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NUTRITION AND DIETETICS

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E-Book



Assessment



Nutrition and Dietetics

Theory



RECOMMENDED DIETARY ALLOWANCES AND MEAL PLANNING

Unit 1

OBJECTIVES

At the end of this lesson, the student will be able to

- Know the various factors which influence our RDA and the difference between requirement and RDA
- Define the term balanced diet and understand the importance of consuming a balanced diet
- Discuss the use of food groups and RDA in planning balanced diets
- Understand the principles and aims of meal planning
- Identify the factors that need to be considered while planning meals
- Learn the steps involved in meal planning
- Understand the concept of food exchanges in meal planning
- Learn different ways of reducing the cost of a meal without affecting its quality



Nutrients are needed by humans in specific amounts to ensure good health and well being. These nutrient needs are met by eating the right kinds and amounts of food. While planning

balanced diets, we need certain guidelines regarding the kinds and amounts of nutrients that we require for maintenance of good health.

Each day our body needs a supply of a number of nutrients to carry out its activities efficiently. Based on research the amounts and kinds of nutrients needed for good health have been determined.

1.1 RECOMMENDED DIETARY ALLOWANCES

Recommended Dietary Allowances (RDA) are estimates of intakes of nutrients which individuals in a population group need to consume to ensure that the physiological needs of all subjects in that population are met.



The recommended dietary allowance (RDA) is the guideline stating the amount of nutrients to be actually consumed in order to meet the requirements of the body.

Evolution of Recommended Dietary Allowances (Indian Council of Medical Research- ICMR For Indian Population)

- ❖ Following the recommendations of the League of Nations in 1937, an attempt to recommend dietary allowances for energy, protein, iron, calcium, vitamin A, thiamine, ascorbic acid and vitamin D for Indians was made in 1944 by the Nutrition Advisory Committee of the Indian Research Fund Association, now called Indian Council of Medical Research (ICMR).
- ❖ Between 1950 and 1968, in the wake of recommendations for energy and protein requirements by the Food and Agricultural Organization (FAO) and based on the international data provided by the FAO/ WHO expert groups and those available in India, the recommendations for dietary requirements were revised.
- ❖ A few years later, a newer set of data were generated by various researches and surveys conducted by renowned institutions like Avinashilingam Institute for Home Science and Higher Education for Women – Deemed University, Coimbatore, National Institute of Nutrition, Hyderabad.
- ❖ ICMR and National Nutrition Monitoring Bureau (NNMB), created a necessity to revise RDAs further. In 1988 an expert committee constituted by ICMR modified the reference body weight for Indian adults and RDAs in respect of energy fat, vitamin D and vitamin A. Recommendations on the safe intake of fat in terms of both visible and invisible

dietary fats were made. For the first time, recommendations for certain trace elements, electrolytes (sodium and potassium), magnesium and phosphorus, vitamin K and vitamin E and dietary fibre were considered.

A number of approaches such as

- Dietary intake of nutrients
 - Growth
 - Nutrient balance
 - Minimal loss of nutrients and
 - Nutrient turnover
- were utilized in arriving at the RDAs.

Difference between Requirement and Recommended Dietary Allowances

The requirement for a particular nutrient is the minimum level that needs to be consumed to perform specific functions in the body and to prevent deficiency symptoms. It should also maintain satisfactory stores of the nutrients in the body.

Requirements are the quantities of nutrients that healthy individuals must obtain from food to meet their physiological needs. The recommended dietary allowances (RDA) are estimates of nutrients to be consumed daily to ensure the requirements of all individuals in a given population. The recommended level depends upon the bioavailability of nutrients from a given diet. The term bioavailability indicates what is absorbed and utilized by the body. In addition, RDA includes a margin of safety, to cover variation between individuals, dietary traditions and practices

Recommended Dietary Allowances = Requirement + Margin of safety

The margin of safety is added to take care of factors such as

1. Losses during cooking and processing
2. Short periods of deficient intake



3. Nature of the diet
4. Individual variations in requirements

The requirement for vitamin C or ascorbic acid is actually 20 mg/day, but since the vitamin is easily destroyed during pre-preparation, cooking and storage, the recommended intake is twice the requirement and is 40 mg/day

1.1.1 Factors influencing RDA

The RDAs apply to healthy individuals and are set high enough to cover individual variation. Recommended dietary allowances of an individual depend on many factors like

1. **Age** - Adults require more total calories than a child, whereas a growing child requires more calories per kg of body weight than an adult.
2. **Sex** - Males with high Basal Metabolic Rate (BMR) require more calories than females.
3. **Physical activity** - The type of activity also determines the energy requirements. Based on the nature of work and level of activity different occupations are classified into three categories:
 - Sedentary
 - Moderate
 - Heavy

Sedentary (light work): A sedentary person is one who does most of the work sitting at one place using only his hands and head. A few examples of individuals undertaking sedentary work include teachers, tailors, typists, clerks, office executives, housewives who have household help.

Moderate (neither too light nor too strenuous hard work): A person is said to be a moderately active individual if his/her work involves the use of both hands and feet continuously but not very strenuously. A few examples of people

who would belong to this group would include postmen, housemaids, servants, fishermen, agricultural labourers, housewives who do most of the housework themselves manually.

Heavy (hard, strenuous work): A person is a heavy worker if he/she is involved in hard/strenuous work using hands and feet very fast and continuously for a long period each day. Rickshaw pullers, stone cutters, mine workers, coolies belong to this group.

4. Physiological state : Nutrient requirements are increased in conditions of physiological stress such as pregnancy and lactation.

5. Disease and drugs : Drugs prescribed for treatment can alter the requirement of one or more nutrients.

1.1.2 Recommended dietary intakes for adults



Age : 18 - 29 years

Weight : 60 kg

Age : 18 - 29 years

Weight : 55 kg

Fig.1.1 Reference man and Woman

Recommended dietary intakes for adults are based on age, sex, body size and activity level. In the case of adults, there are substantial variations in RDA particularly for energy and protein depending on the age, body weight, and activity pattern. That is why RDAs have worked out on the basis of a “Reference individual”. The **Reference man** is an **Indian man** in the age



Table no 1.1. RECOMMENDED DIETARY ALLOWANCES FOR INDIAN 2010

Group	Particulars	Body wt kg	Net Energy Kcal	Protein g/d	Fat g/d	Calcium mg/d	Iron mg/d	Vitamin A Retinol µg/d	Thiamin mg/d	Riboflavin mg/d	Niacin mg/d	Pyridoxine mg/d	Ascorbic acid mg/d	Folic acid mg/d	Vit B12 mg/d
Man	Sedentary work	60	2320	60	25	600	17	600	4800	1.2	1.4	16	2.0	40	200
	Moderate work		2730		30					1.4	1.6	18			1
	Heavy work		3490		40					1.7	2.1	21			
Women	Sedentary work	55	1900	55	20	600	21	600	4800	1.0	1.1	12	2.0	40	200
	Moderate work		2230		25					1.1	1.3	14			1
	Heavy work		2850		30					1.4	1.7	16			
Pregnant Woman		+350	+23	30	1200	35	800	6400	+0.2	+0.3	+2	2.5	60	500	1.2
		+600	+19	30	1200	21	950	7600	+0.3	+0.4	+4	2.5	80	300	1.5
Lactation	0-6 months	55	+600	+19	30					+0.2	+0.3	+3	2.5		
	6-12 months		+520	+13	30										
Infants	0-6 months	5.4	92/kg	1.16 g/kg	-	500	46 µg/kg	350	2800	0.2	0.3	710 µg/kg	0.1	25	0.2
	6-12 months	8.4	80/kg	1.69 g/kg	19		5			0.3	0.4	650 µg/kg	0.4		
Children	1-3 years	12.9	1060	16.7	27	600	9	400	3200	0.5	0.6	8	0.9	40	80
	4-6 years	18.0	1350	20.1	25		13	400	3200	0.7	0.8	11			100
	7-9 years	25.1	1690	29.5	30		16	600	4800	0.8	1.0	13	1.6		120
Boys	10-12 years	34.3	2190	39.9	35	800	21	600	4800	1.1	1.3	15	1.6	40	140
Girls	10-12 years	35	2010	40.4	35		27			1.0	1.2	13	1.6		
Boys	13-15 years	47.6	2750	54.3	45	800	32	600	4800	1.4	1.6	16	2.0	40	150
Girls	13-15 years	46.6	2330	51.9	40		27			1.2	1.4	14			
Boys	16-17 years	55.4	3020	61.5	50	800	28	600	4800	1.5	1.8	17	2.0	40	200
Girls	16-17 years	52.1	2440	55.5	35		26			1.0	1.2	14			

Source: Dietary Guidelines for Indians - A Manual by Kamala Krishnaswamy, B. Sesikeran (Second Edition 2011), NIN, ICMR



group of 18-29 years doing **moderate work** and weighing **60 kg**. Similarly, an **Indian woman** 18-29 years old doing **moderate work** and weighing **55kg** is referred to as the Reference woman.

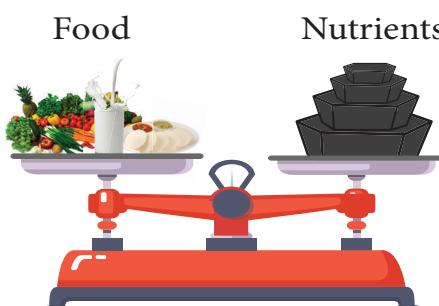
The RDA is based on scientific knowledge and prepared by the National Nutritional Advisory Committee (ICMR). The Committee revises the RDA every 10 years. The current RDA for Indians was set up in 2010. The recommended dietary allowances for Indians (2010) is given in table 1.1

1.2 BALANCED DIET

A “**Balanced Diet**” can be defined as one which contains different types of foods in such quantities and proportions that the need for calories, minerals, vitamins, and other nutrients is adequately met and a small provision is made for extra nutrients to, withstand short durations of leanness.

A balanced diet should provide around 50-60% of total calories from carbohydrates, 10-15% from proteins and 20-30% from both visible and invisible fat.

In addition, a balanced diet should provide bioactive phytochemicals such as dietary fibre, antioxidants and other nutraceuticals which have positive health benefits.



Different food in the right amount and proportion provide all essential nutrients and thus make a balanced diet

Fig. 1.2 Balanced diet

Balanced Diet enhances the quality of life as it:

- ❖ meets nutritional requirement
- ❖ prevents degenerative diseases
- ❖ improves longevity
- ❖ prolongs productive life
- ❖ improves immunity
- ❖ increases endurance level
- ❖ develops cognitive ability
- ❖ helps in coping up with stress

Points to be considered in planning a balanced diet

- ❖ Calorie allowances can be \pm 50, while for all other nutrients minimum RDA must be met.
- ❖ Energy from cereals should not be more than 75 percent.
- ❖ Include two cereals in one meal e.g. rice and wheat.
- ❖ To improve protein quality the ratio of cereal protein to pulse protein should be 4:1.
- ❖ Two to three serving of pulses should be taken a day.
- ❖ Include at least one medium size fruit. The fruit can be given raw without much cooking.
- ❖ Five servings of fruits and vegetables should be included in a day
- ❖ The diet should include minimum 100ml milk per day.
- ❖ Foods rich in fibre should be included.
- ❖ One-third of the nutritional requirements, at least calorie and protein should be met by lunch and dinner.



Fig no 1.3 Food Guide for planning a balanced diet

In order to plan balanced meals for people, the foods we use in our daily meals are classified into four basic food groups: on the basis of the major nutrients present. The food groups are chosen because of the specific nutrients contributed by each to the total diet. This practical tool devised to guide food selection to meet nutritional needs is termed '**Food Guide**'.

A food guide is a practical tool in meal planning and evaluation

It's a guide that helps us to make healthy food choices

It tells us all the food groups our bodies need and how many servings of each group we need

How to plan a meal with the help of the Food Guide?

- ❖ Include foods from each of the four broad food groups
- ❖ Choose the minimum number of servings from each group
- ❖ Make choices within each group
- ❖ Include one food from the protein group in each meal
- ❖ Use seasonal foods

1.3 MEAL PLANNING

Any individual who carries the responsibility of providing meals has to take decisions regarding what to serve, how much to serve, how much to spend, where to shop, how much to buy, how to prepare food, how to serve meals and at what hour to serve the meal. All such decisions are a part of planning meals. Extending this concept further, one could define meal planning as a simple practical exercise which involves applying the knowledge of food, nutrient requirement, and individual preferences to plan adequate and acceptable meals. In other terms, **meal planning means planning for adequate nutrition**.



Meal planning means planning diets which will provide all nutrients in required amounts and proportions i.e. adequate nutrition.

As the family's well-being and health are depended on how well they are fed. It is a challenge to every meal-planner to meet it and when well done, it proves to be a satisfying and rewarding experience.

Meal planning thus is both an art and a science: **art** in the skillful blending of colors, texture, and flavor; and **science** in the wise choice of food for optimum nutrition and digestion.

1.3.1 Objectives of Meal planning

1. To satisfy the nutritional needs of the family members.



2. To keep expenditure within the family food budget.
3. To take into account the food preference of individual members.
4. Using methods of cooking to retain maximum nutrients.
5. To economize on time, fuel and energy.
6. To serve attractive and appetizing meals.

Providing a meal that would be enjoyed and accepted by one and all in the family is rather difficult. Individual preferences, varied nutrient needs, varied food habits, are a few factors that would influence meal planning. The crucial aspect to be considered then is how best to plan adequate and satisfying meals, within the socio-cultural, economic, regional and psychological framework of the individual.

The various factors influencing meal planning are illustrated in figure 1.4

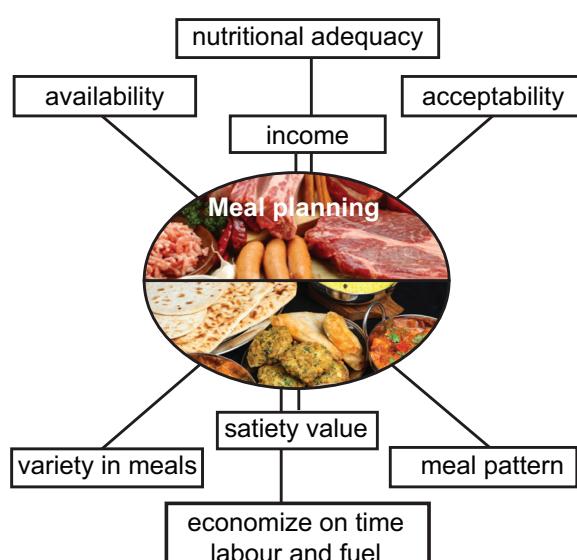


Fig. 1.4 Factors affecting Meal Planning

1.3.2 Factors affecting Meal Planning

1. Nutritional adequacy:

The nutritional requirement of the individual to be served is an important consideration in meal planning. This point is

particularly important when we are planning meals for a family. In a family, there might be different individuals - a child, an adolescent, an adult, a pregnant woman or an elderly person. Each of these individuals has his/her own specific nutrient requirements. **The basic aim while planning meals should be to fulfill the nutrient needs of each individual**

How do we ensure this? This can be ensured by planning balanced meals according to the recommended dietary intakes for different individuals. No single food can meet all the nutritional requirements. Therefore, to achieve a balance of nutrients a combination of different foods need to be included in the diet. The diet can be planned by including foods from the four food groups. Although all nutrients are important, the requirement for certain nutrients is proportionately higher in certain age groups. e.g.- Iron in an adolescent girl and a pregnant woman. Therefore identifying rich sources of various nutrients within the same food group is required. e.g.- whole cereals and rice flakes are rich in iron among cereals, milk and fish have high calcium content among animal foods.

2. Food cost and economy

The expenditure on food is an important part of a family's budget and it is influenced by

- ❖ Family size
- ❖ The number of children
- ❖ Age group
- ❖ Activity and
- ❖ Special needs of pregnancy, lactation and disease condition.

The proportionate expenditure on food depends upon the income levels i.e. it increases with a decrease in total income. Moreover, in case of low-income level, a higher proportion is spent on buying staples rather than protective foods like milk, vegetables, and fruits. Therefore the aim should be to achieve



maximum nutritional benefit at minimum cost. For example, pulses can be used as a source of protein instead of animal foods or less expensive cuts of meat can be used. For achieving economy in meal planning, the following considerations are important.

1. Knowledge of prevailing prices of food items.
2. Knowledge of proportion of edible portion of different food stuffs as they vary widely. It may be high as 100 percent in foods like milk or low as 35-40 percent in leafy vegetables. This helps to decide the quantity of food to be purchased.



Meal planning helps to ensure nutritious meals according to personal likes / dislikes

3. Buying foods from fair price shops and retail outlets.
4. Bulk purchase of non-perishables.
5. Using seasonal foods as they are not only economical but also nutritious.
6. Minimizing nutrient losses during preparation and cooking.
7. Making proper use of left over foods and the commonly discarded foods e.g. green leaves of vegetables like radish leaves.

3. Acceptability of meals

Acceptability of meals is as important as meeting nutritional needs or planning within the budget. To make meals acceptable the following considerations are important.

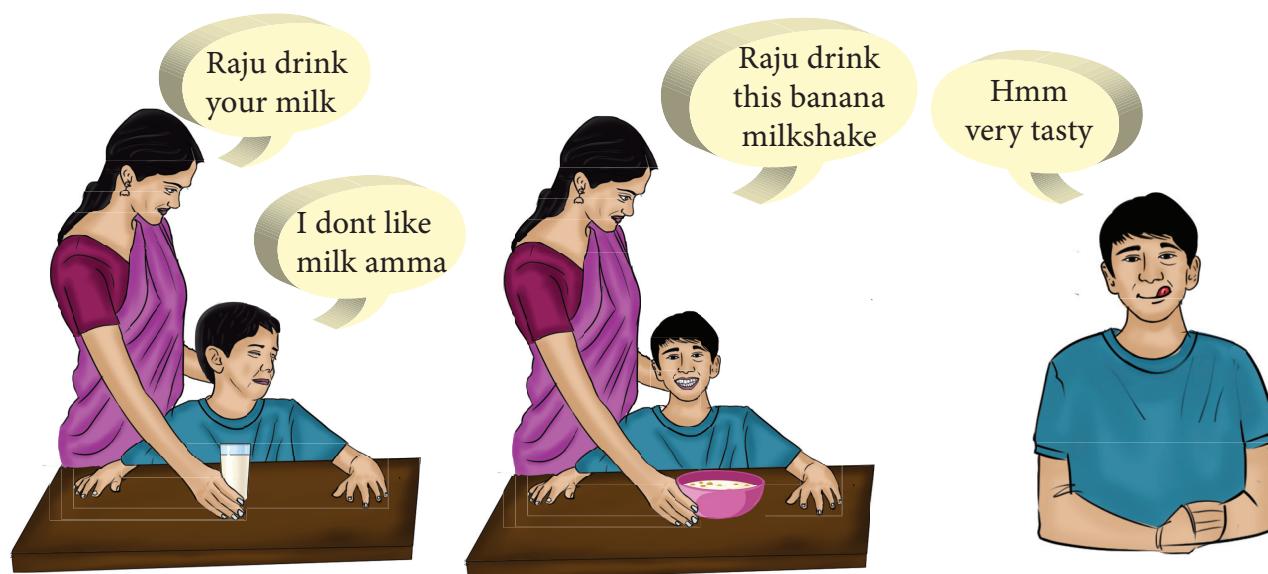
a. Likes and dislikes

The meal planned should not only meet RDA but also individual preference, particularly vegetarian or non-vegetarian preferences. The likes and dislikes of all the family members should be kept in mind. If a person does not like greens, it can be tried in a different form or substituted by some other equally nourishing food. Food habits, religion, traditions, and customs of the individual should be considered in planning the menu.

b. Variety

The meal should have variety in colour, texture, taste and flavor for better acceptability. Variety can be achieved by

- selecting foods from each food group
- including a variety of vegetables to add colour
- avoid repeating the same food in different meals as well in the same meal in a different form.
- use different methods of cooking such as baking, boiling, frying to bring variety in texture.
- use alternative garnishes and accompaniments.



The form in which food is served influences food acceptance

c. Food habits and religious beliefs

Religious and socio-cultural beliefs influence the choice of food. Certain foods are prohibited by certain religions. Also, the socio-cultural factors either promote or prohibit the intake of particular foods in different families and communities.

d. Food availability and seasonal variation

As far as possible, seasonal and locally available foods should be used. Vegetables and fruits in season are not only cheap but have the highest nutrient content and best flavour.

e. Food Fads

Wrong notions and beliefs regarding consumption of food are prevalent in different communities many of which are baseless and may deprive an important nutrient source. For example, fad-like milk and fish should not be included in the same meal. These food fads need to be discouraged.

f. Portion sizes

While planning and preparing a meal, it must be ensured that the quantity prepared be easily consumed by the person of the given age, sex and

activity. At the same time, the quantity must meet nutritional needs. These quantities are referred to as “one serving portion” or “portion sizes”.

1.4 Steps in meal planning

The following steps may be adopted in planning meals.

1. Recommended Dietary Allowances

To plan a balanced diet the first step is to know the recommended dietary allowances for different age groups.

2. Food list

The next step is to prepare a food list i.e., a list of quantities of various food groups to be included in the diet so that it is balanced and can meet the RDA. This can be done by

- Selecting foods from all the five food groups.
- Deciding the quantities of the selected foods as multiples of portion sizes.

The number of portion of various food groups to be included in planning a balanced diet for adults is given in Table- 1.2



Table 1.2 Portion size for menu plan

Food groups	Portion (g)	Energy (Kcal)	Protein (g)	Carbohydrate (g)	Fat (g)
Cereals and Millets	30	100	3.0	20	0.8
Pulses	30	100	6.0	15	0.7
Egg	50	85	7.0	-	7.0
Meat, chicken or fish	50	100	9	-	7.0
Milk (ml) and milk products	100	70	3.0	5	3.0
Roots and Tubers	100	80	1.3	19	-
Green leafy vegetables	100	46	3.6	-	0.4
Other vegetables	100	28	1.7	-	0.2
Fruits	100	40	-	10	-
Sugar	5	20	-	5	-
Fats and oils	5	45	-	-	5

Source: Dietary Guidelines for Indians - A Manual by Kamala Krishnaswamy, B. Sesikeran (Second Edition 2011), NIN, ICMR

To calculate the day's requirement of above-mentioned food groups for an individual, multiply gram per portion with the number of portions

For example, the quantity of cereals and pulses to be included for an adult man doing sedentary work is 375g (30×12.5) and 75g (30×2.5) respectively.

Table 1.3 Balanced diet for adults- sedentary/moderate/heavy activity (number of portions)

Food groups	Portion (g)	Type of work					
		Sedentary		Moderate		Heavy	
		Man	Woman	Man	Woman	Man	Woman
Cereals and millets	30	12.5	9	15	11	20	16
Pulses	30	2.5	2	3	2.5	4	3
Milk	100 ml	3	3	3	3	3	3
Roots and tubers	100	2	2	2	2	2	2
Green leafy vegetables	100	1	1	1	1	1	1
Other vegetables	100	2	2	2	2	2	2
Fruits	100	1	1	1	1	1	1
Sugar	5	4	4	6	6	11	9
Fats and oils	5	5	4	6	5	8	6

For vegetarians substitute one pulse portion with one portion of egg/meat/chicken/ fish

Source: Dietary Guidelines for Indians - A Manual by Kamala Krishnaswamy, B. Sesikeran (Second Edition 2011), NIN, ICMR



Table 1.4 Balanced diet for infants, children, and adolescents (number of portions)

Food groups	g/portion	Infants 6-12 months	1-3	4-6	7-9	Years					
						10-12		13-15		16-18	
						Girls	Boys	Girls	Boys	Girls	Boys
Cereals & millers	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
Others 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

*Quantity indicates top milk. For breastfed infants, 200 ml top milk is required.

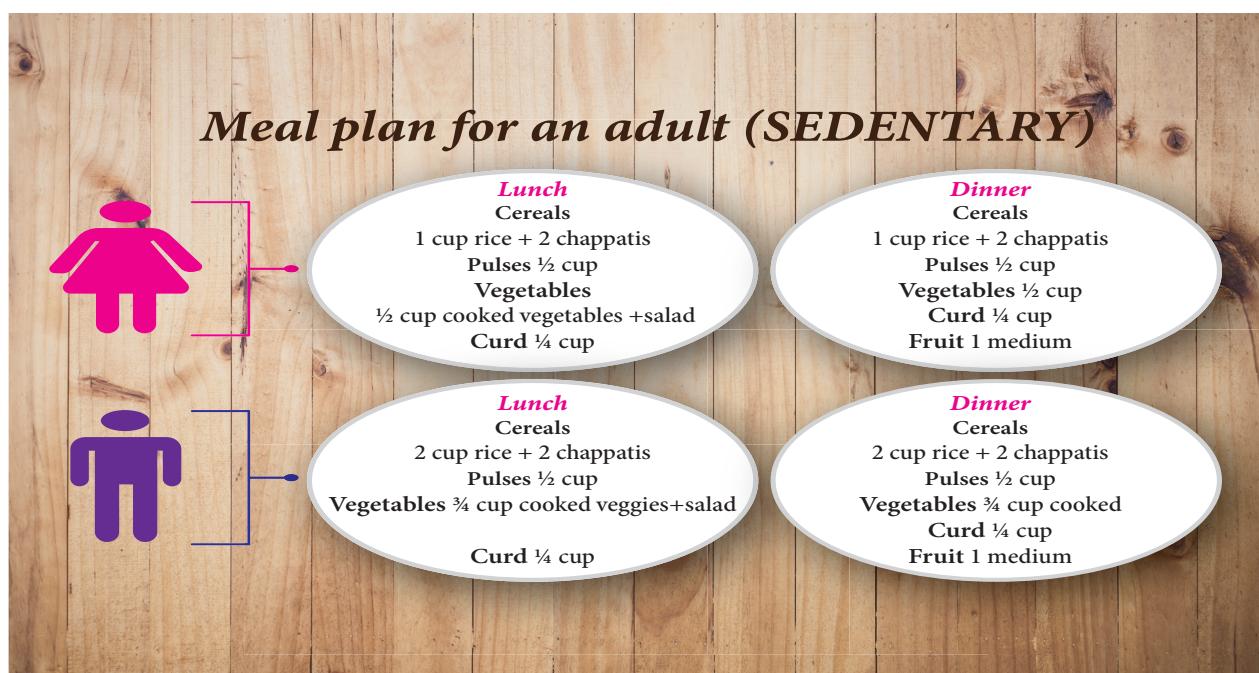
One portion of the pulse may be exchanged with one portion (50g) of egg/meat/chicken/fish

Source: Dietary Guidelines for Indians - A Manual by Kamala Krishnaswamy, B. Sesikaran (Second Edition 2011), NIN, ICMR

3. Making the menu

The foods that are listed in step II are converted into the actual recipes and distributed in

different meals like breakfast, lunch, evening tea and dinner.





1 day menu for an adult (sedentary work)

- Energy – 2875 kcal
- Protein – 60 gm (60kg wt.)

Meal	Food	Quantity
Early Morning	Milk or tea with sugar	1 cup
Breakfast	Bread with egg or paratha with curd, coffee	1 egg, 2 bread, 2 paratha, 1
Mid-day	Fruit chat or fruit juice or Tea with biscuits	1 cup, 4-6
Lunch	Vegetables, Chapati, Rice, Curd, Salad	1 cup, 2, 1 plate, 1 cup mixed
Evening Tea	Tea with snacks	1 cup
Night Dinner	Dal/ rajama, Vegetables, Chapati	1 cup 1 cup , 3
Bed time	Kheer/fruit	1 cup/fruit

1.5 Food Exchange

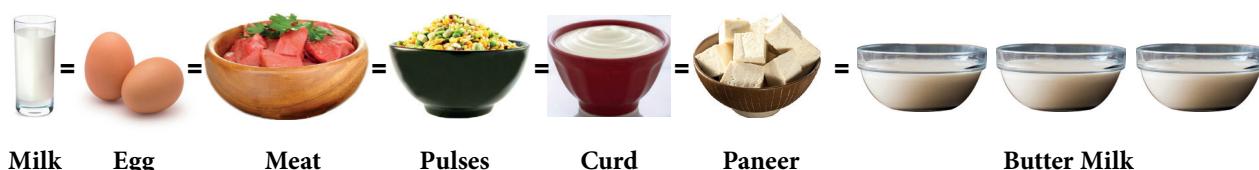
Each food group has similar food items that have been placed together in one food group. Therefore, if we substitute one food for the other in the same group, we will be able to get almost the same nutrients. For example, 'X' takes one glass of milk and roti in breakfast, 'Y' eats poha (rice flakes) and one Katori of curd whereas 'Z' eats one fresh cheese (paneer) sandwich. Looking at their food selection, all of them take milk or its product along with cereals and get approximately the same nutrients. So we can say that substitution of one food item with the other within a group in such a way that the nutrients provided by them are approximately the same is called '**Food Exchange**'.

Substitution of one food item with the other in such a way that the nutrients provided by them are the same is called "Food exchange".

If you are modifying the same meal for different family members, then how will you decide on how much of one item is equivalent to another one? If you are not sure about how to go about exchanging one food item with another in the correct proportion, then you may not be able to fulfill everyone's requirements correctly. For example, if you are exchanging milk with egg then you should know how much of milk is equivalent to one egg or if one does not want to eat an egg, in that case, how much of pulses should be given instead?

Food exchanges help you to modify the diet for an individual according to needs, likes, dislikes and food habits and help you to make the diet more flexible and interesting. The following illustration gives you a fair idea about the exchanges that can be done among various foods so that the nutrients derived by these foods remain the same.

Protein Rich Foods



1 glass of milk = 1 egg = 1 medium size katori meat = 1 big katori pulses
= 1 big katori curd = 1/4 cup of paneer = 3 cups of butter milk



Cereals



1 Chapati = 1 bread slice = 1 potato = 1/2 cup rice = 1/2 cup dhal = 4 salted biscuits = 1/2 cup noodles
= 1 idly = 1 plain dosa = 1/2 cup Upma/poha

Fat



1 tsp of butter = 1 tsp of oil = 2tsp mayonnaise = 4-5 pieces of nuts
= 10-12 pieces of peanuts = 5 tsp cream.



Activity : 1

Your brother does not like milk but your sister is very fond of it. How will you solve this problem?



Activity : 2

Select nutritious snacks from the following food items. (i) Aval Uppuma (ii) FrenchFries (iii) Kozhukkatai (iv) Vegetable cutlets (v) Pizza (vi) Puffs (vii) Peanut balls

1.6 Low-Cost Balanced Diets

The income of the family or more specifically, the amount of money available for food per person influence the kind and amount of food to be included in each meal. To understand this better consider the three income groups - low, middle and high.

People with limited income or those belonging to the lower income group may not be able to include much of milk, meat, and fruits in their daily diet as these are expensive foods. So the crucial decision is what food items to select that would enable them to plan nutritious meals at low cost. Well, there are many ways in which one

can ensure nutritious meals without increasing the cost. To begin with, one could use:

- ❖ more of the cheaper foods like cereals. It would further lower cost if high price cereals such as rice or wheat are partially replaced by millets i.e. ragi, jowar, bajra and partially by roots and tubers i.e. potato, colocasia, tapioca
- ❖ jaggery instead of sugar
- ❖ seasonal and locally available fruits and vegetables only
- ❖ food combinations (cereal and pulse) and processes like germination, fermentation improve the nutritive value (as they add extra nutrients without extra cost)
- ❖ cheaper variety of pulses and cheap nuts such as groundnuts
- ❖ vegetable oils to increase energy and essential fatty acid intake
- ❖ inexpensive yellow fruits like papaya or mango and greens to increase vitamin A and C intake
- ❖ green leafy vegetables to improve the intake of vitamin A, iron and calcium
- ❖ at least 150 ml of milk to improve the intake of riboflavin, calcium besides improving the protein quality of the diet.



People belonging to the “middle income group” can surely have more variety by including more of cereals (rice\wheat), pulses, milk, fruits, and vegetables. They can have reasonable amounts of fats\oils and sugar in their diets. However, use of nuts\oilseeds and other miscellaneous foods like jam, jellies etc would be limited. As income rises one gets the freedom to choose from a wide variety of foods –or out of season, locally available or purchased from outside. Consumption of milk and milk products, meat, vegetables, fruits, fats, and oils tends to increase. But care needs to be taken that foods like fats, oils, sugars, are not taken in amounts more than needed by the body.

1.6.1 Dietary Guidelines to reduce the cost of a meal

1. The inclusion of millets like ragi, jowar, and bajra can reduce the cost of a meal.
2. Combination of cereals and pulses improve the quality of cereal as well as pulse protein.
3. Pulses like horse gram can be included to reduce the cost of a meal.
4. Fermenting, malting and sprouting can be done at home which enhances the nutritive value without increasing the processing cost.
5. Greens, particularly from trees like drumstick or agathi, are cheaper. Locally available or kitchen garden produce can be used.
6. Leaves of cauliflower, carrots, knolkhol and beet root which are highly nutritious can become part of a meal. Curry leaves can be used in consumable form like chutneys, chutney powder or in ground form in curry leaves pulao.
7. Inexpensive and nutritious fruits like papaya and guava can be included in the diet.
8. Inclusion of dry fish (like nethili) may supply a good amount of nutrients without increasing the cost.

9. Jaggery can be used instead of sugar.
10. Toned milk with low fat is less expensive but gives all other nutrients except fat.
11. Steamed foods are less expensive than fried foods. Low-cost diets have less amount of fats, oils, and sugars.
12. Natural foods are less expensive compared to processed and preserved foods.
13. Foods that are distributed through the public distribution system (Ration shops) can be used.
14. Recipes made at home are cheaper than bought. Homemade food can be carried to the workplace instead of buying from the canteen.
15. The inclusion of locally available ingredients and seasonal foods reduce the cost of a meal



Activity : 3

Mr. A. is an accountant in a government office in Chennai. His office timings are 9.00 a.m. to 5.30 p.m. His meal pattern is as follows. He has bed-tea early morning. Before leaving for his office he eats a heavy breakfast. He carries a packed lunch to office (which he eats around 1.30 p.m.). Before lunch, around mid-morning, he usually takes tea along with his friends. Around 4- 4.30 p.m. he has another cup of tea supplemented with a snack. He returns home around 7.30 p.m. and has dinner right away. Then late at night, before going to bed he drinks a glass of milk.

Now answer the following questions

- a) What is the meal frequency adopted by Mr. A?
.....
- b) List the various meals Mr. A has had in a day.
.....
- c) Can you suggest a menu for dinner for Mr. A?



POINTS TO REMEMBER

MEAL PLANNING

1. Plan meals according to the age, sex, income, activity pattern, work schedule of the individual.
2. Do plan meals in advance
3. Ensure that meals planned help to meet the recommended dietary intakes for each member of the family.
4. Include at least one food item from each of the three food groups in each meal.
5. Include seasonal and locally available foods in the meals.
6. Economize on the resource- time, labour and fuel.
7. Include in the meals those foods/dishes which are liked by family members.
8. Prepare the dishes in the way people know or are familiar with
9. Introduce variety by including foods of different colour, texture and flavor in each meal.
10. Avoid repetition of foods and method of preparing foods
11. Ensure that meals prepared relieve hunger and give a feeling of satisfaction and fullness.



Activity : 4

Look into the given menus and tell which is better one ? Why?

Menu-I	Menu-II
	
Chapathi	Chapathi
Rice	Rice
Potato masala	Rajmah
Dhal	Lady's finger masala
Curd	Carrot raita
Salad	Salad (cabbage, cucumber, beetroot)
	Papad

Make a list of different food items included in the meals consumed in your family yesterday. Categorize these food items into the four food groups. Analyze and discuss whether your family ate balanced meals or not.

Meal	Food items	Food groups	Remarks
Early Morning			
Breakfast			
Mid morning			
Lunch			
Evening			
Dinner			
Post Dinner			



Activity : 5

Give the capacity of the following

1. One tea cup – gms
2. One teaspoon – gms
3. One tablespoon – gms
4. $\frac{1}{4}$ cup – tsp
5. 2 table spoon – tsp

SUMMARY

- ❖ Each day our body needs a supply of a number of nutrients to carry out its activities efficiently. Nutrients are needed by humans in specific amounts to ensure good health and well being.
- ❖ Recommended Dietary Allowances (RDA) are estimates of intakes of nutrients which individuals in a population group need to consume to ensure that the physiological needs of all subjects in that population are met
- ❖ Recommended dietary allowances of an individual depend on many factors like Age, Sex, Physical activity, and Physiological state
- ❖ In order to meet the recommended dietary allowances, it is important to eat a balanced diet
- ❖ A “Balanced Diet” can be defined as one which contains different types of foods in such quantities and proportions that

the need for calories, minerals, vitamins, and other nutrients is adequately met and a small provision is made for extra nutrients to withstand short durations of leanness.

- ❖ A balanced diet should provide around 60-70% of total calories from carbohydrates, 10-12% from protein and 20-25% of total calories from fat.
- ❖ Meal planning helps in planning a balanced diet. Meal planning is a simple practical exercise which involves applying the knowledge of food, nutrient requirement, and individual preferences to plan adequate and acceptable meals.
- ❖ Meal planning helps to meet the nutritional requirements of the family, fulfills family needs, saves time and energy, provides variety, gives satiety and considers the individual likes and dislikes
- ❖ Food exchanges help us to modify the diet of an individual according to their needs, likes, dislikes and food habits and help us to make the diet more flexible and interesting
- ❖ The income of the family or more specifically, the amount of money available for food per person influence the kind and amount of food to be included in each meal. There are many ways in which one can ensure nutritious meals without increasing the cost.

A-Z

GLOSSARY

Terms

Activity level:

Pregnancy:

Lactation:

Meanings

Level of activity of a person-sedentary (light), moderate or heavy. Activity level is chiefly related to the occupation of an individual.

The state of carrying a developing embryo or fetus within the female body. Pregnancy lasts for about nine months

Period when the mother breastfeeds her infant.



Meal Pattern:	Number of meals consumed in a day and the timing and nature of different meals.
Mid-afternoon meal:	Referring to a meal consumed between lunch and tea usually consisting of items like fruits, soups, beverages, snacks.
Mid-morning meal:	Referring to a meal consumed between breakfast and lunch usually consisting of a beverage and a snack. Soups and fruit-based items are also served.
Physiological stress:	Stress on the body due to normal physiological events unlike the stress caused by disease. Periods of physiological stress are generally rapid growth phases (e.g. infancy, adolescence, pregnancy, and lactation).
Food fads:	A fad diet is a diet that promises weight loss or other health advantages, such as longer life, and usually relies on pseudoscience rather than science to make many of its claims.



Evaluation

I. Fill in the Blanks

1. A balanced diet should provide _____ percent of calories from carbohydrate.
a) 50-60 b) 20-30 c) 40-50
2. _____ Servings of fruits and vegetables should be included in a day.
a) Seven b) two c) five
3. _____ can be used instead of sugar to reduce the cost of a meal.
a) sweeteners b) jaggery c) molasses
4. Inclusion of millets like _____ and _____ also helps to reduce the cost of a meal.
a) Ragi and bajra b) wheat and rice
c) brown rice and red rice
5. Meal planning is both a _____ and an Art.
a) Science b) Philosophy c) Chemistry
6. During periods of physiological stress nutrient needs are_____.
a) Increased b) decreased c) no change
7. Nutritive value of pulses can be improved by _____.
a) Roasting b) boiling
c) sprouting
8. Use _____ vegetables and fruits, which are rich in nutrients and are available at a reasonable cost.
a) imported b) seasonal c) organic
9. One-third of the day's calorie and protein requirements should be met by _____.
a) tea b) breakfast c) lunch
10. 100 ml of milk provides _____ k.cal of energy.
a) 70 b) 30 c) 40
11. 30g of pulses provide an average of _____ g protein.
a) 6 b) 15 c) 20





II. Answer the following (2 marks)

1. Define a Balanced diet.
2. Define RDA.
3. Define Reference man.
4. Define Reference Woman.
5. Define Food exchange list.
6. What is Meal Planning?
7. List sedentary activities.

III. Answer the following (3 marks)

1. Explain the objectives of planning a meal.
2. List the importance of a balanced diet.
3. List the importance of planning a menu.
4. Discuss the factors determining RDA.
5. How can you ensure nutritional adequacy in meals?
6. How can you achieve variety in meals?
7. List the ways by which you can maximize nutrients in a meal plan.
8. Why is it important to consider the likes and dislikes of individual family members during meal planning?
9. Classify occupations based on activity.

10. What are the qualities of a well-planned meal?

11. Differentiate between seasonal foods and out of season foods.

12. List at least two points you will keep in mind in order to prepare an attractive and appealing meal.

13. List the different types of work. Which kind of work requires maximum energy?

14. What are the requirements of a Balanced Diet?

IV. Answer the following (5 marks)

1. What are the factors to be considered in planning a menu?
2. What are food exchange lists? How are they used in planning diets?
3. Discuss in detail the steps involved in planning a menu.
4. Describe the different ways by which you can reduce the cost of a meal?
5. What are the points to be considered in planning a diet?
6. What are recommended dietary allowances? How were they arrived at?



ICT CORNER

RECOMMENDED DIETARY ALLOWANCE AND MEAL PLANNING

Eager to know the proper meal?

Let's check that here..

Steps:

Step 1: Use the URL or scan the QR Code to launch the “**Daily energy requirements calculator**” activity page.

Step 2: Click on “**Calculate your energy needs**” on the left of the window, feed in the details to know the energy need.

Step 3: Click on the “**Calculate your daily nutrient requirements**” and “**Average recommended number of serves**” to know them respectively.

Step 4: You shall know the “**Balance Diet**” by playing the game suggested.

Step 1

Step 2

Step 3

Step 4

DOWNLOADING

To go inside the app directly you can either use **QR code** or the given link

<https://www.eatforhealth.gov.au/node/add/calculator-energy>

*Pictures are indicative only





NUTRITION IN PREGNANCY, LACTATION AND INFANCY

Unit 2

OBJECTIVES

This chapter briefly discuss about:-

- Physiological changes during pregnancy
- Nutritional requirements of pregnant and lactating women, consequences of malnutrition during pregnancy and lactation.
- Nutritional needs of infants, advantages of breast milk, artificial feeding, weaning and problems of weaning.



Pregnancy and lactation are the most stressful periods in the life of a woman. Adequate nutrition before and during pregnancy has greater potential for a long term health impact than it does at any other time. Studies in human and animals indicate that nutrition during pregnancy influences not only the normal development of the foetus and immediate help of the new-born infants, but there are now also compelling data that nutrition during pregnancy influences the subsequent morbidity and mortality of the off-spring when they are grown adults. Current recommendation for the nutrition during

pregnancy stress the importance of a proper pattern of weight gain and an adequate intake of calories, proteins, vitamins and minerals to allow for optimal foetal development and the preservation of maternal health.

2.1 Nutrition in pregnancy

A woman who has been well nourished before conception begins her pregnancy with reserves of several nutrients so that the needs of the growing foetus can be met without affecting her health.

2.1 a. Physiological changes during pregnancy

- Total plasma volume in a non-pregnant women averages 2600 ml. By 34 weeks it is about 50% greater than it was at conception.
- Increased blood volume produces a high glomerular filtration rate. It appears that the renal tubules are unable to adjust completely and a percentage of nutrients that would have been reabsorbed in the non-pregnant women are excreted in the urine.

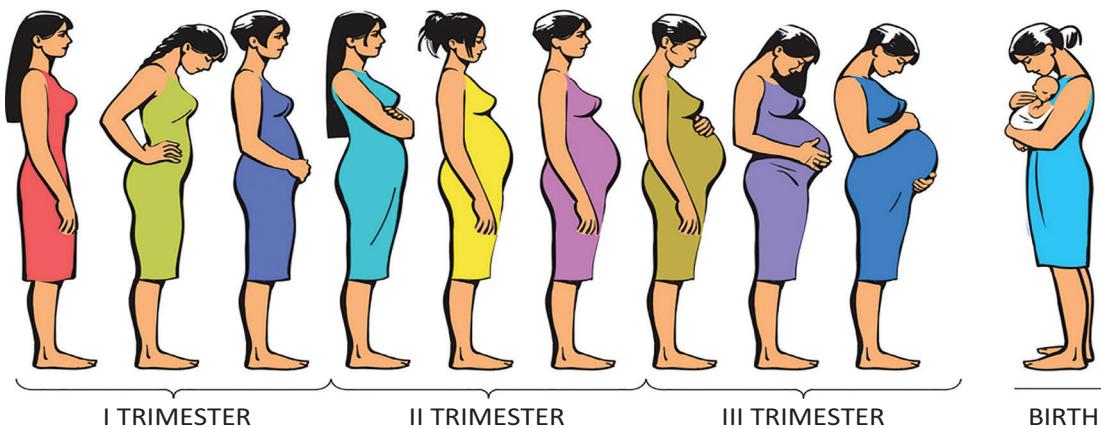


Fig 2.1 Stages of pregnancy

- There is a decreased ability to taste saltiness. This may in fact, be a physiologic mechanism for increasing salt intake.
- The ability to excrete water is lowered and oedema in the legs and ankle is common and normal.
- Gastrointestinal motility diminishes, to allow for increased absorption of nutrients. This often results in constipation.
- A relaxed lower oesophageal sphincter can cause regurgitation and heart burns.
- Increased progesterone level relaxes the uterine muscle to allow expansion with foetal growth.
- High oestrogen levels during pregnancy promote a gynaecoid type of fat distribution.

2.1 b. Role of Placenta

The placenta is the principal site of production for several hormones responsible for regulation of foetal growth and development of maternal support tissues. It is also involved for exchange of nutrients, oxygen and waste products.

2.1.1 Weight gain during pregnancy

A healthy women gains an average weight about 11-13 kg during pregnancy. About 900 to 1800g is an average gain during the first trimester. Thereafter 450 gram/ week during the remaining of the pregnancy is usual.

The overweight women (20 % or more above the ideal weight for height and age) entering pregnancy have increased risk of complications like hypertension, diabetics, etc. Even in this group it is not advisable to restrict weight gain by limiting calories from food intake. Hence obese women should receive atleast 30 kcal/ kg body weight and are advised to reduce weight by exercise rather than diet restriction. While low weight gain in pregnancy is associated with a higher incidence of pre - maturity and low birth weight babies.

“Sharp sudden increase in weight after the 12th week of pregnancy which may indicate excessive, abnormal water retention, should be watched. Weight reduction should never be undertaken during pregnancy. Excessive weight gain places an extra strain on the organs and increase the incidence of toxæmia.”



The uterus enlarges up to 500 times its normal size? It can go from a couple of ounces to 1-2 pounds in weight. Once after delivery it gradually goes back to its original size.

Tables 2.1 and 2.2 give the components of weight gain during pregnancy and recommended weight gain based on body mass index.



Table 2.1 components of weight gain during pregnancy.

Gestation (weeks)	12	13-27	28-40
Foetus	5	1500	3000
Placenta and amniotic fluid	50	1000	1500
Maternal tissues and blood	600	6000	7000
Total weight gain	655	8,500	11,500

Source – Hytten, F. and Leitch, I. Physiology of Human Pregnancy, Blackwell Scientific Publishers, Oxford, London and Edinburgh, 1971.

Table 2.2 recommended weight gain for pregnant women based on body mass index.

Weight category based on BMI	Total weight gain (kg)
Under weight (BMI < 19.8)	12.5 – 18
Normal weight (19.8 – 26)	11.5 – 16
Over Weight (26 – 29)	7 – 11.5
Obese (>29)	6.0

Source – B.Srilakshmi., Dietetics., New Age International Publishers.



Your heart grows! Yes, your heart organ actually enlarges while you are pregnant. It works harder and beats at a more rapid pace due to the increased volume of blood in your body. Your blood volume alone increases by 40 – 50% during pregnancy.

Due to undernourishment of the mother the baby is at an increased risk of being premature with low birth weight and development irregularities. Intrauterine nutrition is highly important for the growth of the central nervous system and kidneys of

the foetus, which mature during the latter part of the pregnancy. Therefore nutrition deficits before birth can never be wholly reversed after birth.

Schematic diagram, figure 2.2 shows the relationship between maternal and foetal malnutrition.

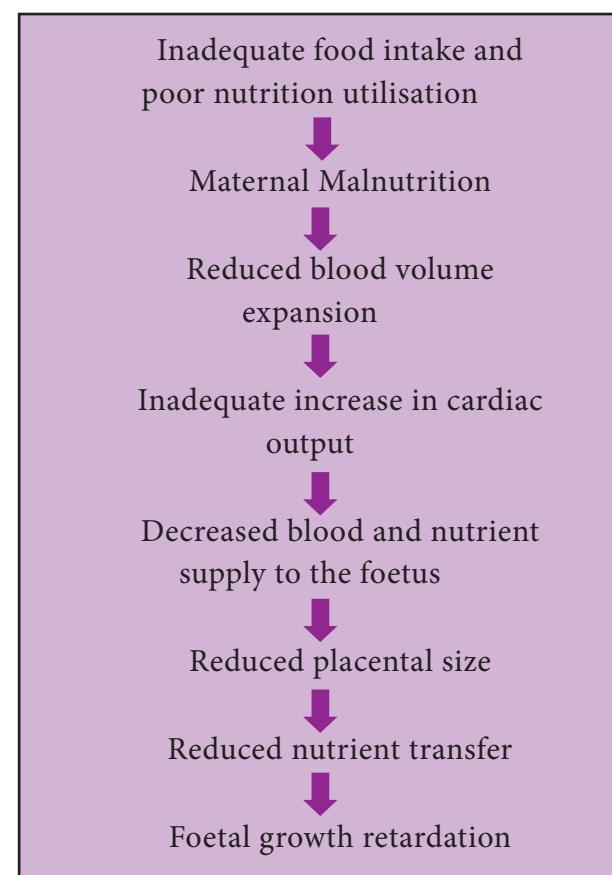


Fig 2.2 Relationship between maternal and foetal malnutrition.

2.1.2 Effects of under nutrition on the mother

a) Maternal body size

Early marriage tradition in many poor societies and pregnancy during adolescence before the genetic potential of growth is achieved, imposes additional burden which results in the poor growth of the foetus and birth of growth retarded child.

b) Multiple nutrient deficiencies.

Multiple nutrient deficiencies due to poor diet are markedly aggravated during

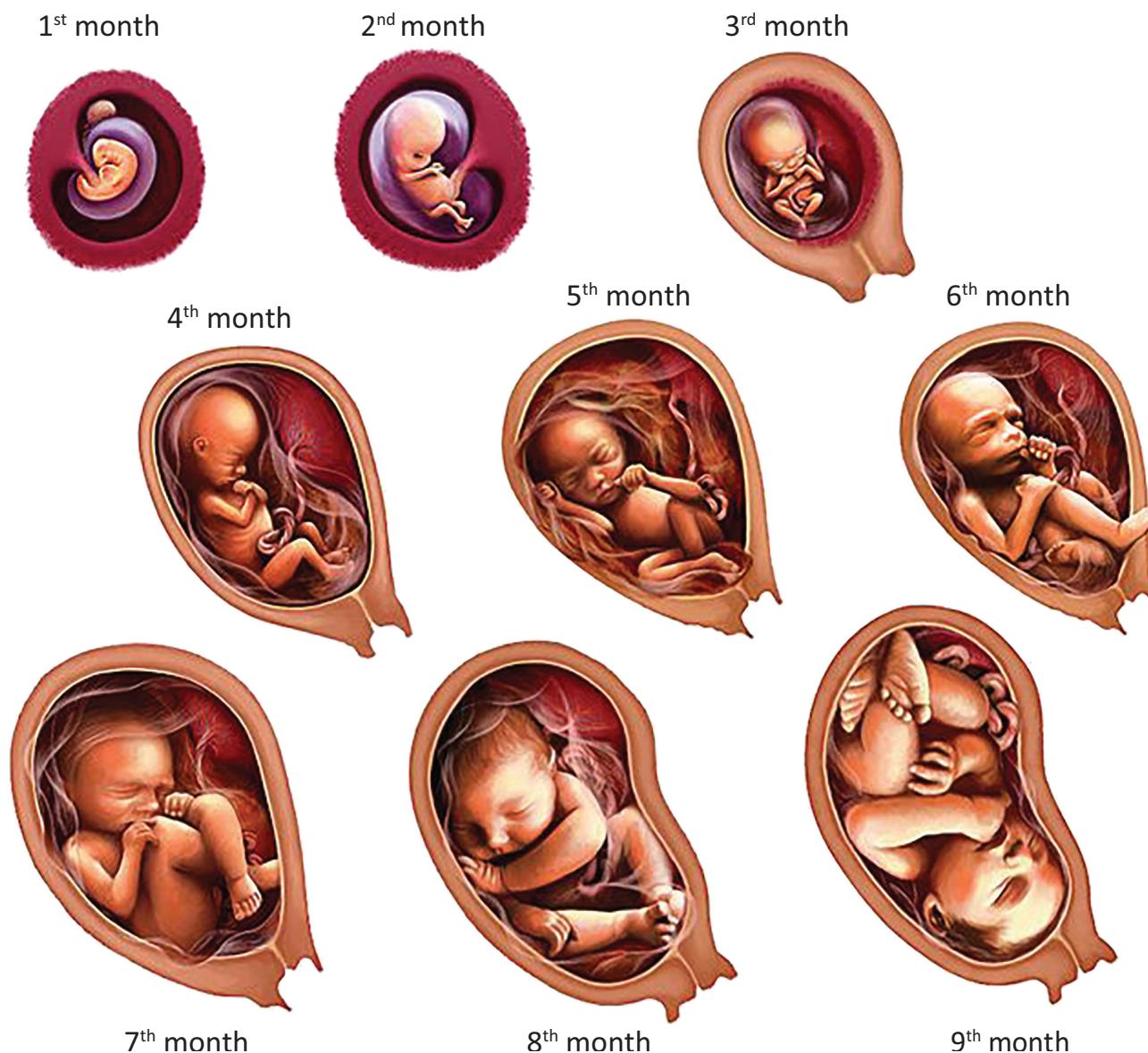


Fig 2.3 Stages of foetal growth

pregnancy. The incidence of anaemia, signs and symptoms of B complex vitamin deficiency such as angular stomatitis, glossitis, tingling and numbness, burning feet are common among low socio economic group. Serum levels of many nutrients such as serum iron, folic acid, vitamin B12, riboflavin, vitamin A and bone density are significantly lower in women from low income group as compared to the well to do women.

c) Maternal mortality

Anaemia, heavy bleeding and toxæmia seems to contribute to nearly 30 - 40 % of maternal death, indicating that maternal

malnutrition is a major determinant of high maternal mortality.

d) Placental function

There is an impairment in placental function due to maternal malnutrition. Earlier opinion that placenta could function normally at the expenses of maternal resources is now been a question.



Activity : 1

Conduct a survey among pregnant women and find out weight gain during trimesters.



2.1.3 Effects of maternal malnutrition on the foetus

a) Congenital malformations in the foetus

Foetal wastage is high in low-income population, one can assume that dietary deficiencies do contribute to higher incidence of congenital malformations. The incidence is much higher if mothers have suffered from viral infection such as rubella, influenza etc.

b) Birth weight

The birth weight of infant is influenced by many factors such as maternal age, parity, height, altitude, ethnic origin and socioeconomic status. Since mother's belonging to low income groups are lighter and shorter, it may be argued that the low birth weight observed in this population is an effect of maternal size, which in turn is an outcome of poor nutritional status of the mother.

c) Infant mortality

The major components of infant mortality i.e. perinatal (28 weeks of gestation to 7 days postnatal) and early neonatal (7 days - 1 month after birth) mortality, are directly related to the health and nutritional status of the mother during pregnancy. Due to high incidence of low birth weight and prematurity in poor - communities perinatal and neonatal death rates are also higher and contribute to almost 60 % of infant deaths.

d) Development of brain and mental function

The peak period of human brain growth is in the last few weeks of intrauterine and first 6 months of extra uterine life. After this, the brain growth slows down, nutritional insults during these phase can be expected to affect brain development and lead to poor mental function.

e) Delayed consequences of foetal growth retardation

In recent years, it is increasingly recognised that effects of foetal malnutrition

continues into the adult age, if the infant survives. It is observed that the incidence of chronic metabolic disease like diabetes, hypertension, cardiovascular insufficiencies and cerebrovascular stroke are more common in these infant when grown into adulthood than the normal birth weight adults.

2.1.4 Nutrition requirement during pregnancy

a) Calories

Energy requirement during pregnancy is increased for maintaining the growth of the foetus, placenta and maternal tissues and for the increased basal metabolic rate (BMR). The additional energy cost of pregnancy for a 55 kg woman has been estimated to be around 80,000 kilocalories. The energy needs are evenly distributed throughout the pregnancy. Energy requirements are also influenced by the pre pregnancy body weight, physical activity and age. WHO recommends an additional 150 Kcal/day in the 1st trimester and 350 Kcal/day in the last 2 trimesters.

b) Protein

The additional protein requirement during pregnancy is mainly due to accretion of protein by the foetus, the enlargement of uterus, mammary glands, placenta, formation of amniotic fluid and storage reserves for labour, delivery and lactation which is around 1000g for the entire pregnancy. For this additional daily requirement, allowance of a good quality protein like 10g milk or egg protein per day has been suggested. The protein required for a pregnant woman is 82.2g/ day. Women who are chronically undernourished and underweight, those with infection and infestation and adolescent pregnant women, may require extra protein in the form of milk or other animal proteins and calories for repletion of tissue proteins to enable them to withstand the stress of pregnancy and lactation.



Table 2.3 ICMR recommended dietary allowances of an expectant mother 2010

Nutrient	Normal adult women	Pregnant women
Energy Kcals		
Sedentary work	1900	+350
Moderate work	2230	+350
Heavy work	2850	+350
Protein gm	55	82.2
Fats gm	30	30
Calcium mg	600	1200
Iron mg	21	35
Vitamin A		
Retinol µg or	600	800
Carotene µg	4800	6400
Thiamine mg		
Sedentary work	1.0	
Moderate work	1.1	+0.2
Heavy work	1.4	
Riboflavin mg		
Sedentary work	1.1	
Moderate work	1.3	+0.3
Heavy work	1.7	
Niacin equivalent mg		
Sedentary work	12	
Moderate work	14	+2
Heavy work	16	
Pyridoxine mg	2.0	2.5
Ascorbic acid mg	40	60
Dietary folate µg	200	500
Vitamin B12 µg	1.0	1.2
Magnesium mg	310	310
Zinc	10	12

c) Minerals

i) Calcium

Calcium requirement suggested by ICMR for an adult woman is 600mg / day. Requirement increases during pregnancy to 1200 mg/ day. Increased intake of calcium by mother is highly essential, not only for

the classification of foetal bones and teeth but also for protection of calcium resources of mother to meet the high demands during lactation. Dairy products are a primary source of calcium. Green leafy vegetables like agathi and gingelly seeds also contribute to calcium.

ii) Iron

Normal iron requirement for an adult woman is 21 mg/ day, ICMR requirements during pregnancy is 35 mg / day. Additional iron requirement during pregnancy is computed from iron needs for foetal growth (250 mg), expansion of maternal tissue including the red cell mass during pregnancy, (400mg) the iron content of placenta and the blood loss during parturition (250mg). There is, however, saving (150 mg) due to cessation of menstruation (amenorrhea). The iron absorption is better when taken with Vitamin C rich fruits i.e. fruits like 'amla' (Indian gooseberry), guava and other citrus fruits. Liver, dried beans, dried fruits, green leafy vegetables, eggs, enrich serials and iron fortified salt provide additional sources of iron.

d) Vitamins

i) Vitamin A

Normal Requirements of β - carotene for an adult woman is 4800 µg and during pregnancy it is increased to 6400 µg. Same level is suggested during pregnancy. Liver, egg yolk, butter, dark green and yellow vegetables and fruits are good sources of vitamin A.

ii) Vitamin D

Vitamin D is a highly essential as it enhances the maternal calcium absorption. Its active form calcidiol and calcitriol cross the placenta with ease and play an important role in calcium metabolism of the foetus. Maternal deficiency of vitamin D results in neonatal hypocalcaemia and hypoplasia.

iii) Thiamine, Riboflavin, Niacin, Pyridoxine

Since the requirements of B complex vitamins like thiamine, riboflavin, niacin



are related to calories, the additional amount recommended during pregnancy and lactation are based on additional calories. Thus, the additional amounts (mg) recommended during pregnancy is 0.2 mg thiamine, 0.2 mg riboflavin, and 2 mg niacin equivalents. The additional amount of pyridoxine recommended is 2.5 mg during pregnancy as well as lactation.

iv) Folate

During pregnancy there is considerable increase in the demand for folates, which are required for DNA synthesis in the rapidly growing tissue. The greatest significance of folic acid and its potential influence on pregnancy outcome is its role in preventing neural tube defects, such as **spina bifida**. Folic acid deficiency can lead to anencephaly. Recommended daily intake for adults is 100 μ g and for pregnant women 400 μ g. To reach this level, the consumption of green vegetables should be increased and additional folate supplements should be given even in pre pregnancy stage and throughout pregnancy.

v) Vitamin B 12

The recommended intake of vitamin B12 for adults is 2 μ g per day. During pregnancy, additional amount is required for haemopoiesis and liver storage for the foetus and subsequent secretion in milk. During the later half of pregnancy, the requirement of vitamin B12 increases to 3.0 μ g per day to provide for foetal storage of 50 - 100 μ g.

2.1.5 Dietary guidelines

Usually a diet containing 3 cups of milk or its equivalent, 2 servings of meat, fish, poultry, eggs, or a source of complete protein, a dark green yellow vegetables and generous serving of citrus fruits will provide a foundation for a nutritionally adequate diet. Between the 6th to 14th week of pregnancy 75% women suffer from nausea which in turn affect the appetite. The conception of small and frequent meals at regular intervals are helpful to many women. This pattern is also very helpful in the later part of pregnancy



when discomfort is experienced after last meal due to overcrowding by foetus in the abdominal cavity. Plenty of water, at least 4 to 6 glasses in addition to what is contained in the form of milk and other beverages should be taken daily throughout pregnancy. It is recommended that, pregnant women limit their intake to two cups of caffeine containing beverages per day like tea, coffee and chocolate.

More fibre should be included in the diet to prevent constipation which is a common problem during pregnancy. 5 - 6 servings of fruits and vegetables should be included in the daily diet. Inclusion of green leafy vegetables ensures minerals like calcium and iron. Raw fruits and vegetables are to be included in the

diet to meet vitamin C and fibre requirement. Fatty rich foods, fried foods, excessive seasoning, strongly flavoured vegetables may be restricted in the case of nausea and gastric distress.

2.1.6 Dietary problems

a) Nausea and vomiting

Nausea in pregnancy may be due to nervous disturbances, placental protein intoxication or due to derangement in carbohydrate metabolism. Morning sickness of early pregnancy can be improved by small and frequent meals. Liquids may be best taken between meals instead of with food. If the condition develops to hyperemesis gravidarum, a severe prolonged persistent vomiting, peripheral parenteral nutrition and careful oral



feeding is essential. Fruits and vegetables can be given, fat rich foods, fried foods, exercise seasoning, coffee in large amounts and stronger flavoured vegetables may be restricted or eliminated if the nausea persists.

b) Heart burn

Increase progesterone production, cost decreased tone and mobility of the smooth muscles of gastrointestinal tract. This leads to regurgitation. Heartburn is a common complaint during the later part of pregnancy. This is usually, can be relieved by small and frequent meals limiting the amount of food consumed at one time and drinking fluids between meals. Sitting upright after meals at least for 3 hours before lying down may also help.

c) Constipation

The pressure of the enlarging uterus on the lower portion of the intestine, in addition to the hormonal muscle relaxant effect of placental hormones on the gastrointestinal tract may result in constipation. Increased the fluid intake and use of natural laxative foods such as whole grains, dried fruits and other fruits, vegetables that are rich in fibre, juices usually induce regularity.

d) Oedema

Mild, physiologic oedema is usually present in the extremities in the third trimester. Swelling of lower extremities may be caused by the pressure of the enlarging uterus on the veins returning fluid from the legs. The normal oedema requires no sodium restriction or other dietary changes.

e) Pica

Consumption of non - food items like laundry starch, ice cubes or clay is called pica. It occurs more often during pregnancy than at any other time. A deficiency for essential nutrient, such as calcium or iron, results in the eating of non - food substances that contain these nutrients



Activity : 2

Suggest some fibre rich diets to avoid constipation during pregnancy.

2.1.7 Practices incompatible with pregnancy

Besides malnutrition, a variety of lifestyle factors can have adverse effects on pregnancy and some may teratogenic. People who are planning to have a children can make the choice to practice healthy behaviours.

a) Alcohol

Alcohol consumption during pregnancy can cause irreversible mental and physical retardation of the foetus. Foetal alcohol syndrome (FAS) of the leading causes of mental retardation is the only one that is totally preventable.

b) Medicinal drugs

Drugs other than alcohol can also cause complication during pregnancy, problems in labour, and serious birth defects. For this reason pregnant women should not take any medicines without consulting their physician.

c) Illicit drugs

The recommendation to avoid a drugs during pregnancy also includes illicit drugs, of course. Unfortunately, use of illicit drugs such as cocaine and marijuana, is common among some pregnant women. Drug of abuse, such as cocaine, easily cross the placenta and impact foetal development further more they are responsible for preterm birth, low birth weight infant, perinatal death, and sudden infant death. If these new-born's survive their crisis and behaviour at birth are abnormal, and their cognitive development later in life is impaired.

d) Smoking and chewing tobacco

Smoking cigarettes and chewing tobacco at any time exert harmful effects, and pregnancy dramatically magnifies the hazards of these



practices. Smoking restrict the blood supply to the growing foetus and soulmates oxygen and nutrient delivery and waste removal. Smokers tend to eat less nutritious food during their pregnancy than do non-smokers which in turn impairs foetal nutrition. A positive relationship exist between sudden infant death syndrome (SIDS) and both cigarette smoking during pregnancy and postnatal exposure to passive smoke. Smoking during pregnancy may even harm the intellectual and behavioural development of the child later in life. Infants of mother who chew tobacco also have lower weight and higher rates of foetal death than infants born to women who do not use tobacco.

e) Environmental contaminants

Infants and young children of pregnant women exposed to environmental containment such as lead and mercury show signs of impaired cognitive development.



In order to prepare body for birth, it produces a hormone called relaxin which softens your ligaments. This softening helps your baby pass through your pelvis during labour.

f) Vitamin mineral megadoses

The pregnant women who is trying to eat well may mistakenly assume that more is better when it comes to vitamin - mineral supplements. This is simply not true, many vitamin are toxic when taken in excess, and the minerals are even more so, some at levels not far above recommendations.

g) Caffeine

Caffeine crosses the placenta, and the developing foetus has a limited ability to metabolize it. For this reason, pregnant

women may wonder whether they should give up coffee, tea, and colas because of their caffeine contents. Research studies have not proved that caffeine (even in high doses) causes birth defects in human infants (as it does in animal), but limited evidence suggests that moderate - to - heavy use may lower infant birth weight.

h) Weight loss dieting

Weight loss dieting, even for short periods, is hazardous during pregnancy. Low - carbohydrate diets or fats that causes ketosis deprive the foetal brain of needed glucose and may impair its development. Such diets are also likely to lack other nutrients vital to foetal growth. Regardless of prepregnancy weight, pregnant women should never intentionally lose weight.

i) Sugar substitutes

Artificial sweeteners have been extensively investigated and found to be safe for use during pregnancy. (Women with phenylketonuria should not use aspartame). It would be prudent for pregnant women to use sweeteners in moderation and within an nutritious and well balanced diet.



Activity : 3

Prepare a low cost iron rich diet for a pregnant women

2.2 Nutrition in lactation

Nutritional link between the mother and child continues even after birth. Born baby depends for some period solely on breast milk for their existence. During the first two or three days after birth, a small amount of Colostrum is secreted. The amount of milk produced corresponds either to the productive capacity of the mother or the nutritional requirements of the infant. Many factors influence milk production, nutritional status being one of them. Nutritional requirements



of the mother during lactation mainly depends on the volume of milk produced, duration of lactation, and the composition of breastmilk to meet the requirements of the growing infant.

2.2.1 Role of hormones in milk production

Sucking by infant initiates hormonal changes that leads to milk production and let down reflex, which releases milk as shown in figure 2.4

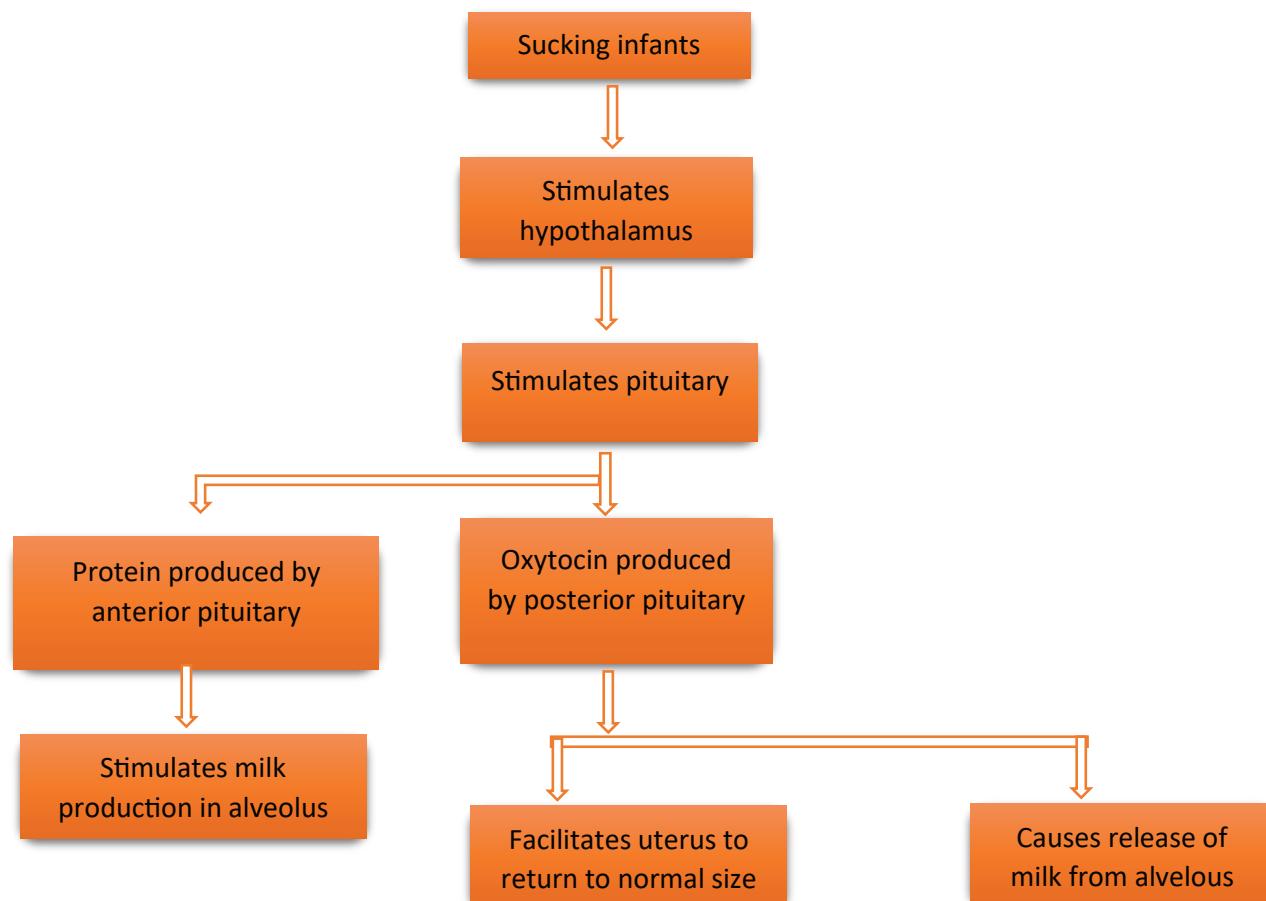


Fig 2.4 process of stimulation of milk production

This process of lactation is controlled by various hormones. The source of the

hormones and their function is summarised in table 2.4

Table 2.4 Hormonal control of lactation

HORMONE	SOURCE	ACTIVITY
Oestrogen	Ovary and placenta	Stimulates breast development during pregnancy
Progesterone	Ovary and placenta	Stimulates breast development during pregnancy
Prolactin	Anterior pituitary gland	Simulates milk production
Oxytocin	Posterior pituitary gland	"Let down" reflex: Smooth muscles surrounding the alveoli of the nipples contract to allow the release of milk.



2.2.2 Nutrient requirement during lactation

a) Energy

The additional energy needed for lactation is drawn from maternal adipose tissue stores laid down during pregnancy. Depending on the adequacy of the stores, additional energy input may be needed in the lactating woman's daily diet. This is the reason nutrition expert committee (2010) prescribed additional calories 600 and 520 respectively for 0 - 6 months and 7 to 12 months.

b) Protein

During lactation, protein requirement has been computed on the basis of secretion of protein in milk. An additional daily intake of 22.9 g for the first 6 months and 15.2 g during 7-12 months of lactation is prescribed. If energy or protein is lacking, there will be a reduction in milk volume rather than in milk quality.

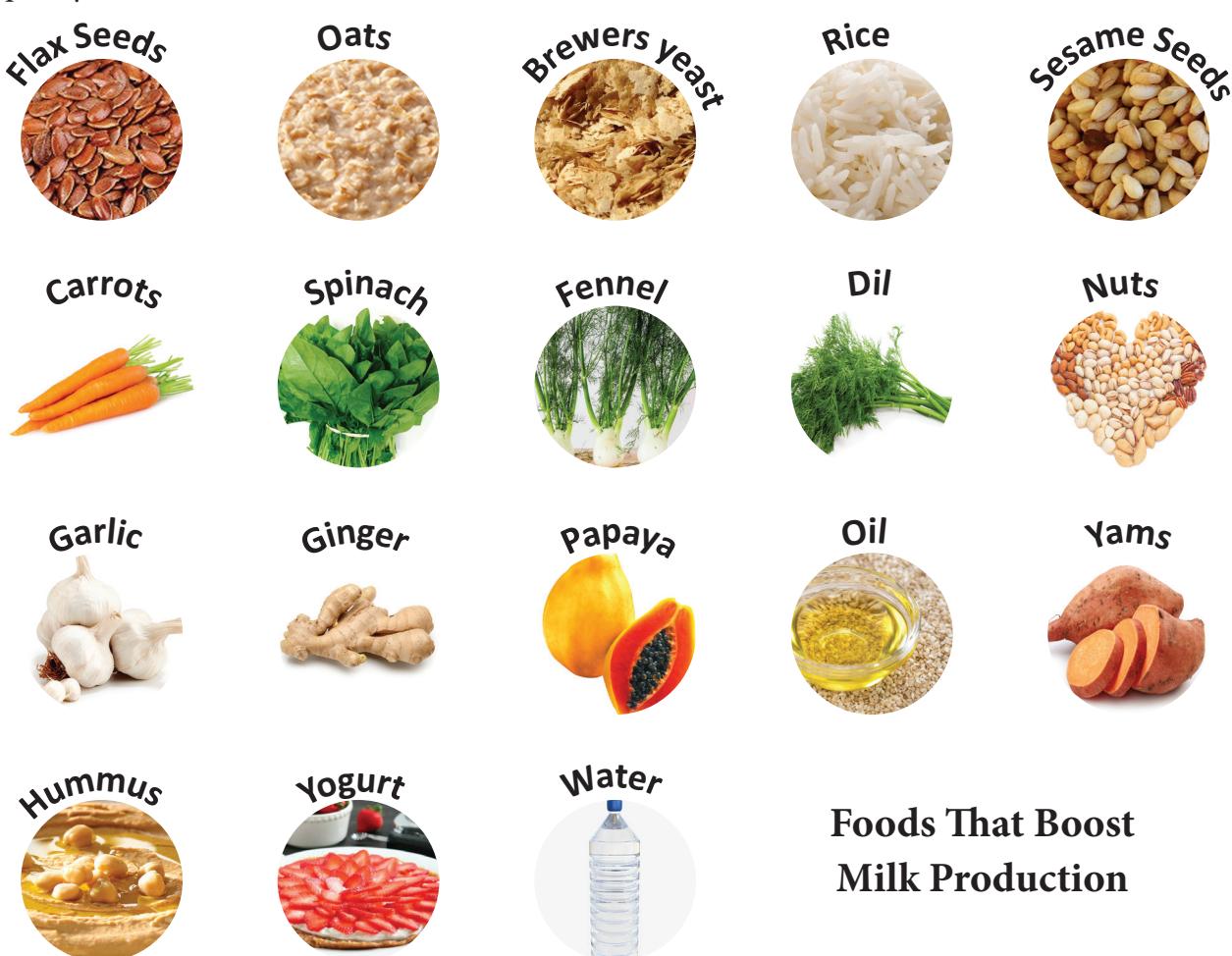
c) Minerals

i) Calcium

The increased amount of calcium that is required during gestation for mineralization of the foetal skeleton is now diverted into the mother's milk production. Both during pregnancy and lactation 1200 mg has been prescribed by ICMR. The retention of dietary calcium in lactating women is about 30 %, hence an extra amount of 600 mg is prescribed. About one litre of milk or milk products should be given to lactating mother to meet 1200 mg of calcium.

ii) Iron

The iron requirement during lactation is 25 mg per day. The baby is born with the relatively large reserve of iron since milk is not a good source of iron. A good allowance of iron in the mother's diet during lactation does not convey additional iron to the Infant. Iron requirement during lactation is the sum



Foods That Boost Milk Production



of the requirement of the mother and that required to make up the iron lost in breast milk. Since there is an amenorrhea during lactation the basal requirement will be same as in adult women 14 μ g/kg.

d) Vitamins

i) Vitamin A

The quantity of retinol present in 680 ml of human milk is 50 μ g, so the ICMR recommends an additional allowance of 350 μ g of retinol. This can be achieved by including liver, fish liver oil, egg yolk, milk and green leafy vegetables in the diet.

ii) Thiamine, Riboflavin, Niacin

Thiamine content of mother's milk depends on mother's diet. Dietary allowances for thiamine for lactating mothers is 0.5 mg/1000 kcal and their daily requirement is computed on the basis of their energy allowance. The additional allowance recommended by ICMR (2010) on the basis of additional calorie allowances 0.3 mg for 0 to 6 months lactation and 0.2 mg for 7-12 months.

Additional allowance of riboflavin corresponding to the increased energy allowance would be 0.3 mg. RDA for riboflavin during lactation is computed on the basis of 0.6 mg 1000 kcal. If the diet meets the requirement of protein and calcium the requirement of riboflavin would be definitely met. Milk is not only a good source of calcium but also a good source of riboflavin.

The nicotinic acid content of the breast milk of Indian women ranges between 100 and 150 μ g per 100ml. The amount lost in milk is between 0.9 and 1.2 mg per day. The dietary allowances for niacin is 6.6 mg niacin equivalents per 1000 kcals.

iii) Folic acid

The folic acid content of breast milk secreted by Indian women is 1.6 μ g per 100ml.

Table 2.5 ICMR recommended dietary allowances of a lactating mother-2010

Nutrient	Normal women	Lactating women	
		0-6 months	7-12 months
Energy Kcals			
Sedentary work	1900		
Moderate work	2230	+600	+520
Heavy work	2850		
Protein gm	55	77.9	70.2
Fats gm	30	30	30
Calcium mg	600	1200	1200
Iron mg	21	25	25
Vitamin A			
Retinol μ g	600	950	950
Carotene μ g	4800	7600	7600
Thiamine mg			
Sedentary work	1.0		
Moderate work	1.1	+0.3	+0.2
Heavy work	1.4		
Riboflavin mg			
Sedentary work	1.1		
Moderate work	1.3	+0.4	+0.3
Heavy work	1.7		
Niacin equivalent (g)			
Sedentary work	12		
Moderate work	14	+4	+3
Heavy work	16		
Pyridoxine mg	2.0	2.5	2.5
Ascorbic acid mg	40	80	80
Dietary folate μ g	200	300	300
Vitamin B12 μ g	1.0	1.5	1.5
Magnesium	310	310	310
Zinc	10	12	12



At the higher level, the amount of folate lost by the mother would be about 25 μ g a day. An additional allowance of 100 μ g of folate should be provided during lactation.

e) Fluid

An increase intake of fluid is necessary for adequate milk production, since milk is a fluid tissue. Water and beverages such as juices, soups, buttermilk and milk, all add to the fluid necessary to produce milk. A lactating mother should take 2-3 litres of fluid per day.



Human milk boost a baby's immune system big time helping baby fight viral, bacterial, and parasitic infections including respiratory tract infections, ear infections, bacterial meningitis, pneumonia, urinary tract infections, infant diarrhoea, common cold and flu.

2.2.3 Dietary guidelines

- “Galactogogue” or lactogogue act by increasing the prolactin secretion which in turn increases milk production. They also work psychologically and have a marginal effect on milk production. Sucking is the best lactogogue. The diet can include lactogogues, which stimulate the production of milk. Garlic, milk, almonds, and garden cress seeds are considered to increase the milk production in certain regions of India.
- Weight gain beyond that desirable for body size, should be avoided. When the baby is weaned, the mother must reduce her food intake in order that obesity may be avoided.
- It is better to control constipation by inclusion in the diet of raw and cooked fruits and vegetables, whole grains and an adequate amount of water than by use of laxatives.

- No food need be withheld from the mother unless it causes distress to the infant. Occasionally, tomatoes, onions, members of cabbage family, chocolate, spices and condiments may cause gastric distress or loose stools in the infant.



Activity : 4

Suggest a few recipes that promotes milk production.

2.2.4 Practice incompatible with lactation

Some substance impair milk production or enter breast milk and interfere with infant development. Some medical condition prohibit breastfeeding. This section describes these circumstances.

a) Alcohol

Alcohol easily enters breast milk, and its concentration peaks within an hour of ingestion. Infants drink less breast milk when their mother have consumed even small amount of alcohol.

b) Medical drugs

Many drugs are compatible with breastfeeding, but some medicines are contraindicated, either because they suppress lactation or because they are secreted into breast milk and can harm the infant.

c) Illicit drug

Illicit drugs of course are harmful to the physical and emotional health of both the mother and the nursing infant. Breast milk can deliver such high dose of illicit drugs as to cause irritability, tremors, hallucination and even death in infants.

d) Smoking

Cigarette smoking reduces milk volume, smokers may produce too little milk to meet their infant's energy needs. Consequently infants of breast feeding mothers who smoke gain less weight whereas infant's of those who do not smoke.



e) Caffeine

Caffeine taken during lactation may make a breastfed infant irritable and wakeful. During pregnancy caffeine consumption should be moderate say 1-2 cups of coffee a day. Larger doses of coffee may interfere with the availability of iron from the milk and impair the infant iron status.

2.3 Growth and development during infancy

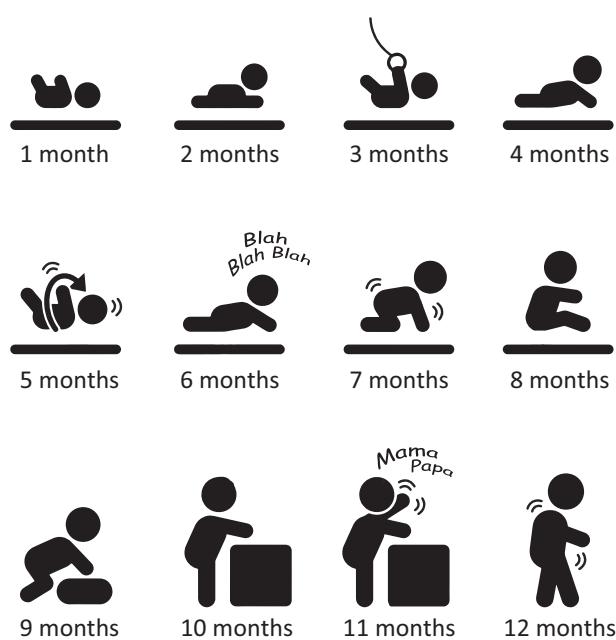


Fig 2.5 Stages of growth of an infant

Next to foetal period, the infants 1st year is the time of most rapid growth. According to WHO figures the average weight of most healthy new-born babies is around 3.2 kg. Healthy child doubles birth weight by six months. His weight becomes 3 times by the time the child is one year old. The normal birth length of 50 to 55 cm increases by another 23 to 25 cm during the first year. With increase in length the body proportions also change. At birth the child has 75% water 12 to 15 % fat. By the end of the one year the water content decreases to 60% and fat increases to 24 %. Muscles would be comparatively well developed at the end of the year. Infant have rapid heart rate, 120 - 140 per minute. But the haemoglobin level of well-

nourished infant is 17 - 20 g per 100 ml. This provides a reserve for expansion of the blood circulation and adequate oxygen carrying capacity to the growing tissue during the first 4 - 6 months.

The full term infant is able to digest protein, emulsified fats and simple carbohydrates such as lactose. Salivary secretion and gastric acidity are low in infants under 3 months. Kidney reach their full functional capacity by the end of 1st year. During the first few months the glomerular filtration rate is somewhat lower and therefore the excretion of high concentration of solutes is more difficult. The increase in the number of brain cells is most rapid during foetal life and in the first five to six months after birth.

2.3.1 Nutritional requirements

a) Energy

Study reveal that basal and total energy requirement for infants are higher than adults per unit body weight. Infants require 92 Kcal / kg body weight. For one month old infant, 50 % energy intake is used for basal energy, 25 % for activity and 25 % for growth. Extremely active children may require up to 40% energy for activity. 70% of calories can be met by milk alone and rest of the calories have to be supplied by supplementary foods after six months.

b) Protein

Protein intake of a healthy infants is about 1.16 g/ kg body weight. The recommendations for infants are based on the total protein content and amino acid pattern of the average daily intake of human milk. Human milk provides all the amino acids more than the required amount needed for proper growth. Histidine, which is a non-essential amino acid for adults, is necessary for growth and maintenance of an infant. Human milk protein is 100% utilised. If calories and protein requirements are not met, infant suffer from protein energy malnutrition.



This is a range of clinical disorder resulting in severe cases to marasmus or kwashiorkor.

c) Fats and essential fatty acids

Fat intake should be 35 % E depending on the physical activity of the child from age 6 months to 2 years. Linoleic acid is the most important essential fatty acid for an infant. DHA levels in red blood cells and neural tissues help in improving visual acuity and cognitive performance of infants. Both cow's milk and mother's milk satisfy the requirements of EFA. EFA requirement of young children is 3% E which can be satisfied by 19g per day visible fat.

d) Minerals - Calcium and phosphorus

Rapid growth requires 500 mg of calcium and 750 mg of phosphorus with a ratio 1:15. Adequate prenatal nutrition supply a store of bone minerals to prevent rickets provide postnatal care furnishers a liberal supply of calcium and phosphorus. Large percentage of calcium from breast milk is retained by the infant. When sufficient calcium is not supplied to the infant, there motor development is delayed. Ca: P ratio of 1.2: 1 as in cow's milk is lower compared to 2: 1 in human milk.

i) Iron

RDA of iron for an infant is 46 $\mu\text{g}/\text{kg}$ bodyweight starting from 3 months. At birth, body contains 80mg/ kg. This is about 3 times that of an adult. During the first four months, blood volume doubles and concentration of iron in haemoglobin falls to about half, that present at birth.

ii) Zinc

High levels are present in colostrum and it promotes normal growth. Zinc is necessary for normal brain development.

e) Vitamins

i) Vitamin A

The RDA for retinol is 350 μg . Daily intake of Vitamin A by Indian infants through breast milk is about 140 μg during the first 6

months of life. After six months egg yolk is supplemented in the infant's diet.

ii) Vitamin D

It is essential for utilisation and retention of calcium and phosphorus. A good supply of vitamin D during pregnancy benefits the mother and it helps satisfactory development of the infant. The vitamin D requirement of child is 400 I.U. if there is minimal exposure to sunlight.

Table 2.6 ICMR recommended dietary allowances for infants 2010

Nutrient	Months	
	0-6	6-12
Energy Kcals	92	80
Protein gm	1.16	1.69
Fats gm	-	19
Calcium mg	500	500
Iron mg	46 $\mu\text{g}/\text{kg}$	05
Vitamin A		
Retinol μg or	350	350
Carotene μg	2800	2800
Thiamine mg	0.2	0.3
Riboflavin mg	0.3	0.4
Niacin equivalent $\mu\text{g}/\text{kg}$	710	650
Pyridoxine mg	0.1	0.4
Ascorbic acid mg	25	25
Dietary folate μg	25	25
Vitamin B12 μg	0.2	0.2
Magnesium mg	30	45
Zinc mg	-	-



Activity : 5

Collect birth weight and height of 5 infants.



2.3.2 Breast feeding



The Infant should be put to breast within half an hour after normal delivery and within 4 hours after caesarean sections. Prelacteal foods like honey, distilled water, glucose should not be given.

a) Colostrum

During the first two or three days after delivery, thick and yellowish fluid is secreted from the mammary gland. This differs from the regular milk and is called “colostrum”. It is secreted in small quantity of about 10- 40 ml which is rich in protein. Colostrum is the first immunization to the infant. It contains an interferon like substance which possesses strong antiviral activity. Colostrum contains B12 binding protein which renders B12 unavailable for the growth of E. coli and other bacteria. It also contains antibodies against viral diseases such as smallpox, polio, measles and influenza. Enzymes like lysozyme, peroxidase and xanthine oxidize that promote cell malnutrition are found to be more in colostrum. Colostrum contains large quantities of protective substances and enhances the development and maturation of the baby's gastrointestinal track. Colostrum helps a baby pass his or her first stool.



Breastfeeding can actually reduce baby's risk of disease later in life including type 1 and 2 diabetes, Hodgkin's disease, leukaemia, obesity, high blood pressure, high cholesterol levels, ulcerative colitis, asthma, eczema and also lowers risk for sudden infant death syndrome (SIDS)

Table 2.7 Composition of Colostrum

Nutrient	Amount
Energy kcal	58
Fat g	2.9
Calcium mg	31
Phosphorous mg	14
Iron mg	0.09
Protein g	2.7
Lactose g	5.3
Carotene I.U	186
Vitamin A I.U	296

b) Transition milk

During the next two weeks, the milk increases in quantity and changes in appearance and composition. This is called “transition milk”. The immunoglobulin and protein content decreases while the fat and sugar content increases. Exclusive breastfeeding of colostrum and transition milk minimises infections related to neonatal deaths. The composition of milk changes even during the length of a single feed to exactly suit the need of a particular baby.

2.3.3 Advantages of breast feeding

Breastfeeding is not only beneficial to the infant but also to the mother. The advantages of breastfeeding can be considered under nutritional, immunological, psychological, economical and physiological and other factors.



Body is constantly making the perfect milk for baby. Milk changes its nutritional profile as baby grows (milk made for a 3 month old is different than for a 9 month old) milk can even change day to day. For example water content may increase during times of hot weather and baby sickness to provide extra hydration.



a) Nutritional benefits

The composition of human milk is best suited to the infants and provide nutrients in easily digestible and bioavailable form.

i. Carbohydrate

Human milk is the sweetest milk due to the high amount of lactose. Lactose which is present in higher levels in human milk facilitates the absorption of magnesium and calcium and favours amino acid absorption and nitrogen retention.

ii. Protein

Human milk contains 1.1 g percent protein. Human milk has 20% casein and 80 % whey proteins which constitutes lactalbumin and lactoferrin. Lactalbumin has an amino acid pattern that mainly approaches that of body protein and provides more essential amino acids than casein. Breast milk contains amino acids specific for brain development. Human milk offers a high tryptophan to neutral amino acids ratio which controls brain serotonin synthesis. Human milk also contains binding proteins of thyroxine, corticosterol, vitamin D, folate and B12.

iii. Lipids

Lipids Present in human milk are unsaturated fat, essential fatty acids, prostaglandin precursors, fat soluble vitamins, steroids, phospholipids and cholesterol. Lipids involved in the development of brain are mostly long chain polyunsaturated fatty acids. These are abundant in the breast milk. Human milk contains cholesterol and is essential for synthesis of myelin of the nervous system. Presence of chlorine, acetylcholine, phospholipid precursors and carnitine ensure optimum metabolism and brain development.

iv. Minerals

Unlike vitamins, mineral content of human milk is minimally influenced by

mother's stores and immediate intake of calcium, magnesium, phosphorus, iron, copper, zinc, sodium and potassium. Minerals in the breast milk are largely protein bound and balance to enhance bioavailability. Calcium content in human milk is 28 mg and calcium phosphorus ratio of 2:1 in human milk is favourable. Breast milk ensures better oxygen saturation and increases the bioavailability of trace elements like copper, cobalt, selenium, iron and zinc.

v. Vitamins

Breast milk contains more vitamin A, C and E than cow's milk. Breast milk contains water soluble vitamin D along with fat soluble fraction which protects against rickets. riboflavin, pyridoxine and B12 content of human milk are also related to the dietary intake of mother. Heat liable vitamins like thiamine and ascorbic acid are completely available in human milk. Breast fed infants receive about 25 -30 μ g of folate daily, most of which is available for absorption.

b) Hormones and growth factor benefits

Breast milk is so rich source of hormones like thyroid stimulating hormone (TSH), thyroxin, parathyroid hormone, corticosteroids, calcitonin, erythropoietin, oxytocin, growth hormone releasing factor, insulin and prolactin. It contains growth regulating factors, growth promoting factors and growth modulators.

c) Immunological benefits

These factors are present in colostrum as well as in matured milk.

i. Macrophages

Human milk contains macrophages. They contribute immunity in two ways: (a) They engulf and digest bacteria. (b) These cells synthesize complement, a protein involved in establishing immunity to infectious organism.



ii. Lymphocytes

Lymphocytes are the white blood cells responsible for mediating most aspects of the immune system, with its ability to attack a wide range of infectious microorganisms. Human milk contains T and B lymphocytes.

iii. Immunoglobulins

Immunoglobulin are the difference in proteins that include all types of antibodies. Immunoglobulin are resistant to the acidity for the stomach.

iv. Lactoferrin and Vitamin B12 binding protein

Lactoferrin is an iron containing protein found both in colostrum and mature milk. It's in which the growth of staphylococcus organism and E coli by tying iron that is needed for growth. Similarly vitamin B12 binding protein present in breast milk makes vitamin B12 unavailable to pathogens that require B12 to survive in the infant's gastrointestinal track.

v. Lactobacillus bifidus factor

It is a nitrogen containing carbohydrate in human milk. It encourages the growth of microorganism, lactobacillus bifidus and produces acetic acid or lactic acid from lactose and depresses the growth of pathogenic or disease producing organism like Escherichia coli.

vi. Enzymes

Breast milk supplies enzymes like amylase, lipoprotein, lipase, bile salt, stimulated lipases, oxidases, lacto peroxidase, and leucocyte myeloperoxidase. These enzymes increase digestibility and also act as defence against microbes. Enzymes like lysozyme, peroxidase and xanthine oxidase promote cell maturation.

d) Psychological benefits

An infant derives a sense of security and belonging in the mother and child relationship from the comfort of being held than from feeding process.

Table 2.8 Calorie percentage from protein, fat and carbohydrate in human and cow's milk.

Nutrient	Breast milk	Cow's milk
Total energy (per 100 ml)	65	65
Protein	07	19
Fat	47	55
Carbohydrate	31	26

Source: Gopalan C., B.V Ramasastri and S.C Balasubramanian (2011), Nutritive value of Indian foods, NIN, ICMR, Hyderabad, India.

2.3.4 Breast feeding during illness

- Breast Feeding is to be done during illness because -
- Breast milk is the most easily digestible food for the sick baby
- Breast feeding is the best pacifier to the sick baby
- Breast milk satisfies the nutritional and fluid demands
- Breast milk offers anti-infective and immunological factors.

 **WORLD ALLIANCE FOR BREAST FEEDING ACTION (WABA)** insists exclusive breast feeding for 6 months.

Artificial feeding

Though no milk can be real substitute for mother's milk, sometimes it is necessary to give artificial feeding. Circumstances under which artificial feeding is essential are

- The mother is suffering from serious illness, fever or infection,
- Another pregnancy intervenes during lactation



- The child is too weak to nurse or cannot because of harelip for cleft palate
- Breast milk has completely stopped or insufficient for the child
- Mother is not available to feed the child
- The mother is on anticoagulants, steroids and radioactive drugs,
- Death of the mother.

2.3.5 Weaning



Weaning begins from the moment supplementary food started and continue still the child is taken off the breast completely. The ideal time to start semi solid food is when a baby is ready to sit up, swallow and eat taste other foods, the baby's stomach is ready to digest food and the baby has good appetite and accepts food readily and there is no more activity in the child.

2.3.6 Types of supplementary foods

a) Liquid supplements

i. Milk

At about the sixth month of life the frequency of breastfeeding is reduced to three or four times per day and animal milk is substituted. Since the proportion of nutrients in animal milk differs from the human milk, the cow's milk is diluted with boiled and cooled water in the proportion of 2: 1 for the first feeds. The amount of water is gradually reduced so that

in the course of a few weeks the baby receives undiluted animal milk. Two feeds, with 225 ml of milk per feed is an ideal replacement. Sugar can be added for taste and it to increase calories.

ii. Juice of fresh fruits

Oranges, tomatoes, sweet lime, grapes, serve to supplement the protective nutrients not present in sufficient amounts in breast milk as well as in animal milk. It is advantages to start feeding small quantities of fresh fruit juice even in the 3rd or 4th month of life.

iii. Soup from green leafy vegetables

In case fresh fruits are not available, green leafy vegetables may be used as an alternative. Strained soup can be given in the beginning with unstrained soup later on

b) Solid supplements

Mashed food is started around the 7th or 8th month of life. Around this time, the infant is already receiving animal milk, fruit juice or vegetable soup and fish liver oil.

i. Cereal and starchy gruels

To meet the increasing demands of calories and protein, well-cooked mashed cereal like rice, rice flour, rice flakes and ragi flour mixed with milk and sugar can be given. Addition of a small amount of vegetable oil to the porridge makes it less glutinous increasing the energy density.

ii. Vegetables

Cooked, Mashed vegetables like potato, green leafy vegetables and carrots can be introduced to get vitamins and minerals and colours in the diet

iii. Fruits

All fruits, with the exception of banana which is mashed, must be stewed and sieved for one year old baby. Thereafter, it is given simply stewed, with the addition of little sugar and lime juice for favour.



iv. Non vegetarian foods

A small amount of hard boiled yolk of egg is given to start with and if the infant tolerates, the amount maybe gradually increased to a complete yolk of an egg. Yolk is a good source of vitamin A, iron and protein. Soft custard is also a suitable way in which to introduce egg yolk.

v. Pulses

Well cook pulses along with cereals in the form of kichidi / pongal can be given or can be made into porridge. Pulse and meat preparation can be given alternate days.

2.3.7 Points to be considered while introducing weaning foods

- Introduce only one food at a time
- Allow the infant to become familiar with the foods before trying to give another
- Give a very small amounts of any new food at the beginning, for example, one teaspoon full or less.

- At first strained fruits, vegetables and cereals are given.
- Variety in choice of food is important
- If, after several trials, the baby has an acute dislike for a particular food, omit that item for a week or two and then try again.
- Food should be given between breast feeds.
- Give freshly prepared food
- By one year, the infant can be given family diet, modified, in small quantities but at frequent intervals in addition to milk. The best indication of adequacy of the diet is the growth pattern of the child.

2.3.8 Low cost supplementary foods

Indian mothers wean infant into the traditional adult diet because of their ignorance of low cost weaning foods and also because of in capacity to buy expensive commercial foods.

Table 2.9 Low cost supplementary foods

Name of the product	Composition
Indian multipurpose food (C F T R I)	Low fat groundnut flour and Bengal gram flour (75:25) fortified with vitamins A and D, B1 B2 and calcium carbonate. Contains 40 percent protein.
Malt food (C F T R I)	Cereal malt, low fat groundnut flour and roasted Bengal gram flour (40:40:20) fortified with vitamins and calcium salts. Contains 40 percent protein.
Supplementary food (NIN)	Roasted wheat flour, green gram flour, groundnut, sugar or jiggery.(30:20:8:20). Contains 12.5 percent protein.
Win food (Gandhigram Rural Institute)	Pearl millet, green gram dal, groundnut flour and jaggery. (50:15:25:25). Contains 20 percent proteins.
Amutham	Rice flour, ragi flour, Bengal gram flour, sesame flour, groundnut flour and jaggery. (15:15:15:10:10:25). Contains 14 percent proteins.
Poshak	Cereal (wheat, maize, rice or jowar) pulse (chana dhal or green gram dhal) and oil seed (groundnut) and jaggery. (4:2:1:2).
Kerala Indigenous Food. (KIF)	Tapioca, Bulgar wheat and groundnut. (25:50:25).



2.3.9 Foods to omit

Concentrated sweets, including baby food “desserts”, have no place in an infant’s diet. They convey no nutrients to support growth, and the extra food energy can promote obesity. Canned vegetables are also inappropriate for infants, as they often contain too much sodium. Honey and corn syrup should never be fed to infants because of the botulism. Infants and even young children cannot safely chew and swallow popcorn, whole grapes, whole beans, hard candies and nuts; they can easily choke on these foods, a risk not worth taking.

SOME INTRESTING FACTS ABOUT INFANTS

- When baby is born their hearing isn’t 100% up to par. There is still of fluid which tends to impair somewhat they are able to recognise is this sound of mother’s voice. They respond to this sound above all others.
- They may cry a lot but the fact of matter is new born babies don’t shed tears! Although the tear ducts and glands are working, they produce just enough to lubricate and protect the babies Eyes. Look for those teardrops to start flowing between 1 and 3 months.
- Since adults are so much taller and wider than a baby you are naturally assume they have more bones right?
- Wrong! Baby is born but 270 bones and by the time he reaches adulthood the number drops to 206! Reason for the loss of bones is due to the fusion of spine and skull as baby grows.
- New-born babies are very near sighted and their vision only allows them to see people and objects that are clear rest when they are within 8 to 12 inches away.

Government Schemes for pregnant and lactating women*

Tamil Nadu government in a move to provide optimal nutrition for pregnant and lactating women, the Tamil Nadu government is all set to increase the benefits given under Dr Muthulakshmi Reddy Maternity Benefit Scheme by ₹5,000. The cash assistance being provided to pregnant mothers under Dr Muthulakshmi Reddy Maternity Benefit Scheme is being further enhanced to ₹18,000 from ₹12,000, said state health department officials. The new guidelines are under process to allot ₹18,000 along with revised nutrition programmes under the scheme. The financial aid of ₹12,000 was being given in three instalments (₹4000) for pregnant women aged 19 years or more on conditional release and restricted for first two deliveries only. However, the conditional release is being updated coupled with new nutrition plans and is likely to be implemented in April, said public health director Dr K Kolandaisamy. Every pregnant woman below poverty line who avails all required antenatal services during pregnancy in concerned primary health centre can benefit from the scheme. Mothers who deliver in government institutions and complete immunization for the child up to third dose of vaccinations under universal immunization programme are given the cash assistance. Other conditions are being upgraded and will be implemented shortly, state health department officials. The registration of pregnant women is mandatory with the ‘Pregnant and Infant Cohort Monitoring and Evaluation (PICME)’ portal that generates a 12-digit ‘Reproductive and Child Health’ (RCH) ID number and the entries to avail the benefit can be done only for the mothers having PICME number with her during delivery. A total of 25,698 pregnant women received cash assistance of ₹21.76 crore under Dr Muthulakshmi Reddy Maternity Benefit Scheme in the last two years in the districts of Tamil Nadu government.

*Refers to (NOT FOR EXAMINATION).



SUMMARY

- ❖ A whole new life begins at conception. Organ system develop rapidly, and nutrition plays many supportive roles. Maternal nutrition before and during pregnancy affects both the mother's health and the infant's growth.
 - ❖ All pregnant women must gain weight. Maternal weight gain during pregnancy correlates closely with infant birth weight, which is a strong predictor of the health and subsequent development of the infant.
 - ❖ Nausea, constipation, heartburn, and food sensitivities are common nutrition related concerns during
- pregnancy. A few simple strategies can help alleviate the discomforts.
- ❖ Lactation is an automatic physiological process that virtually all mothers are capable of doing. Most lactating women can obtain all the nutrients they need from a well-balanced diet.
 - ❖ Breast milk excels as a source of nutrients for the young infants. Its unique nutrient composition and protective factors promote optimal health development throughout the first year of life.

A-Z

GLOSSARY

Amenorrhea	It is the temporary or permanent absence of menstrual periods.
Anencephaly	It is the absence of a major portion of the brain, skull, and scalp that occurs during embryonic development.
Cerebrovascular stroke	A stroke occurs when the blood supply to part of your brain is interrupted or reduced depriving brain tissue of oxygen and nutrients. Within minutes, brain cells begin to die.
Caesarean delivery	A surgically assisted birth involving removal of the foetus by an incision into the uterus, usually by way of the abdominal wall.
Down syndrome	A genetic abnormality that causes mental retardation, short stature, and flattened facial features.
Foetal alcohol syndrome (FAS)	The cluster of symptoms seen in an infant or child whose mother consumed excess alcohol during pregnancy, including retarded growth, impaired development of the central nervous system and facial malformations.
Hypocalcaemia	A condition in which the blood has too little calcium.
Hypoplasia	Underdevelopment or incomplete development of a tissue or an organ.
Low birth weight (LBW)	A birth weight of 2500gms or less, indicates probable poor health in the new-born and mother during pregnancy.



Spina bifida

One of the most common types of neural tube defects characterised by the incomplete closure of the spinal cord and its bony encasement.

Toxaemia

An abnormal condition of pregnancy characterised by hypertension and oedema and protein in the urine.



Evaluation

I. Choose the correct answer

1. The total plasma volume in a non-pregnant women averages _____ ml.
(a) 2500 (b) 2600
(c) 2800 (d) 3000
2. A healthy women gains an average weight about _____ kg during pregnancy.
(a) 11-13 (b) 14-15
(c) 1-12 (d) 11-15
3. Consumption of non-food items like laundry starch, ice cubes are clay is called _____.
(a) oedema (b) heart burn
(c) pica (d) nausea
4. _____, dieting is hazardous during pregnancy.
(a) exercise (b) weight loss
(c) over eating (d) yoga
5. _____ stimulates milk production.
(a) oxytocin (b) prolactin
(c) progesterone (d) oestrogen.

II. Short answers

1. What is the role of placenta during pregnancy?
2. Suggest some ways to overcome nausea and vomiting during pregnancy?
3. What is meant by pica?
4. Write the minerals requirement for lactating mother?
5. Write short notes on Colostrum?

III. Brief answers

1. Write briefly about the weight gain during pregnancy?
2. Write about the effects of undernutrition on the mother during pregnancy?
3. Smoking and chewing tobacco exerts harmful effects during pregnancy. Give reasons.
4. Explain Hormonal control of lactation.
5. Write the practice incompatible with lactation?
6. Write briefly about colostrum?
7. Write about the immunological benefits of breast milk?



IV. Detailed answers

1. Write in detail about the physiological changes during pregnancy?
2. Explain the need of weight gain during pregnancy?
3. Write the effects of malnutrition on the foetus?
4. Suggest a diet for pregnant mother to avoid constipation?
5. Write the nutritional requirement during lactation?
6. Explain the process of stimulation of milk production?
7. Write the types of supplementary foods?



NUTRITION DURING PRE SCHOOL, SCHOOL AGE AND ADOLESCENCE

Unit 3

OBJECTIVES

At the end of this lesson, the student will be able to

- Understand the growth and development associated with the different phases of life like the preschool, school age and adolescence.
- Understand the different nutritional factors that may affect the growth and development during preschool, school age and adolescence.
- Understand the nutritional requirements and nutrition related problems during preschool, school age and adolescence.



Parents look forward to being proud of strong, healthy, competent and happy sons and daughters. To grow and to function well in this adult world, children need a solid background of sound eating habits. Desirable food behaviors for a lifetime have their beginnings in childhood and adolescence. Nutrient needs change steadily throughout life into old age, depending on the rate of growth, gender, activities and many other factors.

3.1 Preschool Age

Early childhood is a stage in human development which includes toddlerhood (1-2 years) and preschool age(3-5 years). An

infant grows rapidly, doubling its birth weight by 5 months and triples 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. After the age of one year a child's growth rate slows but the body continues to change dramatically. At age one, infants have just learned to stand and toddle; by two years they can take long strides with solid confidence and are learning to run, jump and climb.

Preschoolers are curious about everything that they see and hear. This is a great time for caregivers, both parents and teachers, to mold the children's minds and encourage them to use their creativity and imagination

3.1.1 Nutritional requirements of Preschool children

During this stage, children need vital nutrients for their brain to grow properly and the foundation for a healthy lifestyle should be laid during the preschool age.



The RDA for a preschool child (1-6 years) is given in Table 3.1

Table 3.1 ICMR recommended dietary allowances for pre-school children

Nutrient	Years	
	1-3	4-6
Weight (Kg)	12.9	18.0
Energy (kcal)	1060	1350
Protein (g)	16.7	20.1
Fat (g)	27	25
Calcium (mg)	600	600
Iron (mg)	9	13
Vitamin A (μ g)	400	400
Beta carotene (μ g)	3200	3200
Thiamine (mg)	0.5	0.7
Riboflavin (mg)	0.6	0.8
Nicotinic acid (mg)	8	11
Pyridoxine (mg)	0.9	0.9
Ascorbic acid (mg)	40	40
Folic acid (μ g)	150	150
Vitamin B12(μ g)	0.2 to 1	0.2 to 1

Source: Dietary Guidelines for Indians - A Manual by Kamala Krishnaswamy, B. Sesikeran (Second Edition 2011), NIN, ICMR

Energy

The energy requirements of toddlers and children vary greatly based on differences in growth rate and level of physical activity. Insufficient food intake during this stage will not only result in under nutrition in terms of inadequate weight gain but will also hinder growth.

Protein

Protein is the primary component in many body tissues. Proteins build, maintain and restore tissues in the body such as muscles and organs. As a child grows and develops, protein is a crucial nutrient needed to provide

optimal growth. Protein intake should be 1.5 to 2 g/kg body weight.

Fat

Until the age of three years, dietary fat plays a role in brain development. Fat comprises approximately 60% of the central and peripheral nervous system that essentially control, regulate and integrate every body system; thus it is essential that growing toddlers obtain adequate fat from their diet. A diet consisting of 30% of total calories from fat will help the child to meet their daily calorie and nutrient requirements for growth.

Vitamins

Vitamin A is essential to support rapid growth and to help combat infections. Inadequate intakes of vitamin A may lead to vitamin A deficiency which can cause visual impairment in the form of night blindness and may increase the risk of illness and death from childhood infections, including measles and those causing diarrhea. Milk, eggs, carrots and green leafy vegetables should be included in the diet of the child. Vitamin C is important for the child's general health and immune system. It can also help their body absorb iron. Good sources of vitamin C include oranges, kiwi fruit, strawberries and tomatoes.

Minerals

Calcium is the principle mineral required by the body for the process of bone mineralization. Toddlers and young children have an increased need for calcium to promote the rapid bone growth and skeletal development that takes place during these early years of life. Around 600 mg of calcium per day is required during this age. Milk is the best source of calcium. Hence the diet of a preschool child should include 1-2 glasses of milk per day.



During periods of rapid growth the body's need for iron increases. Children 6- 24 months old are at the greatest risk of irreversible long-term consequences of iron deficiency like impaired physical and mental development. To meet this increased demand for iron, iron rich foods like rice flakes, dates, egg yolk and greens should be included in the diet.

3.1.2 Diet for the preschool child

The nutritional requirements of the child cannot be satisfied apart from an understanding of behavioral changes that occur. Toddlers begin to show independence and to assert themselves. They are alert to the attitudes of others and readily learn that they can use food as a weapon to gain attention. They mimic siblings and parents. They have short attention span and are easily distracted from eating. Their response to food is often inconsistent

Dietary guidelines for a preschool child

- The diet of the preschoolers should be adequate in quantity and quality of different nutrients. In addition to the amount of milk recommended, the preschool child should have two small servings of protein-rich foods like eggs and other non-vegetarian foods like pulses, paneer or cheese.
- When the child is about 18 months old finger foods such as carrots can be given.
- Proper elimination is usually maintained by a daily diet of fruits, vegetables and whole grain products.
- The diet should include a wide variety of foods. The child who is taught to eat everything on his plate is much more likely to enjoy optimal health than the one who picks and chooses
- Their food intake will improve if the food is interesting and attractive. e.g. chapathis, puris can be made into shapes or can be

served in attractive plates. Flavour or colour of the milk can be changed to encourage the child to drink milk.

- Foods should be slightly seasoned so that they taste better and the child takes it well.
- Food preferences of the child should be taken into consideration.
- Child should never be forced to eat more than he can take.
- The person feeding the child should not show any dislike of the food in front of the child.
- The child should never be hurried while taking the food. The atmosphere should be pleasant and lacking distraction
- Regularity of meal times is essential
- Unripe bananas and fruits should not be given as they are difficult to chew and may choke the child.

3.1.3 Common feeding problems in children

Avoidant/Restrictive Food Intake Disorder is a common eating disorder experienced by young children. Children with this disorder experience a disturbance in their eating which can include a lack of interest in food or a sensory aversion to certain foods

- Eating only certain types of foods
- Refusing vegetables
- Refusing to chew
- Taking a long time to eat and keeping food in the mouth (rumination)
- The toddler/child wants to choose his own food.
- **Pica** is a type of condition where a child might eat non-food or non-nutritional substances persistently. These substances often include dirt, soap, chalk, sand, ice, and hair.

These aversions and restrictions can lead to weight loss and nutritional deficiency among young children.



Picky eaters are very selective about what they eat. They have a fear of new foods called “food neophobia”, which is generally defined as the reluctance to eat, or even taste new foods. Children with neophobia often reject many ‘new’ foods.

3.1.4 Tips for feeding Picky or Fussy eaters

Get them involved
Children are more likely to try foods when they feel a sense of ownership. Include them in meal planning, grocery shopping and food preparation
Be Creative
Serve vegetables as finger foods with dips Use cookie cutters to cut fruits and vegetables into fun shapes Serve traditional meals out of order (for example, breakfast can be served for dinner)
Enhance Favorite Recipes
Blend, slice or shred vegetables into soups, pancakes, muffins or dosai Serve fruit with yoghurt or ice cream
Be a Role Model and Share
Be a role model to children by eating healthy foods yourself. Children may need multiple exposures to new food before they accept it, so do continue offering foods that a child initially rejects
Respect and relax
Children tend to eat sporadically. They have small stomachs and so tend to fill up fast and become hungry again soon after eating. Focus on the child’s overall weekly intake of food and nutrients rather than on daily consumption

3.1.5 Nutrition related problems in pre-school children

Malnutrition is harmful in children as it retards their physical growth and may cause mental disabilities. Deficiency of calorie and proteins may trigger a wide range of pathological conditions in the children. Protein Energy Malnutrition (PEM) is the most common nutritional disorder among children. About 1-2 percent of preschool children suffer from protein energy malnutrition like Kwashiorkor and Marasmus. This is the reason why parents should insist that children drink milk; eat pulses and other sources of proteins.

PEM can affect all age groups but it is more frequent among infants and young children whose rapid growth increases nutritional requirement

Marasmus

- The term marasmus is derived from the Greek work marasmus, which means **withering or wasting**
- Marasmus is a form of severe protein-energy malnutrition characterized by energy deficiency and emaciation.
- Marasmus usually develops between the ages of six months and one year in children who have been weaned from breast milk or who suffer from weakening conditions like chronic diarrhoea.
- marasmus is characterized by stunted growth and wasting of muscle and tissue
- A typical case of marasmus can be described as **bonny cage** having nothing but “skin and bones”

Causes of Marasmus

- Seen most commonly in the first year of life due to lack of breast feeding and the use of dilute animal milk.
- Poverty or famine and diarrhoea are the usual precipitating factors



- Ignorance and poor maternal nutrition are also contributory factors
- Inadequate food intake
- Vitamin deficiencies
- Chronic starvation

Symptoms of Marasmus

- severe growth retardation
- extreme emaciation
- old man's or monkey's face
- loose hanging skin folds over arms and buttocks
- sunken eyes
- wrinkled skin
- temperature is subnormal
- loss or wasting of muscles,
- ribs become prominent, projected ribs
- digestion becomes weak
- body growth and development slows down.

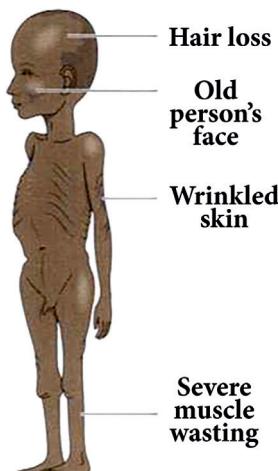


Fig 3.1 Symptoms of Marasmus

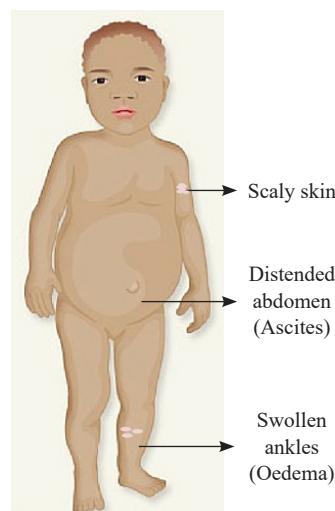


Fig 3.2 Symptoms of kwashiorkor

Causes

Kwashiorkor is most common in areas where there is:

- famine
- limited food supply
- delayed complementary feeding
- protein deficient diet
- infections

Symptoms

The three essential manifestation or signs of kwashiorkor are edema, growth failure and mental changes; in addition there may be changes in hair and skin.

The symptoms of this disease are

- enlargement of liver due to fatty infiltration,
- oedema due to water accumulation
- darkening of the skin with scaly appearance,
- hair becomes reddish-brown,
- legs become thin, and
- retardation of physical as well as mental growth

Eating a protein-rich diet that consists of milk, meat, groundnut, soyabean, jaggery can help in the treatment of kwashiorkor.

Kwashiorkor

Kwashiorkor refers to an **inadequate protein intake with reasonable calorie (energy) intake**. This leads to decreased synthesis of visceral proteins. Kwashiorkor usually occurs at the age of about 12 months when breastfeeding is discontinued, but it can develop at any time during a child's formative years.



Vitamin A deficiency in Children

Vitamin A deficiency (VAD) is a serious health problem among children in many developing or low-income countries. In fact, 250 million children across the world suffer from VAD. It could even result in death when left untreated.

There are many animal sources (liver, whole milk, cheese, eggs, and oily fish) and plant sources (colorful fruits and vegetables as well as greens) of vitamin A. When we don't eat enough of these foods, VAD sets in, leading to various diseases. VAD can also be triggered by inefficient storage, transport, and absorption of vitamin A.

Vitamin A deficiency leads to xerophthalmia which covers a wide range of eye problems like

- Night blindness** is an early symptom of Vitamin A deficiency. When vitamin A is deficient, the formation of rhodopsin is impaired giving rise to night blindness. Children with night blindness are unable to see in poor light condition /darkness.
- Bitot's spot**- Bitot's spots are whitish deposits on the thin lining of the lower eyelid. They are usually spotted in children aged 3–6 years.



Fig 3.3 Bitot's spot

Without sufficient vitamin A, the conjunctiva becomes dull and dries (conjunctival xerosis). This leads to the buildup of keratin protein in the eye, manifesting as dry, triangular lesions with a foamy appearance called Bitot's spots.

If the symptoms of Bitot's spots are not addressed by treating vitamin A deficiency it can affect the cornea of the eye. Cornea is the clear front portion of the eye that allows light to enter and which is partially responsible for our eyes' ability to focus. Corneal xerosis is a drying up of the eyes. With corneal xerosis, the tear glands in the eye malfunction and no longer produce tears and mucus to keep the eye surface moist.



Wrinkling and dark colouring of the conjunctiva on one side, cornea dry and dull (Xerosis)

Fig 3.4 Corneal Xerosis

The cornea then becomes dry and hazy and takes on a parched appearance. It is also more prone to infections at this stage.

Prevention of Vitamin A deficiency

Eat foods which are rich in Vitamin A. Milk, egg, fish oil etc. are rich in vitamin A. Leafy vegetables like various types of greens, vegetables like carrot and fruits like papaya and mango are good sources of vitamin A. Liver, cod liver oil, butter and ghee also provide vitamin A

Based on research conducted by National Institute of Nutrition, Hyderabad, one spoon of Vitamin A syrup to children of 1-5 years age group once in 6 months also prevents vitamin A deficiency to certain extent.

When the children are given Vitamin A syrup once in six months up to five years of age, Vitamin A gets retained in the liver and is available in sufficient quantities till the next