Indira Gandhi National Open University
SCHOOL OF HEALTH SCIENCE

CHO-0001

Foundations of Community Health

NATIONAL HEALTH MISSION
राष्ट्रीय स्वास्थ्य मिशन
राजस्थान



Nutrition

2

Indira Gandhi National Open University
SCHOOL OF HEALTH SCIENCE

CHO-0001

Foundations of Community Health

NATIONAL HEALTH MISSION
राष्ट्रीय स्वास्थ्य मिशन
राजस्थान

Nutrition

2

ignou
THE PEOPLE'S
UNIVERSITY

Indira Gandhi
National Open University
School of Health Sciences

CHO-0001
Foundations of Community Health

Block

2

NUTRITION

UNIT 1
Introduction to Nutrition and Nutritional Assessment 5

UNIT 2
Nutrition During Pregnancy and Lactation 44

UNIT 3
Nutrition for Infant, Child, Adolescent and Elderly 76

UNIT 4
Nutritional Deficiency Disorders 100

UNIT 5
Food Borne Diseases and Food Safety 127

Appreciation of Collaborative Efforts

The development of this Training Module for Community Health Officers (CHOs) is the result of a collaborative effort led by the Department of Medical, Health & Family Welfare, Government of Rajasthan, with valuable technical support from development partners. We sincerely thank all Directors, Project Directors, State Nodal Officers, and technical partners including Jhpiego, WHO, UNICEF, UNFPA, UNDP, IPE Global, IPAS, Evidence Action, JSI and others for their contributions. Their expertise, evidence-based inputs, and field insights have ensured the relevance and quality of this resource. This module aims to strengthen CHOs' capacity to deliver comprehensive, people-centered care at the community level, advancing our shared goal of improved health outcomes for all.

Acknowledging Contributors

The table below highlights the key contributors who played a critical role in the module's development, coordination, technical review, and partner support:

Coordination Committee

Dr. Rommel Singh (AD-Plan)	Ms. Shibumi Prem (Regional PO, Jhpiego)
Ms. Rachana (District Program Officer-NHM)	Dr. Manoj Sharma (Nursing Tutor)

OICs

Dr. Mushtaq Khan (SNO-MNJY)	Dr. Tarun Chaudhary (PD-MH)
Dr. Praveen Aswal (AD-RH)	Dr. Surendra Singh Shekhawat (PD-FW)
Dr. Pradeep Kr. Choudhary (PD- CH)	Dr. Mukesh Digarwal (PD-RKSK/RBSK & AD Ayush)
Dr. S.M. Swami (SNO-NMHP)	Dr. Raghraj Singh (PD-Immunization)
Dr. Nirmala Sharma (Deputy Director Malaria)	Sh. Rajendra Bhakher (Demographer, NHM)

Responsible Partner Coordinators

Mr. Arun Vashisht (NHM, Jaipur)	Ms. Karuna Singh (IPAS)
Dr. Zakariya Chouhan (WHO)	Mr. Devi Prasad Verma (IPAS)
Dr. Rashi Gupta (Jhpiego)	Ms. Manjri Singh (UNICEF)
Ms. Dande Venkata Sireesha (Jhpiego)	Dr. Kapil Agarwal (UNICEF)
Dr. Eshvita Bhadoo (Jhpiego)	Mr. Krishan Gopal Soni (UNFPA)
Dr. Pradeep Chaudhary (NIPI)	Mr Siyaram Sharma (UNFPA)
Ms. Pricella Bassin (IPE Global)	Dr. Abhay Bora (JSI)
Ms. Molshree Rathore (Evidence Action)	Mr. Mudit (UNDP)

CURRICULUM DESIGN COMMITTEE AND EXPERT COMMITTEE

Prof. (Dr.)Pity Koul
Director and Programme Coordinator
Dr. R.S Salhan
Additional DGHS (Retd.) Advisor, NHSRC, New Delhi
Dr. R.K Srivastava
Former DGHS, Govt. of India
New Delhi
Dr. Suneela Garg
Sub Dean & Head Dept. of Community Medicine, MAMC , New Delhi
Dr. Amarjeet Singh
Professor, Dept. of Community Medicine PGIMER, Chandigarh
Dr. Subodh. S. Gupta
Professor, Dept. of Community Medicine, MGIMS, Sevagram, Wardha
Mrs.Santosh Mehta
Principal, RAK College of Nursing, Lajpat Nagar, New Delhi
Dr. Prakasamma
Former Director, National Academy of Nursing Studies and Woman Empowerment (ANSWER) Hyderabad
Dr. Sushma Kumari Saini
National Institute of Nursing Education (NINE) PGIMER, Chandigarh. (U.T)
Dr. Sanjay Rai
Associate Professor Department of Community Medicine, AIIMS, New Delhi
Dr. Himanshu Bhushan
Advisor, NHSRC, New Delhi
Dr. Rajni Ved
Advisor, NHSRC, New
Delhi **Dr. Dilip Singh**
Advisor, NHSRC, New Delhi
Dr. Vinay Bothra
Sr, Consultant, NHSRC
Dr. Sumitha Chalil
NHM, MoHFW, New Delhi
Dr. Reeta Devi
Assist. Prof. (Sr. Scale) & programme Coordinator
Mrs. Rohini Bhardwaj Sharma
Assist. Prof. IGNOU

CURRICULUM DESIGN COMMITTEE

Prof. (Dr.)Pity Koul
Director and Programme Coordinator
Dr. R.S Salhan
Additional DGHS (Retd.) Advisor, NHSRC, New Delhi
Dr. R.K Srivastava
Former DGHS, Govt. of India
New Delhi
Dr. Suneela Garg
Sub Dean & Head Department of Community Medicine, MAMC, New Delhi
Dr. Amarjeet Singh
Professor, Medicine PGIMER, Chandigarh
Dr. Subodh. S. Gupta
Professor, MGIMS, Sevagram, Wardha
Mrs.Santosh Mehta
RAK College of Nursing, Lajpat Nagar, New Delhi
Dr. Prakasamma
National Academy of Nursing Studies and Woman Empowerment (ANSWER) Hyderabad
Dr. Sushma Kumari Saini
National Institute of Nursing Education (NINE) PGIMER, Chandigarh. (U.T)
Dr. Sanjay Rai
Associate Professor Department of Community Medicine, AIIMS, New Delhi
Dr. Rajni Ved
Advisor, NHSRC, New Delhi
Dr. Vinay Bothra
Sr, Consultant, NHSRC
Dr. Sumitha Chalil
NHM, MoHFW, New Delhi
Dr. Reeta Devi
Assist. Prof. (Sr. Scale)
Mrs. Rohini Bhardwaj Sharma
Assist. Prof. IGNOU

BLOCK PREPARATION TEAM

Writers

Unit-1 **Prof. (Dr.) Mehmooda Regu**
SKIMS, Soura, Srinagar

Unit-2 **Dr. Ruchi**
Prof. Community Medicine HIMS, Jolly Grant Dehradun (UK)

Unit-3 **Dr. Abhishek Raut**Asso. Professor MGIMS, Sevagram, Wardha

Unit-4 **Dr. M.M.Singh**
Dir. & Prof. MAMC, New Delhi

Unit-5 **Dr. Dilip Das**
Prof. and Chief Editor Vurdwan Medical College, Dist-Vurdwan, West Bengal

Editors

Dr. Amarjeet Singh
Professor, PGIMER Chandigarh
Unit Transformation and format editing Prof.
(Dr.) Pity Koul
Director and Programme Coordinator
Dr. Reeta Devi
Assist. Prof. (Sr. Scale) Programme Coordinator

COURSE REVIEW COMMITTEE

Dr. Rajesh Kumar
Prof. & Head, Dept. of Community Medicine, PGIMER, Chandigarh
Dr. Suneela Garg
Sub Dean & Head
MAMC, Departmant of Community medicine, New Delhi **Dr. Himanshu Bhushan**
Advisor, NHSRC, New Delhi
Dr. A.K.Sood
Prof. & Dean of Educations & Training, NIHFW, New Delhi
Dr. Prabir Chatterjee
SHRC, Chattisgarh
Dr. S.B Sinha
Advisor HCT, NHSRC
Dr. M.M.Singh
Director & Professor MAMC, Community Medicine, New Delhi
Dr. Jugal Kishore
Director Professor VMMC, Safdarjung Hospital, New Delhi
Dr. Najam Khalique
Department of Community Medicine AMU, Uttar Pradesh
Dr. Dilip Singh Mairembam
Advisor, NHSRC, New Delhi
Dr. Manju Rani
WHO
Dr. Radhika Gupta
Consultant, NHSRC
Dr. Vinay Bothra
Sr, Consultant, NHSRC
Faculty SOHS, IGNOU
Prof. (Dr.)Pity Koul
Director and Programme Coordinator
Dr. Reeta Devi
Assist. Prof. (Sr. Scale) & programme Coordinator
Mrs. Rohini Bhardwaj Sharma
Assist. Prof.
Brig.(Dr) Kanchan Sharma (Retd.)
Senior Consultant, IGNOU
R.K.Puram, New Delhi

CO-ORDINATION

Prof. (Dr.) Pity Koul
Director & Programme Coordinator
School of Health Sciences, IGNOU, New Delhi

Mrs. Reeta Devi
Asstt. Professor. (Sr. Scale) & Programme Coordinator School of Health Sciences, IGNOU, New Delhi

PRODUCTION

Mr. T.R. Manoj
Assistant Registrar (P)
SOHS, IGNOU, New Delhi

May, 2017
© *Indira Gandhi National Open University, 2016* ISBN
:
All rights reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from the Indira Gandhi National Open University.
Further information about the School of Health Sciences and the Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068.
Printed and published on behalf of the Indira Gandhi National Open University, New Delhi by
Prof. Pity Koul, Director, School of Health Sciences.
We acknowledge the reference of material and figures from various sources like NNF, AIIMS, WHO, UNICEF, IGNOU, Govt. of India etc.
Laser Typesetting and Printed at : **Rajasthan State Cooperative Press Ltd., Jaipur**

BLOCK INTRODUCTION

As a Mid level health care provider you need to review the various aspects of nutrition and nutritional assessment including nutritional requirement of various groups such as pregnant and lactating mothers, infants, children, adolescent and elderly. You also need to update your knowledge regarding nutritional deficiency disorders, food borne diseases and food safety. This will help you to make proper nutritional assessments, identify nutritional deficiencies, and counsel the individuals, family and community regarding promotion of nutritional health of all groups. You also need to be aware about National Nutrition Programmes and your role as an educator so that you can advise the community according to their individual practices, religion and cultural background and participate in various activities under these programmes.

Food safety and food borne diseases is an area of importance so you need make continuous efforts to make community aware about the food safety practices and the diseases that may occur due to mishandling of food stuffs, unhygienic practices, ignorance and unethical food adulteration.

This block comprises of five units as given below.

Unit 1 focuses on Introduction to Nutrition and Nutritional assessment.

Unit 2 deals with Nutrition during Pregnancy and Lactation

Unit 3 relates to Nutrition for Infant, Child, Adolescent and Elderly

Unit 4 explains Nutritional Deficiency Disorders

Unit 5 describes Food Borne Diseases and Food Safety

We hope that this knowledge will enable you to fulfill the nutritional and food safety needs of the individual family and community at large.

UNIT 1 INTRODUCTION TO NUTRITION AND NUTRITIONAL ASSESSMENT

Structure

1.0 Introduction

1.1 Objectives

1.2 Concept of Nutrition

1.3 Types of Nutrients
- 1.3.1 Macronutrients
- 1.3.2 Micronutrients

1.4 Meal Planning
- 1.4.1 Aims of Meal Planning
- 1.4.2 Steps of Meal Planning
- 1.4.3 Diet Plan for Different Age Groups

1.5 General Dietary Advice

1.6 Nutritional Assessment
- 1.6.1 Objectives of Nutritional Assessment
- 1.6.2 Methods of Assessment

1.7 Nutrition Education
- 1.7.1 Purpose Nutrition Education
- 1.7.2 Principles of Nutrition Education
- 1.7.3 Methods for Imparting Nutrition Education

1.8 National Nutrition Programmes

1.9 Let Us Sum Up

1.10 Model Answers

1.0 INTRODUCTION

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

This unit focuses on concepts of nutrition. It emphasises various facts about nutrition like concepts and classification of nutrients, common source of various nutrients, special nutritional requirements according to age, sex, activity and physiological condition. This will enable you to help your target

population to prevent nutrition related diseases and you will be able to promote positive health among them.

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

1.1 OBJECTIVES

After completing this unit, you should be able to:

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

1.2 CONCEPT OF NUTRITION

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

Nutrition is the science of food and its relationship to health. Following three processes are involved in the utilisation of food in our body. i) **Ingestion:** It implies intake of food (by mouth) ii) **Digestion:** After ingestion food is digested to make it absorbable. It is achieved by enzymes present in our mouth (saliva), stomach and intestines.

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

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

Food has major physiological functions as follows:

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

Food has social function also, as mentioned below:

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

Psychological function of food includes the following:

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

1.3 TYPES OF NUTRIENTS

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

Functions of nutrients:

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

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

1.3.1 Macronutrients

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

1) **Proteins**

These are of the greatest importance in human nutrition. Proteins are composed of carbon, hydrogen, oxygen, nitrogen and sulphur, phosphorus,

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

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

Functions of Proteins:

1) For growth and development: since they provide the building material i.e. the amino acids
2) For repair of body tissues and their maintenance
3) For synthesis of antibodies, enzymes and hormones. The body requires protein to produce anti bodies. Protein also can furnish energy to the body in shortage of fats or carbony drates in diet. But generally the body depends on carbohydrates and fats rather than proteins.

Sources of proteins:

1) **Animal Source:** Proteins of animal origin are found in milk, meat, eggs, cheese, fish and fowl. These contain all the essential amino acids in adequate amounts. Egg protein is considered to be the best among food proteins because of their high biological value and digestibility.
2) **Plant Source:** Plant or vegetable proteins are found in pulses (legumes) cereals, beans, nuts, oil-seed cakes, etc. They are poor in essential amino acids. In India, cereals and pulses are the main sources of dietary protein because they are consumed in bulk. (Table 1.1)

Table 1.1: Dietary Sources of Proteins

Food	Protein (gm per 100 g. of food)
ANIMAL FOODS	
Milk	3.2-4.3
Meat	18.0-26.0
Egg	13.0
Fish	15.0-23.0
PLANT FOODS	
Cereals	6.0-13.0

Pulses	21.0-28.0
Vegetables	1-4
Fruits	1-3
Nuts	4.5-29.0
Soyabean	43.2
Others	
Oils and fats / Sugar and Jaggery	Nil

Protein Requirements:

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

2) **Fats**

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

Functions of Fats:

1) Dietary fat is concentrated source of energy. One gram of fat supplies 9 calories of energy. This is almost twice the number of calories derived weight for weight, from carbohydrate or protein.
2) Fats are carriers of fat-soluble vitamins, e.g. vitamins A, D, E and K.
3) Dietary fat supplies "essential fatty acids", e.g. Linoleic acid, prevents scaly skin formation. In general, essential fatty acids are needed for growth and maintenance of the integrity of the skin.
4) The fat layer below the skin helps in maintaining our body temperature. 5) Fats provide cushioning for many organs in the body (heart, kidney, intestine etc.) 6) Foods containing fats are tasty.

Sources of Fats:

1) Animal sources: These are ghee, butter, fat of meat, fish oil, etc.
2) Vegetables sources: these are various vegetable oils such as groundnut, gingely, mustard, cottonseed, safflower (kardi) and coconut oil.

Visible and invisible fats:

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

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

Table 1.2: Dietary Sources of Essential Fatty Linoleic Acids

Essential Fatty Acids	Dietary Sources	Per cent Content
Linoleic	Safflower	73
	Corn oil	57
	Sunflower oil	56
	Soya bean oil	51
	Sesame oil	40
	Groundnut Oil	39
	Mustard oil	15
	Palm oil	9
	Coconut oil	2
Arachidonic acid	Meat, eggs,	0.5- 0.3
	Milk (fat)	0.4-0.6
Linolenic acid	Soyabean oil	7
	Leafy greens	varied
Eichosapentaenoic acid	Fish oil	10

3) Carbohydrates

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

Dietary Fibre:

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

Check Your Progress 1

1) List any three functions of Nutrients.

.....

.....

2) List the type of Nutrients.

.....

.....

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

.....

.....

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

.....

.....

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

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

7) List any two functions of protein.

.....

.....

8) ……are the fat soluble vitamins.

9) List any two animal sources of fat.

.....

.....

1.3.2 Micronutrients

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

I) Vitamins

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

Classification:

1) Fat soluble vitamins : Vitamins A, D, E, and K are fat saluble vitamins.
   a) Vitamin A or retinol
   b) Vitamin D (Caliciferol-D2, cholecalciferol D3)
   c) Vitamin E (Tocopherol)
   d) Vitamin K
2) Water soluble vitamins : The following are water saluble vitamins:-
   a) Thiamine (vitamin B1)
   b) Riboflavin (vitamin B2)
   c) Nicotinic acid
   d) Pyridoxine (vitamin B6)
   e) Pantothenic acid
   f) Folic acid
   g) Vitamin B12
   h) Ascorbic acid (vitamin C)

1) Vitamin A (Retinol)

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

Function of Vitamin A: It is needed for1) Normal vision and health of the eyes.

2) Health of the skin and mucous membrane.
3) Skeletal growth.
4) Protection of body against infection.

Sources of Vitamin A:

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

Plant Sources: The cheapest source of vitamin A is green leafy vegetables such as spinach, amaranth, coriander, drum-stick leaves. (Table 1.3)

A daily intake of 100 grams of leafy vegetables provides the daily requirement of vitamin A. Other vegetables (carrots, pumpkin), and ripe fruits (e.g.

mangoes, papaya) are also rich sources. In vegetables and fruits, it occurs in a different form (precursor form) known as carotene. It is converted into vitamin A in small intestine, and then stored in liver. Carotenes are the main source of vitamin A for Indians. Average absorption of carotenes from Indian diet is about 50%.

Table 1.3 : Dietary Sources of vitamin A

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

Daily requirement: (1 I.U. of vitamin A =0.3 u g retinol)

Recommended allowances: See Table 1.4

Table 1.4 : Daily required intake of vitamin A

Group	Retinol mcg	Or B carotene mcg
Adults		
Man	600	2,400
Woman	600	2,400
Pregnancy	600	2,400
Lactation	950	3,800
Infants (0 to 12 months)	350	1,200

Children		
1 to 3 years	400	1,600
4 to 6 years	400	1,600
7 to 9 years	600	2,400
10 to 12 years	600	2,400
Adolescent 13 to 19 years	600	2,400

Effects of deficiency:

1) **Night blindness:** It is inability to see in dim light. It is the earliest symptom of vitamin A deficiency.
2) **Xerophthalmia:** It is the dryness of the eye. The white portion of the eye (conjunctiva) becomes "dry" when the eye lids are kept open for half a minute or so. This is an early clinical sign of vitamin A deficiency. In addition, the conjunctiva appears muddy and wrinkled.
3) **Bitot's spots:** These are brownish, triangular raised, foamy patches seen on the white portion (sclerolconjunctiva) of the eye.
4) **Keratomalacia:** The cornea (black portion) of the eye becomes soft and loses its transparency. It may affect a part or whole of the cornea. If not promptly treated, it leads to complete collapse or destruction of the eye ball, resulting in blindness. Once this stage is reached, no amount of rich food rich in vitamins A or treatment can bring back the eye-sight.

2) **Vitamin D**

It occurs in mainly 2 forms.

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

Functions:

1) Vitamin D is required for the formation of the healthy bones and teeth. It has a direct action on the mineralisation of the bones.
2) It promotes the intestinal absorption and utilisation of calcium and phosphorus.

Sources:

1) **Sunlight:** This is an important natural source of vitamin D. Provitamin, 7-dehydrocholesterol, which is normally present in the skin is converted into vitamin D3 by the action of the ultraviolet rays of the sunlight. The rate at which vitamin D3 is synthesised in the skin depends upon the exposure of the body to the sun.
2) **Foods:** These include egg (yolk), liver and fish. Fish liver oil is the richest source. Milk is generally a poor source. Vitamin D is not found in foods of vegetable origin. (Table 1.5)

Table 1.5 : Dietary source of vitamin D

Source	Microgram per 100 grams
Eggs	1.5
Butter	0.5-1.5
Liver	30-40
Milk	0.1

Daily requirement:

a) **Adults:** They need 2.5 micrograms (100 i.u.) per day. In most climatic conditions, normal adults obtain vitamin D in enough amounts through sunlight.

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

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

3) **Vitamin E**

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

4) **Vitamin K**

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

5) **Thiamine**

It is a water-soluble vitamin. It is relatively stable to heat, but is destroyed in neutral or alkaline solution. It plays an important part in carbohydrate metabolism. In thiamine deficiency, there is accumulation of pyruvic and

lactic acids in the tissues and body fluids. It is also essential for the proper functioning of the nervous system.

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

Table 1.6 : Thiamine in Food Stuffs

Food	Mg per 100 grams
Wheat whole	0.54
Rice, raw home pounded	0.21
Rice, milled	0.06
Bengal gram dal	0.48
Almonds	0.24
Gingely seeds	1.01
Groundnut	0.90
Milk, whole	0.05
Egg , (Hen)	0.13
Liver	0.36

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

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

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

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

6) **Riboflavin**

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

Sources: Good sources are milk and milk products, eggs, liver and green leafy vegetables. Wheat, millets, and pulses are fair sources, but rice is a poor

source. Germinating pulses also furnish riboflavin. It's also synthesised by bacteria in the large intestine.

Daily requirement: 0.6 mg per 1,000 calories.

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

7) **Niacin**

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

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

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

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

8) **Pyridoxine (Vitamin B6):**

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

9) **Pantothenic acid**

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

10) **Folic acid**

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

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

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

11) **Vitamin B12**

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

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

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

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

12) **Vitamin C**

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

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

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

Table 1.7 : Dietary sources of vitamin C

Sources	mg per 100 g	Sources	Mg per 100 g
Fruits		**Vegetables**	
Amla	600	Amaranth	99
Guava	212	Cabbage	124
Lime	63	Spinach	28
Orange	30	Brinjal	12
Tomato	27	Cauliflower	56
Bengal gram	15	Potatoes	17
Green gram	16	Onion	11
		Reddish	15

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

Requirement: Recommended values of Vitamin C are as follows:

Adults	40 mg per day

Pregnancy	40	mg	per day
Lactation	80	mg	per day
Infants and children	40	mg	per day

II) **Minerals**

These are divided into two major groups:

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

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

Table 1.8 : Function of Minerals

Minerals	Function
Calcium	• Development of bones and teeth with phosphorus. • Regulation of contraction and relaxation of muscles e.g. heart muscles. • Regulation of passage of substances across cell membrane. • Facilitation of impulses from one nerve cell or neuron to another. • Clotting of blood.
Phosphorus	• Development of bones and teeth (with calcium). • Formation of phospholipids
Minerals	**Function**
	• Synthesis of certain coenzymes • Formation of basic genetic material such as DNA and RNA. • Formation of ATP- (the form in which the body stores energy)
Iron	• Oxygen transport through haemoglobin, an iron-containing compound. • Fueling muscle contraction through the action of myoglobin which stores oxygen for the immediate needs of muscle cells. • Completing the oxidation of carbohydrates, fats and proteins.

	• Maintenance of higher order brain functions including learning. • Metabolism reactions of various types as a part of enzymes or other substances maintaining the functions of the body's immune system.
Iodine	• Synthesis of the hormone thyroxine secreted by the thyroid gland. (which plays an important role in the regulation of oxidation in cells)
Sodium	• Regulation of balance between extracellular and intracellular fluids. • Regulations of pH of body fluids. • Facilitation of passage of nerve impulses from neuron to neuron. • Regulation of muscle contraction. • Regulation of movement of substances across cell membranes.
Potassium	• Regulation of balance of intracellular and extracellular fluid. • Regulation of pH of body fluids. • Role in muscle contraction. • Role in transmission of nerve impulses.
Chloride	• Regulation of pH of body fluids with sodium and potassium.
Magnesium	• Regulation of transport of substances across cell membranes. • Maintenance of enzyme activity as a coenzyme. • Role in bone mineralisation (deposition of minerals in bones). • Maintenance of transmission of nerve impulses. • Synthesis of protein. • Facilitation of smooth muscle action.

1.4 MEAL PLANNING

It involves applying the knowledge of food, nutrient requirements and individual preferences to plan adequate and acceptable meals. Suitable diet for the individuals and families shall be as per the local food items available, individual dietary habits and as per economic status of families. The diet should also satisfy hunger and taste.

Balanced diet includes the foods from at least 3 to 5 food groups in a meal in adequate amounts and proportions. It should provide all the required nutrients for the given person.

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

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

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

1.4.1 Aims of Meal Planning

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

1.4.2 Steps of Meal Planning

1) It starts with considering a person's or the group's age, sex and physical activity for one full day from morning to night.
2) Three major meals (breakfast, lunch and dinner) and 1–3 small meals snacks (mid-morning evening tea/snack and bedtime) can be planned for one full day. Details depend on the age, work schedule and physiological status.
3) A gap of 2–3 hours should be kept between main and small meals and of 4–6 hours between two main/major meals.

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

5) Use the food pyramid/food groups for selection of groups.

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

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

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

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

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

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

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

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

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

1.4.3 Diet Plan for Different Age Groups

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

Diet Plan for a Toddler: Children aged 1–4 years can eat the same foods as an adult, about half the amount. This stage in life is vital to development both physically and mentally. Therefore, optimum nutrition is vital, not only for the child's health, but also reduction in risk of disease later in life. These few

years can shape eating patterns for their whole life. Healthy foods are good to include. But do not forget to remind the parents to ensure that their children drink plenty of fluids throughout the day. Try also to make foods fun and easy to eat. All kids are different. Any meal plan should account for their likes and dislikes.

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

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

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

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

Check Your Progress 2

1) Name any three sources of vitamin A.

.....

.....

2) Daily requirement of vitamin D is……

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

4) ……are essential for synthesis of DNA.

5) Classify the minerals.

.....

.....

6) Enlist any three aims of meal planning.

.....

.....

7) Enlist three major meals and their ideal timings to take.

.....

.....

1.5 GENERAL DIETARY ADVICE

Let us now discuss general lietary advices at different mean time age as given below:

Breakfast

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

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

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

Accompaniments: Raw fruits or chutneys;

For non-vegetarians: Egg preparations may be used

Lunch

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

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

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

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

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

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

Egg/meat/fish preparations: One portion of this can be eaten instead of one portion of a pulse preparation, e.g. fish curry, mutton curry, chicken curry, prawn pulao.

Sweet preparations or dessert can also be included occasionally but should not be eaten daily.

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

Many people go out to work and carry packed lunch.

Packed lunch: It has certain limitations, which necessitates modification in food preparation and serving style. The following points should be considered for designing a packed food. It is better to have dry food. Gravy preparations or beverages may spill during travel and may require special containers. • It may not be possible to have a large variety of foods as it may require additional preparation in the morning, or additional or many containers. There may not be enough time or a proper place to eat all the different varieties. • Temperature of the food preparation needs to be considered. Very hot food or foods, which require refrigeration if packed, may spoil if it is eaten much later

in the day. Certain hot preparations may not be palatable or may become soggy, e.g. noodles, dosa.

- It should preferably contain food preparations, which are attractive, palatable or can be shared within the peer group.
- Age of the person should be considered.
- Portion size is important.
- It is important not to include biscuits, chips, noodles.
- It should consist of a cereal preparation, vegetables, and a pulse preparation.

Snacks

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

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

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

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

Dinner

Nutritionally, it is similar to lunch and similar food preparations included in this meal are generally more appetising since dinner is generally eaten at home with the family, in a relaxed manner. Those who consume packed lunch need to pay adequate attention to the nutritional quality of their dinner. However,

one must guard against consuming heavy, deep fried and rich food items. Dinner should provide the remaining 1/3rd of the day's energy and nutrient requirement.

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

Table 1.9 : Sample menu providing approximately 2000 kcal

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

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

The example given below is a calculation of percent energy obtained from the three macronutrients:

- Protein: 70g× 4 kcal = 280 kcal divided by 2000 = 0.14 multiplied by 100 = 14%.
- Carbohydrate: 317.5 g × 4 kcal = 1270 divided by 2000 = 0.635 multiplied by 100 = 63.5%.
- Fat: 50g × 9kcal = 450 divided by 2000 = 0.225 multiplied by 100 = 22.5%.

1.6 NUTRITIONAL ASSESSMENT

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

1.6.1 Objectives of Nutritional Assessment

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

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

1.6.2 Methods of Assessment

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

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

Signs used in nutritional survey:

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

However, clinical signs have the following characters:

- Malnutrition cannot be quantified on the basis of clinical signs
- Many deficiencies are unaccompanied by physical signs, and

- Lack of specificity and subjective nature of most of the physical signs.

To minimise subjective and objective errors in clinical examination, standard surveys forms or schedules have been devised covering all areas of the body.

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

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

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

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

Laboratory and Biochemical Assessment:

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

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

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

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

Check Your Progress 3

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

.....

.....

.....

2) Enlist the objectives of nutritional assessment.

.....

.....

.....

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

.....

.....

.....

4) Mid-Arm circumference is measured between……

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

1.7 NUTRITION EDUCATION

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

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

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

1.7.1 Purpose of Nutrition Education

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

1) To educate the individual, the family and the community about **locally available and seasonal** the food sources, nutritive values, proper method of cooking, balanced diet and requirements of energy.
2) To educate them about the food selection, **including fortified foods and reading food labels** , preparation, purchase and storage.
3) To provide information about food substitutes, **dietary supplements** , changes and modification in diet.
4) To educate the effects of various cooking methods on the nutrients.
5) To inform about the importance of various nutrients and their required amount.
6) To inform about signs and symptoms of nutritional deficiencies.
7) To explain about the importance of food hygiene.
8) To underline the nutritional requirements of the vulnerable group (children, pregnancy, location, and old age).
9) To educate to avoid bad habits, prejudices, idiosyncrasies and wrong notions on diet.
10) To educate on methods of prevention and control of nutritional deficiencies.

1.7.2 Principles of Nutrition Education

1) Nutrition education should include all family members.
2) Help the family to understand the importance and objectives of nutrition.
3) Advice should be made according to the individuals, practice, religion and culture.
4) The individual should be given sufficient time to adopt new ideas and habits.
5) They should be encouraged to ask questions (to satisfy their queries).

1.7.3 Methods for Imparting Nutrition Education

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

- **Personal talks:** One to one casual or informal talk with people will yield better results when counselling them on nutrition. First their existing diet and routine life should be analysed against the family background. This will help menu planning, budgeting the foods and exchange list, etc.
- **Group Discussion:** It is organised by a nurse, dietician or any other expert. Group should include the persons with same characteristics.
- **Exhibition and Kitchen Garden:** These are the real aids which can show the practical means of using fresh vegetables and fruits. There is also visual demonstration which helps and motivates people to adopt healthy nutritional preparations.

- **Cooking Demonstration:** Cooking demonstration helps the people to change their menu as per their taste. They can learn various methods of cooking.
- **Posters and Charts:** These can be used to highlight specific features in nutrition. Posters should be comprehensive, colourful and self-explanatory.
- **Practical Methods:** These include short menu planning, budgeting of food, calculating the caloric and other nutrient intake per menu intake. During home visits to the families nurse can guide them as per their family size, income, age group and their food habits.

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

Nutrition education can be organised during:

1) Home visit.
2) School health programmes
3) During special clinics, e.g. ante/ post-natal clinic and preschool clinic
4) Special community health programmes and health camps
5) Indoor and outdoor clinics with patients and their attendants.

1.8 NATIONAL NUTRITION PROGRAMMES

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

1) **Vitamin A prophylaxis programme**

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

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

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

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

2) **Iodine deficiency disorders control programme (IDDCP)**

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

Components of IDDCP programme: Components of IDDCP are as given belows:

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

- **Oral Iodised oil:** The oral administration of iodine as iodised oil or as sodium iodate tablets is technically simpler than the injection method.
- **Iodine Monitoring:** A network of laboratories is available for this.
- **Man Power Training:** Health workers and other engaged in the programme are trained in all aspects of goiter control including legal enforcement and public education.
- **Mass Communication:** It's a powerful tool for nutrition education. It should be fully used in goiter control, work. Creation of public awareness is a key to success of the programme.
- **Hazards of Iodisation:** Amid increase in incidence of thyrotoxicosis has now been described following iodised salt programme.

- **Role of nurse:** A complete assessment is necessary to know the magnitude of the iodine deficiency disorders. It will help in planning and administration of IDD programme. A nurse is direct care provider to the families in community and to the patients in hospitals. You can assess the problem while working in your area. You can help the laboratory workers in iodine monitoring when required.

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

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

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

3) **Mid-Day Meal Programme**

In order to combat malnutrition and improve the health of school children, it is now an accepted procedure in all advanced countries to provide a good nourishing meal to school children. In view of the limited finances in India, it is recommended that the school meal should provide atleast one-third of daily calories requirement and about half of the daily protein requirement of child. Mid-day Meal Programme was initiated in 1962. Following broad principles should be kept in mind for this meal:

- It should be a supplement and not a substitute to the home diet.
- It should supply atleast one-third of the total energy requirement and half of the protein need.
- Its cost should be reasonably low.
- No complicated cooking process should be involved.
- As far as possible, locally available foods should be used; this will reduce the cost of the meal.
- The menu should be frequently changed to avoid monotony.

Table 1.10 : Model Menu

Food Stuffs	g/day/child
Cereals and millets	75
Pulses	30
Oils and fats	8
Leafy vegetables	30
Non leafy vegetables	30
Milk/ substitute	150-200 ml.

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

The important goals to be accomplished are: i)

Reorientation of eating habits, ii) Incorporation

nutrition education into the curriculum.

iii) Encouraging the use of local commodities.

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

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

Some suggestions for preparation of mid-day meal are as under: • Food grains must be stored in a place away from moisture, in air tight containers/bins to avoid infestation. Special precaution should be taken to avoid contamination with pesticides (do not store these in food store area)

- Use whole wheat and broken wheat (dalia) for preparing mid-day meals.
- Rice should preferably be parboiled or unpolished.
- 'Single Dish Meals' using broken wheat or rice and incorporating some amount of a pulse or soya beans and some seasonal vegetable, green leafy vegetables and some amount of edible oil will save both time and fuel besides being nutritious
  (e.g. Broken wheat pulao, leafy khichari, upma, dal-vegetable bhaat)
- Cereal pulse combination is necessary to have good quality protein. The cereal pulse ratio could range from 3:1 to 5:1.
- Sprouted pulses have more nutrients and should be incorporated in single dish meal.

- Leafy vegetables when added to any preparation should be thoroughly washed before cutting and should not be subjected to wash after cutting.
- Soaking of rice, dal, Bengal gram, etc. reduces cooking time. Wash the grains thoroughly and soak in just sufficient amount of water required for cooking. • Rice water if left after cooking should be mixed with dal. If these are cooked separately, should never be thrown away.
- Fermentation improves nutritive value.
- Locally popular food items (khichri, kadhi, idli, dosa, dhokla,) may be encouraged.
- Cooking must be done with the lid on to void loss of nutrients.
- Over coking should be avoided.
- Reheating of oil used for frying is harmful and should be avoided.
- Leafy tops of carrots, radish, turnips, etc. should not be thrown.
- Only 'iodised salt' should be used for cooking mid-day meal.

Why School Meals are given?

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

Role of Nurse in Mid-Day Meal Programme:

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

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

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

b) **Planning and Implementation:** After assessment, you should also participate in planning and implementation of mid-day school meal. You should observe whether the meal is providing one-third of the daily energy required and about half of the daily protein required. You should also

provide this information to the school teachers who are the main persons to plan and prepare mid-day school meal.

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

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

4) ICDS (Integrated Child Development Services Scheme)

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

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

Objectives of ICDS

1) To improve the nutritional and health status of children in the age group of 0 to 6 years.
2) To lay foundations for proper psychological, physical and social development of the child.
3) To reduce mortality and morbidity, malnutrition and school dropout.
4) To achieve an effective coordination of policy an implementation among the various departments working for the promotion of child development.
5) To enhance the capabilities of the mother and nutritional needs of the child through proper nutrition and health education.

Table 1.11: Package of Services under ICDS

The delivery of services to the beneficiaries are as follows:

Services	Target Group	Service Provided By
i) Supplementary Nutrition	Children below 6 years, Pregnant & Lactating Mothers (P&LM)	Anganwadi Worker and Anganwadi Helper [MWCD]
ii) Immunisation*	Children below 6 years, Pregnant & Lactating Mothers (P&LM)	ANM/MO [Health system, MHFW]
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, MHFW]
v) Pre-School Education	Children 3-6 years	AWW [MWCD]
vi) Nutrition & Health Education	Women (15-45 years)	AWW/ANM/MO [Health system, MHFW & MWCD]

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

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

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

Beneficiaries	Calories	Protein (g)
Children(6 months to 72 months)	500	12-15
Severely malnourished Children (SAM) (6 months- 72 months)	800	20-25
Pregnant women and lactating mothers	600	18-20

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

Functions of Angan Wadi Worker (AWW)

- Survey of community and beneficiaries.
- Assesses their growth/development & health status.
- Organises Non-formal education activities for mothers and children.

- Assists PHC staff in providing health services.
- Maintains records of immunisation, feeding and preschool attendance.
- Works for other community based activities, e.g. family planning.
- Mediation between administrator, local school, health staff and community.

Delivery of Services : Let us now go through various activities delivered under ICDS scheme as given below:

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

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

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

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

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

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

- **Training, Supervision & Evaluation:** You can make a supervisory round in Anganwadi in your area to check their health records, attendance and functions they perform. You should guide whenever they need. Nurse should check growth monitoring cards and match with head to foot inspection to identify under nourished children.
- **Health Education:** This must include the diet during pregnancy and lactation, immunisation, treatment of diarrhoea with ORS. Mothers should be encouraged to attend Anganwadis by making them aware about different services of ICDS.

Check Your Progress 4

1) List any three purposes of Nutritional Education.

.....

.....

2) Explain the principles of Nutritional education.

.....

.....

3) Enlist methods of imparting Nutritional Education.

.....

.....

4) Enlist the National Nutritional Programmes.

.....

.....

5) List the services being provided under ICDS.

.....

.....

6) Enlist the functions of AWW.

.....

.....

1.9 LET US SUM UP

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

1.10 MODEL ANSWERS

Check Your Progress 1

1) i) Structural integrity of bones, muscles and other tissues ii) Energy production for physical activity iii) Growth, development and repair.
2) Macronutrient and Micronutrient
3) Proteins, fats and carbohydrates
4) About 16%
5) Ideally only 20–30% of total dietary energy should be provided by fats.
6) There are 3 main sources of carbohydrate, viz., starches, sugar and cellulose.
7) i) For growth and development: they furnish the building material i.e. the amino acids

   ii)For repair of body tissues and their maintenance
8) Vitamins A, D, E and K
9) Ghee and Meat

Check Your Progress 2

1) Carrots, mangoes and papaya
2) 2.5 micrograms (100 i.u.) per day
3) Rickets, Osteomalacia
4) Folic Acid and Vitamin B12
5) • **Major minerals:** Calcium, phosphorus, sodium, potassium, and magnesium.

   • **Trace elements:** These are required by the body in less than few milligrams per day e.g. iron, iodine, fluorine, zinc, copper, cobalt, chromium, manganese, molybdenum, selenium, nickel, tin, silicon and vanadium.
6) i) Help in the purchase, preparation and service of appropriate food items.

   ii) Help to economise on time, labour and fuel.

   iii) Provide variety in the diet through proper selection of foods.
7) Breakfast at 8–10 am, lunch at 2–3 pm, and dinner at 8–9 pm.

Check Your Progress 3

1) Breakfast is the first meal of the day and is very important from the nutritional point of view.

Literally, it means breaking the fast, because it is eaten after a gap of 8–10 hours after the night meal on the previous day, i.e. dinner. It will boost the energy level and help to maintain energy level throughout the day and prevent physical and mental fatigue.

2) • To obtain information on the extent of nutritional problems of a community.
   - To identify the population group 'at risk' or in greatest need of assistance.
   - To develop a nutrition programme that meets the needs defined by the assessment.
   - To evaluate the failure or success of nutrition programme.
   - To assess the degree of malnutrition of preschool and school going children.
3) Height, weight, head circumference, skin fold thickness, mid arm circumference, waist circumference.
4) Shoulder and tip of the elbow
5) Haemoglobin estimation

Check Your Progress 4

1) To educate them about the food selection, preparation, purchase and storage. To inform about the importance of various nutrients and their required amount.

   To inform about signs and symptoms of nutritional deficiencies

2) • Nutritional education should include all family members.
   - Help the family should understand the importance and objectives of nutrition.
   - Advice should be made according to the individuals, practice, religion and culture.
   - The individual should be given sufficient time to adopt new ideas and habits.
   - They should be encouraged to ask questions (to satisfy their queries).
3) Personal talks, Group Discussion, Exhibition and Kitchen Garden, Cooking Demonstration, Posters/Charts and practical method.
4) • National Programme for Control of Blindness or Vitamin A prophylaxis programme
   - Iodine Deficiency Disorders Control Programme (IDDCP)
   - Mid-Day school Meal Programme
   - ICDS (Integrated Child Development Scheme) 5) • Supplementary nutrition
   - Immunisation

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

6) • Survey of community and beneficiaries.

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

UNIT 2 NUTRITION DURING PREGNANCY AND LACTATION

Structure

2.0 Introduction

2.1 Objectives

2.2 Physiological Changes in Body during Pregnancy

- 2.2.1 Changes in Uterus and Breasts
- 2.2.2 Weight Gain
- 2.2.3 Changes in Body Fluids

2.3 Increased Nutritional Requirements during Pregnancy

- 2.3.1 Calories
- 2.3.2 Proteins
- 2.3.3 Micronutrients

2.4 Diet during Pregnancy

- 2.4.1 Meal Planning for Pregnant Woman
- 2.4.2 Food Pyramid
- 2.4.3 Model Menu during Pregnancy

2.5 Anaemia during Pregnancy

- 2.5.1 Causes
- 2.5.2 Diagnosis of Anaemia
- 2.5.3 Signs and Symptoms
- 2.5.4 Effects of Anaemia on Pregnancy and its Outcome
- 2.5.5 Iron Folic Acid Supplementation
- 2.5.6 Counselling for Anaemia

2.6 Lactation

- 2.6.1 Anatomy and Physiology of Breastfeeding
- 2.6.2 Position and Technique of Feeding
- 2.6.3 Composition of Breast Milk
- 2.6.4 Keys to Successful Breastfeeding
- 2.6.5 Advantages of Breastfeeding to the Baby

2.7 Nutritional Requirement during Lactation

2.8 Diet during Lactation

2.9 Importance of Complementary Feeding

2.10 Local Dietary Habits and Nutrition Problems

2.11 Let Us Sum Up

2.12 Model Answers

2.13 References

2.0 INTRODUCTION

In any society, for all families, bearing a healthy child and rearing it to grow into a healthy adult is a prime focus. Accordingly, our government has always given major importance to health of the women in general and during pregnancy and lactation in particular. Even now mortality and morbidity in this group is high. All said and done their adequate nutrition is imperative for uneventful course and outcome of pregnancy. Given the low status of women in Indian society, active support and guidance from health system is of vital importance. In this context being a female health worker, your role is of great significance.

A pregnant woman's body undergoes several changes to prepare her for upcoming motherhood. Her requirements for all the nutrients increase. Malnutrition in mother has been found to be associated with adverse pregnancy outcomes, e.g. anaemia in pregnant women may compromise maternal and foetal health. During lactation nutrition of the baby is solely dependent on the mother. So, diet during lactation helps the mother to maintain a sound health and also ensures good milk supply for the baby. This unit will refresh your knowledge on these issues. This will enable you to guide them with more confidence.

2.1 OBJECTIVES

After completing this unit, you should be able to:

- describe Changes in body during pregnancy;
- explain increased demand of the body for various macro- and micronutrients;
- advise in planning diet during pregnancy and lactation;
- explain anaemia in pregnancy: Causes, prophylaxis and control;
- describe anatomy and physiology of breastfeeding;
- enlist advantages of breastfeeding;
- enlist nutritional requirement during lactation;
- describe importance of complementary feeding; and
- describe local dietary habits; understanding local nutrition problems.

2.2 PHYSIOLOGICAL CHANGES IN BODY DURING PREGNANCY

➢ Right from the conception, there are initially subtle and later on obvious changes in the body that prepare woman to bear a child. The first 1000 days are crucial for a child's development. For the first 270 days in the womb, the baby is entirely dependent on the mother, and for the next 180 days, the baby relies mainly on the nutrition received through

breastfeeding. During the following 550 days, it is essential to provide complementary feeding along with breastfeeding to meet the child's complete nutritional needs.

- ➢ Gaining weight during pregnancy is important because it increases the chances of the baby's proper growth in the womb.
- ➢ Gaining weight during pregnancy is also important because about 80 percent of the baby's brain development takes place during this period. Various hormones prepare her body for this purpose. Weight gain during pregnancy occurs due to the following reasons::
- ✓ Increased blood volume
- ✓ Increase in amniotic fluid
- ✓ Increase in extracellular fluids
- ✓ Growing placenta
- ✓ Enlargement of the uterus
- ✓ Increase in body fat
- ✓ Increase in the baby's weight

Let us now go through various changes which takes place during pregannncy.

2.2.1 Changes in Uterus and Breasts

There is growth and enlargement of uterus due to hypertrophy and hyperplasia of muscles. It is followed by stretching of muscle fibers in later part of pregnancy. Changes in the breasts are more evident in a primigravida. The size of breasts increase and nipples become large, erect and deeply pigmented.

2.2.2 Weight Gain

In normal pregnancy, variable amount of weight gain occurs. Woman may lose weight in the early months because of nausea or vomiting. But subsequently she starts gaining weight progressively until the last weeks of pregnancy. The total weight gain during pregnancy ranges from 9–12 kg. **First Trimester: 0.5 kg x 3 months = 1.5 kg (0 to 12 weeks)**
Second Trimester:1.5 kg x 3 months = 4.5 kg (13 to 28 weeks)
Third Trimester: 2 kg x 3 months = 6 kg (29 to 40 weeks)



- Nutrition during pregnancy is often equated with weight gain because weight is easily measured. Regular gain in weight is considered the best indicator of a successful pregnancy. Low weight gain is associated with increased risk of intrauterine growth retardation (IUGR) and perinatal mortality.

2.2.3 Changes in Body Fluids

During pregnancy the blood volume is markedly raised (40–45% above the prepregnancy volume after 32–34 weeks). It facilitates the increased demand of nutrients by the growing foetus. It also protects mother against the adverse effects of blood loss during delivery.

2.3 INCREASED NUTRITIONAL REQUIREMENTS DURING PREGNANCY

During pregnancy nutritional requirements increases to support foetal and during growth lactation, even more nutrition is needed for growth and development of infant.

2.3.1 Calories

Additional energy is required during pregnancy to support the metabolic demands of pregnancy and foetal growth. The average pregnant woman needs only an additional 150 kcal/day during the first trimester and 350 kcal/day during second and third trimesters of pregnancy.

2.3.2 Proteins

To support the synthesis of maternal and foetal tissues, additional protein is required (up to 20 gm per day).This demand increases throughout gestation. It is maximised during the third trimester. Protein deficiency during pregnancy has adverse consequences, including poor foetal growth.

2.3.3 Micronutrients

All vitamins and minerals are needed for optimal pregnancy outcome. In some instances requirements may be met through diet; for others a supplement is often necessary. The requirement for most of the vitamins and minerals increases with pregnancy. But the magnitude varies.

The following micronucrients such as minerals and vitamins are given in details below:

a) **Minerals:**

i) **Iron:** Its requirement increases from 21 mg/day to 35 mg/day during pregnancy. This is due to – i) expansion of maternal tissues including red cell mass, ii) iron content of placenta, iii) blood loss during parturition and iv) to build the iron store in foetal liver to last for atleast 4–6 months after birth. Total iron requirement during pregnancy is estimated to be approximately 1,000 mg. This is distributed in foetus and placenta (300 mg) and expanded red cell

mass (400 mg). If this increased demand is not met with diet and supplementation, it results in anaemia. It leads to fatigue, and irritability in the mother. Also it may impair foetal growth.
Hence, iron supplements are given to pregnant women.

Dietary sources of iron include animal sources such as liver, meat, fish and poultry and vegetable sources such as green leafy vegetables, ragi, jaggery and dried fruits etc. Phytates, oxalates, carbonates and phosphates present in the vegetarian diet interfere in iron absorption in the intestine. Eggs and tea also are iron absorption inhibitors. Vitamin C promotes the absorption of iron in the gut.

ii) **Calcium:** Its requirement for an adult woman is 600 mg/day. During pregnancy there is increase in the demand of calcium by the growing foetus. So requirement increases up to 1200 mg/day. This is needed for the growth and development of bones and teeth of the foetus and also for the protection of calcium resources of the mother to meet the high demands during lactation. Inadequate intake results in the mobilisation of calcium from mother bones resulting in demineralisation of maternal bones and osteoporosis.

Dietary sources of calcium are milk and milk products. Other cheap dietary sources are green leafy vegetables (GLV), cereals and millets (Ragi). However, bioavailability of calcium from GLVs and cereals is poor because of the presence of oxalates and phytic acid respectively. Some fruits like Sitaphal are also good sources of calcium.

iii) **Zinc:** Deficiency of zinc adversely affects the outcome of pregnancy. Severe deficiency in mother can lead to spontaneous abortions and congenital malformations. The risk of LBW babies doubles and preterm delivery increases three times. The requirement increases from 10 mg/ day (pre-pregnant) to 12 mg/day during pregnancy. Dietary sources of zinc are meat and fish. Wheat, pulses and nuts also provide zinc. But the bioavailability is low.

b) **Vitamins:**

Pregnancy sharply increases requirements for the water-soluble vitamins. Thiamin, riboflavin, niacin, and vitamin B12 requirements increase by about 50%. Vitamins C and B6 requirements double. Requirement for fat soluble vitamins is also increased. If these requirements are not met, maternal stores will be depleted.

i) **Vitamin A:** High levels of some forms of vitamin A can harm the foetus's development if taken in too high amounts during pregnancy. Mothers should avoid vitamin A supplements and animal sources of vitamin A (e.g. Liver) throughout pregnancy.

ii) **Vitamin D:** It is essential as it enhances maternal calcium absorption. Its active forms (calcidiol and calcitriol) can pass through placenta with ease and help in calcium metabolism of foetus. Vitamin D is unique as it can be synthesised in adequate amounts by simple exposure to UV rays, so no recommendation for vitamin D has been made.

iii) **Vitamin B complex:** Requirement for Thiamine, Riboflavin and Niacin increases during pregnancy i.e. +0.2 mg, +0.3 mg and +2.0 mg respectively. Pyridoxine (vitamin B_6) needs are increased during pregnancy. (2.5mg of vitamin B_6 during pregnancy; vitamin B_{12} = 1.2 mg / day). Dietary sources of vitamin B are Liver, dried beans and other legumes, groundnut, milk and orange juice are good sources. Green leafy vegetables provide Thiamine, Riboflavin, Folate and Vitamin B_6. However, animal foods like fish, red meat, poultry, milk, milk products, cheese, and eggs etc. are the natural sources of vitamin B.

iv) **Folic acid:** Adult women require 200 µg of folic acid per day. In pregnancy it is 500 µg/day. It is essential for blood formation and synthesis of essential components of DNA/RNA which increase rapidly during growth. Low folate levels during pregnancy are associated with abortion, Low Birth Weight (LBW) babies and preterm birth. It may also lead to congenital malformations (spina bifida and anencephaly), and cleft-lip and congenital heart defects. Supplementation of folic acid before conception and during first twelve weeks of pregnancy is therefore recommended. Dietary sources of folic acid are Liver, soybean and dark green leafy vegetables.

v) **Vitamin C:** Its daily requirement for an adult woman is 40 mg/day. Additional 20 mg are needed during pregnancy. Dietary sources are Fresh fruits, particularly citrus fruits like lemon, amla, tomato, orange, fresh green leafy vegetables, cabbage, guava and germinating pulses. However, animal foods are poor in this.

Check Your Progress 1

Fill in the blank:

1) The average weight gain during pregnancy is…….

2) The physiological anaemia of pregnancy occurs because the …….. is markedly raised during pregnancy.

3) The increased demand of calories and proteins per day in the last trimester of pregnancy is ……

4) Adult women requires……..of folic acid per day, during pregnancy it requires……..per day.

2.4 DIET DURING PREGNANCY

Child bearing imposes a great physical and psychological strain on the mother. During pregnancy all women need more food, a varied diet, and micronutrient supplements. If this is not met with, the body's own reserves are used, leaving

a pregnant woman weakened. Table 2.1 shows belowed diet for a non pregnant and not lactating women as per activity level.

Table 2.1: Balanced Diet for a Non-Pregnant Non-Lactating Woman

Food Item	Sedentary Worker	Moderate Worker	Hard Worker
Cereals	445 gm	475 gm	610 gm
Pulses	55 gm	60 gm	65 gm
Leafy vegetables	100 gm	100 gm	50 gm
Other vegetables	40 gm	40 gm	100 gm
Roots and tubers	50 gm	50 gm	60 gm
Milk	200 ml	250 ml	300 ml
Oil and fats	20 gm	25 gm	40 gm
Sugar or jaggery	30 gm	30 gm	50 gm

Table 2.2 Shows additional allowances during Pregnancy and lactation.

Table 2.2: Additional* Allowances during Pregnancy and Lactation

Food Item	Pregnancy (g)	Calories (kcal)	Lactation (g)	Calories (kcal)
Cereals	35	118	60	203
Pulses	15	52	30	105
Milk	100	83	100	83
Oil and fats	-	-	10	90
Sugar or jaggery	10	40	10	40
Total		293		521

*These recommendations are in addition to the balance diet for a Non- Pregnant Non-Lactating woman.

Substitutions for Non-vegetarians- 50 % (20–30 g) of pulses can be substituted with one egg or 30 g of meat / chicken / fish. Or 100% pulses can be substituted with two eggs or 50 g of meat / chicken / fish or one egg with 30 g meat and 10 g oil.

2.4.1 Meal Planning for a Pregnant Woman

Eating during pregnancy doesn't mean over indulgence. But it means that a wholesome, balanced diet is consumed to meet the increased nutritional requirement. To meet this, the pregnant woman should eat a variety of foods. There is no need to modify the usual diet. However, the quantity and frequency of usage of the different foods should be increased.

- She can derive maximum energy (about 60%) from cereal like rice, wheat and millets like (Bajra, Ragi, corn, Jowar). (9 portions 30 g each)

- Cooking oil is a concentrated source of both energy and polyunsaturated fatty acids. (Fats/Oils-6 portions-5 gm each)
- Good quality protein is derived from milk, fish, meat, poultry and eggs. However, a proper combination of cereals, pulses and nuts also provides adequate proteins. (2 portions pulses and 1 portion of non-veg-30 gm each) • Mineral and vitamin requirements are met by consuming a variety of seasonal vegetables particularly green leafy vegetables, milk and fresh fruits. (vegetables- 3.5 portions and fruits- 2 portions- 100 gm each)
- Bioavailability of iron in pulses can be improved by fermentation and sprouting and eating foods rich in vitamin C such as citrus fruits. • Milk and milk products are the best sources of biologically available calcium.(5 portions-100 gm each)

Though it is possible to meet the requirements for most of the nutrients through a balanced diet, pregnant women are advised to take regular daily supplements of iron, folic acid, vitamin B and calcium as prescribed by the health care provider. The easy way to remember it is Tricolor Meal (Tiranga Bhojan)

The Indian flag is made of three colors. A tricolor meal consists of foods in three colors: saffron (orange), white, and green

Saffron (orange) color includes red and yellow fruits and vegetables such as tomato, carrot, mango, lentils, papaya, etc.

White color includes milk, curd, buttermilk, rice, flour, egg, radish, and similar foods.

Green color includes leafy vegetables like spinach, fenugreek, bathua, mustard, and other green vegetables like bitter gourd, okra, etc.

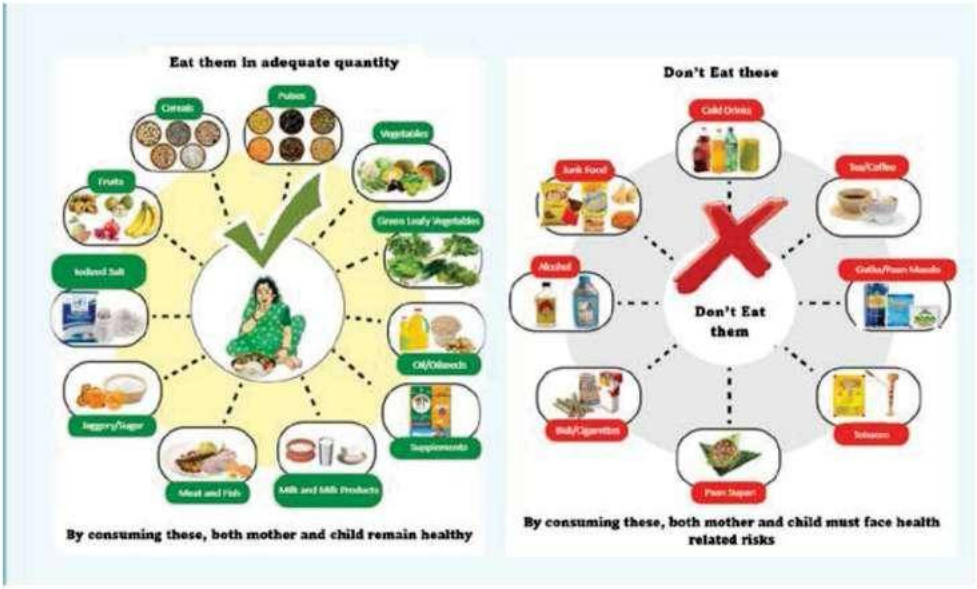
Tips:

- During early months, pregnant women often suffer from morning sickness due to the hormonal and physiological changes. So small amounts of foods with increased frequency (5–6 times a day) should be advised.
- Solid carbohydrate rich foods like bread, and fruits given in the morning or before meals help to relieve nausea. Also fried, rich, strongly flavoured and spicy foods need to be avoided.

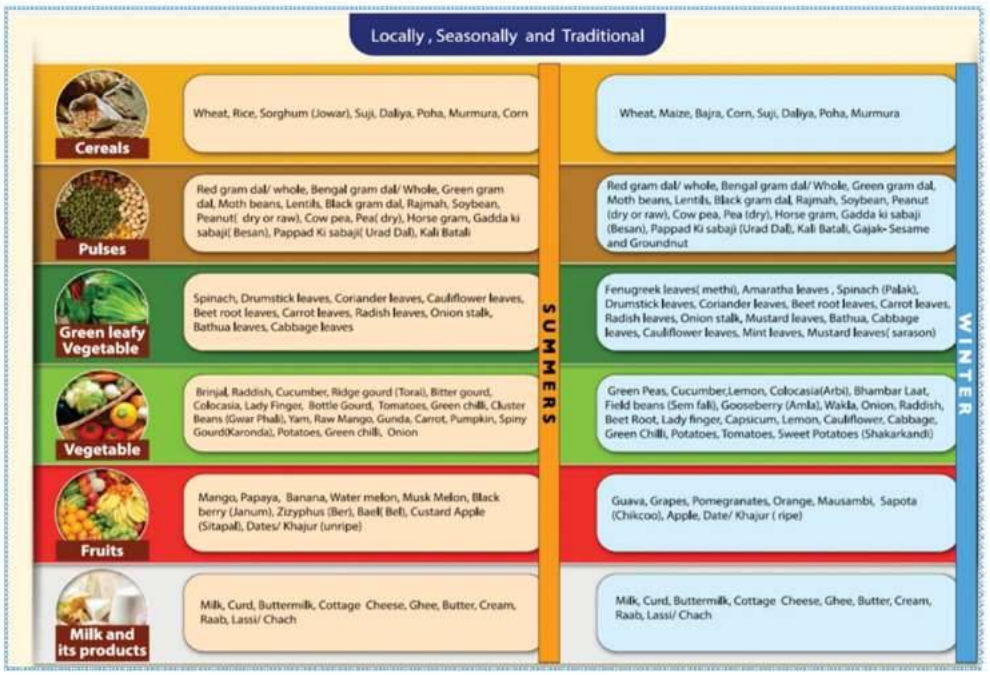
- To meet increased requirements the mother should consume extra food. The mother can be given nutritious snacks (e.g. *poha*, , mix of roasted peanuts, *murmura* (puffed rice) and Bengal grams, sprouts, fruits, egg, yogurt etc) in between meals rather than three meals a day.



- Include a variety of foods, focusing on nutrient dense food choices.



- To meet additional iron needs, whole grain cereals, rice flakes, puffed rice; dried fruits, green leafy vegetables, eggs, enriched cereals and organ meats can be given. Eat seasonally and locally available foods as they are affordable and traditional. (Fig)
- Foods rich in dietary fiber (around 25 g/1000 kcal) like whole grain cereals, pulses, fresh fruits, and vegetables need to be included in the diet to ward off constipation which is a common problem during pregnancy.
- Sufficient fluid intake including 8–12 glasses of water per day.
- Salt intake should not be restricted even to prevent pregnancy-induced hypertension and pre-eclampsia.

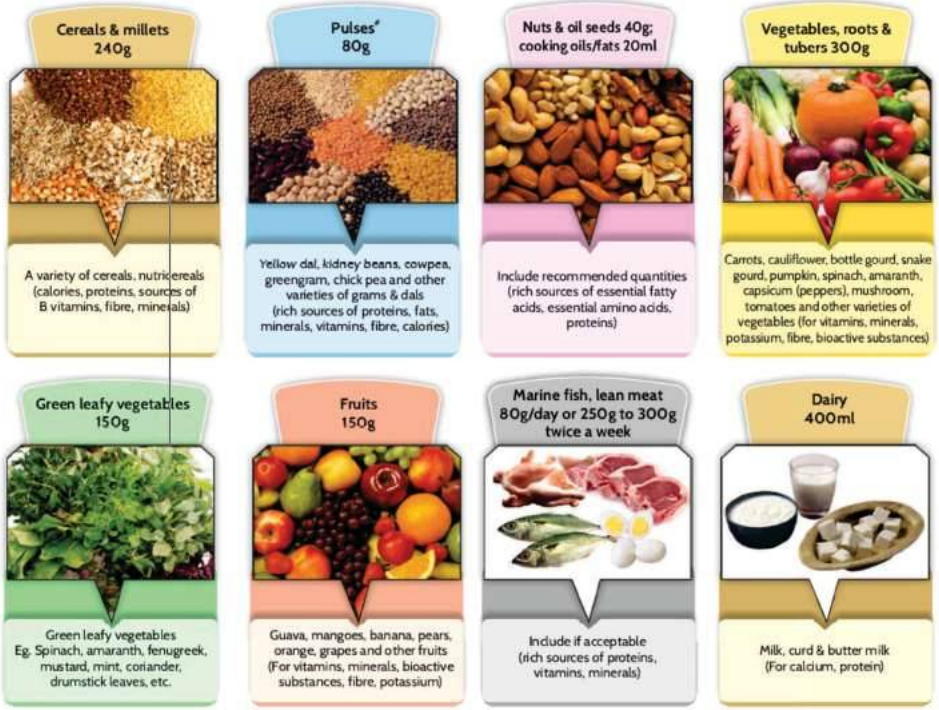


- Excess intake of beverages containing caffeine like coffee and tea adversely affect foetal growth and hence, should be avoided.
- Avoid contaminated/stale foods to protect against food borne illness.

2.4.2 Food Pyramid

The food pyramid is divided into four levels of foods according to recommended consumption for pregnant adult women. The cereals and millets at the base should be eaten in sufficient quantity, vegetables and fruits on the second level should be eaten liberally, milk products and animal source foods on the third level are to be eaten moderately, and at the apex, highly processed foods high in sugar and fats/oils to be eaten cautiously.(Fig. 2.1) ICMR (NIN) 2024

Figure 2.1 Consumption of the following foods daily will be beneficial for a woman's health and fetal development during normal pregnancy



Note: The above chart is only suggestive. The quantities of all foods will remain the same as suggested in the above figure, however, quantity of cereals and pulses will increase or decrease based on the body weight, the total calorie requirement and physical activity level of the women. First trimester: Nutrient-rich balanced diet must be consumed. Second & third trimester: An additional 350 Kcalmust be added (calorie requirement of sedentary women) to the nutrient-rich balanced diet as suggested in the above figure. But for undernourished pregnant women, an additional 100 Kcal per day (total 350+100=450 Kcal/day) is recommended to be added to meet the additional energy requirement (Table 2.1). For overweight pregnant women: Added sugars should be avoided. Refined cereals and edible oil intake should be reduced. #A portion of pulse (dal) can be substituted with fish/chicken/meat/egg.

2.4.3 Model Menu during Pregnancy

Let us go through model mence during pregnancy for one day.

i) **Before getting of the bed:** Tea 1 cup with 1–2 teaspoons of sugar + milk rusk/biscuit

ii) **Breakfast:**

- Milk 200 ml (1 glass) (with Musli/cornflakes)
- Porridge (1 bowl)/ Idli (2 medium)/ Chapati Parantha (2 medium)
- Cheese 30 gm (1 cube)/ egg-1/ sprouts 25 gm (1 bowl) iii) **Mid**

Morning: Buttermilk 1 glass or fruit – 1 medium iv) **Lunch:** Fresh salad, Chapati – 4 medium size (100 gm), preferably made with mix of wheat with Bengal gram/soya

Or

Rice (100 gm)- 4 servings

Pulses (25 gm)- 1 katori or meat or fish or chicken (90 gm), Curd 125 gm (1 bowl), Green vegetables 250 gm (2 bowls), Cooking oil 10 gm (2 teaspoons)

Fruit: 1–2 servings any time during the day

v) **Evening Snacks:** Freshly prepared snacks, such as sandwiches, pav bhaji, noodles, dhokla, khandvi, dal wada, medu wada, dahi wada, appams.

Milk 200 ml (1 glass)

Cheese sandwich (1 small) or Poha (1 bowl) or Upma (1 bowl) or Vada (1 large) vi) **Dinner:** Same as Lunch with variations according to liking

Bed Time: Milk 200 ml (1 glass)



(Weighing 55 kgs before conception with normal BMI 18.5-23)



Dos and Don'ts of Nutrition for pregnant women:

Do's	Don'ts
1. Small, frequent foods, with intermittent nutritious snacks	1. Avoid bulky food.
2. Take biscuits, rusks or other carbohydrate rich foods early in the morning to avoid morning sickness.	2. Avoid stale, spicy and fatty foods.
3. Make your diet rich in whole grains, fruits, vegetables and lean protein.	3. Avoid taking medications without consultation.
4. Go light on the saturated fat.	4. Keep caution when you are eating out. Avoid raw vegetables, fruits, juices, etc. if you are eating out.

5. Include fibre rich food in diet.	5. Avoid fast food, carbonated drinks, and excess tea and caffeinated drinks.
6. Take in plenty of water or any healthy drinks like coconut water , lemon , lassi, milk, (See Fig Below)	6. Avoid tobacoo and Alcohol intake.
7. Use iodised salt for cooking	7. Don't do strenuous work.

Check Your Progress 2

1) The daily requirements of iron and calcium in pregnancy are …….and ……. respectively.

2) Folic acid deficiency during early pregnancy can give rise to …….

3) For non-vegetarian pregnant lady, how can we do substitution in recommended balanced diet with non-vegetarian diet?

.....

.....

4) What is the daily recommendation for fruits and vegetables for pregnant woman?

.....

5) Eating ……rich food can prevent morning sickness in pregnancy.

6) How can we increase the bioavailability of iron in pulses?

.....

.....

2.5 ANAEMIA DURING PREGNANCY

It is said to be present when the haemoglobin concentration in the peripheral blood is 11 g/100 ml or less. Anaemia is responsible for 20% of maternal deaths in India. Iron deficiency is the commonest reason for anaemia.

Nutritional anaemia is a global problem, more so in the developing countries. In India 56% of adolescent girls, 60% of adult females and 80% of pregnant mothers have iron deficiency anaemia.

2.5.1 Causes

It is usually due to deficiency of iron and/or folic acid. Iron, after absorption from the gut, is transported across the placenta to the foetus. In spite of the fact that absorption of iron through the gut is enhanced during pregnancy, this increased demand cannot be met with diet only. In the absence of iron

supplementation, there is drop in haemoglobin level. Thus, pregnancy is an inevitable iron deficiency state. i) **Pre-pregnancy Causes:**

- **Faulty diet:** Diet rich in carbohydrate, high phosphate or phytic acid leads to poor absorption of iron, even when there is no deficiency of iron in diet. Drinking tea or milk with meals also leads to inhibition of iron absorption.
- **Faulty absorption:** High prevalence of worm infestation, or malnutrition often leads to hampered iron absorption.
- **Iron losses** due to repeated pregnancies at short intervals, excessive blood loss during menstruation, Hookworm infestation, chronic malaria, chronic blood loss due to bleeding piles and dysentery also cause iron deficiency anaemia.

ii) **Pregnancy Related Causes:** If the iron reserve is inadequate or absent, the factors which lead to the development of anaemia during pregnancy are:

i) **Increased demands of iron:** The demand of iron during pregnancy is markedly increased. In pregnancy, the overall maternal need for iron averages close to 1000 mg (300 mg for foetus, 500 mg for maternal Hb mass expansion and 200 mg for iron loss through gut, urine and skin). In twins, the iron demand increases substantially. An adequate balanced diet contains not more than 18–20 mg of iron and assuming that the absorption rate is increased by twofold (20%), the demand is hardly fulfilled.

ii) **Faulty diet:** Diet poor in iron, loss of appetite and nausea/ vomiting during pregnancy can lead to diminished intake of iron. Intake of inhibitors of iron with food can lead to less absorption of iron from diet. Tea, coffee, antacids also inhibit iron absorption.

iii) **Pre-pregnancy nutritional status:** Majority of the women actually start pregnancy with inadequate iron reserve or frank anaemia. A normal healthy woman having adequate diet takes about two years to replenish the 1000 mg of iron lost during delivery and lactation. It is the state of the iron reserve which largely determines whether or not and how soon a woman will become anaemic during pregnancy. Short interval between two pregnancies also leads to poor iron reserves.

2.5.2 Diagnosis of Anaemia

Through proper history and physical examination, you can diagnose anaemia in the pregnant woman. Examine her for pallor in conjunctiva, nails, tongue, oral mucosa and palms. Presence of pallor should be co-related with Hb estimation and would require haemoglobin (Hb) estimation for confirming the diagnosis and knowing the severity of anaemia.

• **Investigations:**

i) **Haemoglobin Estimation:** It is the easiest method to diagnose and confirm anaemia. It can be done at Sub Centre (SC) or at the outreach level by Sahli method. The first Hb level will serve as a baseline reading, with

which the later estimations at subsequent antenatal visits can be compared to see the effectiveness of treatment. Pregnant woman having Hb level **below 11 g/dl** at any time during the pregnancy is considered to be suffering from anaemia.

Table 2.3: Levels of Anaemia in Pregnancy

Haemoglobin Level	Degree of Anaemia
More than 11 gm/ dl	No Anaemia
7-11 gm/dl	Moderate Anaemia
Less than 7 gm/dl	Severe Anaemia

2.5.3 Signs and Symptoms

It depends on the degree of anaemia. In initial stages, there are no symptoms. Diagnosis is made during routine clinical and lab examinations.

Symptoms: Lassitude, easy fatigability, weakness and poor exercise tolerance, decreased appetite , light-headedness, indigestion, palpitation, dyspnoea, giddiness and swelling of the legs. On examination: pallor of varying degrees; evidences of glossitis and stomatitis, Pedal oedema.

2.5.4 Effects of Anaemia on Pregnancy and its Outcome

- Mother is at risk of increased blood loss with uterine atony during delivery, thus increasing her risk of needing a blood transfusion.
- Wound healing and immune function are impaired.
- She is more likely to suffer from postpartum depression, poor maternal/infant interaction, and impaired lactation.
- With increased severity, there are increased chances of having LBW/IUGR baby and preterm delivery.
- In severe cases mental development of baby might get affected resulting in cognitive impairment and decrease in IQ in later life.

2.5.5 Iron Folic Acid Supplementation

- While talking to the pregnant woman, stress the need for increased intake of iron during pregnancy. This helps in preventing anaemia and its complications. • Besides recommending IFA, counsel the woman to increase her dietary intake of iron-rich foods, such as green leafy vegetables, whole pulses, , meat, poultry and fish and vitamin C rich fruits and veegtables
- Ensure that you have adequate supplies of IFA in your stock to meet the requirements of all pregnant women registered with you.
- **Prophylactic dose:** All pregnant women need to be given one tablet of IFA (100 mg elemental iron and 0.5 mg folic acid) every day for atleast 100 days, starting after the first trimester, at 14–16 weeks of gestation to

prevent occurrence of anaemia (prophylactic dose). This dosage regimen is to be repeated for three months post-partum.

- **Therapeutic dose:** If a woman is anaemic (haemoglobin less than 11 g/dl) or has pallor, give her two IFA tablets per day (one morning and one evening) for three months. This means that a pregnant woman with anaemia needs to take atleast 200 tablets of IFA for correction of anaemia (therapeutic dose). This dosage regimen is to be repeated for three months post-partum in women with moderate to severe anaemia. The haemoglobin should be estimated again after a month. If the Hb level has improved, continue with two tablets of IFA daily till it comes up to normal. If it does not rise in spite of the administration of two tablets of IFA daily and dietary measures, refer the woman to the MO at the PHC. Women with severe anaemia (Hb of less than 7 g/dl), or those who have breathlessness, palpitations and increased heart rate (more than 100 beats per minute) due to anaemia, should be started on the therapeutic dose of IFA and referred immediately to the MO in the FRU for further management.

2.5.6 Counselling for Anaemia

Many women do not take Iron Folic acid (IFA) tablets regularly due to some common side-effects such as nausea/vomiting, constipation and black stools. Inform the woman that these side-effects are common and not serious. Explain the necessity of taking IFA and the dangers associated with anaemia during pregnancy.

The woman should be counselled on the issues mentioned below:

- Convince the woman about the importance of IFA supplementation and dispel the issues, if any. Tell her that it is normal to pass black stools while consuming IFA and she should not worry about it.
- To avoid constipation, she should drink more water and add roughage to her diet.
- IFA tablets should not be consumed with tea, coffee, milk or calcium tablets as these reduce the absorption of iron.
- IFA tablets must be taken regularly, preferably early in the morning on an empty stomach. In case the woman has nausea and pain in the abdomen, she may take the tablets after meals or at night. This will help avoid nausea. • IFA tablets may make the woman feel less tired than before. However, she should not stop taking tablets and must complete the course, as advised. • Ask the woman to return to you if she still faces problems taking IFA tablets.
  Refer her to the MO for further management.
- Motivate for cooking in iron utensils.
- Emphasise the importance of a high protein diet, such as black gram, groundnuts, ragi, whole grains, milk, eggs, meat and nuts for anaemic women.
- Encourage the woman to take plenty of vegetables and fruits containing vitamin C (like guava, orange and sweet lime), as these enhance the

absorption of iron. Pulses can be sprouted to increase the vitamin C content. Deworming during the second trimester is one of the important interevention.

Check Your Progress 3

1) What is the prevalence of anaemia in pregnancy in India according to NFHS-5?

.....

.....

2) What is the cut off haemoglobin level in pregnancy for anaemia?

.....

.....

3) Mention three factors in the antenatal period that predispose the woman for anaemia.

.....

.....

4) Mention three detrimental effects of iron deficiency anaemia on the pregnancy.

.....

.....

5) What is the overall maternal need for iron during pregnancy?

.....

.....

6) How will you manage a pregnant woman with 9.2 gm% Hb at your centre?

.....

.....

7) Name three fruits that increase the absorption of iron and why?

.....

.....

2.6 LACTATION

Adequate nutrition during lactation is of vital importance. Infant is dependent on mother's milk for first few months of life. While breastfeeding, the mother needs extra nutrients to meet the baby's increasing needs in addition to her own requirements. A satisfactory diet during pregnancy ensures a good store of nutrients for breast feeding. Inadequate nutrition during lactation affects quality and quantity of milk.

2.6.1 Anatomy and Physiology of Breastfeeding

Let us go through anatomy and physiology of breast feeding given below:

Anatomy of Breastfeeding: Human breast consists of the nipple, the areola and the glands and supporting tissue (Fig. 2.2). The breast tissue is composed of the alveoli which are small sacs, made up of millions of milk secreting cells. Their ducts open outside at the nipple area. These ducts become wider beneath the areola to form lactiferous sinuses, where the milk is stored. This system of sinuses and ducts are interspersed in the supporting tissue which consists of fat and connective tissue, which determines the size of the breast.

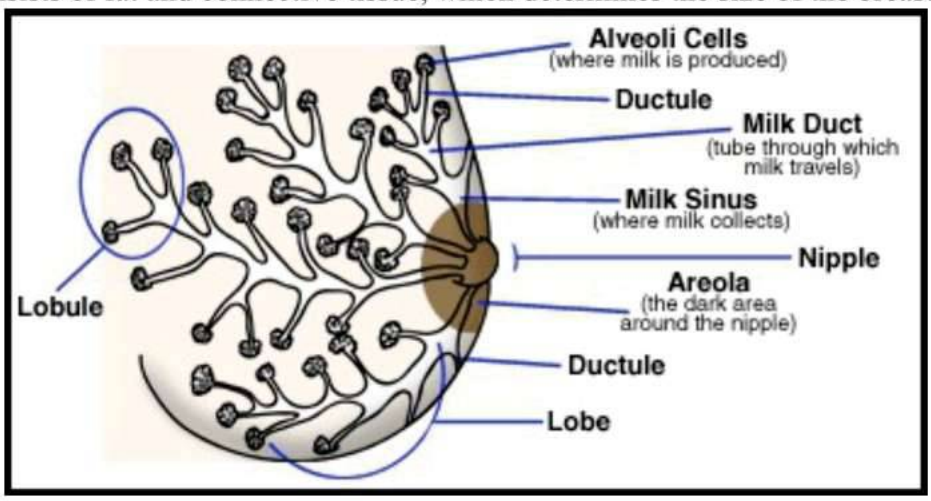


Fig. 2.2: Anatomy of Breast

Physiology of Breastfeeding (Reflexes): Hormones play a major role in pregnancy and lactation. During pregnancy estrogen secreted by the placenta bring about rapid development of glands in the breasts. This increases breast areola and nipple size. Progesterone changes the glandular cells to actual secreting cells. By the time the baby is born, breasts reach a degree of development capable of producing milk. But during pregnancy the placental hormones inhibit the secretion of lactating hormones by the pituitary gland. With the sudden expulsion of placenta during delivery, the source of placental hormones is removed and secretion of lactogenic hormones is increased. This brings about production and secretion of milk. The process of milk production and secretion occurs in two distinct stages as given below:

i) **Prolactin reflex** (Milk production reflex)**:** When baby sucks the breast, nerve impulses are passed up the spinal cord to the anterior pituitary, leading to the secretion of prolactin hormone. It is carried via the blood stream to the alveoli in the breasts where it stimulates milk production. Thus, more the baby sucks, more the milk is produced.

ii) **Let down reflex** (Milk ejection reflex)**:** When the baby sucks, nerve impulses are also passed to the posterior pituitary producing another hormone, oxytocin. It contracts the muscle cells around the alveoli, squeezing out milk and propelling it down to the nipples and in baby's mouth. Oxytocin also makes the uterus to contract, helps in involution of uterus and controls the postpartum bleeding.The letdown reflex is highly sensitive to emotional and psychological disturbances as well as physical contact. The mother's emotions, the baby's cry or even the baby's thought

might initiate this reflex. On the other hand, anxiety, fear and tension may inhibit this reflex. Hence the mother should be comfortable and relaxed while feeding the baby.

These two reflexes operate simultaneously and release milk. As long as pituitary produces these lactogenic hormones, it cannot produce sufficient Follicle Stimulating Hormone (FSH) and Leutenizing Hormone (LH) which bring about ovulation. Thus if mother is practicing exclusive breastfeeding natural family planning occurs.

2.6.2 Position and Technique of Feeding

The mother should find a suitable, undisturbed place for breastfeeding. She must position herself comfortably in sitting or lying position and must be relaxed physically and psychologically. Different positions are cradle position, foot-ball hold position, supine position and side lying position shown in Fig. 2.3.

Mother must hold and position the child in such a way that the body is in line, eyes towards the breast, the chin should touch the breast, lower lip is everted, tongue is under the areola, mouth is wide-open so that more of areola is in child's mouth (Fig. 2.5). Mother should ensure that her baby latches on properly and see that (s)he is not smothered by keeping her fingers in between the baby's nose and her breast. Improper position and technique of feeding predisposes for sore nipple and inhibition of reflexes.

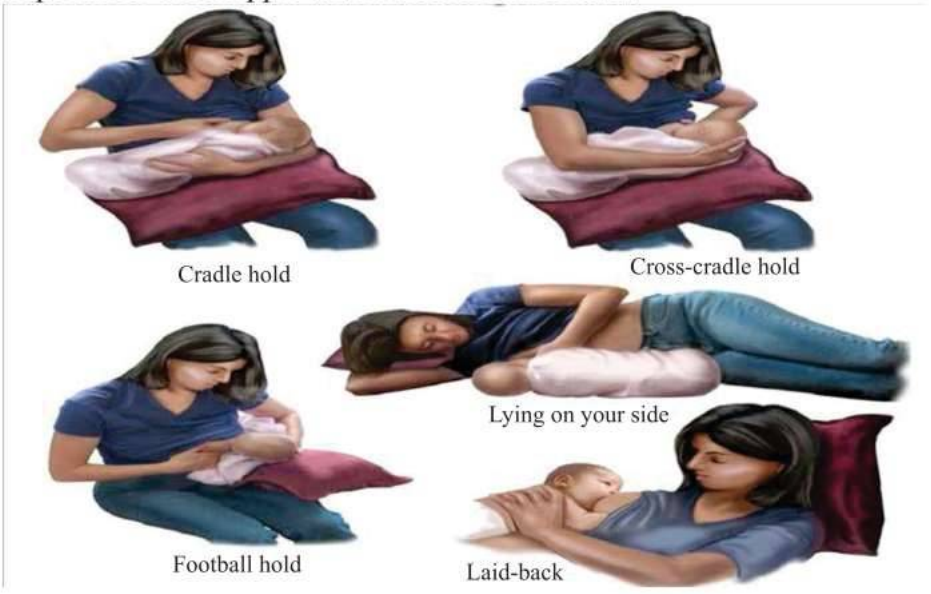


Fig. 2.3: Position and Technique of Breastfeeding

Signs of Good Attachment:

- Baby's chin is close to the breast as shown Fig. 2.4
- Baby's tongue is under the lactiferous sinuses and nipple against the palate as shown in Fig. 2.5
- Baby's mouth is wide open and the lower lip turned outwards • More areola is visible above the Baby's mouth than below it
- No pain while breastfeeding.

- Fig. 2.6 shows signs of poor attachment where nose is pressed against areola and lips not holding nipple with grip.



Fig. 2.4: Good attachment



Fig. 2.5: Good attachment



Fig. 2.6: Poor attachment

2.6.3 Composition of Breast Milk

The first milk (colostrum) is the most suitable food for baby as it is rich in protein and other nutrients. It is a thick, yellowish, viscous liquid secreted in small amount for first few days after delivery and is rich in antibodies and Vitamin A. This should be given to the baby and not discarded. It is called the first immunisation of baby. After a few days of lactation the mother secretes larger amounts of less viscous and whitish milk known as "mature milk" which is more or less a complete food nutritionally.

Table 2.4: Composition of mother's milk

Nutrient	Quantity / 100 ml
Energy	65 kcal
Protein	1.1 g
Carbohydrate	7.4 g
Fat	3.4 g
Calcium	28 mg
Vitamin A (Retinol)	137 I.U.
Thiamine	0.02 mg
Riboflavin	0.02 mg
Vitamin C	3 mg
Iron	Negligible

Under normal conditions, Indian mothers secrete 450–600 ml daily.

2.6.4 Key to Successful Breastfeeding

Following tips can prepare your client for a successful motherhood:

- Prepare the expectant mother for breastfeeding before delivery.
- Examine the nipples and if inverted nipples, take care of them by teaching the woman negative suction technique by plastic syringe and reassure her.
- Tell her to begin breastfeeding as soon as possible after birth, preferably within an hour. In case of caesarian section, mother can start breastfeeding

the child after about 4 hours, when she recovers from the effects of anaesthesia.

- Inform family about side effects of prelacteal feeds and discourage them from giving it to the baby.
- Teach her different positions for breastfeeding and help to adopt the suitable one. She can use pillows for support.
- Tell her to alternate the breast the baby begins with. But make sure that the baby empties the first breast completely before switching to another breast. This ensures that baby gets the hind milk which is rich in fat and keeps the baby satisfied. She should let the baby finish the first breast (about 10 to 15 minutes) before offering the second.
- Mother should feed the child 10 to 15 times a day (3 to 4 feedings during night). Frequent sucking by the child not only stimulates milk production and flow but also prevents engorgement of breasts.
- As the baby grows, she should feed him/ her on demand.
- Burping should be done once or twice during and after each feeding. • If the baby is sleeping peacefully after breastfeeding for 1.5–3 hours, passing urine frequently and gaining weight, the breast milk is adequate.
- Talk to her about importance of breastfeeding exclusively during the first six months as it is ideal for the baby's growth and development. No supplements (water, glucose water, formula, etc.) should be given to the newborn unless a clear medical reason exists.
- Motivate her to eat healthy and be cheerful for a successful motherhood.

2.6.5 Advantages of Breastfeeding to the Baby

Mother's milk is the complete food available for the baby as it:

- Contains all the required nutrients in definite proportions.
- Easily digested.
- Contains antibodies (anti-infective factors) and other protective substances which fight respiratory infection, alimentary diseases and also allergies, eczema and asthma.
- Contains lactoferrin which binds iron and prevents anaemia in infant.
- Bacteriologically clean and pure (hygienic).
- Obtained easily, freely, all the time and at a suitable temperature (cost effective).
- Improves the intelligent quotient (IQ) of the child and vision due to special fatty acids.
- Prevents obesity in the child.
- Prevents/ postpones the onset of lifestyle diseases like diabetes, cancer and hypertension.
- Sucking helps development of jaws and also gives the child chubby-cheek appearance.

Thus, it promotes overall growth and development of the child (i.e. physical, psychological, social, motor and mental development).

Advantages to the Mother: Early initiation of breast feeding helps in quick and early involution of uterus and reduces post-partum bleeding. • Exclusive breastfeeding is a natural contraceptive method

- Prevents cancer of the breast
- Acts as an 'anti-diabetogenic factor' by reducing the requirement of insulin in diabetic mothers
- Helps in restoration of original physique
- Establishes psychological bonding with the baby.

Check Your Progress 4

1) …….. hormone facilitates the release of milk from alveoli.

2) What is the Energy and Protein content of breast milk?

.....

.....

3) How breastfeeding acts as natural contraceptive?

.....

.....

4) Write down three benefits of breastfeeding for the child and mother each.

.....

.....

2.7 NUTRITIONAL REQUIREMENT DURING LACTATION

Breastfeeding imposes greater strain on mother than pregnancy as she has to nourish a rapidly growing infant with breast milk. The mother should eat a wide variety of foods to make sure that her own nutritional needs as well as those of her growing baby are met. If the diet of the mother had been satisfactory during pregnancy, she will have enough stores for the successful breastfeeding. However, if the mother had not taken good care of her diet during pregnancy, her nutrient stores might have become deficient in order to take care of her growing foetus. In such cases, the mother will have to take extra care, so that she and her baby do not land up in malnutrition. Otherwise there is no particular need to modify the usual dietary pattern followed during pregnancy.

Recommended Dietary Allowances (RDA 2024) for lactating mothers is given in Table

2.5. You will appreciate that the nutrient requirements given are for two periods i.e. 0–6 months and 6–12 months and the nutrient needs for the first six months are higher than next six months. Amount of milk produced during the first 6 months is much higher. After 6 months the infant is given additional foods so dependence on breastfeeding decreases gradually.

Table 2.5: RDA for a Sedentary Lactating Woman

Nutrients	0-6 months	6-12 months
Energy (kcal)	+600	+520
Protein (g)	74	68
Visible fat (g)	30	30
Calcium (mg)	1200	1200
Iron (mg)	21	21
Zinc (mg)	12	12
Magnesium (mg)	310	310
Vitamin A (IU)	950	950
Thiamine (mg)	+ 0.3	+ 0.2
Riboflavin (mg)	+ 0.4	+ 0.3
Niacin (mg)	+ 4	+ 3
Vitamin B6 (mg)	2.5	2.5
Vitamin C (mg)	80	80
Dietary Folate (µg)	300	300
Vitamin B12 (µg)	1.5	1.5

Calories

Additional 600 kcal / day are recommended during first 6 months of lactation. Most Indian mothers continue to lactate even after 6 months. But milk production is reduced. So, additional 520 kcal / day are recommended from 6–12 months of lactation.

Protein

Protein requirement also increases for production of milk. The recommended additional protein intake during lactation is 19 g per day for 0–6 months and 13 g per day for 6–12 months. **Fats**

ICMR has suggested an intake of 30 gm of visible fat per day, which is 10 gm more than the non-pregnant non-lactating status.

Micronutrients

MINERALS:

i) **Calcium:** Mother's milk contains about 30 mg of calcium per 100 ml. ICMR has recommend 1200 mg of calcium per day for a lactating mother.

ii) **Iron:** Most mothers have lactational amenorrhoea. It results in saving of nearly 1 mg of iron per day which otherwise would have been lost due to menstruation. This is sufficient. Hence iron requirement during lactation is same as that of a normal adult woman i.e., 21 mg/day.

VITAMINS

i) **Vitamin B Complex:** As the calorie and protein requirements increase during lactation, the requirements of Thiamine, Riboflavin and Niacin vitamins also increase correspondingly. The increments have been as 0.3 mg, 0.4 mg and 4 mg for thiamine, riboflavin and niacin respectively. An additional intake of 0.5 µg i.e. a total intake of 2.5 µg/day has been recommended for vitamin B6

(same as during pregnancy) ii) **Folic acid:**The recommendation for folic acid during lactation is 300 µg/ day i.e. an additional allowance of 100 µg /day. iii) **Vitamin C:** An additional intake of 40 mg/day is recommended (80 mg per day)

2.8 DIET DURING LACTATION

A lactating mother requires not only large quantities of body building and protective foods but also additional energy yielding foods to facilitate formation and secretion of breast milk. Besides adhering to the basic principles of meal planning the following guidelines need to be considered:

- As the nutrient needs are enhanced, the meal pattern may be changed to 5–7 meals a day by introducing in between snack between the meals (just like pregnancy)
- No food needs to be restricted for lactating woman, except spicy and strong flavoured foods as they may cause gastric distress to the mother and may be distasteful for baby.
- Adequate fluids such as water, milk, milk based beverages and fruit juice based on affordability should be encouraged as it facilitates production of milk. Taking extra fluid half an hour before the feed is beneficial. • Any medicine during lactation must be avoided or taken under strict medical supervision as almost all medicines are secreted in the milk and might affect the baby.
- When a mothers diet is inadequate, her milk yield is usually well maintained by drawing on her own reserve of nutrients and evidence of malnutrition is likely to appear in the mother before it does in her child.

An adequate diet during lactation will not only help the mother to maintain a sound health but also ensure good milk supply for a healthy infant.

Additional requirements in diet for lactating woman is given in the diet for pregnancy part. (Table 2.6)

Table 2.6: Balanced Diet for a Lactating Woman

Food Item	Sedentary Worker	Moderate Worker	Hard Worker
Cereals	470 gm	500 gm	635 gm
Pulses	70 gm	75 gm	80 gm
Leafy vegetables	100 gm	100 gm	50 gm
Other vegetables	40 gm	40 gm	100 gm
Roots and tubers	50 gm	50 gm	60 gm
Milk	200 ml	250 ml	300 ml
Oil and fats	30 gm	35 gm	50 gm
Sugar or jaggery	30 gm	30 gm	50 gm

Sample Diet in Lactation: Nutritional requirements during lactation are higher than those during pregnancy. So the diet has to be increased further. You already know about the sample diet in pregnancy. For lactational period, you just have to add:

- One glass of milk
- One serving of chapatti/rice during lunch and dinner, and
- One serving of fruit

Total fluid during the day should be 7–8 glasses. Excess use of highly flavoured, gas producing foods like cabbage, radish, capsicum, onions etc. should be avoided.

2.9 IMPORTANCE OF COMPLEMENTARY FEEDING

At birth, mother's milk alone is adequate for the infant, but after some time breast milk secretion in the mother slowly comes down. Thus infants are likely to get deprived of adequate nutrients due to the increased nutrient requirements and decreased availability of breast-milk. So after six months of exclusive breastfeeding, the baby should gradually be introduced to energy dense nutritional supplements along with continuation of breastfeeding.

Complementary feeding means introducing a range of semisolid foods gradually, until the baby is eating the same foods as rest of the family. It is an

important period as the baby is slowly switched over from only breast milk to other food. Delayed or faulty feeding (quality/quantity) leads to malnutrition of the baby.

The weaning food to start with could be liquids like milk or gradual introduction of semi-solids like 'suzi kheer' or mashed fruits. Infants should start receiving complementary foods at 6 months of age in addition to breast milk, initially 2–3 times a day between 6–8 months, increasing to 3–4 times daily between 9–11 months and 12–24 months with additional nutritious snacks offered 1–2 times per day, as desired. By the age of one year the child should eat half of the mother's diet.

Principles in preparing complementary food supplements:

- Introduce small quantities of food at frequent intervals (3–4 times a day) as the infant will not be able to eat large quantities of food in one sitting at a given time.
- Initially, food should be semi-solid for easy swallowing. Mother should be made aware that initially the infant tends to spit the food out and this should not be mistaken as dislike for that food.
- Counsel the mother to not force feed the baby. If the baby doesn't seem to want it, wait and try again later. If she is using a spoon, wait for the baby to open her mouth when the food is offered. Let the baby touch the food in the dish or on the spoon.

  complementary foods based on cereal-pulse-nut and sugar/ jaggery combinations will provide good quality protein, adequate calories and other protective nutrients.
- Since infants cannot consume bulky complementary food, in sufficient quantities, energy-rich foods like fats and sugars should be included in such preparations.
- Include green leafy vegetables (GLVs), which are rich, yet inexpensive, sources of vitamins and minerals in the diet but make sure to well clean the GLVs before cooking otherwise the infant might develop loose motions. • Since GLVs are rich in dietary fibre, it is advisable to initially feed only the juice of the GLVs after cooking them properly.
- Infants should be introduced to different vegetables and fruits gradually.
- Food should be thoroughly cooked and mashed before feeding.
- If families can afford, egg yolk and meat soup can be introduced.
- At about one year of age, the child should share the family diet.
- Observe hygienic practices while preparing and feeding the complementary food.
- Start by offering a small amount of mashed vegetable, fruit or boiled rice mixed with milk after a milk feed or in the middle of one, if this works better.

2.10 LOCAL DIETARY HABITS AND NUTRITION PROBLEMS

People have their likes and dislikes and their beliefs and taboos about food. Many people are conservative in their food habits. What one society regards as normal or even highly desirable. However, another society may consider revolting or totally inedible. Religion may have an important role in forbidding the consumption of certain foods. Sometimes people choose poor diet, even when good choices are available, because of cultural influences.

Food taboos are the restriction or prohibition of some food items. These restrictions force the people to abstain from certain food and drinking items, as these things are embedded into the cultural and religious threads. Some of the food taboos/ practices give rise to unwanted health implications. A classic example is occurrence of beri-beri in people who thrived on milled and highly polished rice as their staple diet, thus suffering from vitamin B1 deficiency and its manifestation. Similarly populations that consumed the jowar (sorghum) millet almost exclusively as their staple diet, were prone to pellagra.

Families play an important role in shaping the food habits, which are passed from generation to generation, e.g. wheat is the staple cereal in northern States and rice in eastern and southern States. During World War II, when rice was not available, wheat was made available to people of south India, but people refused to eat. In some families, rice water is drained at the end, thus loosing the starch; vegetables are washed after peeling, thus leading to loss of water soluble nutrients. In most Indian households, from low socio-economic status, men of the family eat first and women eat last, usually eating less than the desired. This results in poor health of the women.

The need for providing extra nutrition to the pregnant women is usually not realised in rural families. Nutrition-related practices during pregnancy are usually based on the belief that 'hot' foods are harmful and 'cold' foods are beneficial. A number of food habits and practices are poor from a nutritional point of view. For example, in Gujarat, dals, green leafy vegetables, rice and fruits are avoided by the pregnant mother as people believe that eating more nutritious food will lead to big size baby, thus making the delivery difficult. In some communities food of animal origin are denied in pregnancy as people believe that they can lead to big baby size. In Karnataka, Papaya, sesame, jack fruit, custard apple, pumpkin juice, cucumber, mango, guava, aloe vera are avoided in many families, as they are considered to be abortifacient. Egg, jaggary are also prohibited in some areas owing to the fear of abortion. Ragi, a good source of calcium is avoided in pregnancy as it is said to impart dark colour to the baby. Similarly grapes, orange, jackfruit, apple and guava are avoided during pregnancy and lactation as they are believed to increase the chances of respiratory infections in the child.

In some communities, food is restricted in the postpartum period to two meals a day and water is restricted to one glass only. This is done due to the belief

that it will help in healing of the mother' stomach and in involution. Post-partum practices in the households are usually enforced by elderly female relatives. These women may decide the kinds of food a postpartum woman can consume. Some women may be required to follow a diet of only puffed rice, tea and hot water for the first three days after delivery. The consumption of milk, butter, ghee and some types of fish is encouraged due to the belief that these foods will increase the quantity and quality of breast milk. Postpartum women may consume a large quantity of garlic, to aid in the contraction of the uterus or to 'dry the womb'.

Common foods that are traditionally avoided by postpartum women include certain varieties of GLV, fibrous vegetables, melons, pumpkin, papaya, eggplant, shell fish, eggs (in certain castes and communities), certain varieties of fish, lemons, limes, oranges, grapes, chillies, bell peppers, spices, bananas, yoghurt, and oily food.

In India, cultural practices related to lactation and breastfeeding are based upon the concept of ritual hot and cold foods. Initiation of breastfeeding by Indian women is usually delayed, and starts when colostrum is fully expressed. Colostrum is rejected in some communities as it is considered dirty and not good for the baby. Before the initiation of breastfeeding, infants may be given pre-lacteal feeds, including boiled water, sugar-water, tea, honey, cow or goat milk and mustard seed oil in order to cleanse the infant's digestive system from impurities of the womb, and to substitute breastfeeding before colostrum is completely expressed.

You, as a first line health professional, should be aware of the practices carried out in your area. If you come to know about certain harmful nutritional practices, counsel women and the families regarding these taboos and try to change their perspective. You should also inform them about the benefits of colostrum feeding and encourage them to start breastfeeding as soon as possible, preferably within first hour of the birth. The practice of giving pre-lacteal feeds to newborns should be discouraged as this may lead to introduction of infection in the infant as well as problems in breastfeeding.

Check Your Progress 5

1) The RDA for Energy and Protein during lactation is …… and ……

2) The daily requirements of iron and calcium during lactation are ……and …… respectively.

3) Why mother is told to make sure that one breast is empty before offering another breast to the baby during breast feeding?

.....

.....

4) The most appropriate time for weaning of a baby is…….

5) Include …….. in diet of the infant for optimum intake of vitamins and minerals.

6) By the age of one year the child should be eating……. of mother's diet.

7) Restriction or prohibition of food items in a community or section is known as…….

8) If the staple diet of population is rice or jowar, there is possibility of occurrence of ……. and ……respectively.

9) Practice of giving prelacteal feeds to the newborn baby is harmful as it may introduce …… in the baby.

2.11 LET US SUM UP

In this unit you have learnt about the importance of diet during pregnancy and lactation. Both are the stages of high nutritional requirement not only in terms of quantity but also quality. Balanced diet during pregnancy and lactation results in healthy mother and baby. Anaemia is a commonly occurring problem in pregnancy, which not only affects mother's well-being but can also jeopardize the foetus. With few considerations in diet and iron supplementation, this can easily be avoided. Breast milk is the complete food for the baby and breastfeeding should be started soon after the birth. Till 6 months only mother's milk should be given, followed by complementary feeding at 6 months and continuation of breastfeeding upto 2 years . Complementary is a crucial phase of an infant's life. If not weaned properly and at right time, the child can face many consequences, malnutrition being most common. You also got to know about some unhealthy nutritional practices present in the community. These can be tackled with educating the target group patiently and tactfully.

2.12 MODEL ANSWERS

Check Your Progress 1

1) 11 kgs
2) Blood volume
3) Energy +350 kcal/day and proteins +23 gm /day
4) 200 µg, 500 µg

Check Your Progress 2

1) 35 mg and 1200 mg respectively
2) Neural Tube Defects in foetus
3) 50 % (20–30 g) of pulses can be substituted with one egg or 30 g of meat / chicken / fish or 100% pulses can be substituted with two eggs or 50 g of meat / chicken / fish or one egg with 30 g meat and 10 g oil.
4) Seasonal vegetables- 3.5 portions and fruits- 2 portions- 100 gm each.
5) Carbohydrate
6) By fermentation and sprouting

Check Your Progress 3

1) 80%
2) <11gm%
3) Increased demand of iron, diet poor in iron, taking inhibitors of iron like tea, coffee with food
4) a) Preterm delivery
   b) Increased chances of post partum haemorrhage (PPH)
   c) LBW/IUGR baby
5) 1000 mg
6) * Prescribe 1 large IFA tablet BD for minimum of 100 days.

   Give nutrition education- explain iron rich diet.

   Ensure compliance
7) Guava, orange and sweet lime because they contain vitamin C whichenhances absorption of iron from diet.

Check Your Progress 4

1) Oxytocin
2) E- 65 kcal and P- 1.1 gm/ 100 ml
3) Suckling of breast by infant leads to production of Prolactin and Oxytocin hormones from pituitary. As long as these lactogenic hormones are produced, it cannot produce sufficient Follicle Stimulating Hormone

(FSH) and Leutenizing Hormone (LH) which bring about ovulation. Thus lactation brings about natural contraception, if mother is practicing exclusive breast feeding.

4) **Baby**

- Breast milk is easily digestible and assimilable.
- Contains protective antibodies which boost immunity and prevent infection.
- Improves the intelligent quotient (IQ) of the child.

Mother

- Breast feeding helps in involution of uterus, thus reducing PPH.
- Provides natural contraception for first few months.
- Prevents cancer of breast.

Check Your Progress 5

1) Energy- +600 kcal and Protein 74 gm
2) Iron- 21 mg , Calcium- 1200 mg
3) This ensures that baby gets the hind milk which is rich in fat and keeps the baby satisfied and is necessary for growth of the baby.
4) 6 months
5) Green Leafy Vegetables
6) Half
7) Food Taboos
8) Beri-beri, pellagra 9) Infection

2.13 REFERENCES

1) Dietary Guidelines for Indians - A manual (2nd Edition-2011) National Institute of Nutrition, ICMR, Hyderabad, India.
2) Nutrient Requirements and Recommended Dietary Allowances for Indians (2010): Report of the Expert Group of the Indian Council of Medical Research- icmr.nic.in/final/rda-2010.pdf
3) Dietary Guidelines for Indians 2024
4) Guidelines for Antenatal Care and Skilled Attendance at Birth by ANMs/ LHVs/SNs by MoHFW, GOI, 2010.
5) Williams Obstetrics- 24th Edition
6) DC Dutta's Textbook of Obstetrics -8th Edition
7) Krause's Food & the Nutrition Care Process- 14th Edition
8) Park's Textbook of Preventive and Social Medicine-23rd Edition

9) Community Medicine with Recent Advances- A H Suryakantha 9) Diet Management by Sharma Rekha- 4th Edition,2011.

10) http://danonenutricia.in/pregnancy/diet-plan-in-pregnancy/

11) Human nutrition in the developing countries. Food and Nutrition Series No. 29 by Michael C. Latham. http://portals.wi.wur.nl/foodnut/latham/Lathamtoc.htm#

12) https://www.health.qld.gov.au/multicultural/health_workers/Indian-pregprof.pdf

UNIT 3 NUTRITION FOR INFANT, CHILD, ADOLESCENT AND ELDERLY

Structure

3.0 Introduction

3.1 Objectives

3.2 Significance of Nutrition across Life Cycle

3.3 Infant and Young Child Feeding (IYCF)

- 3.3.1 First Food for the Baby
- 3.3.2 Traditional Foods for Infants
- 3.3.3 Modified Family Food
- 3.3.4 Instant Infant Foods
- 3.3.5 Protective Foods
- 3.3.6 Energy Density of Infant Foods
- 3.3.7 Frequency of Feeding
- 3.3.8 Continued Breastfeeding
- 3.3.9 Active Feeding

3.4 Nutritional needs of Children and Adolescents

3.5 Nutritional needs of Pregnant and Lactating Mothers

- 3.5.1 Nutrition of Pregnant Women
- 3.5.2 Nutrition of Lactating Mothers

3.6 Nutritional needs for the Elderly

3.7 Important National Nutritional Programmes

- 3.7.1 Integrated Child Development Services (ICDS) Scheme
- 3.7.2 National Programme of Mid Day Meal in Schools (MDMS)

3.8 Let Us Sum Up

3.9 Model Answers

3.10 References

3.0 INTRODUCTION

In Unit 2 you have learnt about importance of nutrition during pregnancy and lactation.

Good nutrition is the key to well-being of humans and lays the base for healthy life. It is a fundamental to achieving positive health, functional efficiency and productivity. The nutritional needs of the human body change

across the lifecycle. For any given individual, the requirement of nutrients is dependent on his/her age, physiological status, physical activity, Basal Metabolic Rate (BMR) etc. Nutritional status is internationally recognised as an indicator of national development. Malnutrition, which encompasses both under-nutrition as well as over-nutrition, is recognised as an important public health problem and is one of the toughest challenges that the global community is facing today.

In this unit we shall discusses the nutritional requirements across the lifecycle and how to meet that changed requirement through balanced diet.

3.1 OBJECTIVES

After completing this unit, you shall be able to:

- know the Infant and Young Child Feeding (IYCF) guidelines; • explain the nutritional needs of children, adolescents and elderly; and
- describe important National Nutritional Programmes.

3.2 SIGNIFICANCE OF NUTRITION ACROSS LIFE CYCLE

- Globally 45% of all child deaths are attributed to underweight.
- The magnitude of child under-nutrition in India is one of the highest in the world. Around 39 per cent of under 5 children in India are stunted, 15 per cent are wasted and 29 per cent are underweight with every sixth child in India being severely stunted, one in 20 being severely wasted and one in ten child being severely underweight.
- About 55% men and 75% non pregnant non lactating women are anaemic.
  • Under nutrition during foetal and early childhood is known to be associated with chronic diseases in later life.
- Chronic diseases like coronary artery disease, hypertension, type 2 diabetes, some cancers are related to diet and nutritional status.
- Obesity is associated with higher risk of developing cancer breast, colon, endometrium, gallbladder, oesophagus, pancreas, etc.
- Consumption of foods rich in dietary fiber and antioxidants is associated with reduced risk of certain cancers.

3.3 INFANT AND YOUNG CHILD FEEDING GUIDELINES

Infant and Young Child Feeding (IYCF) is a set of well-known and common recommendations for appropriate feeding of new-born and children under two years of age. IYCF includes the following care practices.

Early Initiation of Breastfeeding means breastfeeding all normal newborns (including those born by caesarean section) as early as possible after birth, ideally within first hour. Colostrum, the milk secreted in the first 2–3 days, must not be discarded but should be fed to newborn as it contains high concentration of protective immunoglobulin's and cells. No pre-lacteal fluid should be given to the newborn.

Colostrum contains large quantities of protective substances and growth factors and has more protein and Vitamins A and K than mature milk. It enhances the development and maturation of the baby's gastro-intestinal tract. The anti-infective proteins and white cells provide the first immunisation against the diseases that a baby encounters after delivery. Although colostrum is secreted in small quantities (30–90 ml), it is sufficient to meet the caloric needs of a normal newborn in the first few days of life. Colostrum also has a mild purgative effect, which helps to clear baby's gut of meconium (the first, very dark stools) and helps to prevent jaundice by clearing the bilirubin from the gut. It stimulates the baby's immature intestine to develop in order to digest and absorb milk and to prevent the absorption of undigested protein.

Exclusive breastfeeding for the first 6 months means that an infant receives only breast milk from his or her mother or a wet nurse, or expressed breast milk, and no other liquids or solids, not even water. The only exceptions include administration of oral rehydration solution, oral vaccines, vitamins, minerals supplements or medicines.

Following are the advantages of breastfeeding, breast milk is:

- the best natural food for babies.
- always clean.
- protects the baby from diseases.
- makes the child more intelligent.
- available 24 hours a day and requires no special preparation.
- nature's gift to the infant and does not need to be purchased.
- Breastfeeding makes a special relationship between mother and baby, helps parents to space their children, and helps mother to shed extra-weight gained during pregnancy.

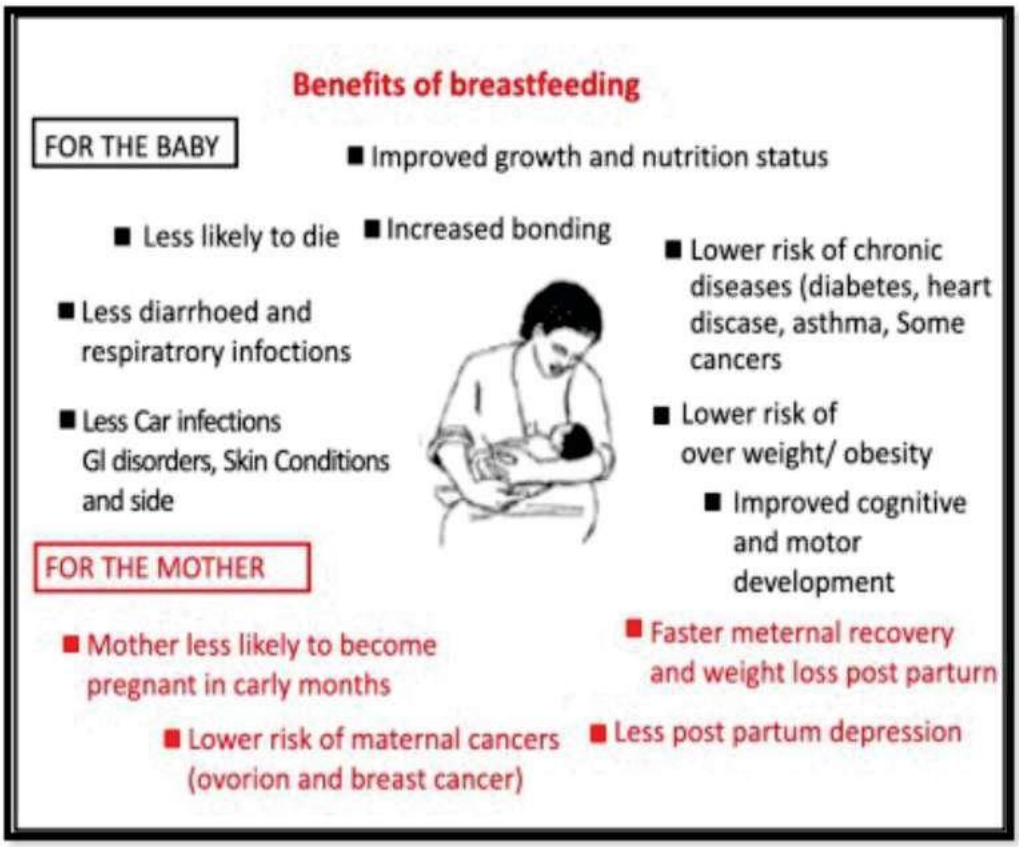


Fig. 3.1: Benefits of Breastfeeding

Complementary feeding means complementing solid/semi-solid food with breast milk after child attains age of six months. After the age of 6 months, breast milk is no longer sufficient to meet the nutritional requirements of infants. However infants are vulnerable during the transition, from exclusive breast milk to the introduction of complementary feeding, over and above the breast milk. For ensuring that the nutritional needs of a young child are met breastfeeding must continue along with appropriate complementary feeding. The term "complementary feeding" and not "weaning" should be used. The complementary feeding must be:

- **Timely -** meaning that they are introduced when the need for energy and nutrients exceeds what can be provided through exclusive breastfeeding.
- **Adequate** - meaning that they provide sufficient energy, protein and micronutrients to meet a growing child's nutritional needs.
- **Safe** - meaning the food is hygienically prepared, stored and fed with clean hands using clean utensils instead of bottles and/or teats.
- **Active feeding** - styles for complementary feeding are also important. Appropriate feeding styles can provide significant learning opportunities through responsive caregiver interaction, enhancing brain development in the most crucial first three years.

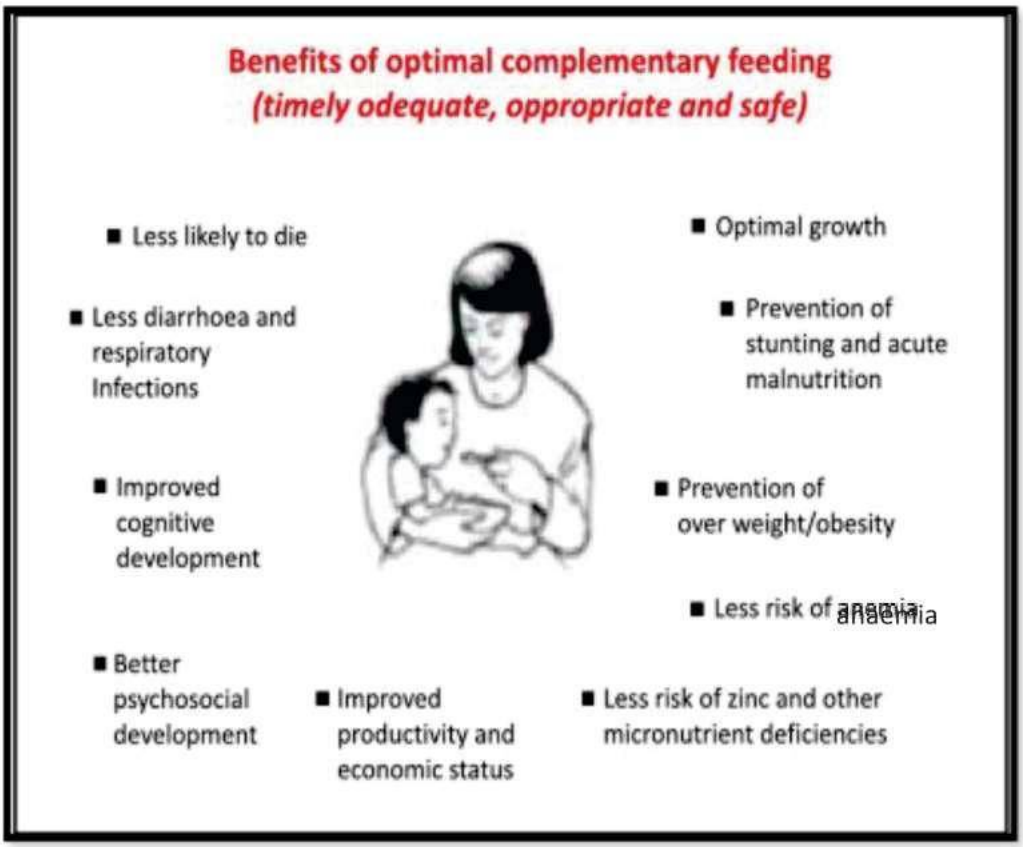


Fig. 3.2: Benefits of Optimal Complementary Feeding

3.3.1 First Food for the Baby

The staple cereal of the family should be used to make the first food for an infant. Porridge can be made with suji (semolina), broken wheat, atta (wheat flour) ground rice, ragi, millet etc, by using a little water or milk, if available. Roasted flour of any cereal can be mixed with boiled water, sugar and a little fat to make the first complementary food for the baby and could be started on the day the child becomes six months old. Adding sugar or jaggery and ghee or oil is important as it increases the energy value of the food. In the beginning the porridge could be made a little thinner but as the child grows older the consistency has to be thicker. A thick porridge is more nutritious than a thin one. In case a family can not prepare the porridge for the infant separately, pieces of half chapati could be soaked in half a cup of milk or boiled water, mashed properly and fed to the baby after adding sugar and fat. Soaked and mashed chapatti could be passed through a sieve so as to get a soft semi-solid food for the infant.

Fruits like banana, papaya, chikoo, mango etc could be given at this age in a mashed form. Infants could also be given reconstituted instant infant foods (preparation of which is discussed a little later) at this age.

3.3.2 Traditional Foods for Infants

Once the child is eating the cereal porridge well, mixed foods including cooked cereal, pulse and vegetable(s) could be given to the child. Most traditional foods given to infants in different parts of the country are examples of mixed foods like khichdi, dalia, sujikheer, upma, idli, dokhla, bhaat-bhaji

etc. Sometimes traditional foods are given after a little modification so as to make the food more suitable for the child. For instance, mashed idli with a little oil and sugar is a good complementary food for the infant. Similarly bhaat can be made more nutritious by adding some cooked dal or vegetable to it. Khichdi can be made more nutritious by adding one or two vegetables in it while cooking.

3.3.3 Modified Family Food

In most families there is a cereal preparation in the form of roti or rice and a pulse or a vegetable preparation. For preparing a complementary food for the infant from the foods cooked for the family, a small amount of dal or vegetable preparation should be separated before adding spices to it. Pieces of chapati could be soaked in half a katori of dal and some vegetable, if available. The mixed food could be mashed well and fed to the baby after adding a little oil. If necessary the mixture could be passed through a sieve to get a semi-solid paste. Thus, rice or wheat preparation could be mixed with pulse and/or vegetable to make a nutritious complementary food for the infant. Modifying family's food is one of the most effective ways of ensuring complementary feeding of infants.

3.3.4 Instant Infant Foods

Infant food mixes can be made at home from food grains available in the household. These mixes can be stored atleast for a month and enable frequent feeding of infants. These are sattu like preparations which is quite familiar in the Indian community. One can take three parts of any cereal (rice/wheat) or millet (ragi, bajra, jowar), one part of any pulse (moong/channa/arhar) and half part of groundnuts or white til, if available. The food items should be roasted separately, ground, mixed properly and stored in airtight containers. For feeding, take two tablespoons of this infant food mix, add boiled hot water or milk, sugar or jaggery and oil/ghee and mix well. Cooked and mashed carrot, pumpkin or green leafy vegetables could be added to the porridge, if available. The infant can be fed with this food whenever freshly cookedfood is not available in the family. The infant food mix could also be made into preparations like halwa, burfi, upma, dalia etc, and given to the child.

3.3.5 Protective Foods

Besides modified family food and reconstituted infant food mixes, protective foods like milk, curd, lassi, egg, fish and fruits and vegetables are also important to help in the healthy growth of the infants. Green leafy vegetables, carrots, pumpkin and seasonal fruits like papaya, mango, chikoo, banana etc., are important to ensure good vitamin A and iron status of the child. Baby needs all foods from six months namely cereals, pulses, vegetables particularly green leafy vegetables, fruits, milk and milk products, egg, meat and fish if nonvegetarian, oil/ghee, sugar and iodised salt in addition to breastfeeding. A diversified diet of the infant alongwith breastfeeding will also improve the micronutrients' status of the child.

3.3.6 Energy Density of Infant Foods

Low energy density of complementary foods given to young children and low frequency of feeding result in inadequate calorie intake and thus the malnutrition. Most of the foods are bulky and a child cannot eat more at a time. Hence it is important to give small energy dense feeds at frequent intervals to the child with a view to ensure adequate energy intake by the child. Energy density of foods given to infants and young children can be increased in four different ways:

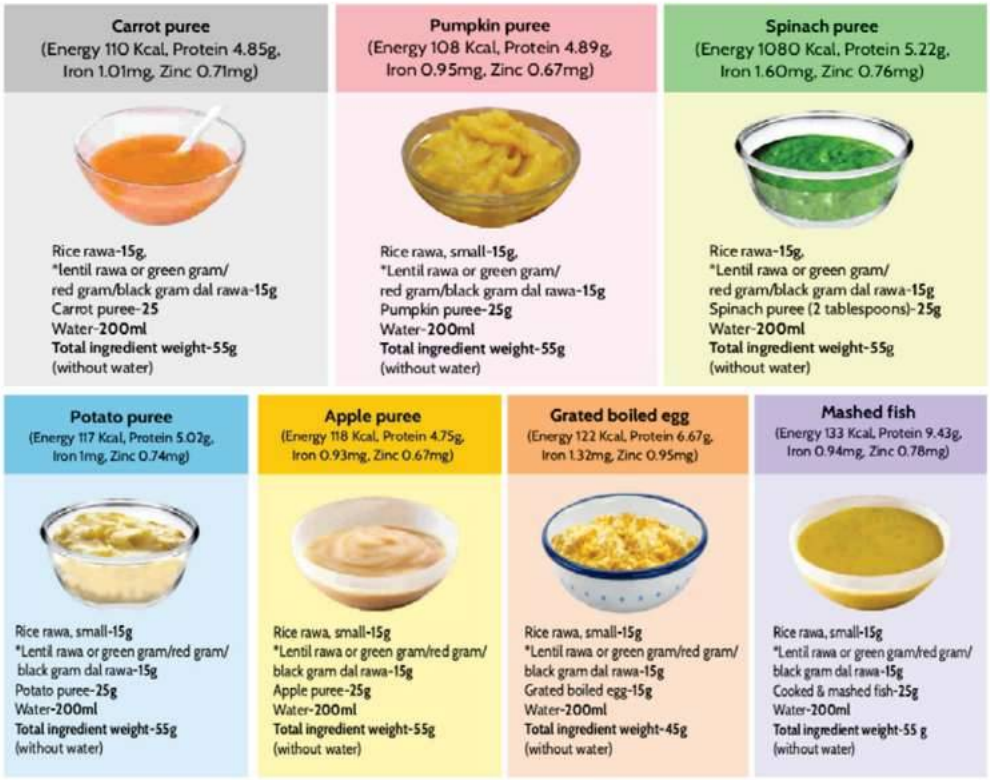
i) By adding a teaspoonful of oil or ghee in every feed. Fat is a concentrated source of energy and substantially increases energy content of food without increasing the bulk. The false belief in the community that a young child cannot digest fat has to be dispelled with by informing that a young infant digests fat present in breast milk and all other foods like cereals and pulses and that there is no reason to feel that a child can not digest visible fat when added to food.

ii) By adding sugar or jaggery to the child's food. Children need more energy and hence adequate amounts of sugar or jaggery should be added to child's food.

iii) By giving malted foods. Malting reduces viscosity of the foods and hencechild can eat more at a time. Malting is germinating whole grain cereal or pulse, drying it after germination and grinding. Infant Food Mixes prepared after malting the cereal or pulse will provide more energy to the child. Flours of malted food when mixed with other foods help in reducing the viscosity of that food. Amylase Rich Flour (ARF) is the scientific name given to flours of malted foods and must be utilised in infant foods.

iv) By feeding thick mixtures. Thin gruels do not provide enough energy. A young infant particularly during 6–9 months requires thick but smooth mixtures as hard pieces in the semi-solid food may cause difficulty if swallowed. The semi-solid foods for young infants can be passed through a sieve by pressing with a ladle to ensure that the mixed food is smooth and uniform without any big pieces or lumps.use milk, curd or lassi to convert the solid food to semi solid form.

Figure 4.5. Complementary food recipes for 6–8 months old infant babies with nutrient composition



** Varieties of dals can be included depending on the availability. 15g of one or more dals can be used for the preparation of the above recipes. Well-cooked and mashed lobia / kidney beans / chickpea can be added to infants' diet | Quantities indicated are for raw ingredients*

3.3.7 Frequency of Feeding

Infants and young children need to be fed 5–6 times a day in addition to breastfeeding. It must be remembered that inadequate feeding of infants and young children during the first two years is the main cause of malnutrition.

3.3.8 Continued Breastfeeding

Breastfeeding must be continued upto the age of two years or beyond. Continuing breastfeeding while giving adequate complementary foods to the baby provides all the benefits of breastfeeding to the baby. In other words, the child gets energy, high quality protein, vitamin A, anti-infective properties and other nutrients besides achieving emotional satisfaction from the breastfeeding much needed for optimum development of the child. Breastfeeding especially at night ensures sustained lactation. In the beginning when the complementary foods are introduced after six months of age, the complementary food should be fed when the infant is hungry. As the child starts taking complementary foods well, the child should be given breastfeeding first and then the complementary food. This will ensure adequate lactation.

3.3.9 Active Feeding

Adopting caring attitude while feeding the baby like talking to the child, playing with the child stimulates appetite and development. One-two year old child should be given food on a separate plate and encouraged to eat

on its own. Eating at the same time and at the same place also helps in improving appetite and avoids distractions.

Optimal IYCF practices

a) Early initiation of breastfeeding; immediately after birth, preferably within one hour.

b) Exclusive breastfeeding for the first six months of life i.e. 180 days (no other foods or fluids, not even water; but allows infant to receive ORS, drops, syrups of vitamins, minerals and medicines when required).

c) Timely introduction of complementary foods (solid, semisolid or soft foods) after the age of six months i.e. 180 days.

d) Continued breastfeeding for 2 years or beyond.

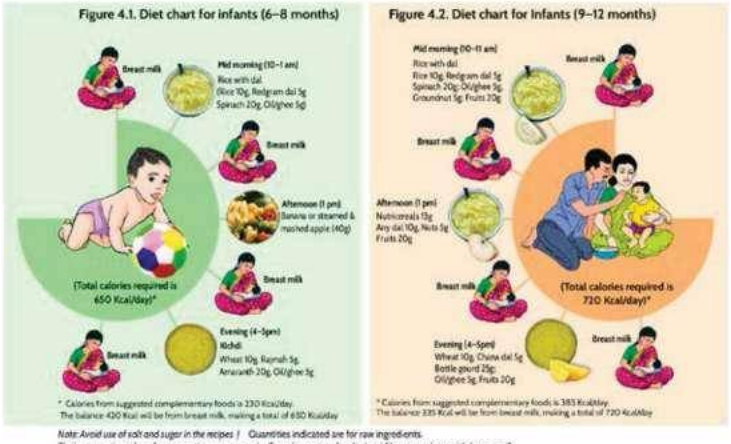
e) Age appropriate complementary feeding for children 6–23 months, while continuing breastfeeding. Children should receive food from 4 or more food groups mentioned below and fed for a minimum number of times (2 times for breasted infants 6–8 months; 3 times for breastfed children 9–23 months; 4 times for non-breastfed children 6–23 months). i) Grains, roots and tubers, legumes and nuts; ii) Dairy products;

iii) Flesh foods (meat fish, poultry);

iv) Eggs,

v) Vitamin A rich fruits and vegetables;

vi) Other fruits and vegetables



Note: Avoid use of salt and sugar in the recipes / Quantities indicated are for raw ingredients.
Timings mentioned are for suggestive purpose only. Complementary foods should be given along with breast milk

f) Active feeding for children during and after illness.

Feeding during illness

- Never starve the child.
- Feed energy-rich cereals-pulse diet with milk and mashed vegetables.
- Feed small quantities at frequent intervals.
- Continue breastfeeding as long as possible.

- Give plenty of fluids during illness.
- Use oral rehydration solution to prevent and correct dehydration during diarrhoea episodes.

Check Your Progress 1

1) Breastfeeding should be started _____ hours after birth:
   (a) Within 1 hour (b) 2 hours (c) 24 hours (d) 48 hours
2) Exclusive breastfeeding is sufficient for ____ months afterbirth:
   (a) 1 month (b) 2 months (c) 6 months (d) 9 months
3) All are true of colostrum except:
   (a) Rich in proteins and minerals
   (b) Rich in anti-infective factors
   (c) Rich in fats
   (d) Secreted for first few days
4) True regarding complementary feeding one of the following is
   (a) Be initiated from 4 month onwards
   (b) Food from 4 or more food groups be given
   (c) Should be given twice a day to all children irrespective of their age
   (d) Need not continue breastfeeding after initiation of complementary feeds
5) True regarding complementary feeding is (Check all that apply)
   (a) Safe
   (b) Home-made
   (c) Liquid in nature
   (d) Timely
   (e) Adequate

3.4 NUTRITIONAL NEEDS OF CHILDREN AND ADOLESCENTS

Childhood and adolescence are periods of continuous growth and development. An infant grows rapidly, doubling its birth weight by 5 months and tripling it by 1 year of age. During the second year, the child increases not only in height by 7–8 cm but also gains 4 times of its birth weight. During the pre-adolescent period the child grows, on an average, 6–7 cm in height and 1.5 to 3 kg in weight every year and simultaneously development and maturation of various tissues and organs take place. Children require more food as compared to adults. This is because the children not only need food for maintaining the BMR, thermogenesis, repairing wear and tear, but also for the

important function of continuous growth. Child therefore needs all kinds of extra nutrients, namely, proteins, fats carbohydrates, minerals and vitamins.

Adolescent period (teenage) is spread almost over decade. It is characterised by rapid increase in height and weight, hormonal changes, sexual maturation and wide swings in emotion. Adolescent growth spurt starts at about 10–12 years in girls and two years later in boys. The annual peak rates for height and weight are 9–10 cm and 8–10 kg. Development of critical bone mass is essential during this period as this forms the ground for maintaining mineral integrity of the bone in later life. The pattern and proportion of various body components like body water, muscle mass, bone and fat increase during the entire childhood and adolescence to reach adult values by about 18 years. Adolescent girls are at greater physiological stress than boys because of menstruation. Their nutritional needs are of particular importance as they have to prepare for motherhood. All these rapid anabolic changes require more nutrients per unit body weight.

Growing children and adolescents require more calcium. Though recommended dietary allowances for calcium are about 600–800 mg/day, it is desirable to give higher quantities of calcium for adolescents to achieve high peak bone mass. To achieve optimal peak bone mass, it is recommended to consume calcium rich foods like milk and milk products, fox tail millet (Ragi), til etc.

Older children and adolescents should consume plenty of milk to fulfill the high calcium requirements. Cooking oils/ghee (25–50 g) should be consumed. Over indulgence in fats may be avoided. Excessive salt intake should be avoided particularly by children having a family history of hypertension. Adolescence is the vulnerable stage for developing wrong food habits as well as bad habits like smoking, chewing tobacco or drinking alcohol. These should be avoided. In addition to consumption of a nutritious well balanced diet, appropriate lifestyle practices and involvement in physical activity such as games/sports should be encouraged among children and adolescents.

Protein and Energy requirements

Based on the FAO/WHO recommendations the energy and protein requirements are worked out for Indian children. These are given in Tables below 3.1 and 3.2.

Table 3.1 : Daily Energy Requirements for Children and Adolescents

Age (years)	Boys (kcal/kg)	Girls (kcal/kg)
1-3	1287	1193
4-6	1752	1630
7-9	2075	1833
10-12	2194	1965
13-15	2447	2056
16-18	2642	2064

Table 3.2 : Daily Protein Requirements of Children

Age (years)	Boys (g/kg body weight)	Girls (g/kg body weight)
1-2	1.81	1.81
2-3	1.67	1.67
3-4	1.61	1.61
4-6	1.52	1.52
7-9	1.48	1.48
10-12	1.46	1.45
13-15	1.4	1.33
16-18	1.31	1.21

Fat Requirements

The minimum visible fat intake would also be 5% of total energy. For their energy intake of 2400 kcal, minimum visible fat intake works out to 12 g/day, but the desirable intake levels should be 20 g/day, which helps to reduce the bulk of diet. Blanew diet for infants, children and adoliscents in shown in Table 3.3.

Table 3.3 : Balanced Diet for Infants, Children and Adolescents (Number of Portions)

Food Groups	g/portion	Infants 6 - 12 Months	1 - 3 yr	4 - 6 yr	7 - 9 yr	Years					
						10 - 12		13 - 15		16 - 18	
						Girls	Boys	Girls	Boys	Girls	Boys
Cereals & millets	30	0.5	2	4	6	8	10	11	14	11	15
Pulses	30	0.25	1	1.0	2	2	2	2	2.5	2.5	3
Milk (ml) & milk products	100	4	5	5	5	5	5	5	5	5	5
Roots & tubers	100	0.5	0.5	1	1	1	1	1	1.5	2	2
Green leafy vegetables	100	0.25	0.5	0.5	1	1	1	1	1	1	1
Other vegetables	100	0.25	0.5	1	1	2	2	2	2	2	2
Fruits	100	1	1	1	1	1	1	1	1	1	1
Sugar	5	2	3	4	4	6	6	5	4	5	6
Fat/ oil (visible)	5	4	5	5	6	7	7	8	9	7	10

Check Your Progress 2

1) True regarding dietary requirement during adolescence is
   a) Requirement is similar to adults
   b) Daily protein requirement is 1gm/kg/day
   c) Desirable fat intake of 20 gm/day
   d) Over indulgence in fats may be avoided
2) True regarding dietary requirement of children is
   a) Requirement is similar to adults
   b) Fatty foods should be avoided
   c) Daily protein requirement is 1gm/kg/day
   d) Calcium requirement is increased
3) True regarding adolescent girls is
   a) Requirement is similar to adolescent boys
   b) More physiological stress compared to boys
   c) Daily protein intake should be doubled
   d) Growth spurt is 12–14 years of age

3.5 NUTRITIONAL NEEDS OF PREGNANT AND LACTATING MOTHERS

We have discussed nutritional needs of pregnant and lactating mother in details in Unit 2. Let us read in brief over here as given below:

3.5.1 Nutrition of Pregnant Women

A pregnant woman needs:

- An adequate nutritious diet
- Adequate rest during last trimester
- Iron and Folic Acid tablets throughout the pregnancy
- Immunisation

Diet

- Increase food intake. A pregnantmother requires 300 extra calories per day to meet the demands of pregnancy.
- Whole gram, pulses and legumes, sprouted pulses, leafy vegetables, jaggery, dates, groundnuts are foods of plant origin having good iron content. • Include green leafy vegetables in daily diet right from the

beginning as all foliage provide "folic acid" much needed during early months.

- Consume one seasonal fruit daily.
- Milk, curd, butter milk, egg, meat, fish are helpful.
- Iodised salt should be consumed as pregnant women requires sufficient iodine for brain development of the child in the womb.
- Take plenty of fluids/water.
- Take small and frequent meals.

Rest

- Heavy work should be avoided throughout the pregnancy.
- Rest (in lying down position) during third trimester is important to enable adequate flow of nutrients from mother to the child.
- A woman should gain 10–12 kg weight during pregnancy.

Iron and Folic Acid tablets

- IFA tablets should be consumed throughout the pregnancy.
- Iron tablets may cause black stools which are harmless.
- Iron and folic acid tablets prevent anaemia and helps a women to deliver a normal healthy baby.
- The folic acid deficiency can cause "Neural tube defects" in the newborns.

Immunisation

Immunisation of the pregnant woman with tetanus toxoid (TT) given between the 5th and 8th months of pregnancy in two doses at an interval of 4 weeks is essential.

3.5.2 Nutrition of Lactating Mothers

A lactating mother requires to eat more than what she was eating during pregnancy. A lactating mother requires 550 calories extra per day to meet the needs of production of mother's milk for the new born baby. A good nutritious diet prepared from low cost locally available foods, family support and care, and a pleasant atmosphere in the family helps improve lactation and ensures health of both the mother and the baby.

Diet

- Include more of cereal, pulse and green leafy vegetable in daily diet.
- Take vegetables and one seasonal fruit a day.
- Take milk, butter milk, fluids and a lot of water.
- Egg, meat, fish are beneficial.
- Energy dense foods like ghee/oil and sugar are necessary to meet the increased energy needs.

Rest

Breastfeed in a relaxed state. Any type of mental tension decreases milk secretion.

IFA tablets

Take iron and folic acid tablets for first six months of lactation.

Check Your Progress 3

1) A pregnant mother requires _____ extra calories per day to meet the demands of pregnancy.

   a) 300 b) 400 c) 450 d) 550

2) A lactating mother requires _____ extra calories per day to meet the needs of production of mother's milk for the new born baby. a) 350 b) 450 c) 550 d) 650

3) True about nutritional requirement of pregnant mother is

   a) Only selected fruits are to be consumed

   b) Consumption of Iodised salt is desirable

   c) Consumption of curd should be limited

   d) Extra fluids are not needed

4) True for lactating mothers is

   a) Stress decreases milk secretion

   b) Iron-folic acid tablets inhibit milk secretion

   c) Nutritional requirement is same as in pregnancy

   d) Ghee/oils should be avoided in diet

5) True regarding pregnancy is

   e) Fatty foods should be avoided in diet

   f) 10–12 kg weight gain should be there

   g) IFA tablets to be taken in last trimester

   h) Heavy work to be avoided in last trimester

3.6 NUTRITIONAL NEEDS FOR THE ELDERLY

Provision of adequate nutrition to elderly is complex. The physiological, social, economic, medical and psychological changes that take place in old age, determine food intake, digestion and nutritional status. The BMR reduces with age and so does the appetite and physical activity. These factors warrant the reduction of diet. The elderly often are lonely and socially excluded that hampers their adequate dietary intake. Chronic illnesses restrict food intake, for example salt has to be restricted in hypertension, sugar in diabetes, fat in cardio vascular disease (CVD) and proteins in renal disease. Owing to this, the 'taste' of food and zeal to cook and eat is lost. Certain psycho-social factors like loneliness, lack of family support, feeling of worthlessness, stresses of daily living and possible economic constraints further limit the intake.

Energy: Evidence regarding nutritional requirements of elderly is lacking and there are no concrete guidelines for the same. But as the BMR and physical activity go down in the elderly the energy requirement need to be curtailed. It is recommended that energy requirement to be reduced by 11% in elderly men and 10% in women, as compared to young adults.

Proteins: Lean body mass protein, turnover and protein synthesis fall with age. WHO expert group has recommended a protein intake of 1 to 1.25 g / kg per day.

Fats and Oils: Fats and oils are recommended at the same level as for the young. In case the person suffers from any chronic lifestyle disease e.g. CVD, hypertension, stroke, etc he might be advised to restrict fat.

Vitamins: It is felt that the vitamin requirement goes up in old age. However, no special requirement has been slated for them.

Calcium: Sufficient amount of Calcium is required for the integrity of bones and to prevent osteoporosis in elderly. A slightly higher amount of calcium is recommended, about 0.8–1g per day.

Iron: The elderly may have lower iron requirements than the young. However, there may be underlying disorders that interfere either with iron absorption or cause blood loss (peptic ulcer, haemorrhoids etc). Hence their iron requirement cannot be scaled down and it should be the same as for the young.

Diet for the Elderly: Except for a marginal reduction in energy requirement, the need for other nutrients almost remains the same. Besides the diet being nutritionally adequate the food preparations for the elderly should be tasty, soft and easily palatable. These basic principles are summarised in Box below.

Principles of the Diet for Elderly

- Simple but nutritious food
- Include green leafy vegetables
- Eat plenty of fruits
- Include whole cereals
- Insist on frequent, small meals
- Drink plenty of fluids
- Avoid fasting
- Avoid fried foods
- Consume low salt and sugar
- Food should be easy to cook

The suggested typical balanced diet for elderly, along with the nutrients supplied with it is given in Table 3.4 below:

Table 3.4 Balanced Diet for the Elderly

Foodstuff	Raw Quantity (gms)	
	Males	Females
Cereals	350	225
Pulses	50	40
Vegetables	200	150
Green leafy vegetables	50	50
Fruits	200	200
Milk and milk products	300	300
Sugar	20	20
Fats and oil	25	20
Approximate nutrient contents of above food items		
Calories	2200	1700
Protein	65 g	50 g
Fat	50 g	40 g
Calcium	1g	0.9 g
Iron	38 mg	30 mg
Vitamin A(Retinol)	1030 µg +v	930 µg+ v

Figure 16.1. Suggested diet for normally nourished elderly men (>60yrs)
(The menu is for reference individual weighing 65Kg & BMI 18.5–23 and with adequate physical activity)



Figure 16.2. Suggested diet for normally nourished elderly women (>60yrs)
(The menu is for reference individual weighing 55Kg & BMI 18.5–23 and with adequate physical activity)



Check Your Progress 4

1) Which of the following is not true regarding diet for the elderly?
   a) Appetite goes down
   b) Dentition restricts food intake
   c) Food requirement is half of young adult
   d) Lack of evidence to predict RDA for elderly.

2) Which of the following is not a principle for diet of elderly?
   a) Restrict to 2 major meals a day
   b) Drink plenty of fluids
   c) Desirable to keep fasting
   d) Energy dense fried foods are desirable

3) Daily calcium requirement in elderly is ____ gms a) 1 b) 2 c) 3 d) 4

4) Daily protein requirement in elderly is ____ gms a) 1 b) 2 c) 3 d) 4

5) Daily iron requirement in elderly is _____ from adults
   a) Lower
   b) Same
   c) More
   d) Depends on age and sex

3.7 IMPORTANT NATIONAL NUTRITIONAL PROGRAMMES

You have read in Unit 1 about for National Nutrition programmes, let us go through the flagship programme of GOI as given below:

3.7.1 Integrated Child Development Services (ICDS) Scheme

Launched on 2nd October, 1975, the Integrated Child Development Services (ICDS) Scheme is one of the flagship programmes of the Government of India and represents one of the world's largest and unique programmes for early childhood care and development. It is the foremost symbol of country's commitment to its children and nursing mothers, as a response to the challenge of providing pre-school non-formal education on one hand and breaking the vicious cycle of malnutrition, morbidity, reduced learning capacity and mortality on the other. The beneficiaries under the Scheme are children in the age group of 0–6 years, pregnant women and lactating mothers.

Objectives of the Scheme are to:

- improve nutritional and health status of children in age-group 0–6 years; • lay foundation for proper psychological, physical and social development of the child;
- reduce incidence of mortality, morbidity, malnutrition and school dropout; • achieve effective co-ordination of policy and implementation amongst the various departments to promote child development; and
- enhance the capability of the mother to look after the normal health and nutritional needs of the child through proper nutrition and health education.

Services under ICDS

The ICDS Scheme offers a package of six services, viz.

- Supplementary Nutrition
- Pre-school non-formal education
- Nutrition and health education
- Immunisation
- Health check-up
- Growth monitoring and
- Referral services

The last three services are related to health and are provided by Ministry/ Department of Health and Family Welfare through NRHM & Health system. The perception of providing a package of services is based primarily on the consideration that the overall impact will be much larger if the different services develop in an integrated manner as the efficacy of a particular service depends upon the support it receives from the related services. For better governance in the delivery of the Scheme, convergence is, therefore, one of the key features of the ICDS Scheme. This convergence is in-built in the Scheme which provides a platform in the form of Anganwadi Centres for providing all services under the Scheme.

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 [MWCD]
ii) Immunisation*	Children below 6 years, Pregnant & Lactating Mothers (P&LM)	ANM/MO [Health system, MHFW]
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, MHFW]
v) Pre-School Education	Children 3-6 years	AWW [MWCD]
vi) Nutrition & Health Education	Women (15-45 years)	AWW/ANM/MO [Health system, MHFW & MWCD]

* AWW assists ANM in identifying the target group

Nutrition and feeding norms for Supplementary Nutrition under ICDS

Provision of supplementary nutrition under the ICDS Scheme is primarily made to bridge the gap between the Recommended Dietary Allowance (RDA) and the Average Daily Intake (ADI) of children and pregnant and lactating women. State Governments/UTs are supposed to provide 300 days of supplementary food to the beneficiaries in a year which would entail giving more than one meal to the children from 3–6 years who visit AWCs. This includes morning snacks in the form of milk/banana/egg/seasonal fruits/micro-nutrient fortified food followed by a hot cooked meal (HCM). For children below 3 years of age, pregnant and lactating mothers, Take Home Rations (THRs) in the form of premixes/ready-to-eat food are provided. Besides, for severely underweight children in the age group of 6 months to 6 years, additional food items in the form of micronutrient fortified food and/or energy dense food as THR is provided. The extent of nutritional supplements to different types of beneficiaries is indicated below:

Nutritional Norms in ICDS (since February, 2009)

Beneficiaries	Calories	Protein (g)
Children (6 months to 72 months)	500	12-15
Severely Malnourished Children (SAM) (6 months-72 months)	800	20-25
Pregnant women and lactating mothers	600	18-20

3.7.2 National Programme of Mid Day Meal in Schools (MDMS)

MDMS is a flagship programme of the Government of India aiming at enhancing enrollment, retention and attendance and simultaneously improving nutritional levels among children studying in Government, Local Body and Governmentaided primary and upper primary schools and the Centres run under Education Guarantee Scheme (EGS)/Alternative & Innovative Education (AIE) and National Children Labour Project (NCLP) schools of all areas across the country. Mid Day Meal (MDM) is also served in drought-affected areas during summer vacation also.

The primary aim of the programme is to provide atleast one nourishing meal to the school going children per day. The objectives are to :

i) served as an incentive for the children to attend school.

ii) reduce dropouts from school.

iii) improve the nutritional status of the child.

There are certain additional advantages of the programme too. It also serves as an opportunity to impart basic health /nutritional education to children. Moreover some local women get employment to cook food for the mid day meal.

It must be remembered that the programme provides a supplement, and not a substitute to the food eaten at home. This meal provides one third the total daily energy requirement and half the need of proteins. The central government (Ministry of Education) supplies the full quota of grains to the states. Food that could be cooked easily, available locally and at low cost is preferable. To avoid monotony it is desirable to change the menu frequently.

To achieve the objectives of the Scheme, the guidelines prescribe the following nutritional content in the mid day meal:

Components	**Primary**	**Upper Primary**
Calories	450 Cal	700 Cal
Protein	12 gms.	20 gms.
Micronutrients	Adequate quantities of micronutrients like Iron, Folic Acid, Vitamin A etc.	

The component-wise break up of above nutrition value of food items constituting Mid Day Meal (MDM), both for primary and upper primary, are as under:

S. No.	**Items**	**Primary**			**Upper Primary**		
		Requirement under MDM (in gms)	**Energy Content (in calories)**	**Protein Content (in gms)**	**Requirement under MDM (in gms)**	**Energy Content (in calories)**	**Protein Content (in gms)**
1.	Food grains (Rice / Wheat)	100	340	8	150	510	14
2.	Pulses	20	70	5	30	105	6.6

3.	Vegetables	50	25	—	75	37	—
4.	Oil & Fat	5	45	—	7.5	68	—
5.	Salt & Condiments	As per need	—	—	As per need	—	—
			480	13		720	20.6

3.8 LET US SUM UP

In the unit we have discussed nutrition for infant, child, adolesent and elderly.

Mid Day Meal Scheme envisages supply of adequate quantities of micro nutrient such as iron, folic acid, zinc and the semicro nutrients are to be supplemented through convergence with the school health and other programmes of the National Rural Health Mission (NRHM) of the Ministry of Health and Family Welfare, for this, no budgetary support is provided under the Mid Day meal scheme. These appropriate supplementations are provided depending on common deficiencies found only in the local are as to the target beneficiary group. National nutrition programme with focus on ICDS + MDMS related to child and adolescent are also been covered.

Check Your Progress 5

1) Mid day meal programme offers :

   a) Half of daily protein and one third of calorie requirement

   b) Half of daily protein and half of calorie requirement

   c) One third daily protein and half of calorie requirement

   d) One third of daily protein and one third of calorie requirement.

2) To a child under 6 years of age, ICDS provides :

   a) 500 kcal energy and 12-15 g protein

   b) 800 kcal energy and 12-15 g protein

   c) 500 kcal energy and 20-25 g protein

   d) 800 kcal energy and 20-25 g protein

3) Which of the following services under ICDS are not provided by the Anganwadi worker herself

   a) Supplementary nutrition

   b) Non-formal pre-school education

   c) Immunisation

   d) Nutrition and Health Education.

4) To a severely malnourished child, ICDS provides :

   a) 500 kcal energy and 12-15 g protein.

   b) 800 kcal energy and 12-15 g protein

   c) 500 kcal energy and 20-25 g protein

   d) 800 kcal energy and 20-25 g protein

5) To pregnant and lactating mothers, ICDS provides :

   a) 500 kcal energy and 20-25 g protein.

   b) 500 kcal energy and 18-20 g protein

   c) 600 kcal energy and 18-20 g protein

   d) 600 kcal energy and 20-25 g protein

3.9 MODEL ANSWERS

Check Your Progress 1

1-a, 2-c, 3-c, 4-b, 5-a,b,d,e

Check Your Progress 2

1-d, 2-d, 3-b

Check Your Progress 3

1-a, 2-c, 3-b, 4-a, 5-b

Check Your Progress 4

1-c, 2-b, 3-a, 4-a, 5-a

Check Your Progress 5

1-a, 2-a, 3-c, 4-d, 5-c

3.10 REFERENCES

1) Rajul K Gupta. Introduction to Nutrition in Public Health. In: Rajvir Bhalwar, editor. Textbook of Public Health and Community Medicine. 1st ed. Pune: Dept of Community Medicine, AFMC Pune in collaboration with WHO India.; 2009. p. 712–6.

2) World Health Organization. Children: reducing mortality [Internet]. WHO. World Health Organization; 2016 [cited 2016 Aug 20]. Available from: http:/
/www.who.int/mediacentre/factsheets/fs178/en/

3) Ministry of Human Resource Development D of W and CDG of I. National Guidelines on Infant and Young Child Feeding [Internet]. 2004 [cited 2016 Dec 3]. Available from: http://wcd.nic.in/sites/default/files/nationalguidelines. pdf

4) Ministry of Health and Family Welfare. Government of India. Guidelines for Enhancing Optimal Infant and Young Child Feeding Practices [Internet]. 2013 [cited 2016 Dec 3]. Available from: http://nrhm.gov.in/images/pdf/ programmes/child-health/guidelines/Enhancing-optimal-IYCF-practices.pdf

5) Rajul K Gupta. Nutritional Requirements of Special Groups: Mothers, Children and the Elderly. In: Bhalvar R, editor. Textbook of Public Health and Community Medicine. 1st ed. Pune: Dept of Community Medicine, AFMC Pune in collaboration with WHO India.; 2009. p. 750–9.

6) NATIONAL INSTITUTE OF NUTRITION. DIETARY GUIDELINES FOR
INDIANS - A Manual [Internet]. 2011 [cited 2016 Dec 3]. Available from: http://ninindia.org/dietaryguidelinesforninwebsite.pdf

7) Ministry of Women and Child Development. Government of India. INTEGRATED CHILD DEVELOPMENT SERVICES (ICDS) SCHEME [Internet]. [cited 2016 Nov 28]. Available from: http://icds-wcd.nic.in/icds/icds.aspx

8) Department of School Education & Literacy. Ministry of Human Resource Development. Government of India. Mid Day Meal Scheme [Internet]. [cited
2016 Dec 7]. Available from: http://mdm.nic.in/Files/School Health Programme/Nutrition_Support/Nutrition_support_Introduction.pdf

UNIT 4 NUTRITIONAL DEFICIENCY DISORDERS

Structure

4.0 Introduction

4.1 Objectives

4.2 Protein Energy Malnutrition (PEM)

- 4.2.1 Magnitude of the Problem
- 4.2.2 Causes
- 4.2.3 Classification of PEM
- 4.2.4 Signs and Symptoms of Malnutrition
- 4.2.5 Severe Acute Malnutrition (SAM)
- 4.2.6 Management and Prevention of Malnutrition

4.3 Childhood Obesity

- 4.3.1 Signs and Symptoms
- 4.3.2 Assessment of Obesity
- 4.3.3 Management of Obesity
- 4.3.4 Prevention of Obesity in Children

4.4 Vitamin Deficiency Diseases

- 4.4.1 Vitamin A Deficiency
- 4.4.2 Vitamin B Deficiency
- 4.4.3 Vitamin C Deficiency
- 4.4.4 Vitamin D Deficiency

4.5 Mineral Deficiency Diseases

- 4.5.1 Iron Deficiency
- 4.5.2 Iodine Deficiency
- 4.5.3 Calcium Deficiency

4.6 National Nutritional Policy and Programmes in India

4.7 Let Us Sum Up

4.8 Model Answers

4.9 References

4.0 INTRODUCTION

In the previous unit, you read about nutrition for infant, child, adolescent and elderly.

Nutrition plays an important role in maintaining our health. There are various nutrients in the food we eat. Adequate amounts of different nutrients in appropriate proportions are required for a healthy body. When diet is not

balanced and is inadequate in terms of calories, proteins, fat, micronutrients and minerals; malnutrition affects our body. In this unit, we shall discuss nutritional deficiency disease especially in children.

Half of preschool children in India suffer from moderate and severe grades of protein-calorie malnutrition. Over 50% women suffer from iron deficiency anaemia (IDA). Many have mild vitamin A deficiency. B-complex vitamins

deficiencies particularly of riboflavin, folic acid and vitamin B12 are also common. In this unit, we will discuss the manifestations of nutritional deficiency diseases, their management, prevention and control in context of national nutritional programmes.

4.1 OBJECTIVES

After completing this unit, you should be able to:

- list common nutritional deficiency diseases;
- describe their signs and symptoms;
- discuss their primary, secondary and tertiary level care;
- outline essential components of national nutrition programmes; and • describe the concepts of nutrition education, health education and other preventive measures.

4.2 PROTEIN ENERGY MALNUTRITION (PEM)

Malnutrition is a state of deficiency or excess of energy, protein and other nutrients. It can manifest as under- or over-nutrition. Under-nutrition could result from a lower than desired intake of one or more nutrients. It leads to a clinical spectrum ranging from no symptom to discomforts of severe malnutrition.

4.2.1 Magnitude of the Problem

Worldwide, 60–70% of childhood deaths results from under-nutrition. In India, nearly half of children under 5 years are stunted and are underweight. Undernutrition is substantially higher in rural than urban areas of India. Proportion of underweight children under five years ranges from 20% in Sikkim and Mizoram to 60% in Madhya Pradesh. More than half of young children in Jharkhand and Bihar are underweight.

4.2.2 Causes

Reduction in food consumption (over a span of few days/weeks) results in acute under-nutrition with wasting. Chronic under-nutrition occurs when long term food consumption (over the years) is insufficient to meet the requirements of daily energy expenditure. This leads to stunting (decrease in height for age). Malnutrition results from several other causes as well, e.g., poverty, large sized families, improper feeding habits, taboos and unhealthy beliefs related to feeding, lactation failure, delayed weaning. Frequent

infections (acute respiratory tract infection, diarrhoea, tuberculosis, HIV etc.) and mal-absorption may also lead to it.

Check Your Progress 1

1) Explain about Protein Energy Malnutrition?

.....

.....

2) List five causes of PEM.

.....

.....

3) …….percent of death among childhood occurs due to under nutrition, worldwide.

4.2.3 Classification of PEM

PEM may be classified according to severity, clinical features and the energy or protein deficit. Severity classifications are based on body measurements (weight and height). Weight of more than 80% of expected for age is taken as normal. Grades of malnutrition are: Grade I (71–80 per cent), II (61–70 per cent), III (51–60 per cent) and IV (<50 per cent) weight of expected for that age.

Stunting: It is defined as a child having height less than 90 per cent from the median height for age according to WHO reference standards.

Wasting: It is defined as a child having less than 80 per cent weight for height from the median of WHO reference standards.

Growth Monitoring

Regular weight and height measurement of children is the best way to know if a child is growing well or not. If complementary feeding is not started at the right time after 6 months of age, the child may become malnourished. Without regular growth monitoring, it is difficult to detect early signs of malnutrition.

Benefits of Growth Monitoring:

- Weight and height measurements help identify whether a child is normal, undernourished, or severely undernourished.
- If a child's weight is not increasing according to age, it signals a risk of malnutrition.
- Anganwadi Centres are equipped with tools to measure children's growth.
- Anganwadi Workers assess the child every month and record the weight in the growth tracker, helping parents understand the child's nutritional status.

Risks of Not Monitoring Growth:

- Severely malnourished children are thinner and shorter than healthy children.
- They gradually lose appetite and eat less food.
- Such children become weak and fall ill frequently.
- Their development slows down, and they often feel tired and inactive.
- Mental development is also affected, making them lag in studies.

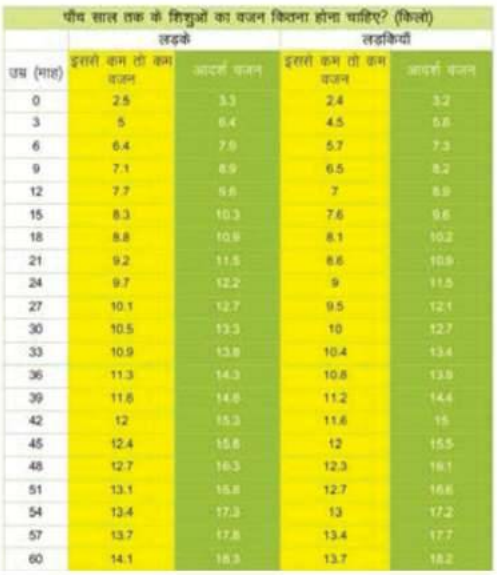
- Frequent illness leads to higher treatment costs and more hospital visits.
- In severe cases, it may even result in child mortality.

Therefore, it is very important to weigh your child every month during MCHN Day or Weight Day to ensure timely action and better health outcomes.

The MAMTA card carries two charts to measure underweight(Age / Weight) and wasting (height or length / weight). The graph for girls are pink and for boys its blue

Chart 1 Measuring Weight As per age

- Weight in Yellow Zone(-2SD) – Underweight
- Weight in Orange Zone(-3SD) – Severely Underweight



पाँच साल तक के शिशुओं का वजन कितना होना चाहिए? (किलो)

	लड़के		लड़कियाँ	
उम्र (माह)	इससे कम तो कम वजन	आदर्श वजन	इससे कम तो कम वजन	आदर्श वजन
0	2.5	3.3	2.4	3.2
3	5	6.4	4.5	5.8
6	6.4	7.9	5.7	7.3
9	7.1	8.9	6.5	8.2
12	7.7	9.6	7	8.9
15	8.3	10.3	7.6	9.6
18	8.8	10.9	8.1	10.2
21	9.2	11.5	8.6	10.9
24	9.7	12.2	9	11.5
27	10.1	12.7	9.5	12.1
30	10.5	13.3	10	12.7
33	10.9	13.8	10.4	13.4
36	11.3	14.3	10.8	13.9
39	11.8	14.8	11.2	14.4
42	12	15.3	11.6	15
45	12.4	15.8	12	15.5
48	12.7	16.3	12.3	16.1
51	13.1	16.8	12.7	16.6
54	13.4	17.3	13	17.2
57	13.7	17.8	13.4	17.7
60	14.1	18.3	13.7	18.2

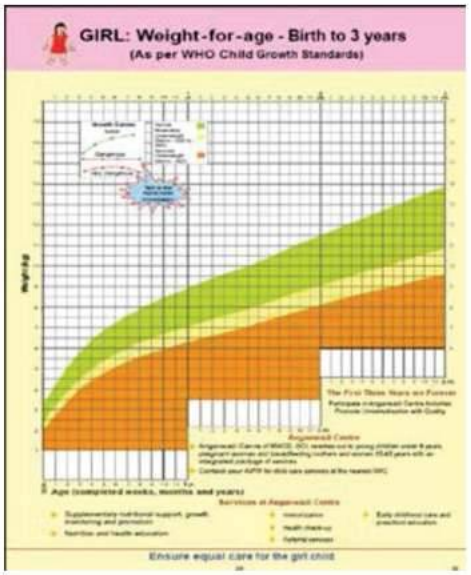


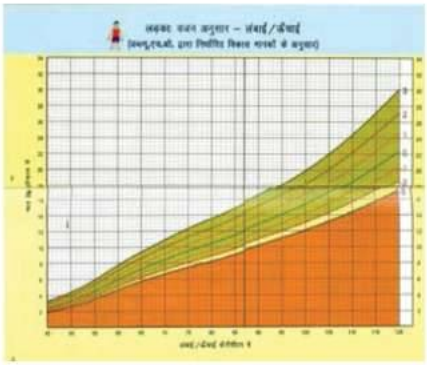
Chart 2 Measuring Height/Length as per weight

- Wasting / Weight in Yellow Zone(MAM)
- Severe Wasting / Weight in Red Zone(SAM)



दुबलापन एवं गंभीर दुबलापन सारणी

लम्बाई (सेमी)	लड़के			लड़कियाँ		
	इससे कम तो गंभीर दुबलापन (किलो) (SAM)	इससे है तो दुबलापन (किलो) (MAM)	इससे है तो सामान्य (किलो)	इससे कम तो गंभीर दुबलापन (किलो) (SAM)	इससे है तो दुबलापन (किलो) (MAM)	इससे है तो सामान्य (किलो)
46.0	2.0	2.0 – 2.1	2.2 – 3.1	2.0	2.0 – 2.1	2.2 – 3.2
48.0	2.2	2.3 – 2.4	2.5 – 3.6	2.3	2.3 – 2.4	2.5 – 3.6
50.0	2.6	2.6 – 2.7	2.8 – 4.0	2.6	2.6 – 2.7	2.8 – 4.0
52.0	2.9	2.9 – 3.1	3.2 – 4.5	2.9	2.9 – 3.1	3.2 – 4.6
54.0	3.3	3.3 – 3.5	3.6 – 5.1	3.3	3.3 – 3.5	3.6 – 5.2
56.0	3.6	3.6 – 4.0	4.1 – 5.8	3.7	3.7 – 3.9	4.0 – 5.8
58.0	4.3	4.3 – 4.5	4.6 – 6.4	4.1	4.1 – 4.4	4.5 – 6.5
60.0	4.7	4.7 – 5.0	5.1 – 7.1	4.5	4.5 – 4.8	4.9 – 7.1
62.0	5.1	5.1 – 5.5	5.6 – 7.7	4.9	4.9 – 5.2	5.3 – 7.7
64.0	5.5	5.5 – 5.9	6.0 – 8.3	5.3	5.3 – 5.6	5.7 – 8.3



There was MUAC(Mid upper arm circumference) tapes which was been used, but now it is not been used. The standard growth monitoring technique is weight/Age/Height

The standard way of measuring the malnutrition levels are weight and height standard. The ready recknor tool are available and also graphs are there

4.2.4 Signs and Symptoms of Malnutrition

This includes growth failure, increased incidence of infections, decreased activity and micro-nutrient deficiencies like anaemia, vitamin A and D deficiency. These children also have loss of muscle mass (wasting) indicated by decrease in MUAC.

The two main clinical syndromes of severe malnutrition are **marasmus and kwashiorkor**, although mixed pictures are also seen. These are differentiated on the basis of clinical and biochemical findings.

1) **Marasmus**

It occurs most commonly in children less than five years. This is due to their increased calorie requirements and increased susceptibility to infections. It results from the body's physiologic adaptation to starvation in response to severe deprivation of calories and other nutrients. Marasmus is more common than kwashiorkor and is characterised by the following features.

1) Body weight is less than 60% of the expected weight for age.
2) Muscle wasting often starts in the axilla and groin, followed by thigh, buttocks, chest, abdomen, and finally the facial muscles. (Fig. 4.2) 3) Absence of oedema.
4) Affected children appear emaciated, irritable, weak, lethargic and have bradycardia, hypotension and hypothermia.



Fig. 4.2 : Child with Marasmus

5) The skin is dry, wrinkled and loose because of the loss of subcutaneous fat.
6) The loss of buccal fat pads on the face gives the child an appearance of monkey or aged face in severe cases.
7) These children are usually alert with strong appetite.

2) **Kwashiorkor**

The term originated from Ga language in Ghana, Africa which means "Disease associated with the birth of a second child", or "the sickness the baby gets when the new baby comes." Diet low in protein results in kwashiorkor. It is characterised by: (Fig. 4.3).

1) Decrease in body weight between 60% and 80% of the expected weight for age.



Fig. 4.3 : Child with Kwashiorkor

2) Generalised oedema, Distended abdomen and enlarged liver,

3) Hair is usually dry, sparse, brittle, easily pluckable and depigmented, appears reddish yellow. With adequate protein intake, hair colour is restored and may result in alternating bands of pale and normal coloured hair also known as the flag sign. It signifies fluctuating periods of poor and good nutrition.

4) Skin changes include shiny, varnished looking skin (64%), dark erythematous pigmented macules (48%), dryness (28%), residual hypopigmentation (18%), and hyper pigmentation and erythema.

5) These children also have muscle wasting but tend to retain subcutaneous fat. **Marasmic Kwashiorkor**

When there is a mixed picture with features of both marasmus and kwashiorkor, then it is known as marasmic kwashiorkor. These children have concurrent gross wasting, oedema and frequently stunted. Mild hair and skin changes are often seen and they also have an enlarged palpable fatty liver.

4.2.5 Severe Acute Malnutrition (SAM)

SAM: Characteristic features of SAM are- weight for height Z score less than 3, bilateral pitting oedema, and marasmic-kwashiorkor (both oedema and wasting). In simpler terms, all children with body weight less than 60% of the expected weight and with oedema should be considered to have SAM. They are at great risk of death due to any undercurrent illness specially infections.

In this context please read the article given here in the box. It explains about, "Managing Severe Malnutrition without any Hospitalisation/ Medicine". It may help you to manage the cases of Malnutrition more comprehensively while you work in the community area with limited resources.

Managing Severe Malnutrition without any Hospitalisation /Medicine

According to the fifth National Family Health Survey (NFHS 5) from 2019-2021, about 36% children under five years of age are stunted (low height for age), 19% are wasted (low weight for height) and 32% are underweight (low weight for age). In view of the high prevalence of malnutrition in India, the government had launched several nutrition programmes at the national level, like special nutritional programme, mid-day meal scheme, applied nutrition programme Poshan Abhiyaan (Launched on 8th March 2018) and Anaemia Mukt Bharat (Launched as a component of Poshan Abhiyaan) program, Eat Right India and Fit India Movement and integrated child development services (ICDS) scheme. Similarly, many nutrition intervention programmes are being implemented in many developing countries with varying success rates.

If parents are instructed about nutritional care of the malnourished child on individual level and a regular follow up is done; constant improvement in the condition of the child can be achieved.

Guidelines for management of malnutrition state that provision of inpatient (hospital) treatment is the only way to treat severely malnourished children.

However, in resource constrained settings such as ours it puts considerable strain on our already crowded health infrastructure. Admission to the hospital requires the care givers (most often parents) to leave their work, leading to loss in terms of productive capacity and entails loss in terms of opportunity costs.

On the other hand, research has shown that domiciliary treatment of severe malnutrition is more cost effective and shows promising results.

As an example, consider Rinku's story (name changed).

Rinku was born on 16th January 1999 at home in a resettlement colony to a primipara mother in a joint family. Both parents were educated up to tenth standard. The family owned a small tea shop. His mother got married at 19 years of age. His birth weight was 1600 grams. Breastfeeding was initiated on third day of life, but was discontinued at one month of age. His maternal as well as paternal grand-mother instructed his mother to stop breastfeeding him as her milk was not considered to be healthy for the child.

There is a belief in north India that in some women the breast milk is "not good" for babies. This kind of diagnosis is usually made by elder ladies in the household when a child is not able to gain weight with breast feeds. In fact, an 'ant test' is popular in villages. In this test, mother's milk is expressed in a cup and an ant is put in it. If the ant dies the mother's milk is declared as 'not good' for the baby.

In Rinku's case also mother's milk was not considered good for him. He was given bottle-feeds with half strength milk. Bottle was boiled once daily. These practices make child more prone to Severe malnutrition resulting in high mortality.

Contact with State health care service/ICDS: Mother and child were not registered with anganwadi as she had come to visit her parents to assist in the delivery of her sister-in-law.

In the month of November (age-10 months) his mother came to our dispensary to enquire about measles vaccine. At that time child had upper respiratory infection. On examination his weight was 3.75 kilogram, hairs were thin and easily pluckable, cheeks bony, no teeth had erupted, he could neither sit nor crawl.

On auscultation, chest had crepts. He was irritable. His mother told that he did not had a sound sleep during night. His diet was deficient in calories and iron. He was referred to the local dispensary where he was prescribed medicines for infection.

When enquired from his mother, why he was not given any supplementary feed, she told he had "*Soka /Parchhanwa*". He did not accept any feed and vomited it out. He was too weak to tolerate supplementary feeds. The family had spent more than 2000 rupees on his treatment without any result, and they felt that he would never recover.

It was then that a home visit was paid by a nurse (Mrs Santosh) to train the mother in steam inhalation. Dietary advice was also given. Second home visit was paid next day to assess his condition. He had improvement in his respiratory problem. He was being given bottle feed. However, the bottle was visibly very dirty. Mother was told to stop bottle-feeding. Hazards of bottle feeding were explained to her. A menu (diet plan) was prepared for the child. The mother was demonstrated how to prepare sujee kheer, mashed banana etc. Spoon feeding was started. Initially he resisted, but later on he enjoyed the feed. The mother was told not to add water in milk. She was also told to feed him every 2–3 hours.

Third home visit was paid after four days. The mother was happy with the progress of her child. She told that he was better, accepting feeds and slept well during night. After one week his weight was 4 kilograms. The mother

was encouraged to continue feeding as instructed. After one month of intervention weight was taken again, it was 5 kilograms. He could sit, and asked for things with gestures. After two months of our intervention, he started crawling, and weight gain continued. After three months his weight was six kilograms, i.e. he shifted to grade 2 malnutrition from grade 4, had 4 teeth and he started standing with support. His mother was motivated to continue feeding him and increase the diet with home cooked food. She was also asked to visit anganwadi. His grandmother was also very happy that child had improved without any medication.

But after that the mother went back to her in-law's place. Her mother in law was happy to see the health of the child, She said "it is surprising that the child had improved without any medication and without spending any money."

At her in law's place she got busy with her routine work and could not take care of her son properly. She came to Chandigarh again for follow-up after three months. The weight gain had stopped and she had started bottle feeds again. Again, she was motivated to continue feeding as advised earlier.

She was asked to come for follow-up again after one month. Thereafter the child started improving. He also gained weight. He started walking. After that there was no follow up for some time.

At present, he is 9 years old and studying in fourth standard, his growth is like any other child of his age. His weight is 30 kilograms.

Case Study

During a routine anganwadi (day care centre) health check-up of under five year children in March 2008, we came across a girl child Neha, 7 month 28 days old suffering from loose stools. On clinical examination, the child was lethargic with some signs of dehydration with delayed milestones with PEM grade IV with milestones corresponding to 3 months of age. She did not have any oedema.

Neha belonged to a poor family with four family members where the father was a daily wager and the only breadwinner for the family. When the birth history of the mother was elicited, it was found that she was the second child of the couple; the first child (also a female) had expired at around 7 months of age due to pneumonia. Both the children were delivered at home. On inquiring about the diet history of the child it was found that she was inadequately weaned and was being fed tea. Each child (0–5 yrs) in the catchment area is registered in the anganwadi and monitored for growth and provided supplementary nutrition along with informal education. While Neha's name was registered in the anganwadi centre (AWC), she had not received any supplementary nutrition so far.

The child was given ORS for diarrhoea, the mother and the grandmother of the child were told about the child's condition and prognosis explained to them. They were advised to take the child to nearest health care facility for admission and management of grade IV PEM. But the family expressed their inability in taking the child to a hospital as they did not have adequate financial resources. Clearly, Neha was fighting a loosing battle.

The turnaround (kayakalp)

The RHTC team took it upon themselves to manage the child in the existing resources. A team was made in the village comprising of various stakeholders

such as RCH/ICDS/ women's committee such as mahila mandal and sakshar mahila samuh. The team informed the community development project officer (CDPO) about the non-receipt of nutritional supplement by the child.

A supervisor was sent to the village in the ensuing week to look into the matter and supply of supplementary food for the child was ensured. The food was rationed to the baby on a weekly basis. Weekly visits were paid to the family by the RHTC team. The family was instructed by the team at frequent intervals on topics relevant to infant feeding, disease prevention, family planning and use of easily available ingredients to prepare nutritious meals for the child. The child was given an oral dose of vitamin A (1 lakh IU), an oral dose of albendazole (200 ml). In between, the child again developed diarrhoea for which she was given ORS powder and zinc supplementation from the local sub-centre and monitored for signs of dehydration. Weight of the child was monitored during these weekly visits. The median rate of weight gain was approx. 19 gm/ day. Her milestones started to improve. She started sitting with support 40 days into the therapy. Within four months she has shifted from grade IV malnutrition to grade II.

Conclusion

Domiciliary treatment of severe malnutrition with close supervision as an integrated public health response model is feasible as the present case studies show. It involves community consultation, mobilisation and participation with due consideration of factors such as socioeconomic condition of the family, high workload for women, less desirability of a daughter, illiteracy and underutilisation of available health and nutritional supplementation services. At home care is less disruptive to domestic routines and allows mothers to continue with house work and other family responsibilities and is therefore associated with low opportunity costs to the family. It also avoids a situation of congregation of children to a hospital or day care centre thus avoiding exposure to acquired infections.

These case studies show that even severely malnourished children can be managed at home. They just need constant follow up and counselling regarding nutrition. This can easily be done by a paramedical worker /nurse at primary care set up. Success can thus be attained by personal attention and care rather than hospitalisation or medication.

Reference: AJ Singh (Editor), (Mrs.) Indrajit Walia, LK Dhaliwal (Co-editors) "Demedicalizing Women's Health", New Delhi, 2010.

4.2.6 Management and Prevention of Malnutrition

There is a need for periodic weighing and charting on growth charts (road to health chart). This will help in detection of early growth deviations for taking early corrective measures to prevent under nutrition. Nursing interventions at the community level can effectively deal with this problem at an early stage. The management involves advising increasing the energy intake up to 150 kcal/kg/ day with frequent energy dense foods (which can be done by adding oil to the food). The protein intake of 3 to 3.5 gm/kg/day is also essential. Inter-current infection, if any should be treated. If the management is effective, it can be assessed by weight gain.

Children with SAM with no complications can also be possibly managed in the community but would require a very close supervision. However, in case they develop any inter-current illness, then they should be promptly referred to a higher health facility for hospitalisation since they can deteriorate very fast. You should remember that decrease in appetite in a marasmic child is a dangerous sign. It can be due to infection and they need prompt assessment, evaluation and management. For details of protocol manging SAM, please refer Course 3, Block 1, Unit 2 also.

Following 10 essential steps are for treatment of inpatient SAM children:

- Treat / prevent hypoglycemia
- Treat / prevent hypothermia
- Treat / prevent dehydration
- Correct electrolyte imbalance
- Treat / prevent infection
- Correct micronutrient deficiencies (Vitamin A, Folic acid, zinc, copper and iron in safe and effective doses)
- Start cautious feeding
- Achieve catch-up growth
- Provide sensory stimulation and emotional support
- Prepare for follow-up after recovery

Prevention of malnutrition: You must remember that there are multiple measures to prevent childhood under nutrition and its adverse outcomes. These include promotion of breastfeeding, complementary feeding, food supplements, micronutrient intervention and general improvement of family and community nutrition.

Check Your Progress 2

1) Write four signs and symptoms of Kwashiorkor.

.....

.....

2) Write four signs and symptoms of Marasmus.

.....

.....

3) What are the management and treatment guidelines for a child with severe PEM?

.....

.....

4) What are the strategies of prevention of PEM?

.....

.....

4.3 CHILDHOOD OBESITY

You have so far learned about one aspect of malnutrition i.e. under nutrition. Now, let us start with the other aspect of malnutrition i.e. childhood obesity. Worldwide, there has been a remarkable increase in the prevalence of obesity in children. Let us go through signs and symptoms, assessment and management of abesity as given below:

4.3.1 Signs and Symptoms

The term overweight refers to excess body weight for a particular height. Obesity refers to excess body fat. Both the conditions result mainly from lack of physical activity and excess intake of calorie. In obese children puberty starts little earlier than their lean peers. If there are endocrine causes of obesity, weight loss may occur with treatment. Fig. 4.4 Shows on obese child.

4.3.2 Assessment of Obesity

Obesity is a symptom rather than a disease. It may be a precursor for other diseases such as diabetes, hypertension and cardiovascular diseases etc. For assessment, you must take a detailed history in every child regarding:

- Rate of weight gain
- Pattern of linear growth
- Milestones

- Appetite and life style



Fig. 4.4 : Obese child

- Record dietary intake, time spent on exercising, watching TV and other indoor activities, such as reading, computer work or games, video games etc. • Ask for episodes of headaches, visual disturbances, menstrual disturbances
  (in girls).
- Enquire about family history of obesity, thyroid disorders, diabetes mellitus, hypertension and heart disease.
- Assess for cultural eating pattern.
- Measure the height and weight to determine the deviation from normal.
- Plot the weight for height and calculate BMI.
- Check vital signs including BP.
- Look for acanthosis nigricans (hyper pigmented velvety folds of skin, behind the neck, in axilla, groin. This is usually associated with type 2 diabetes mellitus, insulin resistant diabetes mellitus.
- Refer to a higher health facility for hormonal tests.
- Assess pubertal status and gynecomastia in boys.
- Analyse the reports of investigations and counsel.

4.3.3 Management of Obesity

Uncomplicated obesity can be managed by alteration in lifestyle, Diet restriction in children (it has to be done very carefully under strict supervision since it can affect the growth of the child and cause nutritional deficiencies). The aim should be restriction of calories without affecting the nutritional requirements or growth.

1) **Dietary management**

It will depend on the age and presence / absence of complications.

- **Children less than three years of age:** Strict calorie restriction is not recommended. But avoid overfeeding.
- **Children aged 3–7 years with no associated diseases:** Advise weight maintenance by preventing weight gain rather than advising weight loss, so that as they gain height which will help in reducing their BMI gradually. Consult a physician if the child has any associated disease.
- **Children aged more than 7 years:** Weight reduction is recommended. Changes in diet should be permanent, rather than short term. Advise for restriction of fast foods, soft drinks, calories from saturated fat. Calorie can be restricted by following simple measures like taking skimmed milk instead of whole milk, no ghee / butter spread on chapatis etc. Increase the consumption of whole grain, fruits and vegetables. Advise on the intake of fiber rich foods to reduce fat absorption from the gut. Restrict eating out and encourage the whole family to eat the same food as the child.

2) **Exercise and physical activity**

Sedentary lifestyle should be discouraged since it is a major contribution to obesity. In the absence of caloric restriction, moderate exercise does not generally lead to weight reduction. However, combination with decreased caloric intake and exercise can achieve significant weight reduction. Physical activity should be mandatory in schools.

Encourage them to participate in sports that they enjoy such as badminton, football, tennis, football, Kho-kho, walking, dancing, swimming etc. Reduce TV viewing and encourage them to do chores at home too. The intensity and duration of exercise must be appropriate to the level of maturity of the growing bones and muscles.

3) **Behaviour modification**

Modification of the child's behaviour should be done in conjunction with the diet and exercise management. This should be done as a team with a therapist. Gain insight into the child's problems and the family environment. Educate the family about the importance of healthy foods and exercise and give rewards for achieving goals. Build the child's self-confidence and esteem and help him deal with the peer pressure. Behaviour modification helps in achievement of long term goals.

4.3.4 Prevention of Obesity in Children

Obesity can be prevented by developing right and healthy eating habits from infancy. They should follow an exercise regime to prevent excess weight gain. This is especially important for children at high-risk groups, e.g. whose parents or relatives are obese. The following tips can be advised to parents for prevention of excessive weight gain.

- Encourage exclusive breastfeeding till 6 months after birth.
- Discourage early introduction of solid foods (start with vegetables).

- Encourage plenty of intake of fruits and vegetables.
- Minimise intake of bottled juice, cold drinks, chocolates.
- Discourage eating out too often.
- Encourage physical activity both outdoors and at home.
- Discourage TV viewing more than 1 hour daily.
- Do not use food as a reward or punishment.
- Be a role model for healthy diet, physical activity and minimal television viewing.
- Offer positive reinforcement for healthy food choices, avoid criticism. • Support health, body image; emphasise strength and health rather than weight and appearance.

4.4 VITAMIN DEFICIENCY DISEASES

Vitamins are micronutrients required by the body for metabolism in minute quantity. Broadly, vitamins are categorised as (a) water soluble and (b) fat soluble. Water soluble vitamins are B complex and C, whereas fat soluble vitamins are A, D, E, and K. We will now discuss these vitamins briefly as follows.

4.4.1 Vitamin A Deficiency

It results mainly from low intake of vitamin A rich diet such as green leafy vegetables, carrot, pumpkin, tomato, milk, butter, cheese, egg yolk, cod liver oil, fish, meat, fruits such as mango, papaya, orange etc. Vitamin A is essential for maintaining vision, integrity of epithelial cell linings of respiratory, intestinal, urinary tract, skeletal growth and certain infections. Deficiency of vitamin A is manifested in the form of xerophthalmia which comprises of night blindness, conjunctival xerosis (dryness of conjunctiva), appearance of Bitot's spot (chalky grey spots on the temporal side of corneo-scleral junction), Kerato-malacia (cornea is soft and ulcerated). (Fig. 4.5 to 4.6) These children are also prone to develop respiratory infections.

Management

Administer 3 doses of vitamin A as follows: first dose immediately on diagnosis, second dose after 24 hours, and third dose 1–4 weeks later. A single dose of oral vitamin A consists of 50, 000 units for children below 6 months, 1,00,000 units for infants aged from 6 months to 12 months and 2 lac unit for children older than one year. Vitamin A is available in the form of syrup with strength of 1 lac unit /ml, capsule (1 lac unit /capsule), or injection. If the child is given injectable vitamin A, the dose is half of the oral dose. Sick children should be given vitamin A as IM injection. (Avoid Overdose!)

Role of Nurses in prevention:

- Promote and encourage breastfeeding focusing on colostrum feeding which is rich in vitamin A.

- Promote intake of locally available dark green leafy vegetables which are rich in vitamin A (carotene).
- If space is available, encourage kitchen garden and growing of green leafy vegetables.
- Administer vitamin A at 9 months (one lac unit oral), and at every 6 monthly intervals after one year of age till five years (2 lac unit every time).

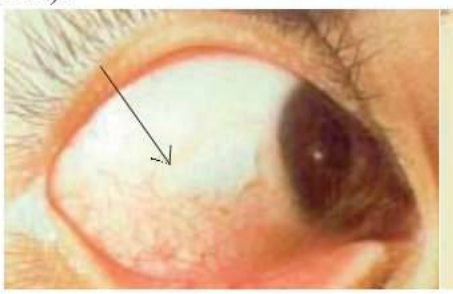


Fig. 4.5: Bilot's spot



Fig. 4.6: Bitot's Spot and kerato-malacia

4.4.2 Vitamin B Deficiency

B complex group of vitamins are B1, B2, B6, B12, folic acid, niacin etc. We will discuss the salient features of deficiency of these vitamins. These are shown as follows:

B1 Thiamine deficiency: It can lead to two diseases (a) Beri Beri, (b) Wernicke's encephalopathy. B1 deficiency is commonly found among rice eating population. B1 is lost during milling, washing and cooking of rice since it is water soluble. Beri Beri can be dry or wet. In dry, there is nerve involvement leading to peripheral neuropathy. In wet variety there is involvement of heart. In Wernicke's encephalopathy, seen among chronic alcoholics, there is ophthalmoplegia, ataxia and multiple nerve involvement.

B2 Riboflavin deficiency: It leads to angular stomatitis, cheilosis, glossitis. It occurs when the diet is devoid of vitamin B2 usually by washing the food item such as rice in water and after cutting the leafy vegetables since B2 is water soluble.

B3 Niacin deficiency: Deficiency manifests in the form of Pellagra which is characterised by 3 Ds - Dermatitis, Dementia, Diarrhoea.

B6 Pyridoxine deficiency: Pyridoxine deficiency is observed in those taking anti-TB drugs INH. It leads to peripheral neuritis characterised by burning and tingling sensation.

Folic Acid deficiency: It results in megaloblastic anaemia and diarrhoea. Its deficiency during early trimester pregnancy can lead to neural tube defect in the foetus.

B12 Cyanocobalamin deficiency: In this condition, the large nerve fibres of the spinal cord are demyelinated, B12 deficiency can lead to pernicious anaemia and infertility.

Nurses' Role in managing B complex deficiency:

1) Early identification for deficiency symptoms.
2) Advice on supplementation of B complex vitamins.
3) Education regarding prevention, balanced diet.

Check Your Progress 3

1) Vitamin A deficiency causes .....

2) Vitamin A deficiency can be prevented by .....

3) Skin ulceration or cracks atangles of mouth indicate ..... and is treated by giving .....

4) The features of B3 deficiency are (a) ..... (b) ..... (c) ……..

4.4.3 Vitamin C (Ascorbic Acid) Deficiency

Vitamin C is necessary for formation and maintenance of collagen, which supports blood vessels, connective tissues, bones and cartilage. Foods rich in vitamin C are citrous fruits such as orange, lemon, sweet lime, and in other fruits such as amla, guava, fresh green leafy vegetables, cabbage etc. Vitamin C deficiency in diet causes scurvy and delayed wound healing. The usual age of onset is from 6 to 18 months. Breast fed infants are protected from this condition since breast milk contain adequate amount of vitamin C.

The common features of scurvy are: lethargy, anorexia, and crying on handling of the child. The child has tender bones and she/he may be reluctant to move the limbs which may be misinterpreted as paralysis (pseudo paralysis). Other manifestations are bleeding from gums, mucous membrane, and petechiae (bluish discolouration of skin), conjunctival bleeding etc.

Role of Nurses in management: Administer Vitamin C as per the age requirement. Daily allowance of vitamin C is 40 mg for adults and 25 mg for infants. She should educate, counsel and advise vitamin C rich diet for prevention.

4.4.4 Vitamin D Deficiency

There are two forms of vitamin D: D_2-calciferol and D_3-cholecalciferol. It is naturally synthesised in the body by exposure of skin to sun. Other sources are milk, vitamin D enriched fats and oils, fish liver oil. Its deficiency in children leads to rickets,where process of calcification of cartilage is incomplete. In adults it causes osteomalacia. Thus, the bone easily gets deformed or fractured. The features of rickets in children are:

1) Bossing of head (frontal and parietal bones involved) in children over 6 months,
2) Sternum projects forwards (pigeon shaped chest),
3) Delayed eruption of primary teeth,
4) Moderate degree of scoliosis, kyphosis or lordosis may occur,
5) Broadening of wrist,

6) Bending or bowing of legs known as knock knee,

7) Pot belly abdomen due to marked hypotonia,

8) Costochondral junction of ribs looks like beads known as 'rickety-rosary'.

Osteomalacia

This condition is seen usually in women during pregnancy and lactation. They complain of difficulty in climbing stairs, standing and have a waddling gait.

Management of Osteomalacia: Administer high dose of vitamin D, viz. 15,000 mg or 6 lakhs international unit orally. If healing line is not seen in X ray within 3–4 weeks of therapy, the above dose may be repeated. Supplementation of vitamin D should be done. Encourage the child to play outdoors in sunlight. Supplement Vitamin D rich foods.

Check Your Progress 4

1) Vitamin C deficiency results in ……..……The common features are .....

2) Mention the cause of rickets .....

3) Give two preventive measures to prevent rickets.

.....

.....

4.5 MINERAL DEFICIENCY DISEASES

Let us now go through mineral deficiency diseases such as iron, iodine and calcium which are important in diet.

4.5.1 Iron Deficiency

Human body contains about 4 gm of iron of which 3 gm are in the blood, with haemoglobin and rest 1 gm. is in stored form. Iron is essential for synthesis of haemoglobin. It is found in other myoglobin and certain other enzymes. There are two forms of iron: Haem is from animal sources such as liver, fish, meat, poultry etc. and non haem is from vegetable sources such as ragi, jiggery, dried fruits etc.

The commonest manifestation of iron deficiency is anaemia, the single most common nutrient deficiency all over the world. The most vulnerable are infants, children of school age group, adolescent girls and pregnant mothers. About 20–25% of adolescent girls suffer from anaemia irrespective of their social class. The impact is more profound in rural girls because of non-availability and nonintake of iron rich foods.

Causes of iron deficiency anaemia

- Excessive blood loss, menstruation, menorrhagia, childbirth,

- Continuation of breastfeeding alone after six months and delayed weaning,
- Poor iron intake in food,
- Decreased iron absorption due to interfering substances such as phytates of wheat, phosphates of egg-yolk, tannin of tea, oxalates of certain vegetables,
- Mal-absorption,
- Infections,
- Hookworm infestation
- Peptic ulcer, bleeding Piles

a) **Signs and symptoms**

Clinically, iron deficiency anaemia is manifested in the form of complaints such as easy fatigability or tiredness, pallor, flat nails, palpitation, breathlessness, failure to thrive, pica, diarrhoea, low mental development. Consequences of iron deficiency anaemia during pregnancy are: abortion, still birth, low birth weight babies, higher infant and maternal deaths.

b) **Actions for management and prevention of Iron deficiency anaemia** • Early identification by asking about symptoms of anaemia, examining and assessing the nutritional status, obtaining diet history.

- Asking history of infection, worm infestation and adequacy in diet intake.
- Blood examination and referring the child if haemoglobin is less than 8 gms.
- Treat the child at health facilities as per the prescribed protocol. • Administer iron supplement as per age either orally or by intra muscular injections. Iron should not be given on an empty stomach.
- Inform regarding possibility of black stool, constipation or diarrhoea after iron supplementation.
- Adolescents should be provided nutritional guidance. Nutrition education should be continued with special emphasis on nutritional need related to the growth, selection of iron rich food items.
- Distribution of Iron and Folic Acid to all teenage girls through school health programme.
- Nutrition counselling to mothers and parents regarding sources of iron rich foods.

  Conduct cookery sessions to demonstrate how to prepare balanced diet economically.

c) Iron Folic Acid Supplementation program:

Supplement type and Age Groups	Intervention/Dose	Regime	Service Delivery
IFA Syrup for Children 6–59 months of age.	1 ml Iron and Folic Acid syrup. Each ml of Iron and Folic Acid syrup contains 20 mg elemental Iron + 100 mcg of Folic Acid.	Biweekly, throughout the period of 6-59 months of age.	First dose administered by ASHAs and remaining doses administered by parents at home. As shakti divas is beening organized in state on every Tuesday under which, Anganbadi centres and schools provided IFA supplementation to enrolled beneficiaries, hance one dose of IFA syrup (1ml) may be provided at *Aanganwadi* centres on Tuesday followed by 2nd dose at Home or AWC.
IFA Pink tablets for Children 5–9 years of age.	1 Pink Iron and Folic Acid tablet. Each tablet contains 45 mg elemental Iron + 400 mcg Folic Acid, sugar-coated, Pink colour.	Weekly, 1 Pink Iron and Folic Acid tablet throughout the period of 5-9 years of age.	Administered by ASHAs & ANMs on *Shakti divas* to non-school going children and for left out children administered during field visits by ASHAs and ANM. Administered by teachers to school going children on Tuesday/shakti diwas.
IFA Blue tablets for	1 Blue Iron and Folic Acid tablet. Each tablet	Weekly, 1 Blue Iron and Folic Acid tablet	Administered by AWWs to non-school going girls

School-going adolescent girls and boys, 10–19 years of age. Out-of-school adolescent girls, 10–19 years of age.	contains 60 mg elemental iron + 500 mcg Folic Acid, sugar-coated, blue colour.	throughout the period of 10-19 years of age.	and by teacher to school goin children an adolescents o Tuesday/shakti diwas.

Under the AMB/AMR program, the state organise **"Shakti Divas"** to generate awareness, mobilize target beneficiaries, and create a momentum around the program. On this day, the IFA T4 approach—Test, Treat, Talk, and Track (follow-up) is implemented at health facilities SHC,PHC, CHC etc and IFA supplementation administration by AWCs and Government Schools, primarily focusing on the six target groups: 1. Children aged 6–59 months , 2. Children aged 5-9 years, 3. Adolescents aged 10–19 years, 4.Pregnant women, 5.Lactating mothers,6. Women of reproductive age (20–49 years).

4.5.2 Iodine Deficiency

Iodine is essential for synthesis of thyroid hormones: T_3 (Thyroiodothyronine), and T_4 (Thyroxine). These are necessary for normal growth and metabolism in the body. Common sources of iodine are sea foods such as sea fish, shrimps, prawn, iodated salt, vegetables grown in iodine rich soil, water etc. The common iodine deficiency disorders are goiter, cretinism and myxoedema.The problem of severe forms of Iodine Deficiency Disease (IDD) has been considerably reduced after universal iodisation of salt. However, the problem of mild IDD persists in many districts of India.

In Goiter, there is enlargement of thyroid gland in the neck as the main presenting feature of iodine deficiency. Endemic goiter is said to be present when the prevalence in a defined population exceeds 10%. Goiter prevalence rates of 5 to 19.9%, 20–29.9% and more than or equal to 30% indicates mild, moderate and severe endemicity of iodine deficiency respectively.

Cretinism is associated with thyroid and iodine deficiency. The characteristic features include deaf, mutism, squint, mental retardation, and spastic neuro–motor disorders. Myxoedematous cretinism is characterised by retarded psycho–motor development, severe short stature, coarse facial features and myxoedema without deaf–mutism.

Preventive measures

• Participation in early detection, notification, geographical mapping for goiter. • Education of the people regarding intake of iodised salt for kitchen and table use and simple measures such as keeping common salt in closed bottles having a tight lid so as to minimise iodine loss during storage, by not putting salt in boiling vegetables but sprinkling after cooking to preserve iodine etc.

4.5.3 Calcium Deficiency

Calcium is one of the vital minerals needed for strong bones and teeth besides having a role in neurotransmission and muscle contraction. Calcium deficiency can lead to irritability, jitteriness, muscle spasm, tremors and convulsions in newborn babies, brittle nails, easy fracturing of bones, numbness and tingling etc. It can also be seen in association with Vitamin D deficiency. Calcium deficiency can cause tetany. Artificially fed children are more prone to develop calcium deficiency. The high phosphate content of non-human milk depresses the level of calcium in the blood. Though rare in breastfed infants, calcium deficiency can occur in such infants whose mothers are deficient in calcium and Vitamin D.

Calcium deficiency affects bones. One common symptom of calcium deficiency is muscle cramps. Muscle ache, especially the thighs, arms, and underarms while moving and walking around may be a sign of calcium deficiency. There can be abnormal heart beat, and osteoporosis leading to fracture. Management lies in supplementing calcium with vitamin D which plays a role in calcium absorption.

Prevention

Calcium deficiency can be prevented by taking calcium rich diet such as milk and dairy products. Exposure of body to sunlight also helps. Other vitamin D rich diet (fortified oils, butter, cheese, eggs, fish) helps in calcium absorption.

Check Your Progress 5

1) Write the management of child with haemoglobin of 8–12 gm%.

   .....

   .....

2) How can you prevent goiter in areas where food and water are deficient in Iodine?

   .....

3) What are the manifestations of calcium deficiency in children?

   .....

   .....

4) Write two preventive measures of calcium deficiency.

   .....

   .....

4.6 NATIONAL NUTRITION POLICY AND PROGRAMMES IN INDIA

One of the important steps taken by the Government of India is the formulation of a National Nutrition Policy in 1993 (NNP). It envisages several

measures to ensure proper nutrition of the population. As a short term direct measure, it calls for expansion of Integrated Child Development Services (ICDS) covering under five children, adolescents, pregnant and lactating women. Under indirect long term changes the policy calls for establishment of food security services. It highlights a need for poverty alleviation programmes and functional public distribution system. It also calls for a need for basic land reforms for landless poor, strengthening of surveillance of nutritional status of children, adolescent girls and pregnant mothers, administering minimal wage, ensuring community participation and education. It also highlights the need for establishing National Nutrition Council and a inter-ministerial coordination committee.

The measures to prevent malnutrition can be stratified at national, community and family level. Promotion of education and literacy in the community with special focus on health and nutrition, exclusive breastfeeding for first 6 months, introduction of complementary foods at 6 months and periodic growth monitoring on growth chart should be done vigorously.

There are many programmes related to prevention of malnutrition in India. (Table 4.1)

Table 4.1: Nutrition Programmes in India

Nutrition Programme	Ministry
Vitamin A Prophylaxis Programme	Ministry of Health and Family Welfare
Special Nutrition Programme	**Ministry of Women and Child Development**
Integrated Child Development Service	**Ministry of Women and Child Development**
Mid-day Meal Scheme	Ministry of Human Resource Development
Iodine Deficiency Disorders Control Programme	Ministry of Health and Family Welfare
Poshan Abhiyaan (National Nutrition Mission)	**Ministry of Women and Child Development**
Anaemia Mukt Bharat	**Ministry of Health and Family Welfare**

Check Your Progress 6

1) Name five nutrition programmes in India.

.....

.....

2) How long the Exclusive breastfeeding shall be given to child.

.....

.....

3) ICDS services are meant for whom.

.....

.....

4.7 LET US SUM UP

In this unit, we have learnt about the common nutritional deficiency diseases such as protein energy malnutrition, vitamin and mineral deficiencies, their causes, signs and symptoms, treatment and prevention. We have also learned about national nutrition policy and names of various programmes related to nutrition in India.

Nutrition assessment would help to identify deficiency dis-orders and enable you to advice appropriatly as per the head.

4.8 MODEL ANSWERS

Check Your Progress 1

1) Malnutrition is defined as a cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions.
2) Five causes for malnutrition are poverty, large families, feeding habits, taboos and believes with regard to feeding, lactation failure.
3) 60 to 70 %

Check Your Progress 2

1) Kwashiorkor
   a) Underweight
   b) Pitting oedema
   c) Thin Body
   d) Apathetic

2) Marasmus

   a) Underweight

   b) Strong appetite

   c) Alert

   d) No oedema

3) Children with severe malnutrition with no complications can be possibly managed in the community but would require a very close supervision. The five treatment guidelines are: i) Treat / prevent infection ii) Correct micronutrient deficiencies (Vitamin A, folic acid, zinc, copper, iron in a safe and effective doses)

   iii) Start cautious feeding iv)

   Achieve catch-up growth

   v) Provide sensory stimulation and emotional support 4)

   Preventive measures are:

- Periodic weighing and charting on growth charts,
- Promotion of breastfeeding,
- Strategies to promote complementary feeding,
- Provision of food supplements,
- Micronutrient intervention and general supportive strategies to improve family and community nutrition.

Check Your Progress 3

1) Blindness

2) Giving vitamin A solution every six months to all well children between 1–5 years and also to all children suffering or recovering from an infection such as measles or from malnutrition.

3) Vitamin B2 deficiency, Vitamin B2 in tablet or syrup form.

4) Dermatitis, Dementia, Diarrhoea

Check Your Progress 4

1) Scurvy, features of scurvy are: bleeding from gums, mucous membrane, petechiae, lethargy, anorexia, and crying on handling of the child, reluctant to move the limbs (pseudo paralysis).

2) Vitamin D deficiency

3) a) Exposure to sunlight

   b) Diet rich in Vitamin D, calcium and phosphorous.

Check Your Progress 5

1) a) Treat any minor ailments or infections and worm infestation promptly if detected,

b) Give iron rich foods in diet such as dark green leafy vegetables, nonvegetarian foods such as meat, fish, poultry etc.

c) Give iron 60 mg and folic acid 0.1 mg daily in tablet or syrup form for 3 months.

2) By encouraging and supplementing use of iodised salt.

3) Calcium deficiency can lead to irritability, jitteriness, tremors and convulsions in newborn babies, tetany, muscle cramps, muscular twitching, weak bones, easy fracture etc.

4) a) Diet rich in calcium such as milk and dairy products, phosphorous and Vitamin D

b) Exposure to sunlight.

Check Your Progress 6

1) i) Vitamin A Prophylaxis Programme ii) Prophylaxis against Nutritional Anaemia iii) Iodine Deficiency Disorders Control Programme (IDD) iv) Balwadi Nutrition Programme

v) Integrated Child Development Services (ICDS)

2) 6 Months

3) Under five Children, adolescent, pregnant and lactating women.

4.9 REFERENCES

1) Current Nutritional Therapy guidelines in clinical practice: A hand book for physician, dieticians and nurses - incorporating revised guidelines for standardized hospital diets. Directorate of Health Services, Ministry of Health and family Welfare, Govt. of India.

2) Parvathi E, Kumari Prema K, Mary G, Shiela J, Sadhana PR, Karthiga, and Anna CR. Nutrition and Dietitics.1st ed. Tamil Nadu Text Book Cooperation, Chennai; 2005.

3) Dutta P. Pediatric Nursing. 2nd ed. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.

4) Gupta P. Essential Pediatric Nursing. 3rd ed. CBS Publishers & Distributers Pvt. Ltd, New Delhi.

5) Ronald E Klinman RE. Pediatric Nutrition. First Ed.2010. Jaypee Brothers Medical Publishers Ltd. St. Louis (USA), New Delhi. 2010; pp. 175-176, 319-486, 559-571.

6) Sachdeva A, Dutta AK, and Jain P M. Advances in Pediatrics, 2nd edition, vol. 2. P:1303-16.

7) Arnold F, Parasuraman S, Arokiasamy P, and Kothari M. 2009. Nutrition in India. National Family Health Survey (NFHS-3), India, 2005-06.

8) International Institute of Population Sciences (IIPS) and ORC Macro. National Family Health Survey (NFHS-3), 2005-06. Mumbai: IIPS, 2007.

9) Boelaert M, Davis A, Le Lin B et al. Nutrition Guidelies (1st edn). Paris: Medecins Sans Frontieres, 1995.

10) Ville de Goyet C, Seaman J, Geijer U. The management of nutriotional emergencies in large populations. Geneva: WHO, 1978.

11) WHO, UN High Commissioner for Refugees (UNHCR), World Food Programme (WFP), International Federation of Red Cross and Red Crescent Societies (IFRC). The management of nutrition in major emergencies. Geneva, 1998.

12) Khanum S, Ashworth A, and Huttley S R. Controlled trial of three approaches to the treatment of severe malnutrition. Lancet 1994; 344: 1728-32.

13) Ashworth A, and Khanum S. Cost effective treatment for severely malnourished children: what is the best approach? Health Policy Plan 1997; 12: 115-21.

14) Collins S, and Sadler K. Outpatient care for severely malnourished children in emergency relief programmes: a retrospective cohort study. Lancet 2002; 360: 1824-30.

UNIT 5 FOOD BORNE DISEASES AND FOOD SAFETY

Structure

5.0 Introduction

5.1 Objectives

5.2 Food Borne Diseases

5.2.1 What is Meant by Food Borne Disease?

5.2.2 Burden of Food Borne Diseases

5.2.3 Causes and Classification of Food Borne Diseases

5.2.4 Signs and Symptoms of Food Borne Diseases

5.2.5 Transmission of Food Borne Pathogens and Toxins

5.3 Food Poisoning and Food Intoxication

5.3.1 Epidemiological Features/Clinical Characteristics

5.3.2 Types of Food Poisoning

5.3.3 Food Intoxications – Features, Preventive and Control Measures

5.4 Public Health Response to Food Borne Diseases

5.5 Food Safety

5.5.1 What is Food Safety?

5.5.2 Food Safety Considerations and Measures

5.5.3 Food Safety Regulatory Measures in India

5.5.4 Five Keys to Safer Food

5.6 Food Storage, Food Handling and Cooking

5.6.1 General Principles of Food Storage of Food Items

5.6.2 Role of Food Handlers in Food Borne Diseases

5.6.3 Essential Steps in Safe Cooking Practices

5.7 Let Us Sum Up

5.8 Model Answers

5.9 References

5.0 INTRODUCTION

In the previous unit, you have learnt about nutritional deficiency disorders. In India, the concept of food safety is now being considred seriously. The current initiative of 'Swachchh Bharat Abhiyaan' by the Prime Minister Shri Narender Modi will also benefit the cause of food safety in times to come. Actually the focus of safety must be on entire supply chain production, processing, distribution and marketing.

We often think that home cooked food is always safe, this is a wrong perception. If adequate care is not taken, even home food can also get contaminated. Of course, it is correct to assume that food taken outside home is more likely to be unsafe and contaminated. Actually, food safety can be compromised at any stage from farm (where food is grown) to fork (when it is consumed). Food can easily become unsafe when we do not follow hygienic principles during its transport, storage, cooking, and serving of food. Safe food does not cause any harm to whosoever consumes it.

In the previous units you have learnt different aspects of food and nutrition. Besides being essential for health and survival food also causes many diseases. This includes food borne infections and food poisoning. It may manifest as mild infections to severe disease. These illnesses may even lead to death and disability if not identified early and treated properly. You may also encounter in your field service area outbreaks of such diseases, particularly of food poisoning.

In this unit you will learn how food transmits many diseases; what are the various food borne diseases and how these manifest. You will also learn how to recognise the food borne illnesses including their severity and to take preventive and control measures. In addition, you will also learn components of food safety and how to make people aware about food safety problems.

5.1 OBJECTIVES

After completing this unit, you should be able to:

- describe the burden of food borne diseases and their consequences;
- recognise, assess and classify different food borne diseases;
- explain modes of transmission of food-borne pathogens and toxins;
- investigate food poisoning cases/outbreaks;
- describe preventive and control measures for food borne diseases;
- identify the signs and symptoms of food poisoning and refer for management;
- define food safety;
- identify the measures to be taken at various levels to ensure food safety;
- make people aware about practicing Five Keys to Safer Food; and
- describe the food storage, food handling and cooking.

5.2 FOOD BORNE DISEASES

Food borne diseases encompass a wide spectrum of illnesses and are growing public health problem worldwide. Let's discuss in detail about the food borne diseases.

5.2.1 What is Meant by Food Borne Disease?

These illnesses result from ingestion of food contaminated with microorganisms (bacteria, viruses, parasites etc) or harmful chemicals (toxins). The contamination may occur at any stage in the process from food production to consumption. This may result from unhygienic food handling practices or environmental conditions including pollution of water, soil etc.

The terms 'food borne illnesses' and 'food borne diseases' (FBD) are generally used interchangeably. In this module, we shall use the term FBD to denote both. In most cases isolated episodes of such diseases occur. Outbreaks of CBD's are also frequent when two or more cases of a similar illness resulting from ingestion of a common food.

5.2.2 Burden of Food Borne Diseases

Borne Diseases are a major public health problem worldwide. The causal relationship between food contamination and resulting illness or death is difficult to establish. Food hence, most such diseases are not reported.

- Unsafe food containing harmful bacteria, viruses, parasites or chemicals, causes more than 200 diseases – ranging from diarrhoea to cancers.
- An estimated 600 million – almost 1 in 10 people in the world – fall ill after eating contaminated food and 420 000 die every year.
- Children under 5 yrs age carry 40% of FBD burden.

5.2.3 Causes and Classification of Food Borne Diseases

Causative agents for food borne diseases are many. Some of the common agents associated with food borne diseases are as follows:

Bacteria: Salmonella, Campylobacter, Escherichia coli, Vibrio cholera, Listeria, Staphylococcus, Clostridium perfringes and botulinum, Bacilus cereus etc.
Virus: Norovirus, Rotavirus, Hepatitis A and E virus etc.
Parasites: Entamoeba histolytica, Giardia lamblia, Cryptosporidium, Fishborne trematodes, Echinococcus spp, Taenia solium/saginata, Ascaris lumbricoides etc.
Toxins: Mycotoxins (e.g. aflatoxins), Marine biotoxins, Mushroom toxins, Shelfish toxins, Plant toxicants etc.
Chemicals: Pesticides, Polychlorinated biphenyls (PCBs), Heavy metals (lead, cadmium, mercury, copper etc.), Nitrites etc.

Classification of Food Born diseases:

In general the FBD are classified into two groups:

a) Food-borne infections: caused by microorganisms

b) Food-borne intoxications: caused by toxins and chemicals

Food poisoning as a clinical entity belongs to both food borne intoxications and food borne infections; in this unit, food poisoning will be described separately.

5.2.4 Signs and Symptoms of Food Borne Diseases

Different causes present with different symptoms, so there is no single syndrome that can be labelled as FBD; however, common symptoms include:

- Abdominal cramps, diarrhoea (which may be bloody), nausea, vomiting, fever, headache, fatigue, and body aches. All of us must have experienced these symptoms sometimes or other.
- Signs and symptoms may start within hours after eating the contaminated food, or they may begin days or possibly even weeks later. But we may not link these to unsafe food taken by us. Quite often we overlook and ignore mild FBD.
- Less commonly, neurologic symptoms may develop, such as blurry vision, dizziness or tingling in the arms.
- In some instances, the most life-threatening problems occur several days after the start of intestinal symptoms. These can include kidney failure, pain and swelling of joints and paralysis that can plague victims for the rest of their lives. We feel that these are a part of our routine lives. Many people are not aware that unsafe food may also cause diseases like jaundice, typhoid etc.

The capacity to tolerate FBD varies from person to person. Some may become ill after ingesting only a few harmful bacteria; others may remain symptom free even after ingesting thousands.

It depends upon the age, physical condition (pregnancy) and any existing disease. Chemical agents in food, such as pesticides can cause neurological symptoms, burning sensations in the chest, neck and abdomen. Some chemicals are extremely poisonous and if ingested may result in severe vomiting within a few minutes. Consumption of these chemicals over a long duration can cause cancer, birth defects damage to the nervous, reproductive and immune system. Toxic metals in food if ingested in sufficient quantities can cause metallic taste in mouth, vomiting and abdominal pain, usually within a few hours.

In modern times, increase in variety of foods along with the eating out culture has predisposed the consumers to hazards related to unsafe food. It is difficult to assure the safety of a food item which has travelled miles before reaching our table or has been handled by people in eating establishments. It may be contaminated with harmful chemicals, pesticides, antibiotic residues, pathogenic microorganisms etc. Hence, consumption of contaminated such food may cause FBD. Food safety may be compromised even through kitchen equipment, surroundings, improper waste disposal and unclean water.

Differences between Food-borne Infections and Intoxication

	Infections	Intoxication
Cause	Bacteria / Viruses /Parasites	Toxins/Chemicals
Mechanism	Invade and / or multiply within the lining of the intestines	No invasion or multiplication
Incubation period	Hours to days	Minutes to hours
Symptoms	Diarrhoea, Nausea / Vomiting, Abdominal cramps and/or Fever	Vomiting, Nausea, Diarrhoea, Double vision, Weakness Respiratory failure, Numbness, Sensory and motor dysfunction
Transmission	Can spread from person-toperson via the faeco-oral route	Not communicable
Factors for food contamination	Inadequate cooking, Cross-contamination, Poor personal hygiene, Bare hand contact	Inadequate cooking, Improper holding temperatures

You need to suspect and identify FBD and take measures for control and prevention.

5.2.5 Transmission of Food Borne Pathogens and Toxins

Food may become contaminated during production and processing, during food preparation and handling or due to improper storage. (Fig. 5.1)

Mishandling of food has been implicated in 97% of all FBD. However, it is preventable through proper implementation of food safety measures and strict enforcement of food hygiene.

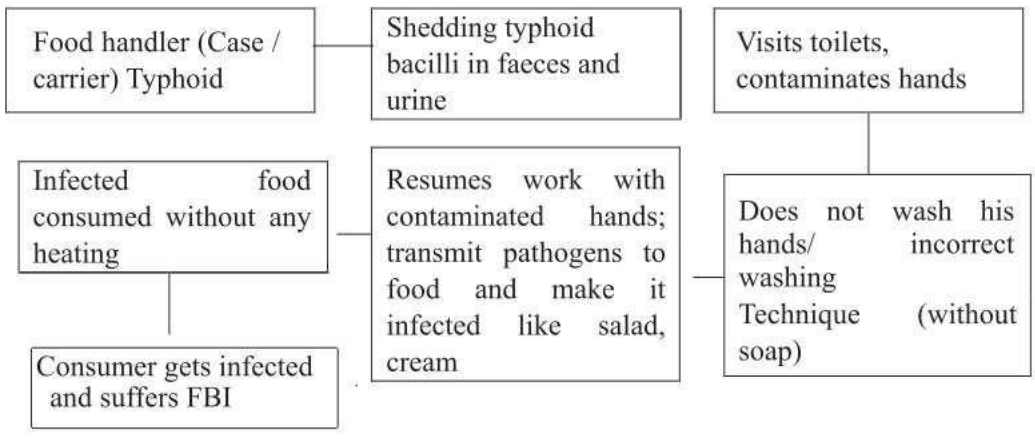


Fig. 5.1: Example of how FBD spread from Food handlers to Consumers

Food production and processing

Foods, such as fruits and vegetables, may be contaminated if washed or irrigated with water that is contaminated with pathogens from animal or human faeces. Animals naturally harbour many food-borne bacteria in their intestines that can cause illness in humans. But often these do not cause illness in the animals. During slaughter, meat and poultry carcasses can become contaminated if they are exposed to small amounts of intestinal contents.

Food preparation and handling

- Infected individuals – Most food-borne pathogens are shed in the faeces of infected persons. These are then transferred to others through food via the faecal-oral route. Bacteria present in infected lesions and our nose may also be transmitted from an infected food-handler to ready-toeat foods.
- Cross-contamination – Pathogens present in one food may be transferred to other foods during cooking if same equipment and utensils are used without washing and disinfecting, especially in case of ready-to-eat foods.
- Inadequate cooking temperature – With insufficient cooking bacteria can multiply and produce toxins within the food. Many bacterial toxins are heat stable and may not be destroyed by cooking. This is particularly true for 're-heating' of stored food (more so for Non-Veg. items)

Food storage

Food held or stored at more than 25ºC to 60ºC) temperature allows multiplication of pathogens. It is an important cause of food-borne outbreaks.

Check Your Progress 1

1) What proportion of Food Borne Diseases is constituted by children under 5 years of age?

.....

2) What are the two major types of food borne diseases?

.....

3) Enlist the causative agents for food borne diseases.

.....

4) List the common signs & symptoms of food borne diseases.

.....

5.3 FOOD POISONING AND FOOD INTOXICATIONS

Now we will discuss about Food Poisoning and Food Intoxication, which shares a large portion of the burden of food borne diseases.

5.3.1Epidemiological Features / Clinical Characteristics

Food poisoning is an acute inflammatory disease of the gastrointestinal tract. It is caused by the ingestion of food contaminated with toxin producing bacteria, their pre-formed toxins, chemical substances or other poisonous substances. Food poisoning is very common. More than 10 million cases occur in India per year. You might have heard of various food poisoning outbreaks.

Some incidents drawn the attention in recent years are discussed here.

An outbreak of Staphylococcal aureus food poisoning due to contaminated "bhalla" (a snack made up of urad dal balls fried in vegetable oil) affected more than 100 children and adults in Madhya Pradesh in 2007. An outbreak of food poisoning due to epidemic dropsy (mustard oil contaminated with argemone oil) was reported from Delhi in 1998 in which 60 persons lost their lives and more than 3000 cases were hospitalised. These are just two examples. Such out breaks keep on occurring.

Following news cuttings describe the recent 'Bihar midday meal tragedy'. It may give you an instant look over the severity of the case.

Bihar midday meal tragedy:

"On 16 July 2013, children aged between four and twelve years at primary school complained that their lunch, served as a part of the Midday Meal Scheme, tasted odd. Children who questioned the food were rebuked by the headmistress. Earlier, headmistress Mrs. Kumari had been informed by the school's cook that the new cooking oil was discoloured and smelled odd. Kumari replied that the oil was purchased at a local grocery store and safe to use. The cook, who was also hospitalised by the poisoning, later told reporters that it looked like there was "an accumulation of residual waste at the bottom [of the oil jar]". The meal cooked at the school that day consisted of soya beans, rice and potato curry. Thirty minutes after eating the meal the children complained of stomach pain and soon after were taken ill with vomiting and diarrhoea. The number of sick children overwhelmed the school and local medical system.

Some of the sick children were sent home, forcing their parents to seek help on their own. According to the official count, 23 children died as a result of the contaminated food. Parents and local villagers said atleast 27 had died. Sixteen children died on site, and four others were declared dead upon arrival at the local hospital. Others died in hospital. Among the dead were two children of a female cook, Panna Devi; her third child survived. A total of 48 students fell ill from the contaminated food. Three remained in a

critical condition as of 17 July. Thirty-one children were moved from the local hospital to the Medical College Hospital for further treatment.

Initial indications were that the food was contaminated by an organophosphate, a class of chemicals commonly found in insecticides. A local government administrator commented "It appears to be a case of poisoning but we will have to wait for forensic reports. Had it been a case of natural food poisoning, so many children would not have died." As per Hospitals authorities the survivors were emitting toxic vapours, which led his team to suspect almost immediately that they had been poisoned by an organophosphate.

Late on 17 July, officials stated that they believed the cooking oil had been placed in a container formerly used to store insecticides. According to state officials, the school's headmistress had bought the cooking oil used in the food from a grocery store owned by her husband. On 20 July police said that a forensic report confirmed the cooking oil contained "very toxic" levels of 'monocrotophos', an or anophosphate in Secticide pesticide."

This news story may have given you a glimpse how the food poisoning can be so disastrous.

You can identify the food poisoning cases based on the following epidemiological features characteristics:

- History of ingestion of common food (as in family functions, hostels/hotels etc)
- A group of persons being affected simultaneously
- Similarity of signs and symptoms in the majority of cases
- Common symptoms are vomiting, diarrhoea, pain in the abdomen, fever etc.
- Short incubation period
- Absence of secondary cases
- Laboratory tests are rarely required

5.3.2 Types of Food Poisoning

a) Bacterial food poisoning:

This is caused by taking contaminated food. It may be –

Infective: Organism enters the body through the food, produce toxin, cause pathology and result in clinical manifestations, e.g., Salmonella,Clostridium perfringes, Vibrio parahaemolyticus OR

Toxic: Due to already formed toxin in the food, e.g., Staphyloccus aureus, Clostridium botulinum, Bacillus cereus etc.

b) Non bacterial food poisoning:

Chemical poisoning: Due to pesticides, arsenic, mercury etc.

c) Certain plants and sea foods: Due to mushrooms, solanine (green potatoes)

Common bacterial food poisoning: source / common foods and clinical features:		
Cause	Source / Common Foods	Clinical Features
Salmonella food poisoning	Man gets infection from animals and poultry. Contaminated major foods - meat, milk and milk products, sausages, custards, egg and egg products. Food contaminated with urine of rats and mice is also responsible.	Sudden onset with chills, fever, nausea, vomiting and profuse watery diarrhoea, may be associated with blood.
Staphylococcal food poisoning	Cutaneous infections (boils, carbuncle etc) of human and animals (particularly cows). Foods involved - salads, custards, milk & milk products etc.	Sudden onset of vomiting, severe and violent is the main feature. Abdominal cramps and diarrhoea also occur, but rarely fever.
Botulism	Soil and dust and the intestinal tract of animals. Foods mostly responsible – home-canned vegetables, smoked or pickled fish, home-made cheese etc.	Major symptoms- dysphagia, diplopia, ptosis, dysarthria, blurring of vision, muscle weakness, quadriplegia. Gastrointestinal symptoms very slight, no fever.
Cl. perfringes food poisoning	Dust and soil is the reservoir of spores. Reheating the stale cooked foods (meat, poultry) prior to consumption is the critical factor.	Moderate diarrhoea with nagging abdominal pain and prostration. Nausea/ vomiting and fever rarely occur.
B. cereusfood poisoning	Soil and food grains mainly cereals (raw, dried and pro-	Manifests in two forms – emetic form with symptoms

	cessed). Cereal based diet – spores can survive cooking and germinate and multiply in favourable temperature.	like staphylococcal food poisoning and enteric form with symptoms like Cl. perfringes food poisoning.

5.3.3 Food Intoxications – Features, Preventive and Control Measures

Besides food poisoning, other commonly occurring intoxications are of two categories:

a) Due to naturally occurring toxins in the food grains: Lathyrism, Epidemic dropsy, Endemic ascites, Toxic polyphenol etc.

b) Due to toxins produced by the fungi in the food grains: Aflatoxicosis, Ergotism.

Characteristic features and common food grains involved in intoxications		
Food Intoxications	Toxins and Foods Involved - Characteristic Features	Preventive and Control Measures
Lathyrism	Consumption of the pulse - lathyrus sativus ('Kesari dal') which contains the toxin - Beta oxalyl amino alanine (BOAA). Neurolathyrism affecting nervous system, gradually developing paralysis of legs. Manifest in stages-latent, no-stick, one-stick, two-stick and finally crawler stage.	Health Education on dangers of consuming this pulse Removal of toxin by soaking the pulse in hot water (steeping method) and parboiling Vitamin C prophylaxis. Banning the crop and/or selective cultivation of pulse strains with low levels of toxin.
Epidemic dropsy	Contamination of mustard oil with argemone oil containing a toxic alkaloid, sanguinarine. Argemone seeds closely	Ensuring supply of pure mustard oil by strict enforcement of laws. Avoiding the use of mustard oil altogether

	resemble mustard seeds and contamination may be accidental and deliberate. The symptoms consist of sudden, non-inflammatory, bilateral swelling of legs, often associated with diarrhoea. Dyspnoea, cardiac failure and death may follow. Nitric acid test and Paper chromatography for detection of argemone oil.	when the disease is prevalent in the locality Health education about argemone seeds and oil; removing argemone weeds growing among oil-seeds crops. All packed cooking oils may have a label 'Argemone Free'.
Endemic ascites	The millet Panicum miliare Locally known as Gandhte contaminated with seeds of Crotalaria (locally known as Jhunjhunia), which contain hepatotoxins – pyrrolizidine alkaloids. Manifests with rapidly developing ascites and jaundice	Educating the people in the affected area, Deweeding of the Jhunjhunia plants which grow along with the staple Simple sieving of the millet at the household level to remove the seeds of Jhunhunia.
Aflatoxicosis	Fungi Aspergilus flavus, parasiticus infests food grains such as ground nut, maize, parboiled rice, sorgum, wheat,	Proper storage of food grains in dry containers, moisture content should be below 10 per cent.
	rice, tapioca under conditions of improper storage and produce Aflatoxins. Characterised by hepatitis,	Not to consume fungi contaminated food grains. Health education to the local

	cirrhosis of liver, and/or enteritis.	people about health hazards.
Ergotism	The ergot fungus, claviceps fusiformis infests food grains such as bajra, rye, sorgum and wheat during flowering stage. Symptoms are acute but rarely fatal; includes – nausea, repeated vomiting, giddiness, drowsiness.	Removal of ergot infested grains by floating in salt water, hand-picking or air floatation.

5.4 PUBLIC HEALTH RESPONSE TO FOOD BORNE DISEASES

As a nurse you may encounter food borne diseases / poisoning cases or outbreaks. Here your tasks would be:

- Early detection, management and referral: Identify the cases and assess for severity. Refer the severe cases urgently to health centre for proper management. Most such cases are mild, self-limiting and resolve without treatment. Assure and help patients accordingly. Ensuring hydration is the mainstay of treatment. Focus on assessment and reversal of dehydration, through ORS or IV fluids in serious cases.
- Reporting of any case /outbreak and investigation: Inform any case/ outbreak immediately to higher level as per the existing programme/project (e.g. IDSP) guidelines. Outbreaks of food poisoning need to be investigated by a team and take part in such investigations (as has been discussed elsewhere in other units). Investigations will help to identify appropriate control and preventive measures.
- Health Education: Educating people about reservoir/source of contamination and transmission, common foods involved, signs/symptoms and danger signs, personal hygiene and food hygiene. Most FBD are preventable by simple behavioural changes. Emphasising the measures for prevention and control including food safety is an appropriate response.

Check Your Progress 2

1) Which is not an epidemiological feature of food poisoning?

   a) Group of persons being affected simultaneously

   b) Similar signs and symptoms

   c) Secondary cases are common

   d) Short incubation period

2) Outbreak of epidemic dropsy may occur due to contamination of which food item and with what?

3) Khesari dal (Lathyrus sativus) is associated with which food intoxications?

   .....

4) Canned food is mostly associated with which bacterial food poisoning –

   a) Salmonella

   b) Staphylococcal

   c) Botulism

   d) Bacillus

5) Mention four common symptoms of food-borne infections.

   .....

6) What are the levels in the food chain when food can be contaminated?

   .....

5.5 FOOD SAFETY

We shall now discuss about the food safety, regulatory measures and the key points to have a safer food.

5.5.1 What is Food Safety?

Food safety describes handling, preparation, and storage of food in ways that prevent FBD. The main idea is a concept of defence to prevent harm to the consumers. Unsafe food poses health threats; endangering everyone. It creates a vicious cycle of illness and malnutrition. Worldwide the importance of food safety has long been recognised and various measures/initiatives undertaken. Today food safety is a public health priority both in developed and developing countries.

5.5.2 Food Safety Considerations and Measures

As you know, food can be contaminated at any point of production, distribution, handling/ preparation and consumption. So, responsibility also lies with concerned people involved at different levels for making food safe. Policy makers, food handlers and consumers can contribute to ensure food safety:

- Policy making/administrative level: This role is of the government. It includes developing policies and regulatory frameworks (Laws, Acts etc); establishing and implementing effective food safety systems (e.g. laboratories, monitoring and surveillance etc) to respond to and manage food safety risks along the entire food chain; fostering collaboration among health and other sectors; etc.
- Food handlers and consumers level: Both need to be aware about the common hazards linked with the food they use; handle and prepare food safely, practicing the WHO Five Keys to Safer Food at home, or when selling

  at restaurants or at local markets; grow fruits and vegetables using the WHO Five Keys to Growing Safer Fruits and Vegetables to decrease microbial contamination etc.
- A new era in food safety has been initiated by formulation of the Food Safety and Standards Act (FSSA) 2006. While eating our favourite panipuri / puri bhaji / Pao bhaji with the street vendor we tend to overlook hygiene. However, the government has included even the small vendors selling food items under the purview of this Act.
- The Act established a new national regulatory body, Food Safety and Standards Authority of India (FSSAI), to develop science based standards for food and to regulate and monitor the manufacture, processing, storage, distribution, sale and import of food so as to ensure the availability of safe and wholesome food for countrymen.
- The main intent of this endeavour was to ensure availability of safe and wholesome food for human consumption. The food manufacturers, suppliers, vendors, eateries, storage, distribution, imports and exports, food services and other related businesses would now be governed by new rules under Food Safety and Standards Regulations (FSSR) 2011. 12th five year plan (2012–2017) also emphasised strengthening of food safety systems.
- Here, it is important to understand that any law is framed with a view to improve the quality of life in society. It is always made keeping in view the future of society. The real impact of any law takes time to show. It is often said that it takes about fifty years after any legislation to bring about any worthwhile intended change in society. Hence, despite the formulation of FSSA 2006, the present status of food hygiene in eating establishments in India is dismal. However, the process has started. Sooner or later, all the Eating Establishments in India will have to comply with the prescribed standards of FSSR 2011.

- Another menace in our country jeopardising food safety is that of Food Adulteration. This is done by perpetrators at various levels, e.g., producers/ manufacturers, Food Business Operators (FBO), grocery merchants for petty monetary gains. Food is adulterated, if there is evidence of substandard quality/ substitution by cheaper substance/abstraction of any constituent of article/ preparation or storage in unsanitary conditions/presence of poisonous ingredients, use of colouring agents/preservatives above prescribed limits/ quantity or purity below the prescribed standards.
- For example, most of the country milk is adulterated with products. The culprits use fertilizers, bleaching and detergents to thicken the milk and give it a frothy appearance. Milk adulteration also involves adding water and removing fats from milk. Often adulterants like starch, wheat flour are added to milk. This lowers the nutritional content of milk and makes it even unfit for consumption. Food can also get adulterated unintentionally due to inappropriate food handling. This includes use of pesticides and fertilizers during farming or harvesting or improper storage, processing, packaging and transportation methods. The impact of food adulteration is grievous as it affects the finances as well as health of people.

Specific checks required for Food Adulteration are given in the following tables – 5.1a, 5.1b, 5.1c, 5.1d, 5.1e.

Table 5.1 (a): Specific check for procurement of rice and tins

Item	Accept	Reject	Comments
Rice			Check for infestation, grain size, colour, un-wanted poli-shing and any foreign material in the grains
			
Tins			Check for dentin/puffing/ leakage • date of Packing • date of Expiry

Table 5.1 (b) : Specific check for procurement of pulses

Item	Accept	Reject	Comments
Pulses (black bean)			Check for infestation, ration, stones, split , rotten ones
Yellow peas			
Black lentil			
Chick peas			

Table 5.1 (c): Specific check for procurement of spices

Item	Accept	Reject	Comments
Spices Fenu-greek			Check for Light, brown and dark defects, foreign materials such as stones or plastics and animal matter such as mouse and bird droppings.
Cumin			

Table 5.1 (d): Specific check for procurement of bread and cheese

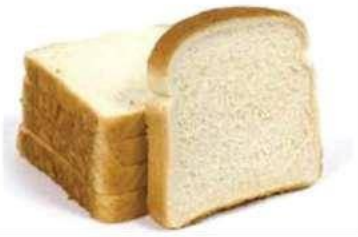
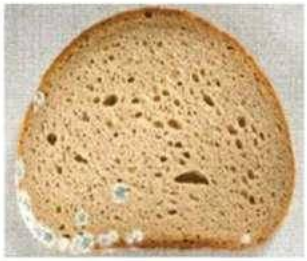
Item	Accept	Reject	Comments
Bread			Check for moulds
Cheese			Check for moulds/ rancid smell If packed checked for the packing

Table 5.1 (e): Specific check for procurement of non vegetarian food items

Item	Accept	Reject	Comments
Eggs			Look for cracked shells. Put in water. If an egg floats, then its quality is under suspicion
Fish			Spoilt fish has grey/ dull gills/ dull or Sunken eyes/ bad Smell/ flabbiness. When outer surface is pressed, finger depression remains in flesh.
Chicken			Spoilt chicken has discoloration of skin, bad smell/ slimy appearance/ flabby texture
Frozen food items			Look for absence of water droplets on products/ textural changes

- Food safety is essentially an issue of prevention. For ensuring food safety, basic hygiene and cleanliness in manufacturing units or kitchens can immensely contribute towards food safety. Good infrastructure with adequate lighting, ventilation, hand washing and toilet facilities for food handlers, adequate and clean storage facilities, clean and maintained equipment and utensils etc. are the most important factors that facilitate food safety. If kitchen has good food storage facilities, clean water supply, if food handlers are healthy, if for public eating establishments good standard are maintained food safety can be, more or less, taken for granted.
- Under FSSA 2006, it is mandatory to get a license for any food business.
- However, new law alone cannot ensure food safety. The need of the hour is also to have an integrated approach to change the mind set of people.

5.5.3 Food Safety Regulatory Measures in India

Government of India is also committed to ensuring food safety. There has been relevant policies/programmes and projects incorporating the issues of food safety. Several acts and regulations were also in place since long. Currently the entire issue of food safety is being re-emphasised and strengthened. There are some aspects needs to be considered while monitoring the food safety measures as shown in Fig 5.2 and 5.3.b and 5.4.

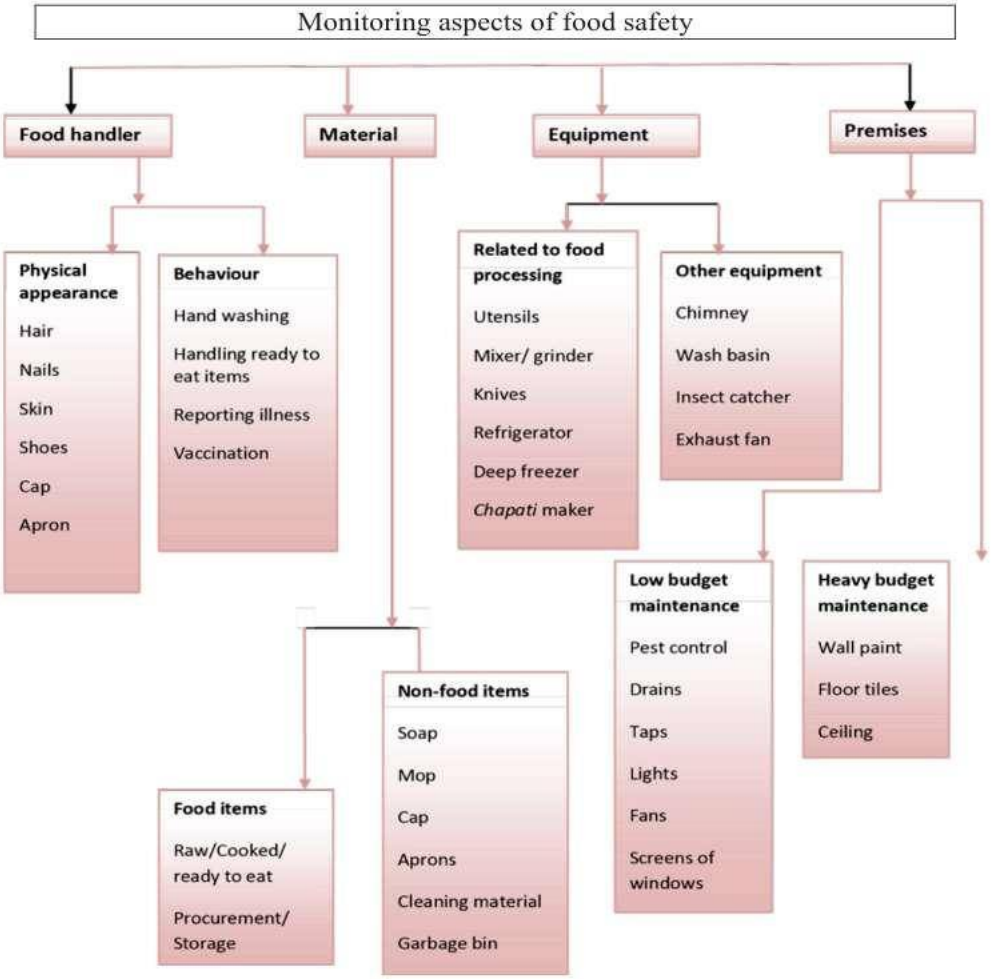


Fig. 5.2: Monitoring aspects of food safety (What to monitor)

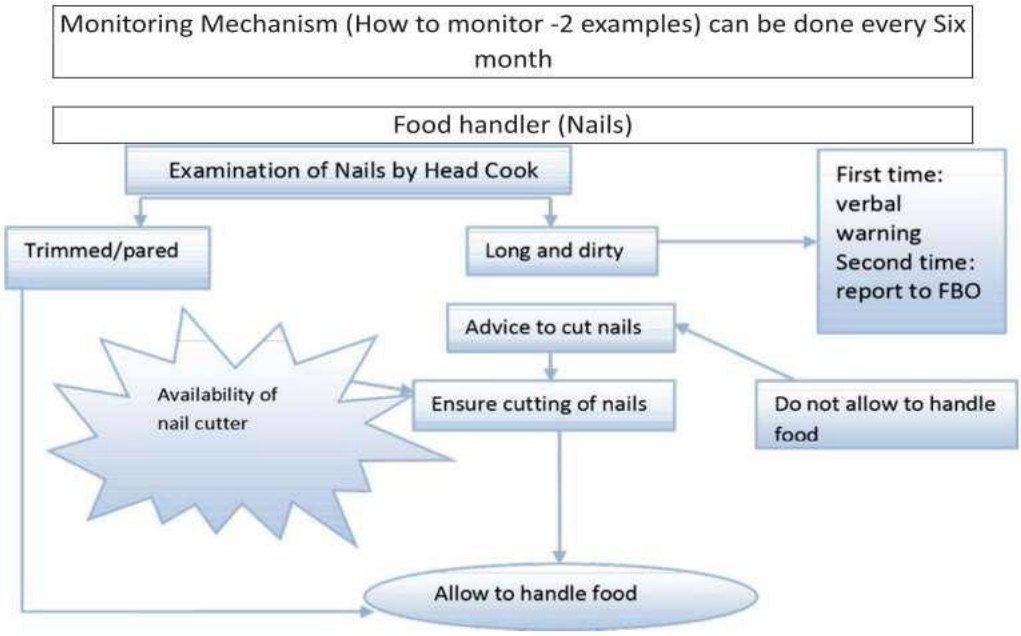


Fig. 5.3(b): Monitoring Mechanism

At present, Food Safety and Standards Authority of India (FSSAI), of Ministry of Health and Family Welfare, established under the Food Safety and Standards Act, 2006, is the regulating body related to food safety. FSSAI is responsible for setting standards for food. e.g.

- Framing of regulations to lay down food safety standards
- Laying down guidelines for accreditation of laboratories for food testing
- Providing scientific advice and technical support to the Central Government Collecting data about food consumption, contamination, emerging risks etc Disseminating information and promoting awareness about food safety.

Consumers can connect to FSSAI through various channels. Recently an online platform called 'Food Safety Voice' has been launched which helps consumers to register their complaints and feedbacks about food safety issues related to adulterated food, unsafe food, substandard food, labelling defects in food and misleading claims and advertisements related to various food products.

5.5.4 Five Keys to Safer Food

i) Keep Clean

- Wash your hands before handling food and often during food preparation
- Wash your hands after going to the toilet
- Wash and sanitise all surfaces and equipment used for food preparation
- Protect kitchen areas and food from insects, pests and other animals

Hand washing is important:
Dangerous microorganisms are widely found in soil, water, animals and people and these microorganisms are carried on hands, wiping cloths and utensils. Hands frequently transport microorganisms from one place to another, hand washing is thus very important. Hands should be washed before handling food and often during food preparation; before eating; after going to the toilet; after handling raw meat and poultry; after changing baby's nappy, after blowing nose; after handling rubbish and also chemicals; after playing with pet animals; after smoking etc. Hand washing method: Wet hands under running water; rub hands together for 20 seconds with soap; rinse hands under running water; dry hands thoroughly with dry clean towel. While washing hands pay attention to finger tips / nails, thumbs, wrists, and in between fingers. Fig. 5.4

ii) Separate raw and cooked food

- Separate raw meat, poultry and seafood from other foods
- Use separate utensils, knives and cutting boards for handling raw foods
- Store food in containers to avoid contact between raw and prepared foods

iii) Cook thoroughly

- Cook food thoroughly, especially meat, poultry, eggs and seafood
- Bring foods like soups / stews to boiling to make sure 70°C temperature
- Reheat cooked food thoroughly iv) Keep food at safe temperatures



Fig. 5.4: Method of hand washing

- Do not leave cooked food at room temperature for more than 2 hours
- Refrigerate promptly all cooked and perishable food (preferably below 5°C)
- Keep cooked food piping hot (more than 60°C) prior to serving
- Do not store food too long even in the refrigerator Do not thaw frozen food at room temperature

What are safe temperatures for food?
Microorganisms cannot multiply if it is too hot or too cold. Cooling or freezing does not kill microorganisms, rather limits growth. The "danger zone" is temperature range of 5°C to 60°C in which microorganisms multiply very fast. Storing food below or above the "danger zone" can effectively limit the production of toxins.

v) Use safe water and raw materials

- Use safe water or treat it to make it safe
- Select fresh and wholesome foods
- Choose foods processed for safety, such as pasteurized milk
- Wash fruits and vegetables, especially if eaten raw
- Do not use food beyond its expiry date

5.6 FOOD STORAGE, FOOD HANDLING AND COOKING

Food born diseases are mainly caused due to unhygienic practices while cooking, handling and storing the food items. Let's now discuss about the general principles of safe storage of food items, role of the food handlers in keeping the food safe and wholesome and the essentials steps to be followed in safe cooking practices.

5.6.1 General Principles of Safe Storage of Food Items

- Chemicals and cleaning supplies like detergents, soap bars, repellents are stored away from food.
- Non-vegetarian and vegetarian products are kept physically separated or stored in different containers / racks / compartments.
- Raw materials are kept separately with proper labelling from semi processed and processed (cooked) foods.
- All foods are stored off the floor and away from the walls (atleast 6 inches). Management of stored items

The principles of FIFO (first in first out) and FEFO (first expiry first out) should be applied in management of stored food items. For items without a label containing date of expiry of best before date, the rule of FIFO is followed. This ensures that the food that has been in store the longest is used first. As food is used, new food is added to the store to replace it; the essential of good storage is to use the oldest food as soon as possible so that nothing is in store too long lest it becomes unsafe to eat. Every storage area should have such a stock rotation policy. For example, when two kgs onions are lying in the storage area, if another five kgs are received then, put the recently received ones behind the onions already in store. Ensure to use the previous ones first. For products having a label containing date of expiry or best before date follow the principle of FEFO. Items with closest expiry date should be used first even if they are delivered later. Remove and return /destroy from store all products whose shelf life has expired.

5.6.2 Role of Food Handlers in Food Borne Diseases

Most of us equate cooks as food handlers. However, the term food handler includes all those involved in various stages / activities related to preparation, processing, cleaning and chopping raw food material / vegetables, processing (peeling, de skinning, cutting, soaking, marinating), kneading of flour, chapati making, boiling/ frying/sauté, washing of dirty utensils cooking and serving of food, e.g. waiter staff/ service staff, chefs, head cooks, dishwashers, receiving and store room staff, bartenders, host/hostesses who handle food, street vendors who sell food items, house maids. Food handlers can cause as well as prevent food borne diseases. (Fig. 5.5)

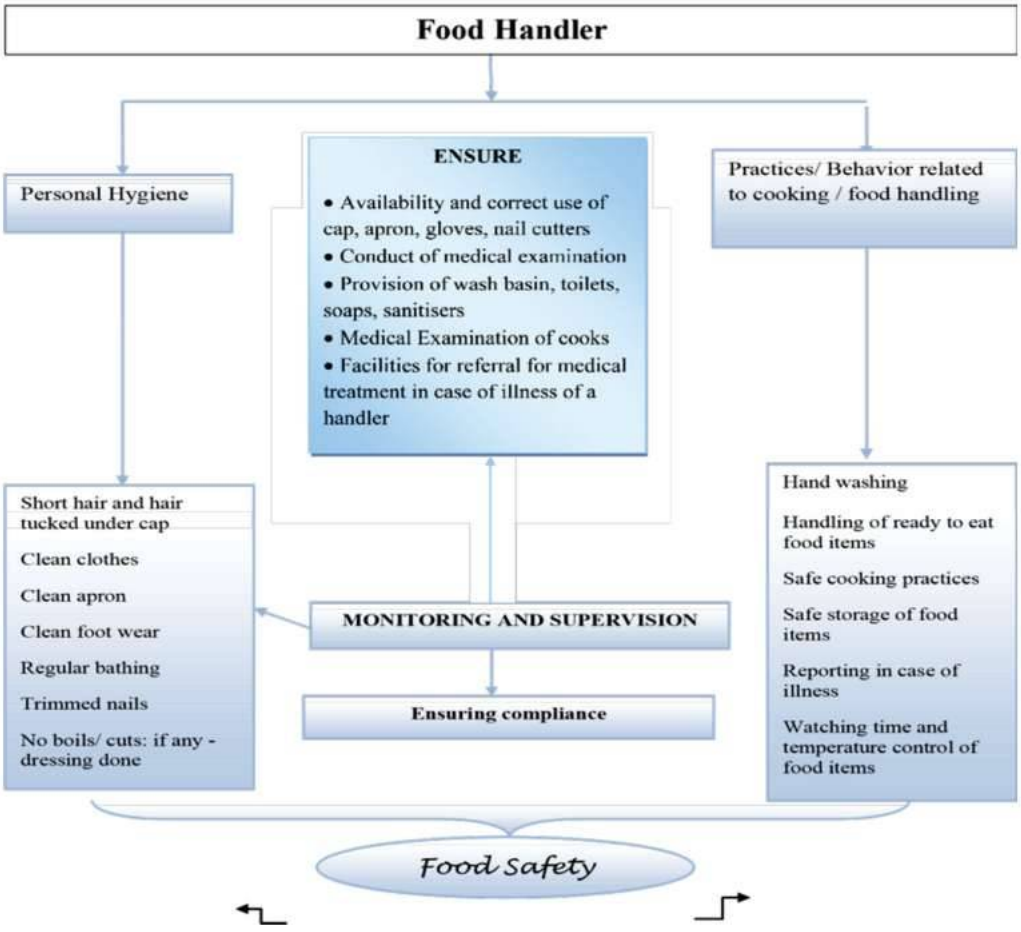


Fig. 5.5: Conceptual framework in food safety: Role of food handlers

It is the prime duty of a food handler to follow hygienic practices and keep the food safe. They are a crucial link in the food safety. Their responsibility is of maintaining food safety during various processes they are involved in while preparing the food. This requires that they maintain good health. If the food handler is not aware about the safety aspects of food, he/she can do more harm than good. Food handlers who suffer from some infectious disease can spread it to people. For example, if they have diarrhoea, their faeces carry pathogens. If they do not wash hands properly after defecating, the germs can reach the victim's gut through the food materials handled with their dirty hands. So, the consumers may eventually develop diarrhoea.

Similarly, if food handlers have eye /ear/skin infection, cough or running nose the related germs will infect the consumers. This spreads through their hands through eye/ ear/ skin discharges, urine, sputum etc. A cook with diseases like jaundice or typhoid may continue to spread these for a long time.

Food handler and good hygienic practices

Food handlers should be aware of their role in food safety. Following basic food hygiene practices need to be observed by every food handler.

- Not to sit on kitchen shelf.
- Not to leave personal items on the kitchen shelf/ cooking area.
- Not to work in kitchen with open sores.
- Not to blow into a bag to open it to put in food.
- Not to blow on food for any reason.
- Not to spit, smoke or use tobacco in kitchen.
- Not to eat in kitchen
- Not to touch food with bare hands.
- Not to use fingers for tasting food
- Not to reuse a spoon without washing after tasting food
- Not to touch hair or other body parts, viz., noses, eyes or ears while cooking.

They should wash and dry their hands whenever they touch any contaminated area. When sneezing or coughing in kitchen is unavoidable, they should turn away from food and cover their noses and mouths with tissue paper or handkerchiefs. Hands should then be thoroughly cleaned at once. Food handlers must tell seniors if they have breached any food safety aspect, e.g., if something has fallen into food or a glass item has broken near exposed food.

Food handlers' health

A food handler suffering from any infectious disease is a potential danger to food safety. He may transmit germs from his body to food (through clothing, hands, coughing, sneezing, boils/cuts or discharge from eye /nose). A food handler should not handle food if he is suffering from – diarrhoea, vomiting, fever, cough, skin lesions (including boils/cuts), eye discharge or nose discharge. Such a person must report his illness to his senior. An infected sore can be covered by bandage, preferably a waterproof one. In case of cold a disposable tissue or a handkerchief must be used to handle the secretions.

Observing good hygiene during food preparation (washing, chopping, slicing, and thawing cooking and cooling) is important for ensuring food safety. Any hygiene lapse in kitchen may cause FBD, e.g., cross contamination to cooked food from raw food while chopping it in kitchen. Before starting cooking raw food material need to be inspected. We should discard it if it is looks suspect, e.g. a cracked egg may be already contaminated by salmonella bacteria. Potential sources of food contamination include – unclean cooking shelves, chopping boards, knifes, utensils / equipment, sinks, clothing, hands or waste bins.
Cockroaches and rats can also contaminate the food. (Fig. 5.6)

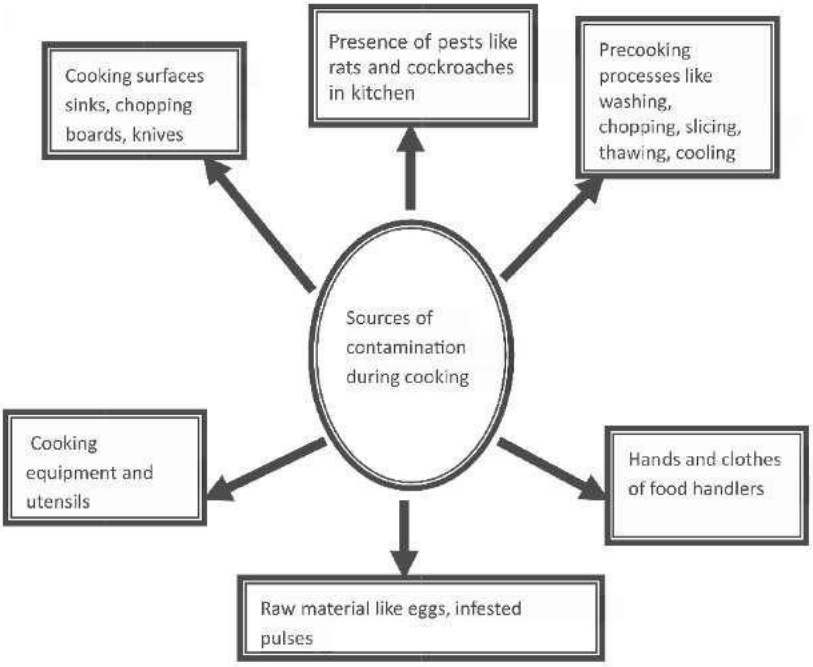


Fig. 5.6: Sources of contamination while cooking

5.6.3 Essentials Steps in Safe Cooking Practices

I) Clean

The first step in hygienic cooking is that all food handlers should wash hands thoroughly with soap and water before entering the kitchen. Fruits and vegetables can have contaminants like pesticides, chemicals, and bacteria on them. So, these need to be properly cleaned / washed. Basins for this purpose should not be used for washing hands. Water used for cleaning should be potable. Unclean water can contaminate raw items. (Fig 5.7)

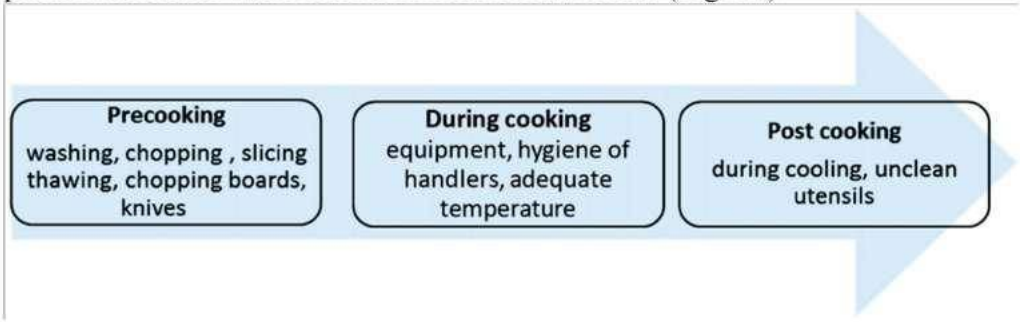


Fig. 5.7: Stages of contamination of food

Chopping/cutting boards, dishes, utensils and countertops should be made of food grade material. These can be cleaned with hot soapy water followed by use of bleach. The knives should preferably be of different colours making identification easier for vegetarian and non-vegetarian food items. Use separate and different colored cutting boards and knives for meat, fish, poultry and cooked products. We need to wash, rinse and sanitise cutting boards, knives and other utensils between uses.

II) Cleaning of utensils

To ensure food safety it is important that everything in the kitchen is clean. This applies to utensils, cutlery and crockery also. If utensils are not cleaned properly, chance of food borne infections increase. First thing here is that in the beginning it should be ensured that these shall be made of food grade material. When we buy utensils etc. care must be taken about their design. Too much of grooves / raised parts / curved portions in the design will invite dirt /grime/ grease accumulation. If the utensil is cracked/ broken/ chipped/ dented same problem may arise.

In India, utensils are mostly washed manually. A sink of adequate size and running water supply in the kitchen is the first requirement for this. Hot water supply is an additional need especially in winters.

1) Steps involved in washing utensils will vary as per the availability of a double / single sink in the kitchen. As a first step before the actual washing process actually begins, any leftover food need to be scraped off from the utensils in garbage bin. It should not be thrown in the sink. Another basic rule is not to allow used utensils to dry. After scraping utensils may be put in the sink and some tap water may be run over these. This will avoid drying off of the leftover food on the utensils , e.g., pressure cookers and kadhais/Pens, may be filled with hot water and let these be so for 10–15 min. (Fig. 5.8)



Fig. 5.8: Scrapping of leftover food from the plate

2) Fill the sink up to about half full with hot water. Else a large bowl can be filled with water instead of the sink itself. This will make it a little easier, in case water needs to be changed.

3) Now soap may be added in the sink water and stirred with hands to foam it.

4) First glassware may be washed. Immerse the utensils in the water and scrub any grease etc off by using a kitchen brush or sponge. Steel wool can be abrasive. Replace the water and add more soap as per the need. (Fig. 5.9)



Fig. 5.9: Scrubbing of dirty utesil with a brush

5) After scrubbing the dishes, rinse these under the tap water, or in the second sink filled with lukewarm water. Replace the water as per the need. (Fig. 5.10)



Fig. 5.10: Rinsing of utensil

6) After this there is a need to check for any remaining dirt / food. Repeat steps 4–5 as per the need. Try soaking it longer or use a stronger cleaning solution, if still not clean.

7) In the end, dry the utensils in a drying rack. Don't use a dirty cloth or hand towel to wipe them. Putting bowls and glasses in the rack upside down to drain off water is a good practice. Access to sunlight for drying is an added advantage. (Fig. 5.11)



Fig. 5.11: Drying utensils in the rack

8) Store the utensils away in the cupboard after drying to protect from dust. After rinsing utensils may be sanitised by using Chlorine (bleach) or Iodine.

Check Your Progress 3

1) What is unsafe food?

.....

2) What are the WHO Five Keys to Safer Food?

.....

3) Food safety standards are laid down by which agency in India?

.....

4) What is the 'danger zone' of temperature for refrigeration of food?

.....

5) For effective hand washing, how long hands should be rubbed with soap and water.

.....

5.7 LET US SUM UP

Food borne diseases are a worldwide public health problem including India and a significant cause of morbidity and mortality. More than 200 food borne diseases occur annually – ranging from diarrhoea to cancer.

Food borne diseases resulting from contaminated food include food-borne infections and food-borne intoxications including food poisoning. These diseases are typically caused by microorganisms (bacteria, virus, and parasites) and/or chemicals/toxic substances. Contamination of food may occur during food production and processing or during preparation, handling and consumption. Personal and food hygienic measures including environmental sanitary conditions are the major contributory factors.

Most diseases occur sporadically, outbreaks of food poisoning are also reported frequently. Most often manifests with gastro-intestinal symptoms, which vary in severity and duration. Majority cases/outbreaks can be diagnosed by easily identifiable clinico-epidemiological characteristics. Immediate public health responses include – early detection and assessment for severity; management, referral and notification. All outbreaks should also be investigated.

Food safety is the present-day priority concern. Besides implementation and monitoring of legislative and regulatory mechanisms at various levels, food safety education is a critical pre-requisite. Food handlers at all levels and the

community should be made aware about practising five keys to safer food – Keep clean; Separate raw and cooked food; Cook thoroughly; Keep food at safe temperatures; and Use safe water and raw materials. Primary and mid-level health workers at the field can really make a difference in this regard.

5.8 MODEL ANSWERS

Check Your Progress 1

1) 40%
2) Food-borne infections and food-borne intoxications
3) Bacteria, Virus, Parasites, Toxins and Chemicals,
4) Abdominal cramps, diarrhoea (which may be bloody), nausea, vomiting, fever, headache, fatigue, and body aches.

Check Your Progress 2

1) C) - Secondary cases are common
2) Mustard oil contamination with argemone oil
3) Lathyrism
4) C) – Botulism
5) Diarrhoea, Nausea / Vomiting, Abdominal cramps, Fever
6) Food production and processing, food preparation and handling, improper storage of food.

Check Your Progress 3

1) 'Article of food whose nature, substance or quality is so affected as to render it injurious to health'
2) 1. Keep clean; 2. Separate raw and cooked food; 3. Cook thoroughly; 4. Keep food at safe temperatures; 5. Use safe water and raw materials.
3) Food Safety and Standards Authority of India (FSSAI)
4) Temperature range of 5°C to 60°C
5) At least 20 seconds

5.9 REFERENCES

1) Park K. Park's Text Book of Preventive and Social Medicine. 23rd Edition. Jabalpur: Benarasi Das Bhanot; 2015.
2) Government of India, Director General of Health Services. CD Alert: Monthly News Letter of National Centre for Disease Control 2009; 13 (4).

3) WHO. Five keys to safer food manual. Available from: www.who.int/foodsafety/publications/consumer/manual_keys.pdf.

4) Food Safety Standards Authority of India. Key aspects to ensure food safety. Available from: http://www.fssai.gov.in/TRAINING MANUAL.aspx

5) Dudeja P , Kaur S and Singh AJ. Food handlers - A crucial link in food safety.New Delhi,New Era International Imprint, 2013.

6) Dudeja P Singh AJ and Kaur S (Editors). Food Safety Implementation-From Farm to Fork. New Delhi, CBS Publishers & Distributors Pvt Ltd, 2016.

7) R K Gupta, P Dudeja & A S Minhas(Editors). Food Safety in 21st Century: Public Health Perspective. Elsevier Publications,New York, Academic Press; 2017.

NOTE

Certificate in Community Health for Nurses (BPCCHN)
Theory Course

CHO - 0001 Foundations of Community Health

Block-1 Introduction to Public Health and Epidemiology

Unit 1 : Concepts of Community Health
Unit 2 : Health Care Planning and Organization of Health Care at Various Levels
Unit 3 : Environmental Health and Sanitation
Unit 4 : Introduction to Epidemiology, Epidemiological Approaches and Processes
Unit 5 : Demography, Surveillance and Interpretation of Data
Unit 6 : Bio-Medical Waste Management and Infection Control

Block – 2 Nutrition

Unit 1 : Introduction to Nutrition and Nutritional Assessment
Unit 2 : Nutrition During Pregnancy and Lactation
Unit 3 : Nutrition for Infant, Child, Adolescent and Elderly
Unit 4 : Nutritional Deficiency Disorders
Unit 5 : Food Borne Diseases Food Safety

Block – 3 Communicable Diseases and Management under National Health Programmes

Unit 1 : Epidemiology of Specific Communicable Diseases
Unit 2 : Communicable Diseases -1 Vector Borne Diseases
Unit 3 : Communicable Diseases -2 Infectious Diseases
Unit 4 : Communicable Diseases -3 Zoonotic Diseases

Block – 4 Non-Communicable Diseases and Management under National Health Programmes

Unit1 : Epidemiology of Specific Non-communicable Diseases
Unit 2 : Non-Communicable Diseases – 1
Unit 3 : Non-Communicable Diseases – 2
Unit 4 : Occupational Diseases
Unit 5 : Mental Health and Substance Abuse Disorders
Unit 6 : Elderly Care

Block – 5 Communication Management and Supervision

Unit 1 : Social and Behaviour Change Communication skills and other Soft Skills
Unit 2 : Work Management and Administration
Unit 3 : Leadership, Supervision and Monitoring
Unit 4 : Health Management Information System
Unit 5 : Financial Management, Accounts and Computing at Sub-Centre
Unit 6 : Records and Reports