



NAHEP
Component 2



Normal And Therapeutic Nutrition

Lesson 2

Maternal Nutrition

Content

DESIGNED AND DEVELOPED UNDER THE AEGIS OF
NAHEP Component-2 Project "Investments In ICAR Leadership In Agricultural Higher Education"
Division of Computer Applications
ICAR-Indian Agricultural Statistics Research Institute

Course Name	Normal and Therapeutic Nutrition
Lesson 2	Maternal Nutrition
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Objectives:

- To gain insights about the physiological changes during pregnancy.
- To understand the concept of growth of foetus during pregnancy.

Definitions

- **Pregnancy:** Pregnancy is the term used to describe the period in which a fetus develops inside a woman's womb or uterus. Pregnancy usually lasts about 40 weeks, or just over 9 months, as measured from the last menstrual period to delivery.
- **Trimester:** The total period of pregnancy is divided in three trimesters i.e. first trimester (week 1 to week 12), second trimester (week 13 to week 28), third trimester (week 29 to week 40).

Pregnancy and lactation are two stages of life when an adult women's needs are increased. She has the responsibility of supporting the growth of foetus internally during nine months of pregnancy and later externally by nursing the infant. Since the growth need at the commencement of life are crucial, good nutrition is a must for the expectant and nursing mother.

PREGNANCY

- Is a greatest physiological stress but not a pathological state
- Is most common major alteration of normal biological life process
- Is an altered physiological and metabolic change in mother because of growing foetus. Therefore, there is altered nutritional requirements.
- There is a need for specific health and dietary care.

Impact of mother's nutritional status on foetus

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

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- Poor stores of nutrients in pre and early pregnancy leads to formation of a small placenta.
- Small placenta causes inability to draw maximum nutrients from mother.
- Better nutrient intake later-on will not alter the placental size. Therefore the new born will be small in size and weak.
- If the new born is a girl, she will be undernourished, unable to achieve her full potential growth and unable to achieve her full pre pregnancy nutritional status will have an impact on future generations to come. Therefore maternal nutrition directly contributes to the well-being of mother and child, Mother should be of normal weight at the time of conception.
- Pregnancy starts from time of conception and lasts for 40 weeks.
- Upto 8th week of life it is the fertilized ovum is called as embryo. Upto 8 weeks after its conception, a human embryo develops from an ovum into a foetus. The next 30 weeks the incomplete foetus continues to develop. When its body is finally mature enough at about 38-40 weeks after conception, the infant is born. During pregnancy, the mother nourishes the foetus through placenta, an organ that forms in her uterus to accommodate the growth and development of the foetus.
- The placenta is the organ through which nourishment flows to the foetus.

The three trimesters:

First trimester:

- The most critical time for foetal development is during the first trimester. Most of the miscarriages/ premature termination of a pregnancy can occur at this time. Currently, about one-third of all pregnancies lead to miscarriage, often so early that a woman does not even realize she was indeed pregnant.

- The foetus develops so rapidly during the first trimester that if an essential nutrient is not available, the foetus may be affected even before the deficiency appears in the mother. Though some women lose appetite and feel nauseative during the first trimester, adequate nutrition is extremely important

Second trimester

- By the beginning of the second trimester, arms, hands, fingers, legs, feet and toes are fully formed. The foetus has ears and begins to form tooth sockets in its jawbone. The foetus begins to look more like a baby.

Third trimester

- After about 28 to 30 weeks of gestation, an infant born prematurely (before 37 weeks of gestation) has a good chance of survival if it is cared for in a nursery for high- risk new-borns. However, the infant will not contain the mineral and fat stores normally accumulated during the last month of gestation. This and other medical problems, such as a poor ability for sucking and swallowing, complicate nutritional care for prematurely born infants.

Physiological Adjustment during Pregnancy

Changes in the mother's body

- Mother establishes some nutrient reserves to help her later
- All vital organs in mother's body increase activity
- All changes are controlled by hormones

The various physiological adjustments are briefly discussed below :

Energy Metabolism: BMR increases during pregnancy resulting in increased demand for the energy. BMR increases by 5% in 1st trimester and 12- 15 % in 2nd & 3rd trimester.

- *Alimentary Functions:* There is some evidence of reduced gastric tone, motility and secretion. Nausea and constipation are commonly observed. The efficiency of absorption of calcium, iron, vitamin B₁₂ and other nutrients is increased.
- *Renal function:* The glomerular filtration rate is considerably increased in pregnancy, as are the clearances of several substances such as creatinine, urea, uric acid etc. The rate of excretions of water is very high in mid-pregnancy and very low in advanced pregnancy.
- *Blood Composition:* The plasma volume increases on an average by about 50 per cent and the red cell mass by about 20 per cent. The concentration of haemoglobin and the packed cell volume usually fall despite the absolute increase in total haemoglobin.
- *Water Balance:* The Total body water may increase by as much as seven litres and in the late pregnancy; the kidney may have some difficulty in disposing of the surplus water ingested.

Weight gain:

- It is better to start pregnancy when the women's BMI is between 20 – 26 because maternal and foetal complications occur at both extremes.
- Consumption of non-food items like laundry starch, ice cubes or clay is called PICA. It is a temporary phenomenon that disappears after pregnancy.
- Normal pregnancy is associated with a weight gain of 11- 13kgs. Indian woman from poor rural areas gain only 5- 7 kgs of additional weight.

Increase in weight is due to

- Weight of foetus ----- 3,300g
- Weight of placenta ----- 650g
- Increased uterine & mammary tissues ----- 450g

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- Water retention decreased extra cellular fluid 1000g, amniotic fluid- 800g
- Increased blood volume ----- 1250g
- Fat stores of mother ----- 4000g

Most of the weight gain is during second and third trimester

- 10 weeks ----- 650g
 - 20 weeks ----- 4000g
 - 30 weeks ----- 8500g
 - 40 weeks ----- 12500g
-
- Low weight gain leads to delivery of low birth weight baby
 - Less than 50% of normal weight gain is said to be low weight gain. This may be because of excessive heavy work or inadequate calorie intake.
 - Whereas excessive weight gain is increase in additional weight of more than 50% of normal. It may result in excessive fat & fluid accumulation
 - Obesity during pregnancy may lead to certain complications
 - Foetus is likely to be overweight & large. Therefore, it becomes difficult for delivery.
 - No dieting is recommended for overweight women in the last weeks of pregnancy.

NUTRITIONAL REQUIREMENTS OF PREGNANCY

LECTURE 2

Objectives:

- To get understanding about the increased need of pregnancy during pregnancy.
- To bring awareness about the nutritional requirements during pregnancy.

Definitions

- **Nutritional requirement:** The amounts of various nutrients required by an organism to sustain healthy life. It depends on age, sex, physiological needs, physical activity, climate etc.
- **Estimated Average Requirement (EAR):** Refers to the average daily nutrient intake level estimated to meet the requirements of half of the healthy individuals in a particular life stage and gender group. It is used primarily to evaluate populations or groups.
- **Recommended Dietary Allowance (RDA):** Refers to the daily dietary nutrient intake level that is sufficient to meet the nutrient requirements of nearly all (97–98 percent) healthy individuals in a particular life stage and gender group. This is derived from the EAR as the mean plus 2 standard deviations (SD) of the distribution of requirements. The term is used to primarily evaluate individual diets. The RDA is inappropriate for dietary assessment of groups as it is the intake level that exceeds the requirement of a large proportion of individuals within the group.

Nutritional Requirements during Pregnancy

The requirements of various nutrients during pregnancy are briefly discussed below:

Energy:

- The Indian Council of Medical Research (2020) recommends an increase of 350 Kcals which considers additional energy needed to support the growth of the foetus, placenta and maternal tissues, as well as to meet the increased metabolic rate.
- ICMR recommended energy requirement of pregnant woman is as follows:

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- Sedentary worker ----- 1660 + 350 = 2010 kcal/ day
- Moderate worker ----- 2130 + 350 = 2480 kcal/ day
- Heavy worker ----- 2720 + 350 = 3070 Kcal/ day

Protein:

- Additional protein is necessary for growth of the foetus, new maternal tissues and to prepare the mother for lactation.
- The ICMR (2020) recommends additional intake of 17.6g per day during the second half of pregnancy. The safe level of intake in terms of high-quality protein during the 2nd and 3rd trimesters is 7.6 and 17.6g respectively.

Additional protein essential for:

- Rapid growth of the foetus
- The enlargement of the uterus, mammary glands and placenta
- Increased maternal blood circulations and subsequent demand of increased plasma protein to maintain colloidal osmotic pressure and circulation of tissues fluid.
- Formation of amniotic fluid and storage reserve of labour, delivery and lactation.
- The transfer of amino acids from the mother to foetus.

If protein requirements are not met during pregnancy:

- There is increased risk of complications of pregnancy
- Foetus may grow at the expense of mother
- Maximum growth of baby cannot be obtained
- Number of cells in tissues particularly in brain may not be normal.

Milk, meat, egg and cheese are complete proteins with high biological value. Additional protein may be obtained from legumes and whole grains, nuts and oil seeds.

Fats and Essential Fatty Acids:

- ICMR Expert Committee has suggested an intake of 30g of visible fat/day during pregnancy to meet essential fatty acid requirement. This level of fat intake would also provide necessary energy density of 20% of energy to the diet.
- **Calcium:**
- During pregnancy additional calcium is needed for growth and development of bones as well as teeth of the foetus.
- ICMR (2020) has recommended a total of 800mg of calcium which takes care of the total calcium needs of the mother and the additional needs of pregnancy.
- A full-term foetal body is made up of 30g of calcium. If these requirements are not fulfilled, then the mother's bones is mobilised resulting in demineralisation of maternal bones leading to easy fractures.

Increased intake of calcium is highly essential for:

- Calcification of foetal bones and teeth
- For protection of calcium depletion from mother to meet high demands during lactation
- Mother's diet should contain less of phytic acid, adequate amount of vitamin D and sufficient amount of calcium to prevent 'Osteomalacia' and muscular cramps. Mother should avoid repeated pregnancies.
- Adequate milk and other dairy products and green leafy vegetables should be consumed (supplements if necessary).

Zinc:

- Zinc has an important role to play in pregnancy
- Apart from being a component of several enzyme systems it participates in the synthesis of nucleic acids – DNA and RNA highlighting its significance in the process of reproduction
- Recent studies indicate that deficiency of zinc affects adversely the course and outcome of pregnancy
- ICMR (2020) has recommended an intake of 12 mg/day of zinc in pregnancy.

Iron:

- Iron is needed for the additional volume of blood and other tissues formed during development of foetus.
- The store for iron is built during prenatal period, because milk, the infant's main food during first three to four months is deficient in iron.
- Normal iron requirement of an adult woman is 15 mg/day. ICMR (2020) has recommended 32 mg of iron per day during pregnancy

The increase in iron during pregnancy is due to:

- Infants are generally born with high Hb levels of 18-22 g/100ml of blood. Iron stores in the liver of the infant lasts from 3-6 months. Iron is also required for growth of foetus and placenta. To achieve these levels mother transfer 240 mg of iron to the foetus during gestation.
- It is also required for the formation of Hb as there is 40 - 50% increased maternal blood volume. For this 400mg of iron is required.
- Loss of maternal iron through skin and sweat is about 170 mg of iron.

Sodium:

Normal adult women's requirement of sodium should be maintained to prevent any defective disorders and deficiency.

1. During pregnancy there is increase in the extra cellular fluid which calls for an 80% increase in the body sodium. Restriction in the diet can cause a several hormonal and biochemical change.
2. When blood sodium levels drops, kidney produces the hormones renin, as a result of which the sodium that is needed for use by the body is retained.
3. When the system is over taxed it can result in sodium deficiency causing an increased risk of eclampsia, prematurity and low birth weight of infants.
4. In case of oedema and hypertension sodium is restricted.

Iodine:

- Due to increase in BMR, iodine requirement are enhanced.
- ICMR (2020) has recommended an intake of 180 µg /day of iodine in pregnancy.
- Iodine deficiency in mother can lead to abortion, still birth, congenital anomalies, increased perinatal mortality, cretinism and psychomotor defects.

Other nutrients:

Estimated Average Requirement (EAR) of other nutrients during pregnancy are as follows

SI. No.	NUTRIENT/day	Normal woman	Adult	Pregnant woman
1.	Vitamin A (µg)	390		406
3.	Thiamine (mg)			
	Sedentary	1.1		
	Moderate	1.4		1.6
	Heavy	1.8		

4.	Riboflavin (mg)		
	Sedentary	1.6	2.3
	Moderate	2.0	
	Heavy	2.6	
5.	Niacin (mg)		
	Sedentary	9	+2
	Moderate	12	+2
	Heavy	15	+2
6.	Pyridoxine (mg)		
	Sedentary	1.6	1.9
	Moderate	1.6	
	Heavy	2.1	
7.	Ascorbic acid (mg)	55	+10
8.	Folic acid (µg)	180	480
9.	Vitamin B12 (µg)	2	+0.2
10	Vitamin D(IU)	400	400

The recommended intake of folic acid is based on its role in promoting normal foetal growth and preventing macrocytic anaemia of pregnancy. Folic acid is needed for the synthesis of essential components of DNA and RNA which increase rapidly during growth thereby increasing the requirements. Folic acid also is essential for the maturation of RBC s which must increase as the mothers blood volume increases.

Impact of nutritional deficiency on pregnancy

Nutrient	Impact of deficiency on the	
	Mother	Infant
Energy and protein	<ul style="list-style-type: none"> • Abortion • Complications during delivery • Ketosis • May not gain enough weight to have normal lactation • Pregnancy induced hypertension 	<ul style="list-style-type: none"> • Premature infant • Low birth weight infant • Less brain cells
Linoleic Acid		<ul style="list-style-type: none"> • Retarded foetal growth
Calcium	<ul style="list-style-type: none"> • Muscular cramps • Repeated pregnancy with poor diet can result in osteomalacia • During lactation breast milk may be deficient in calcium 	<ul style="list-style-type: none"> • Calcification of bones and teeth is decreased • Underweight due to the decreased foetal bone growth.

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Iron	<ul style="list-style-type: none"> • Hypochromic microcytic anaemia. • Complications during delivery 	<ul style="list-style-type: none"> • Born with less stores of iron and susceptible to anaemia.
Iodine	<ul style="list-style-type: none"> • Goitre • Increased risk of miscarriage and still birth 	<ul style="list-style-type: none"> • Chance of getting goitre • Cretinism
Zinc	<ul style="list-style-type: none"> • Foetal mortality • Foetal malformations including central nervous system and teratogenicity 	<ul style="list-style-type: none"> • Reduced intra uterine growth rate • Low birth weight • Preterm baby
Vitamin A	<ul style="list-style-type: none"> • Mortality • Pregnancy induced hypertension 	<ul style="list-style-type: none"> • Decreased levels in foetus so more susceptible for Vitamin A deficiency
Vitamin D	<ul style="list-style-type: none"> • Decreased calcium absorption 	<ul style="list-style-type: none"> • Calcium metabolism of foetus is affected

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Vitamin K	<ul style="list-style-type: none"> • Decreased prothrombin synthesis • Increased loss of blood during delivery 	<ul style="list-style-type: none"> • Increased risk of neonatal haemorrhage
Thiamine, Riboflavin and Niacin	<ul style="list-style-type: none"> • Deficiency symptoms 	
Folic acid	<ul style="list-style-type: none"> • Megaloblastic anaemia • Abruption placentae • Pregnancy induced hypertension 	<ul style="list-style-type: none"> • Foetal malformation • Neural tube defects spina bifida congenital abnormalities like harelip, cleft palate, hydrocephalus • Low birth weight
Vitamin B 12	<ul style="list-style-type: none"> • Pernicious anaemia 	<ul style="list-style-type: none"> • Premature baby
Vitamin C	<ul style="list-style-type: none"> • Premature rupture of foetal membrane 	<ul style="list-style-type: none"> • Increased neonatal death rate

LACTATION

LECTURE 3

Objectives:

- To gain insights about the physiological changes during lactation.
- To understand the importance of lactation.

Definitions

- **Lactation:** Lactation is the process of milk secretion from the mammary glands of a mother soon after childbirth. The milk, thus produced provides nutrition and immunity to the young one. Galactopoiesis is the stage that maintains milk production and requires prolactin and oxytocin
- **Colostrum:** A sticky white or yellow fluid secreted by the breasts during the second half of [pregnancy](#) and for a few days after birth, before [breast milk](#) comes in. It is high in protective antibodies that boost the [new born](#)'s immune system.

LACTATION

Though lactation is a normal physiological process, it makes considerable nutritional demands on the mother. The physiological developments for lactation begins during the later part of pregnancy. Apart from the growth and development of mammary glands, energy reserves are laid down in the form of fat in the body of the mother and this may become available in part to provide the extra energy during lactation.

Physiology of Lactation

- With the onset of puberty and during adolescence, there is an increased secretion of estrogenic hormones which begin to prepare the breasts for lactation.
- During pregnancy, further production of tremendous quantities of estrogens by the placenta bring about a rapid development of the glands in the breasts.

- Large quantities of progesterone change the glandular cells into actual secreting cells, by the time the baby is born, the breasts reach a degree of development capable of producing milk.
- When the baby is put to the breast, the suckling sensation causes nerve impulses to pass from the nipples to the breast and up the spinal cord to the hypothalamus which controls the lactogenic hormone production.

Composition of Breast Milk

- Mother's milk is not only nutritionally adequate but also easy to digest, particularly for the new-born.
- The milk secreted in the first few days, however differs in appearance and composition from the milk secreted later. Small quantities of thick, yellowish viscous fluid known as colostrum are secreted by the mother. Colostrum is rich in antibodies and Vitamin A.
- After a few days of lactation, the mother starts secreting larger amounts of comparatively less viscous and whitish milk known as 'mature milk'

Composition of Breast Milk (ICMR, 2010)

Nutrients	Amount/ 100ml
Energy	65 Kcal
Protein	1.1 g
Carbohydrate	7.4 g
Fat	3.4 g
Calcium	28mg
Iron	Negligible
Vitamin A (Beta carotene)	1120 mcg
Thiamine	0.02 mg
Riboflavin	0.02 mg
Niacin	--
Vitamin C	3mg

Nutritional Requirements of Lactating Mother

Lactating mother's nutritional requirements should meet

1. Her own daily needs
2. Provide enough nutrients in the milk for growing infant
3. Furnish the energy for the mechanics of milk production.

Diet of lactating mother and her nutritional status during pregnancy affects certain extent quality and quantity of breast milk.

Energy:

- The lactating mother needs an additional amount of 600 Kcals. During the first six months of lactating and for the next six months, she requires an additional 520 Kcals. This extra amount can be supplied by whole grain cereals, pulses, milk, curd and its products, fruit juices, soups, vegetables etc.

The additional calorie are required for the following:

Energy content: An average daily milk production for a lactating woman is 680 ml through some women may produce a much as 1000ml. Calorie value of human milk is 70/100 ml. Hence calorie value of 680 ml is 480 calories. The efficiency of conversion of diet calories to milk calorie is 80%. During 7-12 months the milk produced is 580 ml which has a gross energy content of 415 Kcals.

Milk production: The metabolic work involved in producing this amount of milk requires around 570 Kcal for 0-6 months and 510 Kcals for 7-12 months.

Protein:

- The nursing mother needs additional daily intake of 13.6 g for 0-6 months and 10.6 g for 7-12 months. The protein content of human milk is 1.15/100 ml. On an average a mother recreates 680 ml and 580 ml during 0-6 months and 7-12 months of lactation period.
- Assuming a 70% efficiency of conversion of dietary protein into milk protein and a 25% of individual variations, the safe daily intake is calculated.
- This extra protein can be obtained by including protein rich foods like milk and milk products, egg, meat, fish, poultry and cereal pulse combination.

Fat:

- Although the total amount of fat on breast milk is not influenced by the mother's diet, the composition of the milk fat reflects the composition of the mother's diet.
- The requirements of linoleic acid during lactation is 6% of energy. After taking into account the contribution from invisible fat, the visible fat requirement of lactating women is 10% of energy. This supplies a high level of EFA needed. This would correspond to daily intake of 30 g of visible fat.

Calcium:

- Breast feeding is associated with transfer of approximately 200 mg/day of calcium from mother to the infant. Studies demonstrated that the increased calcium demands leads to mobilisation of this important mineral from the mother's skeleton, leading to transient reduction in Bone Mineral Density (BMD) of lumber spine and femoral neck region (4-7 %) during 3-6 months of lactation.
- The increased amount of calcium that is required during gestation for mineralisation of the foetal skeleton is now diverted into the mother's milk production. During lactation 1000mg has been prescribed by ICMR. The retention of dietary calcium in lactating women its about 30%, hence an extra amount of 200 mg is prescribed. About one litre of milk and milk products should be given to lactating mother to meet 1000 mg of calcium.

Iron:

- The iron requirement during lactation is 16 mg/day.
- The baby is born with a 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 of the requirement of the mother and that required to make up the iron lost in breast milk. Since there is amenorrhoea during lactation the basal

requirement will be same as in adult women 14 mcg/kg.

Vitamins:

- Additional need of **Vitamin A** during lactation is calculated on the basis of vitamin A secreted in milk, which is 720 mcg of retinol per day as the quantity of retinol in 680 ml of human milk is 50 mcg.
- **Vitamin D** requirements may be higher during lactation but in the absence of any experimental data, no definite additional intake has been suggested.
- The normal adult women RDA for **Vitamin C** is 55 mg. Assuming a daily milk secretion of 700 ml milk with an ascorbic acid content of 3 mg/100ml by well-nourished women, the additional requirement during lactation is 40 mg. Taking into consideration of the cooking losses (50%) the Expert Committee (2010) recommends an additional intake of 40 mg per day during lactation. Hence lactating mother requires 95 mg of Vitamin C per day.
- **Thiamine, Riboflavin, Niacin, Folic acid, Vitamin B12** lost in milk recreated by the mother is 0.14mg, 0.23 mg, 0.9-1.2 mg, 25 mcg, 0.25-0.3 mcg respectively.
- Intake of these on the basis of additional calorie allowance is
 - Thiamine: 1.7 mg for 0-6 months, 7-12 months,
 - Riboflavin: 2.5 mg for 0-6 months, 2.4 mg for 7-12 months.
 - Niacin: 4 mg for 0-6 months, 7-12 months
 - Folic acid: 280 mcg
 - Vitamin B12: 0.8 mcg
 - Vitamin B6 0.22 mg for 0-6 months, 0.1 6mg 7-12 months.

Nutritional Risk

The lactating women is likely to be at nutritional risk if

- She is under 17 years of age.
- She is economically deprived.
- Her usual diet is nutritionally restrictive or includes unsound nutrition practices.
- She is on a modified diet for chronic systemic disease.

- Her weight is less than 85% of ideal weight.
- She has multiple gestation.
- She has had poor weight gain during pregnancy.
- She has had rapid weight loss while breast feeding.
- She is pregnant while breast feeding.
- She has a history of an eating disorders.

Factors responsible for lactation failure

- Maternal malnutrition.
- Acute maternal illness- fever and dehydration.
- Incomplete emptying- weak sucking by the baby, low birth weight babies, pre term, sick depressed babies and babies with congenital malformation.
- Infrequent feeding, scheduled feeding.
- Short duration of feeds.
- Stress, anxiety, negative influence of environment.
- Engorged breast.
- Sore nipples.
- Lack of confidence.
- Occupation and socioeconomic status.
- Pre lacteal feeds, hospital practice of separating baby and mother.

Factors Affecting Meal Planning of a Lactating Mother

1. Meals are planned according to the nutritional requirements which include needs for the mother and for milk production. A modification of normal basic diet is worked out for a nursing mother. Additional amounts of protein and energy foods are included in this diet. In most regions, it is customary to feed the nursing mother, additional amount of fat (ghee), which supplies energy and vitamin A or some special preparations (Lahia, Ladoos of Methi, mung, garden cress seeds) which contain sources of protein, iron, calcium and vitamin B. Besides, green

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- leafy vegetables and at least two servings of citrus fruit make up the demand of other vitamins.
2. Condiments should be sparingly used, since, apart from being harmful, if used in excess, they may give a flavour to the milk which may be repulsive to the baby.
 3. Besides three large meals, two small in between meals may be planned to meet the increased requirements.
 4. Fluid intake should be adequate to meet the requirements for milk production.
 5. Socio-economic status of the family should be considered, and the selection of food stuffs should be according to the budget of the family e.g. groundnuts, pulses-cereals may be taken instead of meat and milk products for protein sources. Similarly green leafy vegetables may be selected instead of egg and meat products for bringing down the cost of the diet.
 6. Variety should be provided in terms of colour, texture and flavour.
 7. Likes and dislikes of the mother should be taken into consideration.
 8. Age of the mother be taken into consideration. An adolescent mother, who has not completed her own growth, will need additional food for her own growth requirements.
 9. The food should be served in a pleasant atmosphere.
 10. Since some of the medicines can be absorbed into the mother's blood stream and secreted in the milk, use of medication should be under medical supervision.

Assignment:

Visit a pregnant or lactating women. Ask her about the dietary intake and suggest modifications in the diet according to her requirement.

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Lesson 3 INFANCY

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Objective:

- To provide awareness about the growth and development about the infancy
- To gain knowledge and insight about the nutritional requirements of infancy.

Definitions:

- **Infancy:** Infancy is the period from birth of child till first year of life.
- **Nutrient Requirement-** It can be defined as the minimum amount of the absorbed nutrients that is necessary for maintaining the normal physiological functions of the body.

GROWTH AND DEVELOPMENT

- Infancy is the period from birth of child till first year of life.
- Adequate nutrition is very essential during this stage, as the foundation for further growth is laid.
- Infancy is time for rapid growth and development. The body weight of an infant at birth is doubled in about 4 to 5 months and within a year it becomes three times his birth weight.
- There is an increase in the length of an infant from 50 cm at the time of birth to 75 cm within a year i.e. by the first birthday, a child becomes one and a half times longer than what he was at the time of birth,
- Table 1 gives the information of an average growth pattern of an infant.

Table 1: Average Weight and Height Increment during the First Year

Age (months)	Weight increment per week (g)
0-3	200
4-6	150
7-9	100
9-12	50-75

- At birth the child has 75% water and 12-15% fat. By the end of 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.
- Infants have rapid heart rate, 120-140 per minute. At birth the Hb level of a well-nourished infant is 17-20g per 100ml. This provides a reserve for explosion of the blood circulation and adequate oxygen carrying capacity to the growing tissues during 4-6 months.
- The full-term infant is able to digest proteins, emulsified fats and simple carbohydrates such as lactose.
- During the first few months the starch splitting enzymes are not produced at a satisfactory rate and gastric acidity is also low. The stomach capacity of the infant and the ability to digest various food components changes rapidly as the infant grows.
- The brain develops rapidly during foetal life, infancy and early childhood. The increase in the number of brain cells is most rapid during foetal life and 5-6 months after birth. If malnutrition is severe in this period, the number of brain cells are greatly reduced and once the critical period of cell division has passed, adequate diet cannot bring about an increase in cell numbers.
- Kidneys reach their full functional capacity by the end of first 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.

NUTRITIONAL REQUIREMENTS:

- During early infancy, much of nutrient requirements are met through breast milk.
- RDA of infants is based on composition of breast milk.

The requirements of different nutrients are briefly discussed below:

Energy:

- Basal and total energy requirement for infants are higher than adults per unit body weight.
- An adult requires 40 Kcal/kg body weight, whereas infant requires 108 Kcal/ kg body weight
- For a month old infant
 - 50% energy intake is used for basal energy
 - 25% energy for activity, 40% energy for activity (for extremely active child) and
 - 25% energy for growth
- A child who crawls or walks will not gain weight unless additional calories are supplied for proper growth.
- About 70% calories can be met by milk alone and rest of calories have to be supplied by introducing supplementary foods after 6 months.
- The ICMR (2020) recommended that calories allowance for 0 to 6 month old infant 550 Kcals and for 6 to 12 months old 670 Kcals.

Protein:

- Like energy, protein requirements are also higher for infants as compared to adults, due to increased demands for skeletal muscle growth.

Normal and Therapeutic Nutrition

- Protein intake of healthy infants is about 2 gm/ kg body weight.
- Human milk provides all amino acids more than required for proper growth.
- Histidine, a non-essential amino acid necessary for growth and maintenance of infant is present in breast milk.
- Human milk protein is 100% utilized. Protein content of human milk is 1.1 g/ 100ml or 6% of total energy.
- The ICMR (2020) has recommended an intake of 6.7 gm for 0-6 months of age and for 6-12 months as 8.8g.
- Protein requirement/kg body weight decreases gradually during the first 12 months similar to energy requirement.
- If protein and energy requirements are not met, infant suffers from Protein Energy Malnutrition (PEM).
- If excess protein is fed, it is harmful as protein needs to be de-aminated. Infant has a limited capacity to concentrate the waste metabolites as the kidneys are not well developed.

Essential Fatty Acids:

- Linoleic acid is most important essential fatty acid for an infant.
- If infants are fed with less fat, they may develop skin lesions, diarrhoea leading to growth retardation. Supplementation with linolenic acid result in disappearance of symptoms.
- Both cow's and mother's milk satisfy requirement of essential fatty acid.
- Essential Fatty Acid requirements of young children is 3% of energy which can be satisfied by 25 g/day visible fat.

Calcium and Phosphorus

- Large amount of calcium and phosphorus are required as there is rapid growth
- At birth bones are poorly calcified. By the time baby walks, calcification of bones should be done to support the weight of the body.
- If sufficient calcium is not provided motor development is delayed.
- Calcium: Phosphorus ratio is 2:1 in human milk
- High phosphorus leads to hypocalcemic neonatal tetany.
- An RDA of 300 mg/day calcium has been recommended.
- For infants ratio of calcium to phosphorus intake should be 1:1.5.

Iron:

- The RDA for iron is recommended as 3 mg/day for 7-12 months.
- At birth, body contains 80 mg/kg. This is about three times that of an adult.
- During the first four months, the baby's blood volume doubles and concentration of iron in Hb falls to about the half that present at birth.
- There is no reserve store of iron between the age of 6 months and 2 years. Low birth weight infant requires dietary iron earlier in life.
- Premature infants are susceptible to anaemia.
- Deficiency can lead to hypochromic anaemia

Hypochromic anaemia can occur in infants due to

1. Depletion of foetal stores.
2. Greater need for iron during growth
3. Inadequate dietary supply.

Zinc:

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

Sodium:

Intake of sodium by breast fed infant is less than 1/3rd that of one fed on cow's milk. This smaller amount present in human milk is considered adequate.

Iodine:

Goitre in mothers during pregnancy leads to children born as cretins. They are mentally retarded and the condition is irreversible even after treatment.

Vitamin A:

- The RDA of vitamin A is 350µg.
- A healthy infant has sufficient store of vitamin A in liver at birth which may last for 6 months.
- Excess of vitamin A leads to anorexia, hyper irritability.

Vitamin D:

- It is essential for utilisation and retention of calcium and phosphorus.
- Neither human nor cow's milk provides enough vitamin D to prevent rickets.
- A good supply of vitamin D during pregnancy benefits the mother and helps satisfactory development of the infant.
- RDA is 400 IU of vitamin D/ day. This requirement may be obtained through exposure to sunlight.
- Avoid large amounts of vitamin D to prevent hypervitaminosis D.

Vitamin E:

- Food and Nutrition Board has prescribed 5 IU of Vitamin E during infancy.
- Cow's milk is a poor source of vitamin E.

Vitamin K:

- The new-borns are susceptible to haemorrhage caused by lack of vitamin K. Breast fed baby is more susceptible than artificially fed.
- Deficiency of vitamin K in children can occur if mothers have received anticoagulants.
- Excess dosage is harmful.

Vitamin B Complex:

- Thiamine, Riboflavin and Niacin intake up to one year of life depends on the basis of the amounts of vitamins ingested through breast milk.
- Vitamin B6 is stored in the liver during foetal growth, therefore 0.1 mg/d and 0.6 mg/day is recommended for 0-6 months and 6-12 months of age, respectively.
- The RDA of folate in breastfed infants is about 25 $\mu\text{g}/\text{day}$ for 0-6 months and 85 $\mu\text{g}/\text{day}$ for 7-12 months.
- An intake of 1.2 μg of vitamin B12 prevents abnormal haemopoiesis (the production of blood cells and platelets) in infants, hence the recommended.
- Except for Vitamin D, all the Vitamins are adequately supplied in human milk from healthy mother.

Vitamin C:

Vitamin C intake is recommended on the basis of vitamin C ingested by breastfed infants in well-nourished population. ICMR (2020) recommended an RDA of 20 and 27 mg/day for 0-6 months and 7-12 months.

BREAST FEEDING

LECTURE 2

Objective:

- To provide awareness about breastfeeding
- To gain the knowledge about the importance of breast feeding.

Definitions:

- **Colostrum:** The first yellowish fluid that comes from the mammary gland of the mammals (humans) which has high nutritional value and antibodies.
- **Exclusive breast feeding:** As no other food or drink, not even water, except breast milk (including milk expressed) for 6 months of life.

BREAST FEEDING

- Successful breast feeding is an important child rearing skill to be learnt and practiced. The infant should be put to breast within half an hour after normal delivery and within four hours after caesarean section. Prelactoral foods (honey, distilled water and glucose) should not be given. Sucking reflex is most active at birth.
- Fortunately even the poorly nourished mother is able to nurse her child satisfactorily at least during the first few months of life
- Mother's milk is deficient only in iron, but since the baby is born with adequate body stores of iron which can last for the first 3-4 months, hence the child does not need additional supplements during this period.

- Vitamin C is another important nutrient which is present in limited amounts in the mother's milk.

Colostrum

During the first two or three days watery yellowish fluid that comes from the mammary gland, which differs from the regular milk is called Colostrum. It is secreted in small quantity of about 10-40 ml. It is rich in protein. Total fat content is less than mature milk. The concentration of lactose is less. Levels of niacin, pantothenic acid, biotin, riboflavin are low. Vitamin C is secreted at about the same level as in mature milk. Zinc content of colostrum is 20 mg/l, whereas mature milk has 2.6 mg/l of zinc.

Colostrum gives the first immunization to the infant. It contains interferon like substance which possesses strong antiviral activity. Colostrum contains vitamin B12 binding protein, which renders vitamin B12 unavailable for growth of E. coli and other bacteria. It also contains antibodies against viral diseases like small pox, measles and influenza. Enzymes like lysozyme etc. that promote cell maturation are found to be more in colostrum.

Advantages of breast feeding

Breastfeeding is not only beneficial to infant but also to the mother.

1. Nutritional factors

Composition of human milk is best suited to the infants. Mammal's milk is tailor made in terms of nutrients to its young ones. Table shows the comparison data of human milk with cow's and buffalo's milk.

Table: Comparison of human milk with cow's and buffalo's milk (per 100g.)

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NUTRIENT	HUMAN MILK	COW MILK	's BUFFALO's MILK
Water (g)	88	87.5	81
Energy (k cal)	65	67	117
Protein (g)	1.1	3.2	4.3
Carbohydrate (g)	7.4	4.4	5.0
Fat (g)	3.4	4.1	6.5
Calcium (mg)	28	120	210
Phosphorus (mg)	11	90	130
Iron (mg)	--	0.2	0.2
Carotene (?g)	137	174	160
Thiamine (mg)	0.02	0.05	0.04
Riboflavin (mg)	0.02	0.19	0.1
Vitamin C (mg)	3	2	1
Caseinogen & Lactalbumin ratio	1:2	3:1	--

Source: Gopalan C., B.V. Ramasastri and S.C. Balasubramanian (1991), Nutritive Value of Indian Foods, National Institute of Nutrition, ICMR, Hyderabad, 500 007, India.

2. Immunological factors:

- Immunoglobulins: IgA, IgG, IgM
- Cellular elements: Lymphoid cells, polymorphs, macrophages, plasma cells
- Opsonic and chemotactic activities of C3 and C4 complement system.
- Unsaturated lactoferrin and transferrin
- Lysozyme

- Lactoperoxidase
- Specific inhibitors (non-immunoglobulins) antiviral and anti-staphylococcal factors.
- Growth factors for *Lactobacillus bifidus*.
- Para- amino benzoic acid may afford some protection against malaria.

3. Psychological factors:

- Infant derives a sense of security and belongingness in a mother and child relationship.
- Mother will have sense of calm and satisfaction which favours the production of required hormones.

4. Economic factors:

It is economical to breast feed than going for expensive commercial preparations, sterilizing equipment's.

5. Physiological factors

- Breast feeding is an important birth control method. Prolactin (synthesis of milk production), decreases the synthesis of ovarian hormones.
- Uterus of mother comes back to normal size and bleeding is arrested due to secretion of oxytocin and enables mother to shed extra weight accumulated during pregnancy.

6. Other advantages:

- Infants jaw becomes fully developed as he works hard to extract milk.
- Milk is microbiologically sterile and less danger of contamination in breast fed infants, Motility rate is decreased.
- Low danger of incorrect formula and over feeding.
- Decreased chance of allergic reactions as human milk protein do not cause allergies.
- Lower rate of sudden infant death or cot death.

Normal and Therapeutic Nutrition

- Less renal solute load as there is less urea and sodium to excrete.
- Less colic as fats and protein in human milk are more easily digested and less likely to create gastric and intestinal distress.
- Human milk is always fresh and at right temperature.
- Breast feeding can be continued during illness of the infant (diarrhoea etc) and after vaccination.
- Scientific data says breast fed babies are less likely to develop obesity, hypertension, diabetes and atherosclerosis in later life.
- There is evidence to suggest that breast fed babies have better cognitive and IQ score in later life.
- It is one food that makes a complete meal. Meal is always ready – No preparation and no left overs.
- Breast milk is a renewable source. It cannot be adulterated.

Advantages to Mother

- It is convenient for the mother to feed the infant any place and time.
- Risk of breast cancer is low.
- By breast feeding, requirement of insulin decreases for a diabetic mother.

SUPPLEMENTARY / COMPLEMENTARY FEEDING

LECTURE 3

Objective:

- To provide awareness about artificial feeding
- To gain the knowledge about the importance and types of supplementary feeding.

Definitions:

- **Beikost:** Solid food added to an infant's diet.
- **Weaning:** The systematic process of introduction of suitable food at the age of 4-6 months in addition to mother's milk in order to provide needed nutrients to the infant

Artificial Feeding

Circumstances under which artificial feeding is essential are

- Mother suffering from serious illness.
- Another pregnancy intervenes during lactation.
- Child is too weak to nurse or cannot because of harelip or cleft palate.
- Breast milk has completely stopped or insufficient for child.
- Mother is not available to feed.
- If mother is on anticoagulants, steroids and radioactive drugs.
- Death of mother.

Feeding Problems

- Tooth decay (fig)
- Under feeding
- Diarrhoea

- Constipation
- Colic
- Contamination/improper sterilization of bottles etc.

Advantages of bottle feeding

- Creates no additional requirements in mother
- No problems in establishing milk supply
- Volume of milk given is visible
- Feeding in public is acceptable
- Creates no problem for working mothers
- It will be nutritionally adequate, provided correct amount is given
- Other members of family also can feed the baby

Introduction

Weaning

- The term “weaning” comes from the word “*wemian*” which means to accustom. Weaning begins from the moment supplementary food is started and continues till the child is taken off the breast completely. Solid food added to the infant’s diet is called “**BEIKOST**”.

Need for weaning

- Breast milk alone is not able to provide sufficient amount of all nutrients needed to maintain growth after the first 6 months.
- Increasing needs of calories and protein of growing children cannot be met by diminishing output of mother’s milk.
- Milk is a poor source of vitamin C, vitamin D and iron. Therefore weaning (supplementary feeding) has to be resorted to immediately after 6 months.

- It makes the infant gradually accustomed to new tastes and textures of different food, which helps the infant to adjust to family food in early childhood.

Calorie dense foods like malted foods should be given to infants.

Weaning should provide at least 10% of energy

Types of supplementary foods:

Liquid supplements:

- **Milk:** By the sixth month of life, the frequency of breast feeding is reduced to 3 or 4 times per day and animal milk is substituted.
- **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 advantageous to introduce small quantities of fresh fruit juice even in 3rd or 4th month of life.
- **Soup from green leafy vegetables:** Green leafy vegetables can be alternative to fresh fruits. Strained soup can be given in beginning with unstrained soup later on.
- **Fish liver oil:** It is good source of vitamin A and D. Infants should be given few drops to 1/2 tsp per day mixed in small quantity of milk.

Solid supplements mashed:

Mashed food is started around 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.

- **Cereal and starchy gruels:** To meet the increasing demands of calories and protein, well-cooked mashed cereals mixed with milk and sugar can be given."
- **Vegetables:** Cooked, mashed vegetables like potato, green leafy vegetables and carrots can be introduced to get vitamins and minerals and colour in the diet.
- **Fruits:** All fruits, with the exception of banana which is mashed, must be stewed and served for one year old baby.
- **Non-vegetarian:** A small amount of hard boiled yolk of egg is given to start with and if the infant tolerates, the amount may be gradually increased to a complete yolk of an egg. Minced and cooked meat or boiled fish may be fed 3 to 4 times a week.
- **Pulses:** Soft cooked pulses along with cereals in the form of kichidi/ pongal/porridge.

Solid supplements un mashed:

When the baby starts cutting his teeth, it is time to start chopped and lumpy foods. Cooked cereals, pulses and vegetables can be given to the child.

Solids like idli, bread, chapati, rice and dal can be given. Vegetables may be chopped into small pieces, and boiled. Cooked potato, boiled leafy vegetables, slice of raw carrot or fruit segments with all skins and seeds removed is a good exercise for the gums. Fruit should be given instead of juice as it adds bulk to the diet and is good for bowel movement.

Processed foods: Homemade or commercial processed foods can be given as weaning foods. Homemade processed weaning foods can be prepared by using cereal, pulses, nuts and jaggery with or without milk products. Processed foods like pasta, rusks, and biscuits can be given.

Points to be considered in introducing weaning foods:

- Introduce only one food at a time.

- Allow the infant to become familiar with the food before trying to give another.
- Give very small amounts of any new food at the beginning, for e.g. one tsp full or less.
- At first strained fruits, vegetables and cereals are given.
- Fruit juice should be fed only by cup not by bottle.
- When the baby is able to chew, gradually substitute finally chopped fruits and vegetables usually at 8-9 months.
- Variety in choice of foods is important.
- Infants may object to taking some foods by themselves but will take them willingly if one is mixed with other, e.g., egg is mixed with formula, cereal or vegetables.
- 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.
- The mother or anyone feeding avoid showing dislike for a particular food in front of an infant.
- A baby's appetite varies a lot from meal to meal and day to day.
- Use a thin consistency when starting the solid foods. Gradually the consistency is made more solid.
- The child can be fed with a katori and spoon and the baby gets used to an assault method of feeding.
- To make the food calorie dense add oil, butter or ghee to the infant's diet.
- Food should be given between breast feeds.
- Give freshly prepared food.
- Food should be only slightly seasoned.
- The water can be given in between the feedings with a cup and spoon.

Suggested recipes during infancy:

Recipe	Reason
Fruit juice (6 months)	Provide vitamin C which is lacking in milk. Tomato and orange juice also provide some amount of beta carotene.
Greens soup (6 months)	Child gets used to new taste, provides iron, calcium, beta carotene, riboflavin and vitamin C.
Stewed apple (8 months)	Gives calories but should not be given raw as it may choke the child.
Soft custard with egg yolk (8 months)	Provide vitamin A, iron, proteins and B vitamins. Off white should be introduced later as it may cause allergy.
Kichdi (pongal), idli, chapatti + milk, (10-12 months)	Easily digested and gives calorie and good amount of protein.
Malted cereals and gruel made out of rice, rice flour, rice flasks, corn flasks and milk	Meets increased demands of calories and protein.

Assignment

Visit a Anganwadi and meet a lactating women. Tell her about the importance of breast feeding and weaning. Also demonstrate some nutritious recipes to her.

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Normal and Therapeutic Nutrition

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NAHEP
Component 2



Normal And Therapeutic Nutrition

Lesson 4

Preschool Children -Growth and Development

Content

DESIGNED AND DEVELOPED UNDER THE AEGIS OF
NAHEP Component-2 Project "Investments In ICAR Leadership In Agricultural Higher Education"
Division of Computer Applications
ICAR-Indian Agricultural Statistics Research Institute

Course Name	Normal and Therapeutic Nutrition
Lesson 4	Preschool Children -Growth And Development
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Objectives

- To gain knowledge about the growth pattern among preschoolers.
- To acquire knowledge about the nutritional requirements during pre school age.

Definitions

- **Pre-school age:**Preschool age is a period of intensive cognitive development with age from 1–6 years.
- **Growth:** Growth refers to the increase in mass and size of a body.
- **Development:** It is the process where a particular organism, not only grows physically but acquires mental and physiological growth as well.
- **Food habits:** Food habits refer to why and how people eat, which foods they eat, and with whom they eat, as well as the ways people obtain, store, use, and discard food. Individual, social, cultural, religious, economic, environmental, and political factors all influence people's eating habits.

Introduction

- Growth is generally slower than in the first year of life (preschool age 1-6 years) but continues gradually.
- Activity increases as child becomes more mobile.
- By age of 2 years dentition develops completely. Therefore, increased range of foods can be safely eaten.
- There is an increased need for all nutrients, but the pattern of increase varies for different nutrients in relation to their role in growth of specific tissues.
- Preschool years are the best time for a child to start a healthy pattern of living and eating, focusing on regular physical activity and nutritious foods.

Growth and development

- Pre-school years is a long period of gradual growth
- During the second year, the toddler increases in height by 7-8 cm and gains weight by 3-4 kg. Thereafter until the pre-adolescent period the annual gain in height is approximately 6-7 cm and weight is 1.5-3 kg.
- Boys are taller and heavier than girls at each age, except about at 11-12 years, when girls are usually heavier.
- As growth proceeds there are changes in the proportion of water, muscle tissues, fat deposits and skeletal structures.
- The body water decreases gradually, with the addition of adipose tissue and of minerals to the bones.
- By 4 years of age the body protein content has increased to an adult level of 18-19% of the body weight. At a given age, girls have a higher percentage of body fat than boys, but, less muscle tissues.
- The number, size, and composition of bones changes from birth to maturity.
- Even minor limitations of nutrient need during the growing period may prevent the full potential of growth from being attained.

Nutritional Requirements

Energy:

- Required for growth and activity
- Insufficient food leads to under nutrition resulting inadequate weight gain and growth hindrance
- Insufficient calorie intake leads to protein deficiency as proteins are spared for energy.
- As the body weight increases, the calories per kg of body weight also increases. Therefore, the calorie intake is based on age and growth;

for 1-3 years it is 1110 calories and for 4-6 years, it is 1360 calories per day.

Protein:

- There is increase in muscle mass and bone growth which requires positive nitrogen balance.
- The increase in total body size requires larger vascular system to transport nutrients to tissues and all waste products away from tissues.
- Therefore, increase in demand for nutrients for blood formation like protein, iron, folacin and pyridoxine. Bone growth also creates a need for increased protein intake.
- An intake of 12.5 g for 1–3-year-old, which increases to 16.0 g for 4–6-year-olds daily, has been recommended.

Fats:

- Fat energy including invisible fat for children should be 25% of total energy. To provide 25% fat calories, the minimum level of visible fat in the diet of children is 25gm/day

Minerals

Calcium:

- Calcium requirements must be met for the growing bones and teeth and the continuous requirements.
- Skeletal deformities that occur during this period are not reversible; hence an intake of 500mg for 1-3 years and 550mg for 4-6 years is recommended.
- Adequacy of calcium intake is directly correlated with the intake of milk or milk products. Hence the diet of pre scholar should include 1-2 glasses of milk per day.

Iron:

- During growth period, with each kilogram increase in body weight, 30mg of iron is required.
- On an average increase in body weight is 2 kg/year. Therefore 0.2 to 0.5 mg/kg of body weight per day of iron is required.
- Daily intake of 8 mg/ day for 1-3 years' age and for 4-6 years 11 mg/day is recommended.
- Iron rich foods like rice flakes, egg yolk, green leafy vegetables should be included in the diet.
- Dietary lack of iron accompanied by hook worm infestation can lead to anaemia.

Vitamins:

- **Vitamin A** intake of 390 µg/day for 1-3 years and 510 µg/day for 4-6 years old has been recommended.
- A great majority of Indian children do not consume foods containing **Vitamin D** and in spite of this very few have signs of vitamin D deficiency. This shows that much of the vitamin D requirements are met from sunlight and the dietary requirements are probably very small. Hence, the dietary intake is fixed at a level of 600 I.U. per day for all categories of growing age groups. It promotes absorption of calcium from the intestines, and helps in mineralization of bones.
- **Vitamin C** in Indian diets is contributed in a very large extent from cooked vegetables and very small portion from raw vegetables. Considering losses in cooking and storage, the requirement has to be doubled. An intake of 30 mg for 1-3 years and 35 mg for 4-6 years old has been recommended by ICMR.
- **B-Complex vitamins** principally combine with specific proteins to function as part of various enzyme systems, which are concerned with the break down of carbohydrate, protein and fat in the body. Thus, they are inter-related and intimately involved in the

mechanism, which release energy, CO₂ and H₂O as the end product of metabolism.

- **Thiamine** 0.7 mg/day for 1-3 year of age and 0.9 mg/day for 4-6 years of age, for **riboflavin** 1.1 mg/day for 1-3 year of age and 1.3 mg/day for 4-6 years of age and for **niacin** is 7 mg/day for 1-3 year of age and 9 mg/day for 4-6 years of age.
- Allowances for **pyridoxine (B₆)₂**, **folic acid**, and **Vitamin B₁₂** are mainly computed and based on the breast milk content of these vitamins. The recommended dietary intake of nutrients serves as a guide in planning and evaluating satisfactory food intake by children.

Factors affecting nutritional status

- Certain medical conditions and frequent attacks of infectious diseases
- Repeated illness, especially the common illnesses such as diarrhoea, measles, whooping cough and other respiratory infections are the principal underlying causes of malnutrition and frequent weight loss.
- PEM and vitamin A deficiency is most common
- Picky eating habits, refusing to eat or only eating junk foods

Factors responsible for rejecting food by preschool children:

- Child may be at risk
- Worm infestation particularly hook worm
- Nutritional deficiency
- Child may be too tired
- Insufficient time for eating
- Psychologically disturbed
 - Stress of school
 - Absence of father or mother
 - Birth of a sibling
 - Shifting to a new place
 - To draw the attention of parents

Normal and Therapeutic Nutrition

- Unfavorable comments on food by other members of the family
- Repetition of same food, no variety
- Food is not according to the liking of the child.
- Food is not palatable, not at right temperature
- Snack taken just before the meal
- Diversion of attention to play

Food requirements

- Good eating habits begin at infancy
- Transition from infants' diet to regular diet should be smooth and gradual
- Few preschoolers are difficult eaters at times.

Dietary guidelines

- Diet should be adequate in quantity and quality for different nutrients, eg: in addition to milk, pre-school child should have 2 small servings of protein – rich foods. 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.
- Diet should include variety of foods
- Food intake will improve if the food is interesting and attractive. Therefore, flavour, colour, presentation can be changed to encourage the child to drink/ eat more.
- Foods should be slightly seasoned for food to taste better and child will like to eat.
- Child should never be forced to eat more than what he can eat.
- Person feeding the child should not show dislike towards the food which may lead to rejection of food by the child.
- Children are sensitive to flavors. Any change in flavor of food may lead to rejection
- Food preferences of the child should be taken into consideration

Normal and Therapeutic Nutrition

- Regularity of meal times should be followed.
- Different cooking methods and new attractive combination encourage the child to eat more.
- Child should never be hurried while eating the food. Atmosphere should be pleasant, peaceful and with no distractions.
- Foods like tea and coffee should be restricted as they over-stimulate the system
- Inclusion of curd in diet can decrease the incidence of diarrhoea and cold.
- Unripe bananas and apples should not be given as they are difficult to chew and can choke the child.

Assignment

- Visit a family having a child of 1-6 years of age. Plan a day's diet for a the pre-school child by considering his/her food habits.

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NAHEP
Component 2



Normal And Therapeutic Nutrition

Lesson 5

School Age Children -Growth and Development

Content

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Course Name	Normal and Therapeutic Nutrition
Lesson 5	School Age Children -Growth And Development
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Objectives

- To gain knowledge about the growth pattern among school age children.
- To acquire knowledge about the nutritional requirements during school age.

Definitions

- **School-age:** School-age is a period of development of physical, emotional, and mental abilities of children ages 6 to 12.
 - **Growth:** Growth refers to the increase in mass and size of a body.
 - **Development:** It is the process where a particular organism, not only grows physically but acquires mental and physiological growth as well.
 - **Food habits:** Food habits refer to why and how people eat, which foods they eat, and with whom they eat, as well as the ways people obtain, store, use, and discard food. Individual, social, cultural, religious, economic, environmental, and political factors all influence people's eating habits.
- Growth: Growth refers to the increase in mass and size of a body.

Introduction

- The school age period has been called the latent period for growth. The rate of growth slows down and body changes occur gradually.
- Girls usually out stand boys in this period in growth.
- The slow rate of growth during this period results in a gradual decline in the food requirement per unit body weight.

Growth and development

- Growth in early school years proceeds at a moderate rate, although the strenuous activity of this period has a considerable demand on calorie intake.

- The yearly increase in height varies from 4.0 to 7.7 cm in boys and 4.9 to 7.2 cm in girls. The increase in height slowly declines after 14th years in boys and the 12th year in girls.
- The yearly increase in weight varies from 2.5 to 6.6 kg in boys and from 2.3 to 5.2 kg in girls. The yearly weight increase steadily declines after the age of 14 in boys and 13 in girls.

Nutrition Requirement

Energy:

- The child's **energy** increases due to steady increase in growth and activity.
- Requirement for boys is increased from 7-9 to 10-12 years as the reserves are being built for the demands of approaching adolescent period.
- It ranges from 1700 Kcals for 7-9 year old to 2220 Kcals for 10-12 year old boys, while the girls of the same age require about 2060 Kcals.

Protein:

- Body needs for **protein** also increases as these are required for growth and development.
- Girls require more protein between 10-12 years for approaching menarche.
- Recommended allowance are 19g for 7-6 year, 26.2g for 10-12 years boys and 26.6g for 10-12 years girls.

Fats:

- Total fat intake below 25% E is considered to affect the growth in children. To provide 25% total fat calories, a minimum level of visible fat in children should range between 30-45 g /day.

Minerals

Calcium

- 10 – 12 years old children require more calcium than adults to meet skeletal growth demands
- A requirement of 500 mg for 7-9 years and 650mg for 10-12 years of calcium has been suggested by ICMR.

Iron

- Requirement increases as the blood volume increases by 1 g/dl
- Requirement is lower for 10- 12 years girls compared to boys as rate of absorption is higher in girls i.e. 5%.
- Muscular growth is more in boys which demands for more iron requirement
- The requirement of iron for 10–12-year-old girls is 16mg and boys is 12mg.
- Iron deficiency anaemia is a risk factor for poor educational performance in school age children

Iodine

- RDA is 80mcg/day for 7-9 year and 100mcg/day for 10-15 year old.

Folic Acid:

- RDA for folic acid is 140-18- μg taking into account the bioavailability of the food folates

Vitamins:

Vitamin A

- Vitamin A intake increases according to increase in age.
- 290 mcg is required for 7-9 year and 360-370mcg for 10-12 year old.

Vitamin D

- RDA is 400. I.U. This level has promoted maximal calcium absorption in Indian children.

B complex vitamins

- **Thiamin, riboflavin, and nicotinic acid** intakes are based on calorie intake.
- The requirement for **vitamin B₆** is considered to be related to protein intake.
- **B₁₂** is present only in foods from animal origin and Indian diets are basically vegetarian, a dietary allowance of 2 µg per day has been recommended which also takes into account cooking losses and the uncertainty about the extent of absorption of **vitamin B₁₂**.

Vitamin C

- 35-45 mg of **vitamin C** is recommended for this group, which includes a margin of 50% loss during cooking.

Food habits and requirements

- Children who skip breakfast do not make up for nutrient and energy deficits later in the day and tend to perform more poorly in tests of cognition than those who eat breakfast.
- While eating with other children at school, the child observes different attitudes towards food and tastes new foods which he may not normally accept. Television also has an influence in food selection.

The important meals:

Breakfast the Neglected Meal

- With the need to adjust to the school time, the first meal is either scanty or omitted entirely.
- A good breakfast should include some cereal or cereal dal preparation, some milk and fruit. However, if the fruit is preferred at some other time in the day, it may be omitted from the breakfast.

Lunch

This meal may have to be eaten away from home, which is a major change for the child at this stage. The foods, which must find a place in the packed lunch include—

- (a) Cereal preparation such as chapati, upma, bread, etc.,
- (b) Pulse or milk product, which may be dal, chutney, curd, lassi,
- (c) Vegetable preparation or fruit.

There are some points, which must be remembered, in making a packed lunch, which is enjoyable. These are:

- Cool the preparation before packing to avoid spoilage.
- Pack food preparations, which taste good even when these are cold.
- Include some fresh vegetable or fruit, to help moisten the mouth.
- Pack the vegetable/fruit slices in a plastic bag, to retain fresh flavour and texture.
- Pack only as much as the child can eat happily, so that children learn to value food and do not waste it.

Snacks Between Meals:

- Some children may need a mid-morning and a mid-afternoon snack.
- A number of foods are normally available, these include fruits such as guavas, bananas, amlas etc. roasted legumes such as groundnuts, chanas, etc.
- If well chosen, these snacks can provide important nutrients in addition to calories.
- Avoid foods that provide only energy.

Dietary guidelines

- The diet should include foods from all 5 food groups
- Nutritional requirements should meet their increasing activity, growth, and special needs during sickness and injury.
- Quick menus and yet nutritionally satisfying

- Variety in colour, texture, taste and flavour
- Climatic and weather conditions are important consideration. In hot weather extra liquids and salts are to be given because children do not generally like to drink plain water.
- Should suit to varying appetites of children. They prefer small snack meals at frequent intervals than few large ones
- Introduce new foods at frequent intervals
- They should be encouraged to eat with family members

ADOLESCENTS -GROWTH AND DEVELOPMENT, FOOD HABITS AND NUTRITIONAL REQUIREMENTS

LECTURE 2

Objectives

- To gain knowledge about the growth pattern among adolescents.
- To acquire knowledge about the nutritional requirements during adolescents.

Definitions

- **Adoloscence:** The period of a life between being a child and becoming an adult, between the ages of about 13 and 19.
- **Growth Spurt:** Adolescent growth spurt is the fast and intense increase in the rate of growth in height and weight that occurs during the adolescent stage of the human life cycle. This growth practically occurs in all of the long bones and most other skeletal elements. Growth refers to the increase in mass and size of a body.

Introduction

- The period of transition from childhood to adulthood is called adolescence with accelerated physical, biochemical and emotional development.
- The final growth spurt occurs during this period.

Normal and Therapeutic Nutrition

- The growth spurt of boys is slower than that of girls. There are many body changes due to influence of hormones.
- Most noticeable changes are increase in height and weight and development of secondary sexual characteristics. Girls usually attain menarche during this growth spurt.
- They attain their adult stature between 18-20 but bone mass continues to increase up to age of 25.

Growth and development

Stage with Age	Early Adolescence (ages 11-13 years)	Middle Adolescence (ages 14-15 years)	Late Adolescence (ages 16-18 years)
Physical Growth	<ul style="list-style-type: none"> ☐ Puberty: Rapid growth period ☐ Secondary sexual characteristics begin to appear 	<ul style="list-style-type: none"> ☐ Secondary sexual characteristics further develop ☐ 95% of adult height reached 	<ul style="list-style-type: none"> ☐ Physical maturity and reproductive growth leveling off and ending
Intellectual / Cognition	<ul style="list-style-type: none"> ☐ Concrete thought dominates “here and now” ☐ Cause and effect relationships are underdeveloped ☐ Stronger “ Self” than “Social awareness” 	<ul style="list-style-type: none"> ☐ Growth in abstract thought ☐ Reverts to concrete thought under stress ☐ Cause and effect relationships are better understood ☐ Highly self-absorbed 	<ul style="list-style-type: none"> ☐ Abstract thought established ☐ Future oriented; able to understand, plan and pursue long term goals ☐ Philosophical and idealistic

Normal and Therapeutic Nutrition

<p>Autonomy</p>	<ul style="list-style-type: none"> ☐ Challenge the authority of family structure ☐ Lonely ☐ Wide mood swings ☐ Begins to reject childhood likings ☐ Argumentative and disobedient 	<ul style="list-style-type: none"> ☐ Conflict with family predominates due to ambivalence about emerging independence 	<ul style="list-style-type: none"> ☐ Emancipation: Vocational/technical/college and/ or work ☐ -adult lifestyle
<p>Body Image</p>	<ul style="list-style-type: none"> ☐ Preoccupied with physical changes and critical of appearance ☐ Anxiety about secondary sexual characteristics ☐ Peers are idealized as a standard for normal appearance (comparison of self with peers) 	<ul style="list-style-type: none"> ☐ Less concern about physical changes but increased interest in personal attractiveness ☐ Excessive physical activity alternating with lethargy 	<ul style="list-style-type: none"> ☐ Usually comfortable with body image

(Source: From Internet: Vikaspedia)

Food habits

Physical and psycho-social pressures influence adolescents eating habits. Boys fare better than girls in that their large appetite and sheer volume of food leads them to consume adequate nutrients. But the adolescent girls

- Gain weight easily as their physiologic sex differences are associated with fat deposits during this period and comparatively lack of physical activity.
- Social pressures and personal tensions concerning figure control will force them to follow unwise, self-imposed crash diets for weight loss.
- Self-starvation may result in complex and far reaching eating disorders like anorexia nervosa and bulimia.

Teenagers have the reputation of having the worst eating habits. They may skip a meal. Or they may eat fast foods which are generally inadequate in calcium and vitamin A but high in calories, saturated fat and sodium.

Nutritional Requirements

Energy:

- Energy needs increase with metabolic demands of growth and energy expenditure.
- Girls consume fewer kilo calories than boys.
- Increase in appetite leads to satisfying their hunger with snack foods that are high in sugar and fat and low in protein
- Difference in calorie intake of boys and girls starts from 10 years and boys take higher calories than girls.
- The boys require 2860 Kcals at 13-15 years, while 3320 Kcals at 16-18 years of age. Adolescent girls require 2400 Kcals at 13-15years, while 2500 Kcals at 16-18 years of age.

Proteins:

- Protein needs represent 12 – 14% of energy intake
- Protein intake exceeds 1g/kg body weight for pubertal changes in both the sexes and for developing muscle mass in boys.

- The protein requirements for both boys and girls are the same up to the age of ten years. But there is a gradual difference in their requirements from the age of 10 years where the boys have a higher requirement compared to girls due to a bigger stature of boys.
- At the end of growth period boys have one and a half times more lean mass as compared to girls. Girls have larger portions of fat deposits. The boys require 71g and 79g of protein at 13-15 years and 16-18 years of age respectively. The girls require 34.7g and 37.3g of protein at 13-15 years and 16-18 years of age respectively.

Fats:

- Total fat intake below 25% is considered to affect growth in children and adolescents.
- The desirable level of visible fat intake for adolescents is 35-50g/day.
- The essential fatty acid requirements are 3% for adolescents.

Minerals:

Calcium

- Adolescents need more calcium than adults to meet their skeletal growth. About 150 mg of calcium must be retained each day to allow for the increase in bone mass.
- Both the sexes require about 800mg during 13-15 years and 850 mg during 16-18 years of age.

Iron

- Iron is needed for haemoglobin synthesis for increased blood volume and for myoglobin which is needed for muscle growth.
- Girls need to ensure adequate intake of iron as they lose 0.5 mg/day during menstruation. During adolescence there is an increase in body mass corresponding to about 4.3 kg/year in the

female. With a further increase in haemoglobin by 2g/dl in boys and 1g/dl in girls, the respective requirement for growth alone is 0.7 mg/day in boys and 0.45 mg/day in girls while the obligatory losses also increase with age.

- Adolescent boys require about 15-18mg of iron at 13-18 years of age. Girls require 17mg at 13-15 yrs and 18mg at 16-18 yrs.

Zinc

Zinc deficiency is not normally seen in adolescents. Zinc supplements have been shown to increase pubertal growth in adolescents suffering from puberty delay.

Vitamins:

- Vitamin – B- thiamine, riboflavin and niacin increase as per the requirement of calories
- **Vitamin C** requirement for boys is 60mg for 13-15 years and 69mg for 16-18 years old while for girls is 55mg for 13-15 years and 57mg for 16-18 years old.
- Folic acid and B12 are essential for DNA and RNA synthesis
- Vitamin B6: is essential for transamination to synthesise non-essential amino acids. The requirement for B6 is increased. Premenstrual tension can be reduced if adolescent girls consume 100mg/day of vitamin B6.
- Vitamin – D: is essential for skeletal growth
- Vitamin A, C, and E: The structural and functional integrity of newly formed cells depend on the availability of these vitamins.
- Requirement for **vitamin A** for both the sexes require 430 mcg from 13-15 years and 400-480mcg from 16-18 years of age.
-

Dietary guidelines

Diet in adolescence is very important because it influences the future nutritional status.

- The diet should include foods from all the 5 food groups.
- Adequate and well balanced nutritious food should be provided to prevent obesity and malnutrition.
- Enough calcium is required to increase bone density and to delay onset of osteoporosis.
- Include iron rich foods to prevent anaemia.
- Include fruits, green leafy vegetables and other vegetables to meet vitamin and mineral needs.
- Provide variety in colour, texture, taste and flavour.
- Regular physical activity is essential to regulate appetite.
- Home based foods are good and do not get addicted to eating out.
- Avoid empty calorie foods such as carbonated beverages.
- No meal of the day should be missed out.

Assignment

- Plan a day's diet for child of 9 years by considering his/her food habits.
- Plan a day's diet for a girl age 15 years.

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NAHEP
Component 2



Normal And Therapeutic Nutrition

Lesson 6

Geriatric Nutrition

Multiple Choice Questions

DESIGNED AND DEVELOPED UNDER THE AEGIS OF
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Lesson 6	Geriatric Nutrition
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Multiple choice questions

Ques. 1 Choose the correct option

- i World Elders Day is celebrated on-
 - a) 3rd October
 - b) 17th November
 - c) 1st October
 - d) 12th October
- ii The common nutritional problems of old age are-
 - a) Osteoporosis
 - b) Malnutrition
 - c) Anaemia
 - d) All of above
- iii ____ % of calories should be derived from carbohydrates for elderly.
 - a) 50
 - b) 55
 - c) 60
 - d) 65
- iv Which hormone affects the calcium absorption in women?
 - a) Cortisol
 - b) Testosterone
 - c) Thyroxine
 - d) Estrogen

- v Peristalsis is stimulated by-
 - a) Water
 - b) Fibre
 - c) Minerals
 - d) Calcium

- vi The risk for Alzheimer's disease and Parkinson disease is increased due to deficiency of-
 - a) Iron
 - b) Folic acid
 - c) Calcium
 - d) Vitamin C

- vii Taste and smell in elder persons is reduced due to
 - a) Decreased secretion of Hcl
 - b) Loss of teeth
 - c) Loss of taste buds
 - d) All of the above

- viii Psychological changes during the old age are due to
 - a) Loneliness
 - b) Anxiety
 - c) Depression
 - d) All of the above

ANSWER KEY

Ques. 1 MCQs

- i C
- ii D
- iii A
- iv D
- v B
- vi B
- vii C
- viii D

DETERMINANTS OF FOOD CHOICE

Food choice is affected by many factors like biological, economic, physical, social, psychological and attitudes, beliefs in addition to stage of life.

Biological Determinants

Hunger and Satiety: The central nervous system is involved in controlling the balance between hunger, appetite stimulation and food intake. The macro nutrients, carbohydrates, proteins and fats generate satiety signals of varying strength. An important satiety signal may be the volume of food or portion size consumed.

Palatability: There is an increase in food intake as palatability increases. Increasing food variety can also increase food and energy intake. Food is not solely regarded as a source of nourishment but is often consumed for the pleasure value it imparts.

Economic and Physical Determinants

Cost and accessibility: Cost of food is a primary determinant of food choice. Low income groups have a greater tendency to consume foods from few food groups and have low intake of fruit and vegetables. Accessibility to shops is another important physical factor influencing food choice. Tribals who live in remote areas have poor access to shops – even ration shops and food choice is limited.

Education and knowledge: Studies indicate that the level of education can influence dietary behaviour during adulthood. Nutrition knowledge is gained by public through various media, reading food package and of course through health professionals.

Social Determinants of Food Choice

Cultural influences: Cultural influences lead to differences in the habitual consumption of certain foods and in traditions of preparations. It can lead to restrictions such as exclusion of meat or milk or some vegetables from the diet.

Social context: Social influences on food intake refer to the impact that one or more persons have on the eating behaviour of others. Social support can have a beneficial effect on food choice and healthful dietary change. Shaping of food choices takes place in the home. Family and friends influence food choice. There are clear differences in social classes with regard to food and nutrient intakes.

Societal trends, the media and peer pressure also influence on food intake.

It is often considered rude, to refuse food or drink being shared by a group or offered by a host. Often one becomes accepted as a member of a social gathering only if one accepts the food served.

Values: People's values, environmental ethics, religious beliefs, and political views also influence their food choices. By choosing to eat some foods or avoid others, people make statements about themselves that reflect their values. For example, people may select only foods that come in containers that can be reused or recycled. People are also influenced by the advice of religious heads in making food choice.

Social setting: Although the majority of food is eaten in the home, people also eat outside home like in schools, colleges, at work and in restaurants. The availability of health food at home and 'away from home' increases the consumption of such foods.

Meal patterns: People follow different meal patterns. Some have three meals and some have five meals. Some snack more frequently. Some have early meals and some have late meals.

Psychological Factors

Stress: The influence of stress on food choice is complex. The mechanisms for stress induced changes in eating and food choice are motivation differences (reduced concern about weight control) and physiological (reduced appetite) associated with stress. If work stress is prolonged or frequent, then adverse dietary changes could result.

Mood: Food influences mood and mood has a strong influence over choice of food. Attempts to restrict intake of certain foods can increase the desire for these particular foods. Depressed mood appears to influence the cravings.

Image: The fashion and movie industries, not the medical community, have defined what people believe to be the ideal body—sometimes an excessively thin body for women, or an excessively muscular body for men. Both men and women seek “beautiful bodies,” and in doing so, they select or avoid foods that they believe will improve or impair their physical appearance. Such intentions are rational when based on sound nutrition and fitness knowledge, but when based on faddism or carried to extremes, they undermine good health.

Eating disorders: Food choice is affected if an individual suffers from eating disorders like anorexia nervosa or bulimia. The aetiology of eating disorders is usually a combination of factors including biological, psychological, familial and socio-cultural.

Consumer Attitudes, Beliefs, Knowledge and Optimistic Bias

Consumer attitudes and beliefs: Attitudes and beliefs can change food choice. Attitude to dietary fat has changed in the last 50 years with a corresponding decrease in the absolute amount of fat eaten.

Optimistic bias: If people believe that their diets are already healthy, they are not inclined to alter their diets. Thus a perceived need to undertake change is a fundamental requirement for initiating dietary change.

Dietary change is not easy because it requires alterations in habits that have been built up over a life time. Athlete's strong desire to excel in sports can act as a strong motivational factor and the food choices can be appropriate. A pregnant mother changes her food habits for better as she is strongly motivated to get healthy baby.

Medical Conditions: Sometimes medical conditions and the medications used to treat the conditions limit which foods a person can select. Ageing and exposure to medications and chronic diseases can modify the oral sensation and food acceptance.

Food choices are personal and not always sensible and to a great extent they resist change.

Before undertaking diet planning, the planner must understand the dynamics of food choices, because people will alter their eating habits only if their preferences are honoured.

FUNCTIONAL FOODS

FOOD GROUP SYSTEM

Food group system helps in planning balanced diets and to achieve nutrient intake specific to the individual.

Five Food Group Plan

The five food group system suggested by ICMR is given in Table 1.5.

Table 1.5 The five food groups and their major nutrients

Food group	Main nutrients
1. Cereal grains and its products: Rice, Wheat, Ragi, Bajra, Maize, Jowar, Barley, Rice flakes, wheat flour.	Energy, Protein, Invisible fat, Vitamin-B ₁ , Vitamin-B ₂ , Folic acid, Iron, Fibre.
2. Pulses and Legumes: Bengal gram, Black gram, Green gram, Red gram, Lentil (whole as well as dhals), Cowpea, Peas, Rajma, Soybean, Beans.	Energy Protein, Invisible fat, Vitamin-B ₁ , Vitamin-B ₂ , Folic acid, Calcium, Iron, Fibre.
3. Milk and Meat Products: Milk, Curd, Skimmed Milk, Cheese, Chicken, Liver, Fish, Egg, Meat.	Protein, Fat, Vitamin-B ₂ , Calcium.
4. Fruits and Vegetables: Fruits: Mango, Guava, Tomato, Papaya, Orange, Sweet lime, Water melon. Vegetables (green leafy): Amaranth, Spinach, Gogu, Drumstick leaves, Coriander leaves, Fenugreek leaves. Other Vegetables: Carrots, Brinjal, Lady's finger, Beans, Capsicum, Onion, Drumstick, Cauliflower.	Carotenoids, Vitamin-C, Fibre, Invisible fat, Vitamin-B ₂ , Folic acid, Iron. Carotenoids, Vitamin-B ₂ , Folic acid, Calcium, Iron, Fibre.
5. Fats and Sugar: Fats: Butter, Ghee, Hydrogenated fat, Cooking oils like groundnut, Mustard, Coconut. Sugar: Jaggery and sugar	Carotenoids, Folic acid, Calcium, Fibre. Energy, Fat, Essential fatty acids. Energy

Four Food Group Plan

The four food groups suggested by ICMR in 2011 are given in Table 1.6.

Table 1.6 Food groups suggested by ICMR (2011)

Food group	Main nutrients
1. Cereals, Millets and Pulses: Rice, Wheat, Ragi, Bajra, Maize, Jowar, Barley, Rice flakes, Wheat flour, Breakfast cereals. Pulses and Legumes: Bengal gram, Black gram, Green gram, Red gram, Lentil (whole as well as dhal), Cowpea, Peas, Rajmah, Soybean, Beans.	Energy, Protein, Invisible fat, Vitamin-B ₁ , Vitamin-B ₂ Folic acid, Iron, Fibre. Energy, Protein, Invisible fat, Vitamin-B ₁ , Vitamin-B ₂ , Folic acid, Calcium, Iron, Fibre.
2. Milk and Animal Products: Milk, Curd, Skimmed Milk, Cheese, Chicken, Liver, Fish, Egg, Meat.	Protein, Fat, Vitamin-B ₁ , Vitamin-B ₂ , Calcium, Iron.
3. Vegetables and Fruits: Fruits: Mango, Guava, Tomato, Papaya, Orange, Sweet lime, Watermelon. Green leafy vegetables: Amaranth, Spinach, Gogu, Drumstick leaves, Coriander leaves, Fenugreek leaves. Other vegetables: Carrots, Brinjal, Lady's finger, Beans, Capsicum, Onion, Drumstick, Cauliflower.	Carotenoids, Vitamin-C, Fibre, Invisible fat, Vitamin-B ₂ , Folic acid, Iron. Carotenoids, Vitamin-B ₂ , Folic acid, Calcium, Iron, Fibre. Carotenoids, Folic acid, Calcium, Fibre.
4. Oils, Fats and Nuts: Fats: Butter, Ghee, Hydrogenated fat, Cooking oils like groundnut, mustard, sunflower. Sugar: Jaggery and Cane sugar. Almonds, walnuts and gingelly seeds.	Energy, Fat, Essential fatty acids. Energy Protein, ω-3 fatty acids.

The food group system can be used by health professionals for the following purposes:

- **Tool for nutritional assessment and screenings:** A brief dietary history system can disclose inadequacies of nutrient from any of the groups. The information can be the first clue that the subject may be at the risk of developing nutritional deficiency.
- **Tool for nutritional counselling:** The dietary history based on the four food group system allows a health team to counsel or teach a patient about nutrition.
- **Explaining therapeutic diets to the patient:** Therapeutic diets are scientifically based on nutrient composition and groups which can be used in menu planning.
- **Food labelling and surveillance system:** Food groups can be used for food labelling and for nutrition surveillance system.



Fig. 1.7 Food Groups suggested by ICMR (2011)

Source: Dietary guidelines for Indians—A manual, 2011, NIN, Hyderabad.

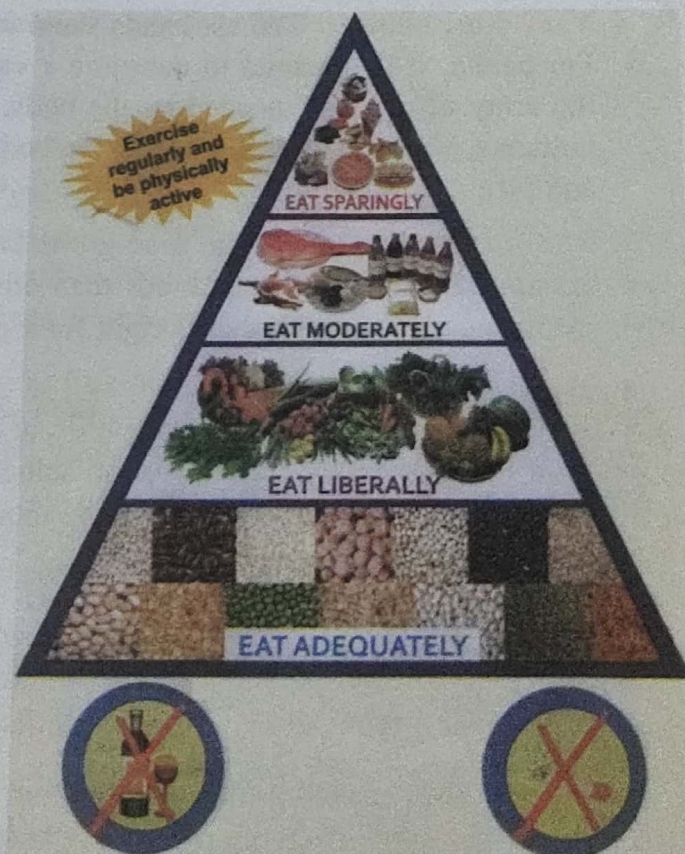
THE FOOD GUIDE

Food Pyramid

Food Pyramid is suggested by ICMR. This is made based on the principles of balanced diet. This pyramid also suggests that one needs to do exercise regularly and abstain from drinking alcohol and taking tobacco.

General Dietary Guidelines suggested by ICMR

- Eat variety of foods to ensure a balanced diet.
- Ensure provision of extra food and healthcare to pregnant and lactating women.
- Promote exclusive breastfeeding for six months and encourage breastfeeding till two years or as long as one can.
- Feed home based semi solid foods to the infant after six months.
- Ensure adequate and appropriate diets for children and adolescents, both in health and sickness.



Abstain from drinking alcohol Say NO to Tobacco

Fig. 1.8 Food Pyramid

- Eat plenty of vegetables and fruits.
- Ensure moderate use of edible oils and animal foods and very less use of *ghee/butter/vanaspati*.
- Avoid overeating to prevent overweight and obesity.
- Exercise regularly and be physically active to maintain ideal body weight.
- Restrict salt intake to minimum.
- Ensure the use of safe and clean foods.
- Adopt right pre-cooking processes and appropriate cooking methods.
- Drink plenty of water and take beverages in moderation.
- Minimize the use of processed foods rich in salt, sugar and fats.
- Include micronutrient-rich foods in the diets of elderly people to enable them to be fit and active.

MyPyramid

MyPyramid is a plan from the U.S. Department of Agriculture, designed in the year 2005 to help people choose the foods and amounts that are right for them, to balance with their daily physical activity. MyPyramid is meant for any healthy person, who is above the age of two years. The following points are emphasized in MyPyramid:

- **Be active:** The person climbing up the steps reminds consumers that one has to do physical activity everyday to be fit.
- **Vary your choices:** The six bands stand for the five food groups plus an area for oils. For health, it is essential to consume a variety among and within these groups to get the array of nutrients needed by the body. No one food or food group supplies all the nutrients, fibre and other substances the body needs. Besides, variety adds flavour, interest and pleasure to eating.
- **Think in proportions:** The food-group bands differ in width, reminding consumers to eat more of some types of foods than others. These widths are just estimates and not specifically the amount that is right for a person.
- **Make moderation the mind-set and everyday eating habit:** For each food group, the wider base stands for foods with little or no solid fats or added sugars; they should be eaten more often. The narrower top stands for foods with more added sugars and solid fats—the more active a person is, the more of these foods he can consume.
- **Customize:** MyPyramid is available for kids and also for vegetarians. They can be used according to a person's need.
- **Improve gradually:** Small steps should be taken towards healthier eating and active living. Small steps add up to big benefits.

Individual foods as well as foods within the same food group vary in their nutrient content. Large fat and energy differences exist within a single food group for example between non-fat milk and ice cream, fish and hot dogs, green beans and french fries, apples and avocados or bread and biscuits yet according to the Food Guide—any of these substitutes would be acceptable. No one food contains all the essential nutrients. Eating foods from each of the

different food groups helps ensure that all nutrient needs are met. People who have low energy allowance are advised to select the most nutrient dense foods within each group, whereas people with high energy needs may select some of the less nutrient dense, higher kilocalorie foods.

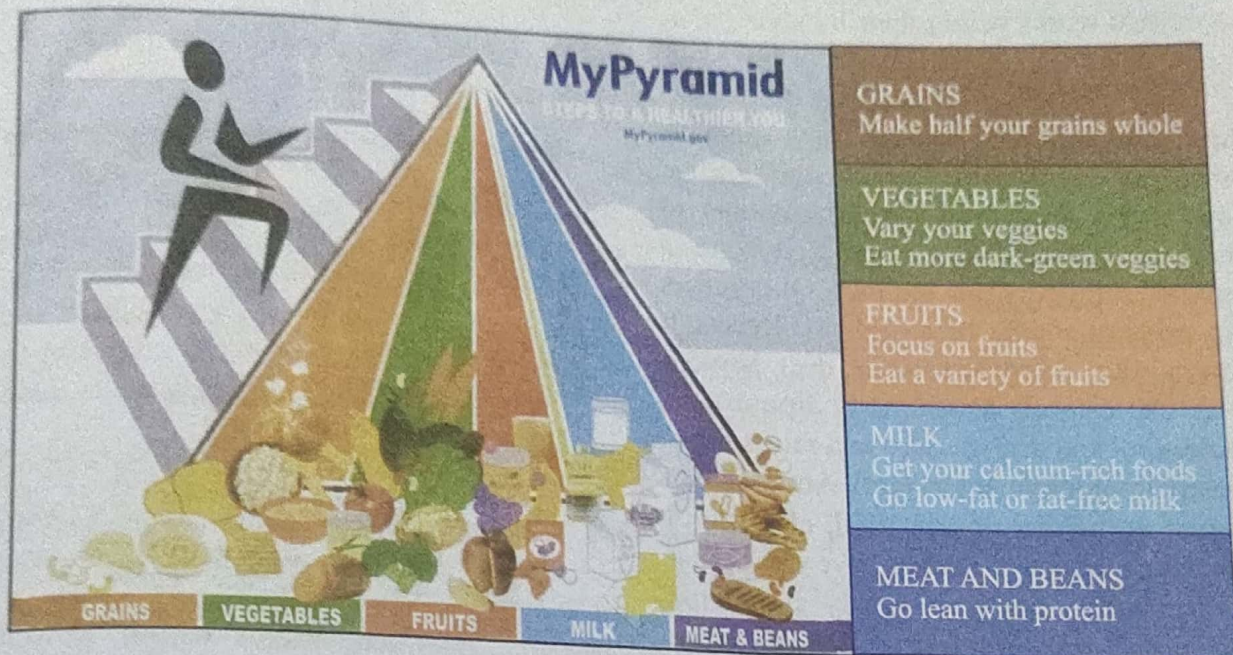


Fig. 1.9 MyPyramid

Source: U.S. Department of Agriculture 2005.

MyPlate

In 2011, the USDA with an assistance from first lady Michelle Obama, launched a new visual guide called MyPlate, which replaced Food Pyramid.

MyPlate is USDA's primary food group symbol, a food icon that serves as a powerful reminder to make healthy food choices and to build a healthy plate at mealtimes. It is a visual cue that identifies the five basic food groups from which consumers can choose healthy foods to build a healthy plate.

The plate is divided into four groups that is, fruits (20%), vegetables (30%), protein group (20%) and grains (30%) and a bowl of dairy product.

Dietary Guidelines of MyPlate

- Balance calories
- Enjoy your food but eat less.
- Avoid over sized portions.
- Foods to eat more often are vegetables, fruits, whole grains and fat free or 1% milk and dairy products.
- Compare sodium in foods.
- Make half your grains whole grains.

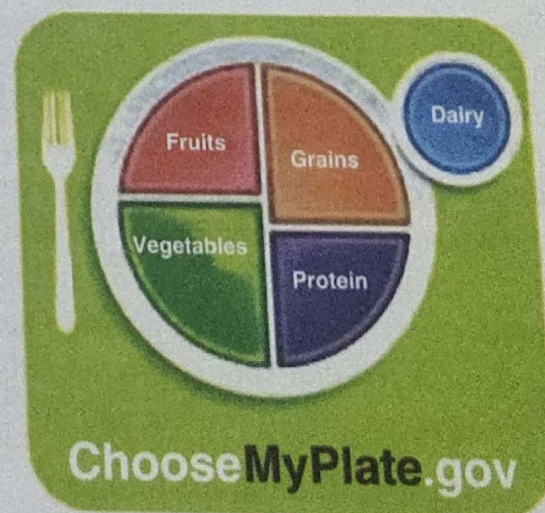


Fig. 1.10 The Food Guide—MyPlate

Source: USDA

- Foods to eat less often are solid fats, added sugars and salt.
- Drink water instead of sugary drinks.

Every family has unique needs and MyPlate helps to discover a personalized healthy eating style that works within their lifestyle.

Mediterranean Diet

Mediterranean diet contains high amounts of fruits, vegetables, beans and grains; low in red meat; and modest amounts of fish, eggs, poultry and dairy. Red wine is another component of the diet. Olive oil is the primary source of added fat. Research shows that Mediterranean diet lowers total cholesterol, low-density lipoprotein cholesterol and triglycerides and raises high-density lipoprotein cholesterol. Antioxidants present in the diet prevent LDL cholesterol from being oxidized. Studies have shown that Mediterranean diet is inversely associated with blood pressure levels. Studies have shown an inverse relationship between adherence to the Mediterranean dietary pattern and weight gain.

A typical meal includes a nut laden salad tossed with olive oil, red wine, lightly cooked fish, cereals, vegetables, garlic and fresh fruit. Herbs and spices are also used. This diet is cardio protective.

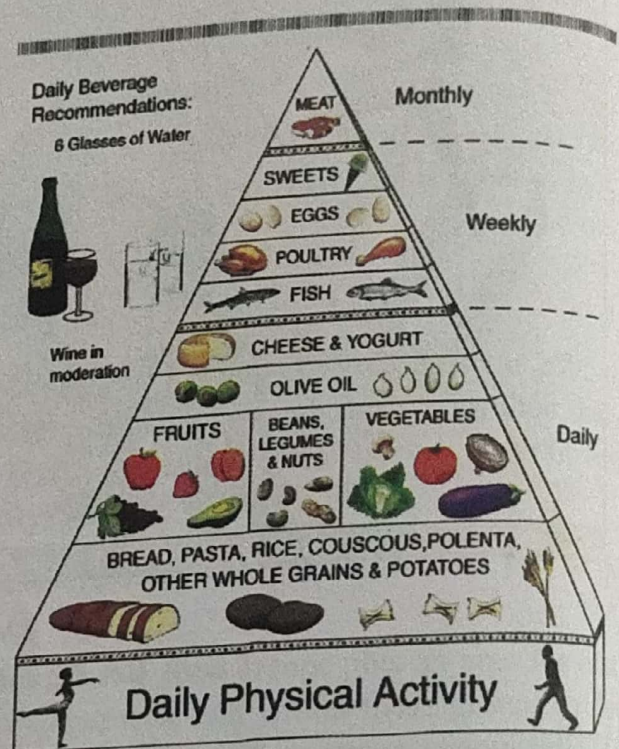


Fig. 1.11 The Traditional Healthy Mediterranean Diet Pyramid

PLANNING BALANCED DIET

Balanced Diet

Balanced diet is one which contains different types of foods in such quantities and proportions so that the need for calories, proteins, minerals, vitamins and other nutrients is adequately met and a small provision is made for extra nutrients to withstand short duration of leanness and it covers energy expenditure and for tissue maintenance, repair and growth. In addition, a balanced diet should provide bioactive photochemicals such as dietary fibre, antioxidants and other nutraceuticals which have positive health benefits. Low glycaemic index foods are preferred.

A balanced diet should provide around 60–70 per cent of total calories from carbohydrate 10–12 per cent from protein and 20–25 per cent of total calories from fat. Balanced diet

- meets nutritional requirement
- provides phytochemicals
- prevents degenerative diseases
- improves longevity

- prolongs productive life
- improves immunity
- increases endurance level
- develops optimum cognitive ability
- helps in coping up stress
- ability to withstand short duration of leanness.
- covers energy expenditure and for tissue maintenance, repair and growth.

Food Exchange Lists

Food Exchange Lists are the basis of meal planning. Food exchange lists are groups of measured foods of the same calorific value and similar protein, fat and carbohydrate. All foods of exchange lists make a specific contribution to a good diet. None of the exchange groups can itself supply all the nutrients needed for a well balanced diet. Exchange lists are based on principles of good nutrition that apply to everyone though extremely helpful for diabetics. Food exchange lists help in manipulation of protein, calories and other nutrients.

Food Composition Tables

In 2017 National Institute of Nutrition has published Indian Food Composition Tables. These tables are data repository for the content of nutritionally relevant chemical constituents and energy values of foods. These tables in addition to nutritive value of Indian foods, also give data on organic acids, polyphenols, oligosaccharides, phytosterols, saponins and phytates. The data compiled in the Food Composition Tables normally comprises of analytical, achival, calculated and/or derived values weighted towards the most representative of the true content in a given food.

Compositional values of foods are useful in manifold ways; in nutritional surveillance, consumer nutrition appraisal, nutrition labeling, etiology of disease prevalence, setting institutional (school) menu standards – meal planning and issue of dietary guidelines or recommendations.

Principles of Planning Diets

- **Meeting nutritional requirements:** A good menu is one which will not only provide adequate calories, fat and proteins but also minerals, vitamins essential for the well being of each member of family. In a balanced diet the ratio of energy distribution from carbohydrate, protein and fat would be 7 : 1 : 2 respectively. The diet should contain 'Basic food groups'.
- **Meal pattern must fulfil family needs:** Meal pattern varies with age, occupation and life stage of the family members. A family meal should cater to the needs of the different members. A growing adolescent boy may need variety of foods to satisfy appetite, whereas a young child may require soft and bland diet. Pregnant women require more greens in the diet. A heavy worker requires more calories and B vitamins than other members of the family. The family meal must offer children enough fat and flexibility in caloric density so that their energy needs are met.
- **Meal planning should save time and energy:** Planning of meals should be done in such a way, that the recipes should be simple and nutritious. Labour and time saving devices can be used.

- **Meal planning should consider economic constraints:** Meals planned that are not within budget, cannot be put into practice. The cost of meals can be reduced by bulk purchasing and using seasonal fruits and vegetables.
- **Meal plan should give maximum nutrients:** Losses of nutrients during processing and cooking should be minimised. Sprouted grams, malted cereals and fermented foods enhance the nutritive value. Good quality protein should be distributed in all meals. Pressure cooker can be used to conserve the nutrients.
- **Meal planning considers individual likes and dislikes:** The meal plan should not only meet RDA but also individual preferences, like vegetarian or non-vegetarian preferences. If a person does not like particular greens, it can be tried in a different form or substituted by some other equally nourishing food. Food habits and dietary pattern should also be considered. Religion, traditions and customs of the individual should be considered in planning the menu.
- **Meals planned should provide variety:** If meals are monotonous they are not relished. Variety can be introduced in colour, texture and taste, by using different kinds of foods and cooking methods. Variety also helps in meeting the nutritional requirement. This helps the child to appreciate different flavours and to accept many foods in his later life.
- **Meals should give satiety:** Each meal should have some amount of protein, fat and fibre to give satiety. While planning menu, the interval between meals is also considered.
- **Menus should include locally available foods:** One can plan balanced diet with locally available millets, green leafy vegetables, fruits, meat and milk products. They are fresh, nutritious and less processed. They are less expensive.
- **Meals should include health foods:** Ideal diets should provide besides nutrients those bioactive chemicals which can help to prevent and retard disease processes. Foods should be rich in antioxidants.

Following the International Conference of Nutrition in 1992 the WHO and FAO recommended that all regions of the world provide advice to the public through qualitative and/or quantitative dietary guidelines relevant for different age groups and lifestyles appropriate for the population. Food based dietary guidelines published as a technical bulletin by the WHO expresses the principles of nutrition education in terms of foods and reinforces the link between dietary pattern and reduced risk of certain diseases.

PLANNING DIETS FOR INSTITUTIONS

In addition to the above factors, the following points are to be considered in planning diets for institutions.

- While planning menu for an institution cyclic menu should be used for one or two weeks meeting the requirement of RDA.
- For planning menus in institutions standardised recipes and procedure should be used. Serving size also needs to be standardized.
- In non commercial institutions complex menus and recipes must be avoided as they can be beyond the skill level of staff.

Table 1.7 Summary of Recommended Dietary Allowances for Indians suggested by ICMR—2010

Group	Particulars	Body wt. kg	Net energy kcal/d	Protein g/d	Vitamin A µg/d	Iron mg/d	Calcium mg/d	Vitamin A µg/d		Thiamine mg/d	Riboflavin mg/d	Niacin equivalent mg/d	Pyridoxine mg/d	Ascorbic acid mg/d	Folic acid µg/d	Vitamin B ₁₂ µg/d	Magnesium mg/d	Zinc mg/d			
								Retinol	β-carotene												
Man	Sedentary work	60	2320	60.0	25	17	600	600	4800	1.2	1.4	16	2.0	40	200	1.0	340	12			
	Moderate work		1.4							1.6	18										
	Heavy work		1.7							2.1	21										
Woman	Sedentary work	55	1900	55.0	20	21	600	4800	600	1.0	1.1	12	2.0	40	200	1.0	310	10			
	Moderate work		1.1							1.3	14										
	Heavy work		1.4							1.7	16										
	Pregnant woman		+0.2							+0.3	+2	2.5							60	300	1.2
	Lactation		+0.3							+0.4	+4										
0-6 months			+600	+19.0	30	21	1200	7600	950	+0.2	+0.3	+3	2.5	80	300	1.5	30	12			
			+520	+13.0						0.2	0.3	710 µg/kg							0.1	25	25
0-6 months		5.4	92 kcal/kg/d	1.16 g/kg/d	-	46 µg/kg/d	500	2800	350	0.3	0.4	650 µg/kg	0.4				45	-			
			80 kcal/kg/d	1.69 g/kg/d	19	05												50	5		
6-12 months		8.4	1060	16.7	27	09	600	3200	400	0.5	0.6	8	0.9	80	80	0.2-1.0	70	7			
			1350	20.1	25	13	600	4800	600	0.7	0.8	11	0.9	40	100	0.2-1.0	100	4			
1-3 years		12.9	1690	29.5	30	16	800	4800	600	0.8	1.0	13	1.6	40	140	0.2-1.0	120	9			
			2190	39.9	35	21	800			1.1	1.3	15	1.6				160	9			
			2010	40.4	35	27	800			1.0	1.2	13	1.6					165	11		
10-12 years		34.3	2750	54.3	45	32	800	4800	600	1.4	1.6	16	2.0	40	150	0.2-1.0	210	11			
			2330	51.9	40	27	800			1.2	1.4	14	2.0					195	12		
13-15 years		46.6	3020	61.5	50	28	800			1.5	1.8	17	2.0	40	200	0.2-1.0	235	12			
			2440	55.5	35	26	800			1.0	1.2	14	2.0					235	12		
16-17 years		52.1	2440	55.5	35	26	800			1.0	1.2	14	2.0	40	200	0.2-1.0	235	12			
			2440	55.5	35	26	800			1.0	1.2	14	2.0					235	12		

Source: Indian Council of Medical Research, 2010 Nutrient Requirements and recommended dietary allowances for Indians. ICMR.

- Menu must take into account the equipment available.
- Availability of food in a particular area should be considered, for example a rural area may not have selection of foods as in an urban area.
- Regional preferences should be considered. Rice based menus are preferred in a region where it is the staple diet.
- There should be flexibility with menu plan. Use of general descriptive terms such as cereal, pulse, fresh fruit or vegetable is advisable as they can be selected according to season, availability and cost.
- Substitute foods must be available in the event of emergencies or shortage.

STEPS INVOLVED IN PLANNING A DIET

There are three steps involved in planning a menu.

Step I: Recommended dietary allowances

To calculate balanced diet, as a first step there is a need to know the Recommended Dietary Allowances for different age groups prescribed by Nutrition Expert Committee of ICMR. Table 1.7 shows Recommended Dietary Allowances for Indians (2010).

Step II: Food list

Food list can be prepared either by using ICMR Tables or Exchange lists.

A. Using ICMR Tables

As a second step while planning the daily diet the foods are chosen from all food groups. To make menu planning more convenient ICMR has suggested the portion size and balanced diets for adults and for different age groups (Tables 1.8, 1.9 and 1.10).

The balanced diets for adults and different age groups are given as multiples of these portion sizes. The portion sizes are given in terms of raw food.

Table 1.8 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 and milk products	100	70	3.0	5	3.0
Roots and tubers	100	80	1.3	19	—
Green leafy vegetables	100	45	3.6	—	0.4
Other vegetables	100	30	1.7	—	0.2
Fruits	100	40	—	10	—
Sugar	5	20	—	5	—
Fats & Oils	5	45	—	—	5

Source: Dietary Guidelines for Indians—A manual, 2011, National Institute of Nutrition, ICMR, Hyderabad.

Table 1.9 Balanced diet for infants, children and adolescents (number of portions)

Food groups	Portion g	Infants 6-12 months	1-3	4-6	7-9	Years					
						10-12		13-15		16-18	
						Girls	Boys	Girls	Boys	Girls	Boys
Cereals and millets	30	0.5	2	4	6	8	10	11	14	11	15
Pulses	30	0.25	1	1.0	2	2	2	2	2	2.5	3
Milk and milk products	100	4*	5	5	5	5	5	5	5	5	5
Roots and tubers	100	0.5	0.5	1	1	1	1	1	1.5	2	2
Green leafy vegetables	100	0.25	0.5	0.5	1	1	1	1	1	1	1
Other vegetables	100	0.25	0.5	1	1	2	2	2	2	2	2
Fruits	100	1	1	1	1	1	1	1	1	1	1
Sugar	5	2	3	4	4	6	6	5	4	5	6
Fats/Oils (visible)	5	4	5	5	6	7	7	8	9	7	10

*Quantity indicates top milk. For breast-fed infants, 200 ml top milk is required.

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

For infants, egg/meat/chicken/fish can be introduced around 9 months.

Table 1.10 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 and milk products	100	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 (visible)	5	5	4	6	5	8	6

B. Using Cooked Food Exchange Lists

The diet can also be prescribed in terms of cooked exchange lists. Each exchange provides 100 kcals.

There is no fat exchange as the calorie value of the recipes include fat that is used. If additional fat or sugar is used, calorie value can be calculated by multiplying with 9 and 4 per gram respectively.

All the food portions in the given list provide approximately the same amount of kilocalories. Portion sizes are strictly defined so that every item on a given list provides roughly the same amount of energy. Any food on a list can be exchanged for any other food on that same list without affecting balance or total calories.

Recipes from exchange lists are selected from all groups and energy and protein values are calculated and compared with the RDA. If energy and protein RDA are met, most of the time all the other nutrients would be met in the diet provided principles of balanced diet are followed.

Table 1.11 Exchange list of 100 kcal
Capacity of one standard katori (k) is 150 ml.

Cereal exchange – 1.5–3.5 g protein	
Idli (big)	1
(medium)	1½
Dosa (big)	½
(small)	1
Phulka	2
Chapathi	1
Puri	1½
Rava idli	1
Veg. sandwich	¾
Bread toast (medium)	1½
Bread pakoda	3
Plain rice	¾ k
Upma	½ k
Veg. noodles	1 k
Coconut rice	½ k
Pongal	½ k
Boiled wheat rava	1 k
Sweet pongal	2 tsp
Paniyaram	1¼ pieces
Vermicelli payasam	2 tsp
Kesari	1½ tsp
Rice flakes upma	½ k
Naan	2/3
Cheese Sandwich	1/3
Ragi puttu	¾ k
Ragi adai	¾
Pulao	½ k
Bise bela bath	½ k
Tamarind rice	½ k
Curd rice	½ k
Idiappam	1
Pulse exchange – 3–5 g protein	
Sambar	1½ k
Rasam	2½ k
Thick dal	½ k
Thin dal	1 k
Channa masala	½ k

Dry peas sundal	3/4 k
Roasted bengal gram chutney (without coconut)	1/2 k
Sprouted moong salad	1 heaped katori
Pesarattu	3/4
Baked masala Vada (with negligible amount of fat)	2 nos
Adai	1
Vada	1
Keerai vada	3/4
Bajji	2
Bonda	1
Meat exchange – 5 g protein	
Egg omelette	1
Scrambled egg	1/2 k
Fish Kolambu	3/4 k
Fish fry small piece	1
Egg gravy	3/4 k
Meat curry	1 k
Egg custard	1/2 k
Milk exchange – 4.5 g protein	
Milk	1 k
Curd	1 k
Cheese	1 cube
Paneer	40 g
Butter milk	1 glass–(350 ml)
Badam milk shake	1/4 glass
Banana milk shake	1/3 glass
Milk kheer	1/2 k
Carrot kheer	3/4 k
Vegetable A exchange	
Curry without coconut and gravy (with simple seasoning)	1 heaped katori
Plain tomato soup	2 k (1 soup bowl)
Soup with white sauce	1 k (1/2 soup bowl)
Mint chutney	1/2 k
Onion chutney	1/2 k
Vegetable B exchange	
Roots and tubers curry	1/2 k
Cutlet	1/2
Fruit exchange	
Apple	1 medium
Banana	1
Custard apple	1
Pine apple	3 slices
Orange	2½
Sapota	2 (small)
Guava	1 (Big)
Fruit salad (no sugar or dressing)	3/4 k

*Work out details are given in appendix.

Step III: Making menu

The foods that are listed in step II are converted into recipes if taken as portions from ICMR tables and distributed in different meals like breakfast, lunch, evening tea and dinner. Recipes in cooked exchange lists are distributed in different meals.

People's eating habits vary enormously and dietitians must respect dietary freedom and diversity when making recommendations. Dietary diversity is one of our culture's strengths and sources of pleasure. There are many ways to eat to be healthy. The best way to achieve a balanced diet is to plan meals in relation to other food for the whole day. It is advisable to eat small regular meals rather than one huge meal.

Apart from diet, factors like no smoking, alcohol in moderation, regular physical activity, adequate rest and medical attention when needed all contribute to a healthy life. Establishing these healthy habits early in life seems to be the most important step one can take to reduce the risks of diseases, in later life.

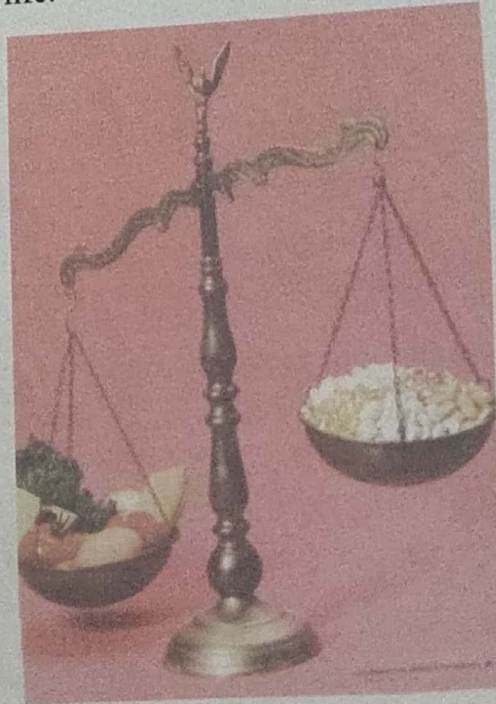


Fig. 1.12 Balanced diets are farm based but not pharmacy based.

Source: The Arthritis Foundation, USA.

January 7th is World Dietetics Day

April 7th is World Health Day

SUGGESTED READINGS

- Dietary Guidelines for Indians – A Manual 2011, National Institute of Nutrition, Hyderabad.
- Longvah T., R. Ananthan, K. Bhaskarachary and K. Venkaiah 2017, Indian Food Composition National Institute of Nutrition, Hyderabad.
- Nutrient Requirements and Recommended Dietary Allowances for Indians. A Report of the Group of the Indian Council of Medical Research. ICMR, 2010.
- USDA Food Guide. www.mypyramid.gov, www.choosemyplate.gov.
- American Dietetic Association. www.eatright.org.