize commonness of IDD ≤5% and ensure 100% consumption of adequately iodized salt (15ppm) at the domestic level.

National Goitre Control Programme

Realizing the magnitude of the problem, the Government of India launched a 100 per cent centrally assisted National Goitre Control Programme (NGCP) in 1962. In August 1992 the National Goitre Control Programme (NGCP) was renamed as National Iodine Deficiency Disorders Control Programme (NIDDCP) with a view of wide spectrum of Iodine Deficiency Disorders like mental and physical retardation, deaf-mutism, cretinism, stillbirths, abortions etc. The programme is being implemented in all the States/UTs for entire population.

Objectives

To check the Iodine Deficiency Disorders in the districts.

Supply of iodized salt.

Resurveys to assess the impact of iodized salt after every 5 years.

Laboratory monitoring of iodized salt and urinary iodine excretion.

Awareness programmes for health Education and Publicity.

They found that after the years the Total Goiter Rate (TGR) in the entire country is reduced significantly. Production of iodized salt also increased 65.00 lakh MT. The consumption of adequately iodized salt at household level has been increased from 51.1% (as per NFHS III report 2005-06) to 71.1% (as per CES report, 2009).

Mid-Day Meal Programme

The Mid-day Meal Scheme first started in Tamilnadu. It is also known as School Lunch Programme. This programme was launched by Ministry of Education in 1961. The aim of this scheme involves the provision of free to school-children on all working days, Protecting children from classroom hunger; Increasing school enrolment and attendance; improved socialisation among children belonging to all castes and Addressing malnutrition, and social empowerment through provision of employment to women, reduce school drops outs, and improve the attendance.

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. As per the current norms, the primary children are provided with 30-gram pulses, 75-gram vegetables and 7.5 grams vegetables.

TithiBhojan

The Modi Government included a new initiative Tithi-Bhojan in the Mid-day meal scheme to encourage local community participation in the programme. This concept was first implemented in Gujarat from where the Indian Government has borrowed it to replicate across the country. It seeks to involve the members of the community in the effort to provide nutritious and healthy food to the children. The members of the community may contribute/sponsor either utensils or food on special occasions/festivals. This is completely voluntary, and the people in the community may contribute food items supplementary to the midday already being provided like sweet, namkeen or sprouts. Greater participation and involvement of religious and charitable institutions is also being promoted. The Social Audit also introduced in mid-day meal scheme with an aim to attract community participation in which people collectively monitors the planning and implementation of this scheme. As per the new Mid Day Meal Rules, 2015' notified on September 2015:

Schools can temporarily use other funds available with the school for Mid Day Meal scheme in case the school exhausts the funds allotted under this scheme for any reason. In case of non supply of meals for specified reasons, Food Security Allowance has to be paid to the beneficiaries. To check the quality of meals, monthly testing of meals on random basis by accredited labs has to take place. The new rules have been notified to ensure regularity and quality of meals supplied.

AkshayaPatra

It was started in the year 2000 for feeding 1500 children in 5schools of Bangalore. Private sectors also involved successfully in this programme.

The objectives of this scheme were provide a balanced meal to underprivileged children, reduce the dropout, improve socialization among castes, address and malnutrition, and also empower women through giving them employment.

UNIT -7
NUTRITIONAL ASSESSMENT

NEED FOR AND METHODS OF ASSESSING NUTRITIONAL STATUS

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

Nutritional assessment aids in identifying

Under Nutrition

Over Nutrition

Nutritional deficiencies

Individuals at the risk of developing malnutrition

Individuals at the risk of developing nutritional related diseases

The resources available to assist them to overcome nutritional problems.

The nutritional status can be assessed by the following methods:

Direct Methods

Nutritional Anthropometry

Clinical Examination

Biochemical tests and

Biophysical methods.

Indirect Methods

Vital statistics of the community

Assessment of socio – economic status and

Diet surveys

16.6 ANTHROPOMETRIC MEASUREMENTS AND INDICES

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

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

Weight:

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

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

The standard reference body weight (kg) of Indians of different age groups is given in the table 16 B Table 16 B Reference body weight (kg) of Indians of different Age groups

	Reference body weight (kg)		
	Age (years)	Male	Female
Infants	0 – ½	5.4	5.4
Children	½– 1	8.6	8.6
	1 – 3	12.61	11.81
	4 – 6	19.20	18.69
	7 – 9	27.00	26.75
	10 – 12	35.54	37.91
Adolescents	13 –15	47.88	46.66
	16 – 18	57.28	49.92
Adults	20 – 50	60	50

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

Anthropometric Indices : Weight for age The Nutritional status can be interpreted using Gomez Classification as follows Weight ≥ 90% Weight for age. Normal.

76 – 90% Weight for age. Grade I malnutrition.

61 ≤ 75% Weight for age. Grade II malnutrition.

≤ 60% Weight for age. Grade III malnutrition.

Linear Measurements

Two types of linear measurements are commonly used. (i) height or length of the whole body

(ii) circumference of the head and the chest.

Height :

The height of the individual is the sum of four components: leg, pelvis, spine and skull. Table 16 C

The Standard Reference height for Indians of different age groups.

Age (years)	Height in cm	
	Boys	Girls
1+	80.07	78.09
2+	90.01	87.93
3+	98.36	96.21
4+	104.70	104.19
5+	113.51	112.24
6+	118.90	117.73
7+	123.32	122.65
8+	127.86	127.22
9+	133.63	133.08
10+	138.45	138.90
11+	143.35	145.00
12+	148.91	150.98
13+	154.94	153.44
14+	161.70	155.04
15+	165.33	155.98
16+	168.40	156.00

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

The height of an individual is measured using a stadiometer.

For infants and children recumbent length (crown – heel length) is measured. The measurement is compared with the standards of the ICMR as given in table 16C to assess nutritional status.

The desirable birth weight and length of an infant is 3 kg and 50 cm respectively. By the time the baby turns the first birth day, the birth weight is doubled and an increment of 25 cm in length is reached.

Changes in body weight from birth till one year

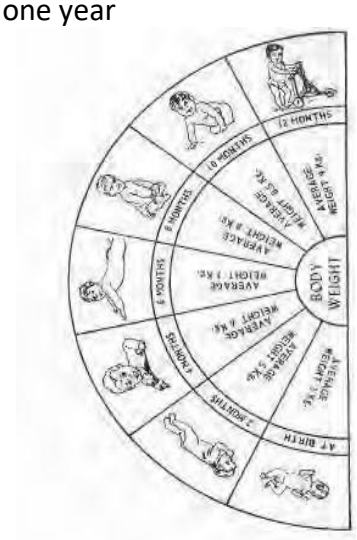


Fig 16.3 Head Circumference :

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

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Fig 16. 4 Measuring head circumference

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

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 the chest / head circumference ratio of less than one may be due to failure to develop or due to wasting of muscle and fat of chest.

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

Fig.16.5 Measuring chest circumference

Source: Jelliffe, D.B., 1989, The Assessment of Nutritional Status of the community WHO Monograph Series, Geneva Mid Upper Arm Circumference (MUAC) :

Mid upper arm circumference at birth in a healthy child is between 10 – 11cm. over the first year the increment in MUAC is 3 to 4 cm as the muscles of the arms start to develop. In the preschool age the increase in MUAC is only one cm. Hence

there is not much difference between the MUAC of a 3 year old from that of a 5 year old. So MUAC is an age independent index. The field workers in nutrition in our country have fixed the desirable value for MUAC as 12 cm for Indian preschool children.

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

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

In the field condition a bangle with a diameter of 4 centimeter can be used as a tool to detect malnutrition. When the bangle moves smoothly over the mid-upper arm of the child, it indicates malnutrition. The bangle test can be conducted with ease in field condition to screen malnourished children.

Fig. 16.6 Measuring mid upper arm circumference

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

16.7 CLINICAL SIGNS OF NUTRITIONAL DEFICIENCY DISORDERS

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

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

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

Condition	Clinical Signs
Protein Energy: Malnutrition	Odema, depigmentation, sparseness and easy pluckability of hair, moon face, enlarged liver, muscle waing.
Vitamin A	: Night blindness, Bitot's spots deficiency in the eye, Xerosis of skin.
Riboflavin deficiency	: Angular stomatitis, cheilosis.
Thiamine	: Oedema, sensory loss, calf deficiency muscle tenderness.
Niacin deficiency	: Raw tongue, pigmentation of the skin.
Vitamin C deficiency	: Spongy and bleeding gum.
Vitamin D	: Rickets, beading of ribs, deficiency Knock – knees, bowed legs.
Iron deficiency:	Pale conjunctiva, spoon – shaped nails.
Iodine deficiency	: Enlargement of thyroid gland.

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

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

Biochemical test:

Biochemical tests can be used to detect the deficiencies by analyzing blood, urine, stools and phlem. For (eg) Estimation of hemoglobin in blood to detect iron deficiency.

Indirect Methods:

Vital Statistics:

Malnutrition influences morbidity, mortality, life expectancy and other health statistics. Hence vital statistics may therefore be considered as indirect indication of the nutritional status of the community. Infant mortality rate, maternal mortality rate and morbidity rate are the vital statistics that can be used to assess the nutritional status of the community.

Assessment of socio – economic status: -

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

Diet surveys:

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

Food Inventory Method: This method is usually employed in Institutions where homogenous group of people take their meals in a common kitchen eg. Hostels, orphanages. In this method the amount of food stuff issued to the kitchen as per the issue register

is taken into consideration. No direct measurement or weighing is done. A study period of one week is desirable.

Food expenditure pattern method

In this method information on the amount spent on food and non-food items during the previous month or week is collected using a questionnaire. This method avoids actual weighing of foods.

24 hour recall

In this method a set of standardized cups suited to local conditions are used. The standard cups help the respondent to recall the quantities of the food prepared and fed to individual members on the previous day. This is usually done for three consecutive days. The advantage of this method is that the intake of each food item by the specific individual in the family such as pre-school child, adolescent, pregnant women can be assessed using the cups.

Diet History:

This method is useful for obtaining qualitative details of diet and studying patterns of food consumption at household and industrial level. The procedure includes assessment of the frequency of consumption, different foods, daily or number of times in a week or fortnight or occasionally. This method is used to study meal pattern, dietary habits, food preferences, and avoidances during sickness.

Weighment method:

In this method, the food either raw or cooked is actually weighed using an accurate balance. It is ideal to conduct the survey for seven consecutive days. Every day food is weighed in the morning and evening before actual cooking. The age, sex, physiological status of the family members should be noted down. Nutrient intake is then calculated using the ICMR food composition tables. Though this method is accurate as the foods are directly weighed, it requires extreme cooperation of the house wives.

The information on food and nutrient consumption is compared with the recommended allowances of the ICMR and the adequacy is determined. A combination of dietary, clinical and biochemical assessment is desirable for assessment of nutrition status of individuals or communities.