



**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 1

### Definitions Used in Nutrition

## Content

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<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 1</b>	<b>Definitions Used In Nutrition</b>
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### Objectives

- To create knowledge about the common terms of nutrition
- To provide the concepts of nutrition.
- **Balanced diet** is one which contains foods from all the food groups and provide nutrients in the amount and proportion required according to one's age, gender and activity.
- **Food** is that which nourishes the body. Food may also be defined as anything eaten or drunk, which meets the needs for energy, building, regulation and protection of the body. In short, food is the raw material from which our bodies are made.
- **Meal** is an eating occasion that takes place at a certain time and includes specific, prepared food, or the food eaten on that occasion.
- **Meal Pattern** A meal pattern is a menu-planning tool used to develop menus for a specific age group. Meal patterns should include food from each of four food groups.
- **Meal planning** involves planning of balanced meals which are colourful, attractive, appetizing and palatable and within the economic means of the individuals concerned.
- **Nutrition** has been defined as food at work in the body. Nutrition includes everything that happens to food from the time it is eaten until it is used for various functions in the body. Nutrients are components of food that are needed by the body in adequate amounts in order to grow, reproduce and lead a normal, healthy life. Nutrients include water, proteins, fats, carbohydrates, minerals and vitamins.

- The study of the science of nutrition deals with what nutrients we need, how much we need, why we need these and where and how we can get them. Nutrition is the result of the kinds of foods supplied to the body and how the body uses the food supplied.
- Adequate, optimum and good nutrition are expressions used to indicate that the supply of the essential nutrients is correct in amount and proportion. It also implies that the utilization of such nutrients in the body is such that the highest level of physical and mental health is maintained throughout the life-cycle.
- **Nutritional status** is the state of our body as a result of the foods consumed and their use by the body. Nutritional status can be good, fair or poor. The characteristics of good nutritional status are an alert, good natured personality, a well-developed body, with normal weight for height, well developed and firm muscles, healthy skin, reddish pink colour of eyelids and membranes of mouth, good layer of subcutaneous fat, clear eyes, smooth and glossy hair, good appetite and excellent general health. General good health is evident by stamina for work, regular meal times, sound regular sleep, normal elimination and resistance to disease.
- Poor nutritional status is evidenced by a listless. Apathetic or irritable personality, undersized poorly developed body, abnormal body weight (too thin or fat and flabby body), muscles small and flabby, pale or sallow skin, too little or too much subcutaneous fat, dull or reddened eyes, luster less and rough hair, poor appetite, lack of vigour and endurance for work and susceptibility to infections. Poor nutritional status may be the result of poor food selection, irregularity in schedule of meals, work, sleep and elimination.

- **Health:** The WHO (World Health Organization) has defined Health as the 'state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'. The word health refers to the condition of the body, good health not only implies freedom from disease, but physical, mental and emotional fitness as well.
- **Malnutrition** means an undesirable kind of nutrition leading to ill-health. It results from a lack, excess or imbalance of nutrients in the diet. India is facing the dual burden of malnutrition, including both under nutrition and over nutrition.
- Under nutrition is a state of an insufficient supply of essential nutrients. Malnutrition can be primarily be due to insufficient supply of one or more essential nutrients; or it can be secondary, which means it results from an error in metabolism, interaction between nutrients or nutrients and drugs used in treatment.
- Over nutrition refers to an excessive intake of one or more nutrients, which creates a stress in the bodily function.
- **Diet** refers to whatever you eat and drink each day. Thus, it includes the normal diet you consume and the diet people consume in groups (hostel diet). Diet may also be modified and used for ill persons as part of their therapy (therapeutic diets).
- **Nutritional care** is the use of nutritional knowledge in planning meals and the preparation of these meals in an acceptable and attractive manner to feed people. It involves assessment of the exiting meal patterns and improving these in an acceptable manner. While the nutritional plan may be general for and group of people, the actual execution is individualized to suit the person's needs and background. Thus, one has to use a lot of ingenuity to succeed in making nutritional care effective in practical terms.

- **Food Exchange:** The word exchange refers to the food items on each list which may be substituted with any other food item on the same list. One exchange is approximately equal to another in carbohydrate, calories, protein and fat within each food list.
- **Reference Indian Man:** Has been defined as “an adult man between 19-39 years of age, weighing 65 kg. He is free from disease and is physically fit for active work. On each working day, he is employed for eight hours in occupation that usually involves moderate activity. While not at work, he spends eight hours in bed, four to six hours in sitting moving about and two hours in walking, active recreation on household duties”. For such a reference man, ICMR has taken a height of 163 cms.
- **Reference Indian Woman:** Is defined as “an adult woman between 19-39 years of age, weighing 55 kg. She may be engaged for eight hours in general household work, in light industry or in any other moderately active work. Apart from eight hours in bed, she spends four to six hours in sitting or moving around (light activity) and two hours in walking, active recreation or household duties”. For such a reference woman, ICMR has taken a height of 151 cm.

## DETERMINATION OF NUTRITIONAL REQUIREMENTS

### LECTURE 2

#### Objectives

- To create knowledge about the requirement of nutrients for humans
- To discuss the factors responsible for varied nutrient requirement among individuals
- To discuss the concept of Recommended Dietary Allowance (RDA).

#### Definitions

1. **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.
2. **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.
3. **Tolerable Upper Level (TUL):** Refers to the highest average daily nutrient intake level that is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the TUL, the risk of adverse effects will increase.
4. **Adequate Intake (AI):** These values are used when EAR or RDA cannot be determined. The AI is the recommended average daily intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group of apparently healthy people that are assumed to be adequate.

- 5. Lower threshold intake (LTI):** Refers to a value derived from the EAR and is calculated as the EAR minus 2 SD of the distribution of requirements. This value is sufficient to meet the needs of the bottom 2% of individuals. However, countries have used a different cut off such as 5% or 10% to evaluate nutrient insufficiency, although the concern is that these values would set a very low expectation of the individual nutrient intake adequacy level.

### General Principles for deriving human nutrient requirements

Several methods have been employed over the years to arrive at the requirement of different nutrients for individuals of different physiological groups and some of these methods have improved with time. The general principles underlying these methods are:

**Dietary intakes:** This approach is used to arrive at the energy requirement of children. Energy intakes of normal growing healthy children are used for this purpose. Currently it is not in use as it is considered to overestimate the requirement and not yield correct figures.

**Growth:** Daily intake of breast milk and its nutrient content are utilized to define the nutrient requirement during early infancy (0-1y). This approach is also no longer in use as it leads to an overestimation of the requirement during early infancy. However, the mode of satisfying the nutrient requirement in early infancy (up to 6 months) is only through breast milk intake.

**Nutrient balance:** The minimum intake of a nutrient for equilibrium (intake = output) in adults and nutrient consistent retention with satisfactory growth in infants and children, for satisfactory maternal and foetal growth during pregnancy, satisfactory breast milk output during lactation have been used widely in arriving at the protein requirements.

**Obligatory loss of nutrients:** The minimal loss of any nutrient or its metabolic product (viz. nitrogenous end products of proteins) through normal routes of elimination viz. urine, faeces and sweat is determined on



a diet devoid of, or very low in the nutrient under study (viz. protein-free diet). These values are used to determine the amount of nutrient to be consumed daily through the diet to replace the obligatory loss of the nutrient and it represents the maintenance needs of an individual (viz. adults). In infants and children, growth requirements are added to this maintenance requirement. This approach has been widely used in assessing the protein requirement. Other losses of N through sweat, hair etc., are not considered in this method.

**Factorial approach:** In this approach, the nutrients required for different functions, are assessed individually and added up to arrive at the total daily requirement. This has been the basis of computing the energy requirements (viz., sleep + rest + occupational activity + non-occupational activity). This approach was being used earlier for assessing the protein requirements also.

**Nutrient turnover:** Results from studies on turnover of nutrients in healthy persons, using isotopically labeled nutrients are employed in arriving at the requirement of certain nutrients. Requirements of vitamin A, vitamin C, iron and vitamin B12 have been determined through this approach. Earlier, radioactive isotopes were used and currently stable isotopes, which are safer and being increasingly used to determine the turnover of nutrients in the body. Stable isotopes are particularly useful, as they are safer, in determining the turnover of nutrients in infants, children, in women particularly during pregnancy and lactation where use of radioisotopes are contraindicated. Stable isotope labeled nutrients are however expensive and difficult to obtain.

**Depletion and repletion studies:** This approach is used in arriving at the human requirement of water soluble vitamins. The level of the vitamin or its coenzyme in serum or cells (erythrocytes, leucocytes) is used as the biochemical marker of the vitamin status. Human requirements of ascorbic acid (vitamin C), thiamine (vitamin B1) riboflavin (vitamin B2), and pyridoxine (vitamin B6) have been determined employing this approach.

Healthy volunteers are first fed a diet with very low levels of the vitamin till the biochemical parameter of the vitamin (or its coenzyme) reaches a low level. Response to feeding graded doses of the vitamin with the diet is then determined. The level at which the response increases rapidly corresponds to the level of the requirement of the vitamin.

## USE OF RECOMMENDED DIETARY INTAKES IN PLANNING BALANCED DIETS

### LECTURE 3

#### Objectives

- To discuss the concept of Recommended Dietary Allowance (RDA)
- To acquire basic knowledge of nutrient [requirements](#), recommended dietary allowances, and dietary modification under different physiological conditions.

#### Definitions

- **Calorie:** Unit used to indicate the energy value of foods. Quantitative requirements are expressed in the terms of energy, i.e., kilocalories (Kcals). Newer unit for energy is Kilo Joules.
- **Calorie Consumption unit (CU):** One unit represents RDA of energy for a sedentary man.
- **Recommended Dietary Intake (RDI):** It is the amount of a nutrient to be actually consumed in order to meet the requirements of the body, recommended dietary intakes are hence based on requirements.
- **Nutrient Requirement:** The requirement for a particular nutrient is the minimum amount that needs to be consumed to prevent symptoms of deficiency and to maintain satisfactory levels of the nutrient in the body.

#### Important points to consider for planning the diets

- A fundamental part of defining nutrient requirements is that the requirement is not the same in all people. It can vary considerably in healthy individuals.
- The median of this distribution is called the estimated average requirement (EAR). The EAR is the nutrient requirement used in public health nutrition, to evaluate the nutrient intakes of a population.
- The 97.5th percentile of the distribution is called the Recommended Daily Allowance. The RDA is for healthy individuals and may be prescribed to satisfy the nutritional needs of specific nutrients in a specific life stage and gender group and ensures that there is a very small risk of the nutrient intake being inadequate.
- With the RDA, there is also the risk of excess intake, since each individual may not actually require that much. There is no need to consume higher doses on regular basis or for prolonged period without supervision.
- Nutrients are also toxic when ingested at very high doses. This has resulted in the definition of the Tolerable Upper Limit of Intake (TUL). Intake of nutrients more than the TUL invites the risk of toxicity.
- It cannot be overstated that when assessing the health and nutritional status of the population, the EAR is recommended as the unit of requirement.

There are two important points that need to remember:

- 1) EAR/ RDA for adults are based on sex, age, body size and activity level
- 2) EAR/ RDA may change for people who are suffering from a disease which influences the nutrient needs.

**Salient features of EAR/ RDA:**

i) **These are expressed in kilocalories (Kcal), grams (g), milligrams (mg) or micro grams  $\mu\text{g}$ ):**

- Requirements for energy are expressed in Kcal. One kilocalorie is the amount of heat required to raise the temperature of one kilogram of water through  $1^{\circ}\text{C}$ .
- 1000 milligrams (mg) = one gram
- 1000 micrograms ( $\mu\text{g}$ ) = one milligram.
- The requirements for protein are given in grams and for vitamins and minerals are expressed in milligrams or micrograms.

ii) **Requirements for energy for adult men and women are based on activity levels:**

- Activity levels can be described as sedentary (light), moderate or heavy. The more the activity, the higher would be requirement for energy.

iii) **Requirements for protein are based on body weight:** The relationship can be expressed as 0.8g protein per kg body weight in the case of the adult. It varies for other age categories.

iv) **Requirements for energy and protein are given as additional intakes in pregnancy and lactation:** Pregnancy and lactation are periods of "physiological stress" because nutrient needs increase considerably to meet the needs of the growing foetus (in the case of pregnancy) and production of milk (in the case of lactation when the mother breastfeeds the baby). Requirements are given in terms of additional intakes (indicated by a "+" sign) for some nutrients like energy and protein. RDIs for the other nutrients are given as total intake figures.

**ENERGY :** As there is always an inherent risk of excess consumption of energy, ICMR (2020) suggested:

- Energy intake recommendations for a normal healthy population should be based on the actual weight and physical activity level of the target population.
- Ensure that energy requirements for groups are based on their average weight and physical activity levels. If the target group has a higher than ideal body weight, based on their BMI, appropriate considerations should be made for an energy intake appropriate for their ideal weight.
- Adequate physical activity should be carried out at any BMI and energy intake level. It is critical to maintain a healthy body weight and prevent overweight or obesity.

### PROTEIN

- The present Expert Group of the ICMR adopted the following approaches to define the protein requirements for Indians of different age groups. A median obligatory nitrogen loss of 48 mg/kg (WHO, 2007) has been used to compute mean (0.66 g/kg/day) and safe protein requirements (0.83 g/kg/day) for healthy Indian adults.
- The cereal-legume-milk composition of the diet for moderately active man has been improved to 3:1:2.5 as compared to the earlier 11:1:3 (ICMR 2010) within a given low cost window to meet daily protein requirements.

### FATS AND OILS

- The visible fat intake for sedentary, moderate and heavy activity has been set at 25, 30 and 40 g/d for adult man and 20, 25 and 30 g/d for adult women as against the single level recommended earlier.

### DIETARY FIBER

- Recommendations for fiber based on energy intake and the level of about 40 g/2000 kcal has been considered as safe intake.

## CARBOHYDRATES

For the first time recommendations have been made for the dietary intakes of carbohydrates.

- The EAR for CHO has been set at 100 g/day for ages 1 year and above with a RDA of 130 g/day, assuming a coefficient of variance (CV) of 15% based on variation in brain glucose utilization.

## MINERALS

### *Calcium and Phosphorus:*

- EAR for calcium for adult man, adult woman and pregnant woman is 800 mg/d.
- For lactating woman, an additional amount of 200 mg is added to EAR of 800 mg and a total of 1000 mg has been set as EAR and adding 10% CV, the RDA is set at 1200 mg. For post-menopausal women the recommendation is 1200 mg/d.

The recommended values for phosphorus for all age groups except for infants are 1:1 ratio with calcium. For infants, it is 1.5 times the value recommended for calcium.

### *Magnesium:*

- EAR is estimated to 320 mg per day and RDA at 385 mg per day for adult males.

### *Sodium and Potassium:*

- Specific recommendations have been made on adequate intakes for sodium and potassium for adult man and woman based on WHO (2012) recommendation.

- With regard to sodium due to emerging concerns on prevalence of hypertension a safe intake of 2000 mg/day which amounts to 5 g/day of salt is recommended
- An intake of 3510 mg/day is recommended for potassium.
- The desirable sodium: potassium ratio in mmol from the diet was fixed at 1:1.

### ***Iron:***

EAR for iron for adult man is 11 mg/day and for adult woman it is 15 mg/day.

***Selenium:*** The present Committee recommended 40 µg/day as adequate intake of selenium.

***Iodine:*** Based on intake of Iodine in the diet through food and as fortified salt, the recommendation of 150 µg/day is retained for adults. The recommendations of IOM of 250 µg/day for Iodine during pregnancy, have also been adopted.

## **VITAMINS**

### **Water Soluble Vitamins**

#### ***Thiamine and Riboflavin:***

- The daily intake of these vitamins is related to the energy requirements. In the absence of direct studies, the committee recommends the requirements of thiamine (men- 0.6 mg/1000 kcal; women- 0.8 mg/1000 kcal) and riboflavin (men- 0.9 mg/1000 kcal; women- 1.1 mg/ 1000 kcal) based on ETK-AC (1.15) and EGR-AC cut-off values (1.2), respectively for thiamine and riboflavin.

### **Niacin:**

- Based on the EAR of 5.6 mg/1000 Kcals for adults, which was derived by urinary metabolite studies of niacin, 10% CV (20% 2 SD) was added to EAR to derive the RDA. Individual requirements were computed based on energy requirements. The EAR (RDA) was set at 12 mg/day (14 mg/day) and 9 mg/day (11 mg/day) for sedentary men and women respectively.

### **WATER**

- The water required from beverages for adult man ranges from 32-58 ml per kg body mass and for woman, it ranges from 27-52 ml per kg body mass, with sedentary working group at lower end and the heavy working group at higher end of the range.
- For children, the requirement is greater than 60 ml per kg body mass and for adolescent boys it ranges from 47-60 ml per kg body mass, while, for girls it is 39-49 ml per kg body mass.
- For pregnant woman, based on the working intensity, the water required from beverages ranges from 2.1 to 3.2 litres per day.
- For old-age, irrespective of gender, the present consensus for water requirement from beverages is 33 ml per kg body mass for sedentary activity and 38 ml per kg body mass for moderate activity.

### **ANTIOXIDANTS**

- Realising the importance of dietary antioxidants, the ICMR committee deliberated on the information on consumption of antioxidants and recommended a minimum of 400 g/day of fruits and vegetables to obtain sufficient amounts of antioxidant nutrients such as beta-carotene, vitamin C and certain non-nutrients like polyphenols and flavonoids which may protect against chronic diseases.



- This should be complemented with sufficient amount of vegetable oil so as to obtain vitamin E.

### Use of EAR in planning balanced diets

The amounts of different foods to be consumed would depend on the EAR. The higher the requirement for a particular nutrient, the more should be the consumption of foods rich in that nutrient.

SUMMARY OF EAR FOR INDIANS - 2020

Age Group	Category of work	Body Wt (kg)	Energy (**) (Kcal/d)	Fats/ Oils (visible) (#) (g/d)	Protein (g/d)	CHO (g/d)	Cal cium (mg/ d)	Magne sium (mg/ d)	Iron (mg/ d)	Zinc (mg/ d)	Iodine (µg/ day)	Thiamine (mg/ d)	Ribo flavin (mg/ d)	Niacin (mg/ d)	Vit B6 (mg/ d)	Folate (µg/ d)	Vit B12 (µg/ d)	Vit C (mg/ d)	Vit A (µg/ d)	Vit D (IU /d)
Men	Sedentary	65	2110	25	42.9	100	800	320	11	14.0	95	1.2	1.6	12	1.6	250	2	65	460	400
	Moderate		2710	30								1.5	2.1	15	2.1					
	Heavy		3470	40								1.9	2.7	19	2.6					
Women	Sedentary	55	1660	20	36.3	100	800	270	15	11.0	95	1.1	1.6	9	1.6	180	2	55	390	400
	Moderate		2130	25								1.4	2.0	12	1.6					
	Heavy		2720	30								1.8	2.6	15	2.1					
	Pregnant woman	55 + 10	+ 350	30	+7.6 (2 <sup>nd</sup> trimester) +17.6 (3 <sup>rd</sup> trimester)	135	800	320	32	12.0	180	1.6	2.3	+2	1.9	480	+0.2	+10	406	400
	Lactation 0-6m		+600	30	+13.6	155	1000	270	16	12.0	200	1.7	2.5	+4	+0.22	280	+0.8	+40	720	400
	7-12m		+520		+10.6	155						1.7	2.4	+4	+0.16	280				
Infants	0-6 m*	5.8	550	-	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6-12m	8.5	670	25	8.8	-	-	-	2	2.0	130	-	-	-	0.5	71	1	-	170	-
Children	1-3y	11.7	1010	25	9.2	100	400	111	6	2.5	65	0.6	0.8	6	0.8	90	1	22	180	
	4-6y	18.3	1360	25	12.8	100	450	131	8	3.7	80	0.8	1.1	8	1.0	111	1	27	240	400
	7-9 y	25.3	1700	30	19.0	100	500	178	10	4.9	80	1.0	1.3	10	1.3	142	2	36	290	
Boys	10-12y	34.9	2220	35	26.2	100	650	223	12	7.0	100	1.3	1.7	12	1.7	180	2	45	360	400
Girls	10-12y	36.4	2060	45	26.6	100	650	214	16	7.1	100	1.2	1.6	12	1.6	186	2	44	370	400
Boys	13-15y	50.5	2860	50	36.4	100	800	294	15	11.9	100	1.6	2.2	16	2.2	238	2	60	430	400
Girls	13-15y	49.6	2400	35	34.7	100	800	270	17	10.7	100	1.3	1.9	13	1.8	204	2	55	420	400
Boys	16-18y	64.4	3320	40	45.1	100	850	338	18	14.7	100	1.9	2.5	19	2.5	286	2	69	480	400
Girls	16-18y	55.7	2500	35	37.3	100	850	279	18	11.8	100	1.4	1.9	14	1.9	223	2	57	400	400

\*: AI; \*\*: There is no RDA for energy. The EAR is equivalent to the Estimated Energy Requirement (EER); #: Visible fat requirement is in proportion to EER;

## Normal and Therapeutic Nutrition

### SUMMARY OF RECOMMENDED INTAKES FOR OTHER MINERALS AND TRACE ELEMENTS

SNo.	Minerals/Trace Element	Recommended intake
1	Phosphorous	1000 mg/day
2	Sodium	2000 mg/day
3	Potassium	3500 mg/day
4	Copper	2 mg/day
5	Manganese	4 mg/day
6	Chromium	50 µg/day
7	Selenium	40 µg/day

### TOLERABLE UPPER LIMIT (TUL) FOR NUTRIENTS

Age Group	Category of work	Protein (PE ratio)	Calcium (mg/d)	Magnesium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Iodine (µg/day)	Niacin (mg/d)	Vit. B6 (mg/d)	Folate (µg/d)	Vit. C (mg/d)	Vit. A (µg/d)	Vit. D (IU/d)
Men	Sedentary	<40%	2500	350	45	40	1100	35	100	1000	2000	3000	4000
	Moderate												
	Heavy												
Women	Sedentary	<40%	2500	350	45	40	1100	-	-	1000	2000	3000	4000
	Moderate												
	Heavy												
	Pregnant woman	<30%	2500	350	45	40	1100	-	-	1000	2000	3000	4000
Lactation 0-6m 7-12m	<40%	2500	350	45	40	1100	-	-	1000	2000	3000	4000	
Infants	0-6 m	<15%	-	-	40	4	-	-	-	-	-	600 <sup>S</sup>	1000
	6-12m	<15%	-	-	40	5	-	-	-	-	-	600 <sup>S</sup>	1500
Children	1-3y	<15%	1500	65	40	7	200	-	-	-	350	600 <sup>S</sup>	2500
	4-6y	<15%	2500	110	40	12	300	-	-	-	550	900 <sup>S</sup>	3000
	7-9 y	<15%	2500	110	40	12	400	-	-	300	800	900 <sup>S</sup>	3000
Boys	10-12y	<15%	3000	350	40	23	600	-	-	600-800 (9-17y)	1050	1700	4000
Girls	10-12y	<15%	3000	350	40	23	600	-	-	-	1300	1700	4000
Boys	13-15y	<15%	3000	350	45	34	900	-	-	-	1550	2800	4000
Girls	13-15y	<15%	3000	350	45	34	900	-	-	-	1800	2800	4000
Boys	16-18y	<15%	3000	350	45	34	1100	-	-	-	1950	2800	4000
Girls	16-18y	<15%	3000	350	45	34	1100	-	-	-	2000	2800	4000

S: adopted from IOM

## FOOD EXCHANGE LISTS

### LECTURE 4

#### Objectives

- To discuss the concept of Food Exchange Lists (FEL)
- To acquire basic knowledge of food exchange system and application of knowledge acquired for healthy eating.

#### Definitions

- **Food Exchange:** The word exchange refers to the food items on each list which may be substituted with any other food item on the same list. One exchange is approximately equal to another in carbohydrate, calories, protein and fat within each food list.
- **Food groups:** Foods are grouped together because they provide similar amounts of the key nutrients of that food group. To meet the nutrient requirements essential for good health, you need to eat a variety from each of the five food groups daily, in the recommended amounts. It is not necessary to eat from each food group at every meal.

#### Food Exchange Lists (FEL)

- The Food Exchange Lists (FEL) are the basis of a meal planning. Food exchange lists are groups of measured foods with similar 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 by 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 easy manipulation of protein, calories and other nutrients.

- Nutritive value of diets calculated using food composition tables is time consuming and laborious and also cannot be calculated by a layman.
- Detailed calculations are not required in day-to-day practice. Therefore, FEL becomes very useful.

### **Advantages of Food Exchange List (FEL):**

1. It helps the patients to plan a wide variety of menu within their daily food allowances.
2. The 'FEL' contains a variety of foods so that the patients can choose foods to their liking and have variety every day thus avoiding monotony.
3. When patients move from one part of the country to another, they can easily formulate their diets based on locally available foods.

An exchange list will contain foods of similar chemical composition. There will be some variations in the chemical composition with each exchange list. The food exchange lists are used in meal planning to make a quick and fairly accurate estimation of the nutritive value of diets. These are used to calculate the energy, carbohydrate, fat and protein content of the meals.

### Comprehensive Food Exchange List:

Food Exchange	Raw Food (g)	Protein (g)	Carbohydrate (g)	Fat (g)	Energy (KCal)
Cereals	30	3	20	0.8	100
Pulses	30	6	15	0.7	100
Egg	50	7	—	7.0	85
Meat, Chicken, Fish	50	9	—	7.0	70
Milk (Cow)	250 ml	8	12	11	180
Skim Milk	320	8	15	—	94
Roots and tubers	100	1.3	19	—	80
Green leafy Vegetables	100	3.6	—	0.4	45
Other Vegetables	100	1.7	—	0.2	30
Fruit	100	—	10	—	40
Fat	5	—	—	5	45
Sugar	5	—	5	—	20

The exchange lists were first published by a **Joint Committee of the American Dietetics Association, American Diabetic Association and the US Public Health Services in 1950**, and were revised in 1976.

**Table: Relationship of the Three Food Group Pattern to the Eight Food**

Function/Food Group	Major Nutrient	Food Exchange
<b>Body Building</b>	Protein	Milk
		Meat
		Pulse
<b>Energy Giving</b>	Carbohydrate & Fat	Cereal /starches
		Fat
		Sugar
<b>Protective</b>	Minerals, Vitamins & Dietary Fibre	Vegetables (excluding starchy \ vegetables)
		Fruits

**Exchange Lists**

In the making of an exchange list, similar foods are grouped together so that specified amounts of all the foods listed in that group or exchange, have approximately the same energy, carbohydrate, protein and fat content. The nutritive value of specific foods in the exchange list may slightly differ from the average value for that food exchange, but when a variety of foods are selected in the daily diet, these differences in nutritive value tend to cancel out. So, any one food in a particular food exchange list can be exchanged for any other food in the same list. Therefore, using the exchange lists in meal planning allows one to make a wider choice in selecting foods within every exchange, while controlling the total energy, carbohydrate, protein and fat in the day's diet. As the diet patterns and foods used in diets of Indians are different from those of developed countries of the West, a modified version of the American Exchange List

has been developed for Indians, which is based on the three food group pattern according to the different functions of food.

The details of each of the eight exchange lists in the Comprehensive Food Exchange List are being discussed below.

### **CEREAL/STARCH EXCHANGE**

- The basis of this exchange is one big slice of bread (30g) or a small wheat flour chapati made out of 20g flour which contains about 15g carbohydrates.
- Each exchange of cereal thus provides on an average about 15g carbohydrate, 2g protein, negligible fat and 70 kcal.
- One cereal/starch exchange is about 20g of almost all raw cereals or starches excepting root vegetables where 60g makes one exchange, because of their higher moisture content. Similarly, 30g of bread is taken as one exchange.

### **PULSE EXCHANGE**

- The basis for this exchange is 30g of raw pulse containing 7g of protein.
- Each exchange of pulse on this list, excepting soya bean, provides on an average about 7g protein, 17g carbohydrate, negligible fat and 100 kcal.
- Sprouted pulses are also included in this exchange; however, 30g of raw pulse on sprouting weighs nearly 70g due to water absorption. When sprouted, the ascorbic acid, thiamine, riboflavin and niacin content of these pulses increases significantly.

### **MILK EXCHANGE**

- Each exchange of milk or milk product on this list contains about 8g protein, 12g carbohydrate, 10g fat and 170 kcal.

- However, amount of fat will vary depending on what kind of milk is chosen, e.g., skim milk has only traces of fat whereas one exchange of buffalo milk has 16g fat.
- If skim milk is substituted for cow's milk, 320ml of skim milk is taken as one milk exchange. This amount provides 8g protein, but has negligible fat and only 93 kcal.

### MEAT EXCHANGE

- The basis for this exchange is 40g of edible portion of mutton muscle providing 7g of protein.
- Each exchange of meat or meat substitute on this list provides on an average about 7g of protein, 5g of fat, negligible carbohydrate and 70 kcal.
- The amount of fat and energy content of the food in this exchange may vary depending upon what kind of meat or meat substitute is chosen.

### VEGETABLE EXCHANGE

The vegetable exchange is divided into two groups A and B on the basis of their carbohydrate content.

#### Vegetable A exchange:

- All vegetables with 3% or less carbohydrate are included in this group.
- 100g or 1/2 cup of vegetables make one exchange which has negligible fat and protein and provide about 12 kcal.
- This exchange includes leafy vegetables such as bathua, spinach, lettuce, mustard leaves, vegetables of the gourd family such as bottle gourd, snake gourd, ridge gourd, tinda, and cucumber and radish.
- Using only 1 exchange of vegetable A in the day's diet contributes negligible amount of protein, carbohydrate and fat, but if more than one exchange is used then their nutritive contribution is taken as : 2 exchanges of vegetable A =1 exchange of vegetable B.



### **Vegetable B exchange:**

- This exchange includes all the vegetables that are not included in vegetable A exchange or cereal /starch exchange.
- A carbohydrate content of 7g is taken as the constant in this exchange, i.e., that much portion of various vegetables which provide 7g of carbohydrate is taken as one vegetable B exchange.
- Each exchange of the vegetables on this list provides on an average about 7 g carbohydrate, 2g protein, negligible fat and 40kcal; the amount of protein may vary although slightly from 1 to 4g.

### **FRUIT EXCHANGE**

- A portion of fruit that contains about 10g of carbohydrate is taken as one fruit exchange.
- Each exchange of fruit on this list provides on an average about 10g of carbohydrate, negligible protein and fat and 40kcal.
- High carbohydrate fruit such as dates or banana is chosen, then only 30-35g constitutes one exchange.
- Low carbohydrate fruit such as musk melon or water melon is chosen, then as much as 300g is taken as one fruit exchange.
- Moderate levels of carbohydrate such as apple, apricot, cherries, guava, lichi, papaya, pear, plum, etc. vary in amount from 75-100g per ex-change.

### **FAT EXCHANGE**

- One teaspoon or 5g of fat or oil is the basis for this exchange.
- This exchange includes butter, edible fats and oils, such as hydrogenated fats and vegetable oils, cream, nuts, oilseeds, salad dressings, etc. Each exchange on this list provides about 5g of fat and 45kcal.

## SUGAR EXCHANGE

- One teaspoon or 5g of sugar is the basis for this exchange.
- This exchange includes sugar, jaggery, honey, jam, jellies, marmalades etc. Each exchange on this list provides on an average 5g carbohydrate and 20kcal.
- When jams, jellies, etc., are chosen then 7 to 8g or 1½ teaspoon of it is taken as one sugar exchange, as this amount of jam or jelly contains 5g of carbohydrates.

**Assignment:** Prepare a menu with the help of food exchange list for vegetarian pregnant women having protein energy malnutrition.

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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 2

## Maternal Nutrition

## Content

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<b>Lesson 2</b>	<b>Maternal Nutrition</b>
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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 8<sup>th</sup> 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.

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- *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 B<sub>12</sub> 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"> <li>• Abortion</li> <li>• Complications during delivery</li> <li>• Ketosis</li> <li>• May not gain enough weight to have normal lactation</li> <li>• Pregnancy induced hypertension</li> </ul>	<ul style="list-style-type: none"> <li>• Premature infant</li> <li>• Low birth weight infant</li> <li>• Less brain cells</li> </ul>
Linoleic Acid		<ul style="list-style-type: none"> <li>• Retarded foetal growth</li> </ul>
Calcium	<ul style="list-style-type: none"> <li>• Muscular cramps</li> <li>• Repeated pregnancy with poor diet can result in osteomalacia</li> <li>• During lactation breast milk may be deficient in calcium</li> </ul>	<ul style="list-style-type: none"> <li>• Calcification of bones and teeth is decreased</li> <li>• Underweight due to the decreased foetal bone growth.</li> </ul>



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

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

## 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

## Normal and Therapeutic Nutrition

- 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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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 3 INFANCY

### Content

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ICAR-Indian Agricultural Statistics Research Institute

<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 3</b>	<b>Infancy</b>
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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.



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- 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  $\mu\text{g}$  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.



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- 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.

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- 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
<b>Fruit juice (6 months)</b>	Provide vitamin C which is lacking in milk. Tomato and orange juice also provide some amount of beta carotene.
<b>Greens soup (6 months)</b>	Child gets used to new taste, provides iron, calcium, beta carotene, riboflavin and vitamin C.
<b>Stewed apple ( 8 months)</b>	Gives calories but should not be given raw as it may choke the child.
<b>Soft custard with egg yolk (8 months)</b>	Provide vitamin A, iron, proteins and B vitamins. Off white should be introduced later as it may cause allergy.
<b>Kichdi (pongal), idli, chapatti + milk, (10-12 months)</b>	Easily digested and gives calorie and good amount of protein.
<b>Malted cereals and gruel made out of rice, rice flour, rice flasks, corn flasks and milk</b>	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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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 4

## Preschool Children -Growth and Development

### Content

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<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 4</b>	<b>Preschool Children -Growth And Development</b>
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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, CO<sub>2</sub> and H<sub>2</sub>O 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 (B<sub>6</sub>)<sub>2</sub>**, **folic acid**, and **Vitamin B<sub>12</sub>** 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.

### References

1. Gordon Wardlaw Gordon M. & Insel Paul M. (1992). Contemporary Nutrition.(p-p 479-482) , Boston, Mosby year Book.
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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 5

### School Age Children -Growth and Development

## Content

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NAHEP Component-2 Project "Investments In ICAR Leadership In Agricultural Higher Education"  
Division of Computer Applications  
ICAR-Indian Agricultural Statistics Research Institute

<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 5</b>	<b>School Age Children -Growth And Development</b>
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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 14<sup>th</sup> years in boys and the 12<sup>th</sup> 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-  $\mu\text{g}$  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 B<sub>6</sub>** is considered to be related to protein intake.
- **B<sub>12</sub>** 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 B<sub>12</sub>**.

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

## Normal and Therapeutic Nutrition

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

**(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.

## References

1. Gordon Wardlaw Gordon M. & Insel Paul M. (1992). Contemporary Nutrition. (Pp 479-482) , Boston, Mosby year Book.
2. Khanna K, Gupta S, Passi S J, Seth R, Mahna R and Puri S(2001) Textbook of Nutrition and Dietetics. Institute of Home Economics, University of Delhi.
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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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Division of Computer Applications  
ICAR-Indian Agricultural Statistics Research Institute

<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 6</b>	<b>Geriatric Nutrition</b>
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## Multiple choice questions

### Ques. 1 Choose the correct option

- i World Elders Day is celebrated on-
  - a) 3<sup>rd</sup> October
  - b) 17<sup>th</sup> November
  - c) 1<sup>st</sup> October
  - d) 12<sup>th</sup> 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



**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 7

### Importance and Modification of Normal Diet to Therapeutic Diets

#### Content

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Division of Computer Applications  
ICAR-Indian Agricultural Statistics Research Institute

<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 7</b>	<b>Importance And Modification Of Normal Diet To Therapeutic Diets</b>
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### Objectives

- To discuss about the importance of therapeutic diets
- To gain knowledge about the different types of therapeutic diets.

### Definitions:

- **Diet:** In nutrition, diet is the sum of food consumed by a person or other organism.
- **Diet Therapy:** Diet therapies are specially designed and prescribed for medical and/or general nutritional reasons.

### Introduction

- The diet used for feeding a normal, healthy individual needs to in certain respects so as to make it suitable to meet the modified nutritional needs when the individual is suffering from a given illness.
- It is imperative that the basis for planning of such modified diets, i.e., therapeutic diets should be the normal diet.
- Therapeutic diets are planned to maintain or restore good nutrition in the patient.

### DIET THERAPY

It is the use of diet (food and drink) not only in the care of the sick but also in the prevention of disease and maintenance of health. It is concerned with the use of food as an agent in affecting recovery from illness.



## **OBJECTIVES** of diet therapy:

- i) To maintain a good nutritional status.
- ii) To correct nutrient deficiencies which may have occurred due to the disease.
- iii) To afford rest to the whole body or to specific organs affected by the disease.
- iv) To adjust the food intake to the body's ability to metabolise the nutrients during the disease.
- v) To bring about changes in body weight whenever necessary.

## **The advantages of using normal diet as the basis for therapeutic diets are**

1. It emphasises the similarity of psychological and social needs of those who are well, even though there are quantitative and qualitative differences in requirements, thus ensuring better acceptability.
2. Food preparation is simplified when the modified diet is based upon the family pattern and the number of items requiring special preparation is reduced to a minimum.
3. The calculated values for the basic plan are useful in finding out the effects of addition or omission of certain foods. e.g; if vegetables are restricted, vitamin A or Vitamin C deficiency can occur.

## **THERAPEUTIC ADAPTATIONS OF THE NORMAL DIET**

A normal diet may be modified according to disease, symptoms, condition of the patient and the metabolic changes. Therapeutic modifications which are commonly done are :

1. **Change in consistency** so as to provide a normal, soft or a fluid diet. In conditions like diarrhoea, fevers etc., the digestive system may be affected and a liquid or soft diet is recommended. The presence of ulcers in the mouth may hinder the intake of solid food. On the other hand, in diseases like diabetes and hypertension, a normal consistency diet may be recommended.
2. **Modifications in energy intake**, for example, high or low energy diets. Depending upon the metabolic changes, modification in activity patterns and the weight of a patient, suitable alterations in the energy intake are done. An obese diabetic would thus be recommended a low energy diet while an underweight tuberculosis patient would be advised a high energy intake.
3. **Modification in the content of one or more nutrients**, for example, high or low protein diets, low sodium diets, moderate fat diet or a high carbohydrate diet. It is imperative to increase the nutrient intake in certain diseases where the loss of nutrients is enhanced or the body's needs are increased for example, the increased water and electrolyte needs during diarrhea or elevated protein requirements in chronic fevers like tuberculosis. On the other hand, restriction of some nutrients in certain diseases proves beneficial like restriction of sodium in hypertension, fat in liver disorders and carbohydrates in diabetes.
4. **Modification in the fibre content**, such as high and low fibre diets. Diseases affecting the functioning of the gastro-intestinal system generally require modifications in the fibre content of the diet. Patients of diarrhea are advised to decrease their fibre intake, while patients suffering from constipation are asked to increase the intake of fibre-rich foods.
5. **Bland diets** are prescribed to avoid irritation of any kind to the alimentary tract as in case of peptic ulcers. Such diets are chemically,

## Normal and Therapeutic Nutrition

mechanically and thermally bland. Strong spices, stimulants and strongly flavoured vegetables and fruits as irritants are avoided. The foods served should be at room temperature and very hot or very cold foods are avoided.

6. **Exclusion of certain foods.** In allergic conditions, certain specific foods to which the individual is allergic are entirely excluded from the diet. Generally foods to which people may be allergic are protein foods like milk, egg and seafoods and so these foods have to be eliminated. In Case of malabsorption syndrome like celiac disease, the gastro-intestinal mucosa being sensitive to wheat protein, wheat and its products have to be completely excluded from the diet.
7. **Increase in the frequency of feeding.** In some disease conditions, the patient may not be able to eat very large amounts of foods at one time. It may thus become essential to give smaller meals at frequent intervals as in fevers, diarrhea, ulcers etc.
8. **Modify the mode of feeding.** In patients who are not able to take foods orally, special feeding methods like tube or intravenous feeding may have to be adopted to meet the nutritional needs.

As far as possible, every therapeutic diet should be patterned after the patient's normal, usual diet, making use of available foods, adapted to the patient's food preferences and, above all, keep the patients in nutritional homeostasis. A therapeutic diet is, therefore, a normal diet, qualitatively and quantitatively modified as per the patient's special needs and in line with the general principles of meal planning.

### MODIFICATIONS IN CONSISTENCY

The most common therapeutic modification is a change in consistency. A normal consistency diet is used for most of the patients in hospitals who are permitted to eat without any restriction in respect of the type and amount of food. Such a diet is known by various names - regular, general or full diet. However, for most acute illnesses, the consistency of the diet is modified to either soft or fluid, depending upon the tolerance of the patient.

### NORMAL DIET

A normal diet is defined as one which consists of any and all foods eaten by the person in health. Regular normal diet

- It is the most frequently used diet in all hospitals.
- It is used for ambulatory and bed ridden patients whose condition does not necessitate a special diet of one of the routine diets.
- Many special diets progress ultimately to a regular diet.
- Nutritionally balanced since it is based on the three food group pattern.
- Ease in planning and preparation.
- Psychologically advantageous, thus having a better acceptability.
- Easy to evaluate and modify accordingly, if necessary.

**Foods allowed:** All foods that are eaten by a person in normal health.

**Foods to be used in restricted amounts:** Fatty foods like rich cakes, pastries, halwas, etc. Fried foods like poories, paranthas, pakoras, etc. Strongly flavoured vegetables like turnip, capsicum, radish, etc. Too many spices, relishes or pickles.

## Types of therapeutic diets

1. Clear-fluid diet
2. Full-fluid diet
3. Soft diet

### FLUID DIETS

Fluid diets are febrile states, post-operatively or whenever the patient is unable to tolerate solid food. These diets are used for patients requiring easily digested foods which are free from mechanical and chemical irritants. The degree of nutritional adequacy of these diets will depend upon the type of fluids permitted. Fluid diets are of two types

- (i) Clear fluid diet,
- (ii) Full fluid diet

#### Clear-fluid diet

- Whenever an acute illness or surgery produces a marked intolerance for food as may be evident by nausea, vomiting, anorexia, distension and diarrhea, it is advisable to restrict the intake of food.
- In acute infections before diagnosis, in acute inflammatory conditions of the intestinal tract, following surgery of the colon or rectum when it is desirable to prevent evacuation from the bowel, etc. clear fluid diet is suggested.
- This diet is also given to relieve thirst, to supply the tissues with water, to aid in the removal of gas.

The diet is made up of clear liquids that leave no residue; it is non-gas forming, non-irritating and non-stimulating to peristaltic action.

## Normal and Therapeutic Nutrition

- This diet is entirely inadequate from nutritional standpoint since it is deficient in protein, minerals, vitamins, and calories.
- It should not be continued for more than 24 to 48 hours.
- The amount of fluid is usually restricted to 30 to 60 ml per hour at first, gradually increasing the amount, as per improvement in the patient's tolerance. This diet must provide 300k cal and no protein.
- This diet can meet the requirement of fluids and some minerals and can be given with 1 to 2 hour intervals.

### Full-fluid diet

- This diet bridges the gap between the clear fluid and soft diet.
- It is used following surgery, acute gastritis, acute infections and during diarrheal episodes.
- This diet is also suggested when milk is permitted and for patients not requiring special diet but too ill to eat solid or semisolid foods.
- In this diet foods which are liquid or which readily become liquid on reaching the stomach are given.
- This diet may be made entirely adequate and may be used over an extended time without fear of developing deficiencies, provided it is carefully planned.
- This diet is given at intervals of 2-4 hours intervals. This diet gives 1200kcal and 35g of protein.

### Soft diet

- This is one of the most frequently used routine diets; many hospital patients are placed on this until a diagnosis is made.
- It bridges the gap between acute illness and convalescence. It may be used in acute infections, following surgery, and for patients who are unable to chew.
- The soft diet is made up of simple, easily digested food and contains no harsh fibre, low in fat and with mild or no seasoning.

- It is nutritionally adequate when planned on the basis of a normal diet. Patients with dental problems are given mechanically soft diet.
- It is often modified further for certain pathologic conditions as bland and low residue diets. In this diet, three meals with intermediate feedings should be given.
- This diet should provide 1500 kcal and 35-40 g of protein. Light diet should be given before regular diet.

### MECHANICAL SOFT DIET

Many people require a soft diet simply because they have no teeth. Such a diet is known as a **mechanical or a dental soft diet**. It is not desirable to restrict the patient to the food selection of the customary soft diet and the following modifications to the normal diet may be done :

- Vegetables may be chopped or diced before cooking.
- Hard raw fruits and vegetables are to be avoided ; tough skins and seeds to be removed.
- Nuts and dried fruits may be used in chopped or powdered forms.
- Meats to be finely minced or ground.
- Soft breads and chapatis can be given.

### Disease condition for its use

1. In cases of limited chewing or swallowing.
2. Patients who have undergone head and neck surgery.
3. Dental problems.

### Table: Contents of soft, full-fluid and clear-fluid diets

<b>Foods allowed</b>
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### Normal and Therapeutic Nutrition

Types of food	Soft diet	Full-fluid	Clear-fluid
Cereals	Refined, finely ground whole grain	Gruels, porridges, kanji, ragi, malt	Barley water
Pulses	All dals	Dal soups, dal payasam	Dal water
Vegetables and Fruits	Juices, pureed, cooked and mashed or baked, ripe banana	Strained juices, cooked and pureed fruits and vegetables.	Clear strained fruit juice
Milk	Milk and milk products, cheese, fine cream	Milk and milk beverages, milk shake, lassi	Whey water
Fats and oils	Butter, oil, cream, margarine	Butter, oil and cream	--
Meat and fish	All except pork, minced fish, poultry	--	--
Eggs	All except fried	Only in beverages	--



### Normal and Therapeutic Nutrition

Sugar and jaggery	All	Sugar, jaggery and glucose	Sugar or glucose
Nuts and oil seeds	None	None	None
Beverages	All	Tea, coffee, egg, non-carbonated beverages	Tea, coffee (without milk) carbonated beverages, coconut water
Soups	All	Strained	Fat free broth
Desserts	Custard, kheer, pudding	Custard, ice cream plain gelatin	Plain gelatin

## METHODS OF FEEDING

### LECTURE 2

#### Objectives

- To discuss about the importance of therapeutic diets
- To gain knowledge about the different modes of feeding.

#### Definitions:

**Enteral feeding:** Enteral feeding refers to intake of food via the gastrointestinal (GI) tract. The GI tract is composed of the mouth, esophagus, stomach, and intestines. Enteral feeding may mean nutrition taken through the mouth or through a tube that goes directly to the stomach or small intestine.

**Tube feeding:** This is done by passing a tube into the stomach or duodenum through the nose which is called nasogastric feeding or directly by surgical operation into stomach known as gastrostomy and into jejunum is called jejunostomy feeding

#### Special Feeding Methods

Enteral nutrition can be provided either orally or by tube feeding. By definition enteral means “within or by the way of the gastrointestinal tract”. In practice enteral nutrition is generally considered as tube feeding.

Enteral administration involves the esophagus, stomach, and small and large intestines (i.e., the gastrointestinal tract). Methods of administration include oral, sublingual (dissolving the drug under the tongue), and rectal. Enteral administration may be divided into three different categories, depending on the entrance point into the GI tract: oral (by mouth), gastric (through the stomach), and rectal (from the rectum). (Gastric introduction involves the use of a tube through the nasal passage (NG tube) or a tube in

the belly leading directly to the stomach (PEG tube). Rectal administration usually involves rectal suppositories.)

Parenteral administration is via a peripheral or central vein. In pharmacology, the route of drug administration is important because it affects drug metabolism, drug clearance, and thus dosage.

**Enteral or oral diet** As far as possible, the patient should be encouraged to ingest food through the oral route. Supplements may be added whenever necessary.

**Oral feeding** is the best for the nourishment of a patient. But in the following conditions it is not possible to give the feeding orally and tube feeding or parenteral feeding is resorted.

- Those who cannot swallow due to paralysis of the muscles of swallowing (diphtheria, poliomyelitis) or cancer of the oral cavity or larynx.
- Those who cannot be persuaded to eat.
- Those with persistent anorexia requiring forced feeding.
- Semiconscious or unconscious patients.
- Severe malabsorption requiring administration of unpalatable formula.
- Short bowel syndrome.
- Those who are undernourished or at risk of becoming so.
- Those who cannot digest and absorb.
- After surgery.
- Patients with neurological and renal disorders or have chronic fevers or diabetes.
- Babies of very low birth weight.

**Enteral via tube feeding** Tube feeding may be advised where the patient is unable to eat but the digestive system is functioning normally. Full fluid diets or commercial formulas may be administered through this route.

### Parenteral-peripheral vein feeding

- Intravenous (IV) feeding is advised when the patient cannot take in food via the digestive system.
- A major surgery, traumatic injury or debilitating (making someone very weak) disease may cause malnutrition in view of the increased metabolic demands.
- If the patient's condition is further complicated by the inability to eat or take enteral feeds, the only alternative left to maintain nutritional status is through intravenous feeding.
- This mode of feeding done through peripheral veins is suitable only for short-term therapy. Intravenous formulas generally consist of dextrose, vitamins and electrolytes.

### Parenteral-Total parenteral nutrition (TPN)

- When intravenous therapy has to be carried out for longer periods of time, the peripheral veins are unsuitable and therefore, a larger central vein has to be selected and a special surgical procedure adopted.
- Dextrose, amino acids, vitamins, minerals, fatty acids can all be administered through this route. The complete sustaining of increased nutritional requirements through intravenous feeding has been termed total parenteral nutrition (TPN).
- The use of the large central vein to deliver life sustaining nourishment avoids the complications of vascular inflammation and thrombosis which may occur in peripheral vein feeding.

## Tube Feeding

This is done by passing a tube into the stomach or duodenum through the nose which is called nasogastric feeding or directly by surgical operation into stomach known as gastrostomic and into jejunum is called jejunostomic feeding.

A satisfactory tube feeding must be

- Nutritionally adequate
- Well tolerated by patient so that vomiting is not induced
- Easily digested with no un favorable reactions such as distension, diarrhea or constipation.

Tube feeding is given in the following conditions —

- (i) Babies who have low birth weight and cannot suck
- (ii) Those who are undernourished and cannot take or retain food taken orally
- (iii) Persistent anorexia patients, who need forced feeding
- (iv) After certain types of surgery
- (v) Patients with severe malabsorption
- (vi) Patients who cannot absorb or digest food
- (vii) Semiconscious or unconscious patients or any other condition which prevents intake of sufficient food.

Since the feed must be formulated to meet the nutritional needs of the patient, it is also called formula feed. It is important that the formula should be such that it is well tolerated. Many types of formulas can be made or purchased to serve the needs of the patient. The foods fed by tube may be :

- (i) Natural liquid foods
- (ii) Raw or cooked foods blended to liquid form, or
- (iii) Commercially made special formulated diets.

## Composition

- The form of proteins in the formula can be intact proteins (milk, egg) or protein hydrolysates containing peptides and amino acids.
- When the patient has normal enzymatic digestive function (absorption) intact proteins are included in the formula. But if there is severe lack of enzyme or malabsorption, protein hydrolysates are used in the formula.
- Carbohydrate is in the form of polymers of glucose, which are easily broken and absorbed. Starch or disaccharides (sucrose or lactose) may also be used. Lactose is avoided in many ready-made formulas because in some problems of absorption, lactose is not tolerated.
- Fats used in the formulas are vegetable oils, butter, lecithin, mono and diglycerides and medium chain triglycerides (MCT). Formulas are fortified with vitamins and minerals to ensure adequate nutrition.
- Formulas normally provide **1 kcal/ml**. Formulas are likely to be low in fiber, unless enriched with fiber.

## Osmolality

- The number and size of particles per kg of water is called **Osmolality**. This is an important factor in deciding patient tolerance.
- **Isotonic** formulas as the word indicates, have the same osmolality as body fluids and are well tolerated. Hyper osmolar formulas (with higher osmolality) may cause rapid movement of fluid and electrolytes across the cell wall, if these are introduced in the intestine.
- Any formula which has a high level of electrolytes has high osmolality. Thus glucose and sucrose have higher osmolality than complex carbohydrates; free amino acids have higher osmolality than intact proteins; fat has little effect. It is good to remember that carbohydrates have the greatest influence on osmolality, because they are digested very rapidly.

## Types of Formulas

Names of formulas indicate their components and their nutritional make-up. Thus Balanced Complete Formulas are made from ordinary foods or baby foods by blending these. These can be made at home or in hospital.

**A milk-based formula** is prepared from cow's, toned or skim milk with addition of pasteurised eggs, a source of carbohydrate and supplements of vitamins.

**Lactose-free formulas** are made for lactose-sensitive patients.

**Specialty formulas** are made for specific conditions, with the needed adjustments in nutrient content. For example, high fat and low carbohydrate formulas are made for pulmonary conditions; for phenylketonuria, a formula low or devoid of phenylalanine is given. In trauma or liver disease, a formula low in aromatic amino acids and high in branched chain amino acids is given.

## The mode of administration of formula

- It is decided taking patient's condition and the period for which tube feed is to be given. For short term feeding nasogastric tube is used.
- When there is injury to the esophagus or for long term tube feeding, a gastrostomy tube may be surgically inserted into the stomach. This route is not suitable for patients with unchecked vomiting or where gastric emptying is disturbed.
- A jejunostomy tube may be used when the stomach must be bypassed.

- The feeding can be continuous or intermittent. Intermittent feeding permits patient to move about. Like all other diets, diluted formulas are fed in the beginning and gradually concentration is increased to full strength. The rate of feeding is begun slowly and then increased gradually. This decreases the possibility of diarrhea. The patient's bed (head side) is raised while feeding, to reduce chance of air block.

### Home Tube Feeding

- Long term tube feeding can be given at home, with guidance from the health care team. The care-provider needs to be given instructions about how to maintain sanitation and hygiene in handling feeds and the equipment used.

### Parenteral Nutrition

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

### Total Parenteral Nutrition (TPN)

- TPN is used only when it is not possible to use enteral route and the patient is hyper metabolic or debilitated.
- Before giving TPN, a thorough nutritional and metabolic assessment of the patient is done.



- The blood levels of various nutrients are monitored frequently during TPN and the solution adjusted.

### Composition of Solutions:

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

### Home Care of Patients

- The family could be guided to take care of the patient's nutrition at home. Thus over 25 per cent Nursing home residents could be taken care of at home. There is a need to set up home health care to reduce the need for institutional care.

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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 8

### Nutritional Management of Fevers

## Content

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<b>Lesson 8</b>	<b>Nutritional Management Of Fevers</b>
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- **OBJECTIVES**

- i To learn about fever, its classifications and etiology
- ii To understand the metabolic changes during fever.

- **DEFINITIONS**

- i **Basal Metabolic Rate:** It is the amount of energy required to carry on involuntary work of the body, when it is in the stage of rest.
- ii **Cachexia:** It is general weight loss, wasting and reduction in vitality of body and mind.
- iii **Carriers:** A typhoid patient who is asymptomatic but continues to excrete the bacteria for weeks.

- **FEVER AND ITS CLASSIFICATION**

**Fever** is an elevation of body temperature above normal which results from an imbalance between the heat produced and eliminated from the body.

- **ETIOLOGY**

Fever may occur in response to an infection, inflammation or a number of other causes brought about by

- i **Internal factors or Endogenous factors:** This could be caused within the body. Examples- antigen-antibody reactions, malignant cancer, graft rejections.
- ii **External factors or Exogenous agents:** These are caused by bacteria, fungi, virus etc. which invades the body, the cause is from a source outside the body.

Fevers may be classified as acute or chronic.

**Acute fevers:** Acute fevers are of short duration but the body temperature may rise to even above 104°F. Fevers accompanying infections like chicken pox, tonsillitis, influenza, pneumonia, typhoid, malaria are few examples of acute fevers. Malaria, though an acute

fever is also called a recurrent fever because of repeated episodes of high fever.

**Chronic fever:** These are of long-duration. The temperature may remain low but fever continues for a longer period of time, even several months, as in the case of tuberculosis. Thus, chronic fever is one which has slow, gradual onset and is low in severity.

- **METABOLIC CHANGES**

With a rise in body temperature above normal (98.4°F or 37°C), the following metabolic changes occur inside the body. These changes are in proportion to the elevation of body temperature above normal and the duration of fever.

- i) There is a 7% increase in BMR with every 1°F increase in body temperature or 13% increase with every 1°C rise in body temperature. This change is more significant in patients suffering from acute fever. (1°C = 34°F)
2. Glycogen and adipose-tissue stores decrease significantly because of increased energy expenditure.
3. The rate of protein catabolism increases depending upon the severity of infection and the duration of fever. There are increased losses in long continuous fevers than in short duration fevers. Protein breakdown is especially marked in fevers such as typhoid, malaria, poliomyelitis and tuberculosis. This leads to increased nitrogen wastes and places an additional burden on the kidneys.
4. There is loss of body fluid in the form of excessive sweat and urine formation. The sweating occurs in response to high fever while the volume of urine is increased to eliminate nitrogen wastes.
5. There is increased loss of minerals like sodium, potassium, chloride etc., through sweat, urine and vomiting leading to electrolyte imbalance.
6. The absorption of nutrients like protein, minerals and vitamins decreases.

The above changes are accompanied by a loss of appetite resulting in low intake of food which leads to loss of weight. If fever is prolonged, the patient may become severely emaciated.

### General dietary consideration

**Energy:** Increased by 50%, if the temperature is high and tissue damage is high should be able to ingest 600-1200 Kcal daily.

**Protein:** During prolonged illness 100g of protein with liberal calorie intake for efficient utilization. High protein beverages can be supplemented.

**Carbohydrates:** Glycogen stores are replenished by readily absorbable glucose.

**Fats:** Judiciously increased. Fried foods to be avoided.

**Minerals:** Sufficient intake of NaCl through soups, fruit juices and milk for calcium.

**Vitamins:** Vitamin A, C and B-complex requirements increase in proportion to calories. Oral therapy of antibiotics in short courses interferes the absorption of B-complex vitamins, hence necessitates supplementation.

**Fluid:** Must be liberal to compensate the losses from sweat and to permit adequate volume of urine for excreting the waste. 2500-5000 ml/day.

**Ease of digestion:** Bland, readily digested, soft or of regular consistency food should be used to facilitate digestion and rapid absorption.

### Intervals of feeding:

- Small quantities of food at intervals of 2-3 hrs to provide nutrition without overtaxing the digestive system.
- Upon improvement 3 meals can be given along with bedtime feeding

## Normal and Therapeutic Nutrition

- The duration of fevers is shortened by antibiotic and drug therapy therefore the nutritional needs can be met without difficulty
- In acute fevers as the patient's appetite is often very poor, small feedings of soft or liquid food at frequent intervals is desired
- Sufficient intake of fluids and salt is essential.



## CAUSES, SYMPTOMS AND DIETARY MANAGEMENT OF TYPHOID

### LECTURE- 2

- **OBJECTIVES**

- i To learn about acute fever
- ii To know about causes, symptoms and dietary management of typhoid.

- **DEFINITIONS**

- i **Graft Rejection:** A rejection of a donated bone marrow by the patient's body.
- ii **Candidiasis:** A disease caused by a species of the yeast- like fungus; affecting the skin and nails.

- **TYPHOID**

- Typhoid fever is an infectious disease caused by a bacteria *Salmonella typhosa*. The infection is transmitted through the faecal-oral route i.e. by consumption of food, water or milk contaminated with intestinal contents.
- It may affect all age groups but commonly occurs in children. The incidence of typhoid fever has greatly reduced due to improved sanitation and inoculation.
- Antibiotic therapy has shortened the duration of fever in typhoid to a few days as compared to 3-4 weeks in the past.
- Source of infection: Faeces and urine of the patient or carriers. Drinking water, milk, food infected with intestinal contents of the patients.

### **Body Changes in Typhoid Fever**

There is loss of tissue protein which may amount to as much as 250-500 g of muscle tissue a day. Body stores of glycogen are quickly depleted and the water electrolyte balance is disturbed. The intestinal tract is highly inflamed and irritable and diarrhea is, therefore, a frequent complication which interferes with the

absorption of nutrients. Ulceration in the intestines, i.e., Peyer's patches may be so severe that haemorrhage and even perforation of intestine may occur. If the condition remains unchecked, it can often lead to extensive changes in liver with complicated diseases of the gall bladder and bile passage.

### **Clinical symptoms**

- i Graded fever which follows an upward ladder pattern.
- ii Abdominal pain, cramps and diarrhoea.
- iii Anorexia and vomiting
- iv Internal haemorrhage and malena

### **Treatment**

It involves

- i Rest in bed
- ii Keeping the patient warm
- iii Antibiotic therapy
- iv A modified diet

### **Dietary Management (Dietary guidelines)**

During high fever, there is an aversion towards foods in the form of anorexia, nausea and vomiting. The diet should be planned with the following objectives:

- i To maintain adequate nutrition
- ii To restore positive nitrogen balance
- iii To provide relief from symptoms
- iv To correct and maintain water and electrolyte balance
- v To avoid irritation of intestinal tract.

To achieve the above objectives, the nutrient intake may be modified as follows:

## Energy

- It is recommended to increase the energy intake by 10-20%. Initially, during the acute stage, a patient may be able to consume only 600-1200 Kcal/day, but the energy intake should be gradually increased with recovery and improved tolerance.

## Protein

- The requirement of protein is related more to the severity and duration of the infection rather than to the height of the fevers.
- Since there is excessive destruction of tissues, the protein intake should be increased to 1½ to 2 times the normal, i.e., 1.5 to 2g protein/kg body wt /day.
- For efficient utilization of protein, energy intake should be adequate. To minimize the tissue loss, protein foods of high biologic value such as milk and eggs should be used liberally as they are most easily digested and absorbed.
- To achieve this, regular meals should be supplemented with high protein beverages.

## Carbohydrates

- A liberal intake of carbohydrates is suggested to replenish the depleted glycogen stores of the body.
- Cooked, easily digestible carbohydrates like simple starches, glucose, honey, cane sugar etc. should be included as they require much less digestion and are well assimilated.

## Dietary fibre

- As the symptoms of typhoid include diarrhea and lesions in the intestinal tract, all forms of irritants have to be eliminated from the diet.

- All harsh, irritating fibre should, therefore, be avoided in the diet, as it is a mechanical irritant.

### Fats

Fats are required mainly to increase the energy intake. However, due to the presence of diarrhea, fats only in the emulsified form like cream, butter, whole milk, egg yolk should be included in the diet, as they are easily digested and well tolerated by patients.

### Minerals

- There is excessive loss of electrolytes like sodium, potassium, and chloride due to increased perspiration.
- Salty soups, broths, fruit juices, milk, etc. should be included to compensate for the loss of electrolytes.

### Vitamins

- As infections and resultant fevers apparently increased the requirement for vitamin A and deplete tissue stores of vitamin C, there is a need to increase the intake of both these vitamins.
- With the increase in energy requirements the need of B group vitamins also increases. Moreover, the use of antibiotics and drugs interferes with the intestinal bacterial synthesis of some B group vitamins. So, vitamin supplements may have to be given for some time.

### Fluid

- In order to compensate for the losses through the skin and sweat and also for ensuring adequate volume of urine for excreting waste, a liberal intake of fluids is very essential.
- A daily fluid intake of 2.5 to 5 litres is desirable. Fluids may be included in the form of beverages, soups, juices, plain water etc.

### Foods to be used in restricted amounts or avoided

- High fibre foods like whole grain cereals and their products e.g. whole wheat flour and cracked wheat, whole pulses and pulses with husk,
- All raw vegetable and fruits excluding papaya and banana.
- Fried fatty foods such as samosas, pakoras, halwas, ladoos, etc.
- Chemical irritants such as condiments, spices, pickles, relishes, chutneys and strongly flavoured vegetables like cabbage, capsicum, turnip, radish, onion and garlic.

### Foods to be Included

- Plenty of fluids like juices and soups.
- Milk and milk based beverages.
- Low fibre foods such as refined cereals and their products, dehusked pulses, well cooked fruits, vegetables in soft and puree form and potatoes.
- Foods providing proteins of high biologic value e.g. eggs, soft cheeses, tender meats, fish, poultry, etc.
- Plain gelatin-based desserts, sugars, honey, jam.

## CAUSES, SYMPTOMS AND DIETARY MANAGEMENT OF TUBERCULOSIS AND INFLUENZA

### LECTURE- 3

- **OBJECTIVES**

- To learn about chronic fever
- To know causes, symptoms and dietary management of tuberculosis and influenza.

### DEFINITIONS

- Expectoration:** It is the act of spitting out saliva or mucus from the air passages via mouth.

- ii **Lymphadenopathy:** Swollen, firm and sometimes tender lymph nodes secondary to any number of causes ranging from infections to cancer is termed as lymphadenopathy.
- iii **Opportunistic Infection:** Infection by an organism that does not ordinarily cause disease but which becomes pathogenic under certain circumstances such as impaired immune response is known as opportunistic infection.

## TUBERCULOSIS

- Tuberculosis is a chronic infectious disease and is one of the major causes of illness and death in the underdeveloped countries as well as the deprived sections of developed countries. Malnutrition resulting from poverty and ignorance combined with unhygienic living conditions and poor sanitation makes an individual susceptible to the infection.
- Tuberculosis is caused by a bacteria *Mycobacterium tuberculosis*. The bacteria most often affect the lungs, leading to pulmonary tuberculosis. The infection may be localized in other organs like lymphnodes or kidneys or may be generalized.

### Body Changes in Tuberculosis

Pulmonary tuberculosis is accompanied by

- Wasting of tissues
- Exhaustion, cough
- Expectoration
- Fever

It is characterized in the early stage by a marked rise in body temperature, flushed face, increased circulation and respiration, constant fatigue, loss of weight, cough and a general run down condition. If the temperature rises above 39°C, the metabolic rate may increase 20-30% above normal.

In the acute stage, the disease is quite similar to that of acute fevers.

## Treatment

Rest, antibiotic therapy and fresh air along with nourishing food are the four factors necessary to provide recovery from tuberculosis.

## Dietary Treatment

Chronic fever leads to increased tissue breakdown and malnutrition. Therefore, the objectives of dietary treatment are:

- i To reduce mortality by providing nutrients required by body's immune mechanism,
- ii To prevent or control weakness and loss of weight, and
- iii To accelerate convalescence.

To achieve the above objectives, the following nutrient modifications are made:

- **Energy**

As the patient with chronic tuberculosis is undernourished and under-weight, energy needs are increased in order to minimize weight loss and achieve desirable weight. Therefore, energy intake needs to be increased by 300-500 Kcal/day above the normal intake.

- **Protein**

In fevers of prolonged duration like tuberculosis, there is a considerable wasting of body tissues. Serum albumin level is often low. Therefore, it is essential to increase the protein intake. Protein foods of high biological value should be included in the diet. Emphasis should be laid on cereal and pulse combinations besides animal foods to improve protein quality. About 1.2 to 1.5g of protein per kg body weight per day must be given.

- **Carbohydrates and Fats**

Enough carbohydrate should be included. Too much fat should be avoided as it frequently causes gastric upset and diarrhea.

- **Minerals**

A liberal amount of calcium should be included in the diet to promote the healing of tuberculin lesions. Iron supplementation may be necessary, if the patient suffers from haemorrhages.

- **Vitamins**

The diet should provide liberal amounts of all vitamins especially vitamin A, B, C and D.

**Foods to be included**

- i Cereals (ragi, jowar, bajra)
- ii Pulses ( black channa, moth, rajmah)
- iii Nuts and oilseeds
- iv Green leafy vegetables like fenugreek, mint, spinach, cabbage, drumstick leaves, cauliflower greens
- v Citrus fruits (guava, amla, capsicum)
- vi Milk and its products
- vii Jaggery, sugar

**Foods to be restricted**

- i Excess fat
- ii Fried preparations
- iii Organ meats ( liver, kidney, brain)
- iv Red meat
- v Refined sugars



## INFLUENZA

- Influenza, also known as flu, is the clinical condition that results from infection with influenza virus.
- It is an acute infection of short duration. It spreads from person to person by contact and inhalation of virus.
- The main effects of the influenza virus are on the upper respiratory tract, the nose and throat, with possible spread and involvement of the lungs and bronchi.

### Symptoms

Headache, lassitude, myalgia, shivering, sore throat, pyrexia and fever.

Given below are some of the **common symptoms** for influenza:

1. Runny nose, accompanied by repetitive sneezing
2. Sore throat and throat irritation
3. Congestion in the nasal passages
4. Muscle pain, especially in the legs, back and the arms
5. Mild to severe headaches
6. In milder cases of influenza, the temperature rises to 102 oF and lasts for two or three days. In severe cases, it may go upto 104 o F and last for four to five days.
7. Weakness, tiredness and fatigue
8. Deep chest cough due to irritation in the windpipe or Dry cough
9. Sweats and chills

### Causes of Influenza

- i The influenza virus spreads from one person to the other through droplets in the air, when an infected person coughs or sneezes. The virus enters your body, in case you happen to inhale any of these droplets.

- ii Talking can also cause the virus to get transmitted from one person to the other.
- iii Touching objects that have already been used by an infected person.
- iv Many of us get infected because of sharing utensils and other similar items with those who are already suffering from the flu.

### Diet for Influenza

General principles of dietary treatment are followed for influenza patient.

Given below are some of the **foods that should be included** in a diet for influenza:

- i Leafy greens like spinach cabbage, sprouts
- ii Broccoli
- iii Carrots
- iv Ginger
- v Garlic
- vi Onions
- vii Oranges and orange juice
- viii Lemon
- ix Peppers

While some of the foods help alleviate influenza and its symptoms, others are known to aggravate it. Given below are some of the **food items that should be eliminated** from a diet for influenza:

- i Spices and condiments, and pickles
- ii Sugar and sweets
- iii Processed meat
- iv Bananas, or dried, stewed or tinned fruits
- v Refined flour and bakery products
- vi Alcoholic beverages
- vii Coffee, aerated drinks and other caffeinated beverages

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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 9

## Gastrointestinal Disorder

### Content

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<b>Lesson 9</b>	<b>Gastrointestinal Disorder</b>
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## Objectives

- To discuss about the parts of gastrointestinal system
- To understand the role of different parts of gastrointestinal tract
- To describe the common gastrointestinal disorders.

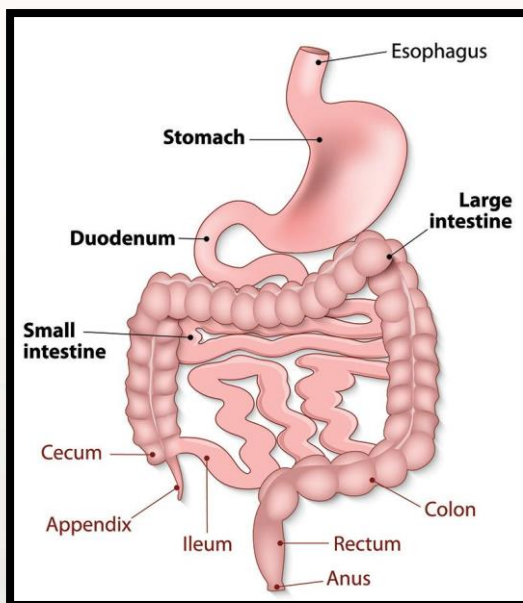
## Definitions

- **Absorption** - The passage of nutrients in food from the small intestine into the cells in the body.
- **Bowel** - Small and large intestine.
- **Bowel movement** - Passage of stool (body wastes) from the large intestine through the rectum and anus.
- **Colitis** - Irritation and inflammation of the colon (large intestine).
- **Colon** - The large intestine.
- **Digestive tract** - The organs that are involved in digestion; including the mouth, salivary glands, esophagus, stomach, pancreas, liver, gallbladder, small intestine, and large intestine.
- **Duodenum** - The first part of the small intestine, nearest to the stomach.
- **Esophagus** - The tube that connects the mouth to the stomach.
- **Excrete** - Remove waste from the body.
- **Peristalsis** - The movement of food through the digestive tract, aided by contractions of muscles in the stomach and intestines known as peristalsis.
- **Mucus** - A thick, jelly-like substance made by the intestines and other organs of the body (such as the nose), that helps coat and protect the lining of the organ. Mucus also helps stool pass through the large intestine and rectum more easily.

- **Nausea** - A feeling of needing to vomit (throw-up).

### Gastrointestinal system –

- The gastrointestinal system includes the gastrointestinal tract (mouth, pharynx, esophagus, stomach, small intestine, large intestine, including rectum) and the glandular organs (salivary glands, liver, gallbladder and pancreas) that are not part of the tract but secrete substances into it via ducts connecting these organs to the tract (Fig.1).



**Fig. 1 Gastrointestinal system of human**

### Function of alimentary tract -

- The overall function of the gastrointestinal system is to process ingested foods into molecular forms that can be transferred, along with salts and water, from the external environment to the body's internal environment, where they can be distributed to cells by the circulatory system.
- The entire esophagus functions as one tissue during swallowing.
- As the bolus of food is moved voluntarily from the mouth to the pharynx, the upper sphincter relaxes, the food moves into the

esophagus, and the lower esophageal sphincter relaxes to receive the food.

- Peristaltic waves move the bolus down the esophagus and into the stomach.
- The small and large intestines serve as organs of digestion, absorption and excretion.
- Digestion is initiated in the mouth and stomach and is continued in the duodenum and jejunum with the aid of secretions from the liver, pancreas and small intestine.
- Absorption occurs primarily in the jejunum; the only substances absorbed in the terminal ileum are fats, bile salts and vitamin B12.
- The large intestine or colon exists for the purpose of absorbing water and excreting the faecal mass.

### **Alimentary tract at work-**

The alimentary tract provides the body with a continual supply of water, electrolytes and nutrients. To achieve this requires

1. Movement of food through the alimentary tract.
2. Secretion of digestive juices and digestion of the food.
3. Absorption of the digestive products, water and the various electrolytes.
4. Circulation of blood through the gastro intestinal organs to carry away the absorbed substances
5. Control of all these functions by the nervous and hormonal system.

Common gastrointestinal disorders:



Indigestion	Abdominal discomfort
Peptic ulcer	Erosion of mucus membrane, Helicobacter pylori
Carcinoma	Any part of the GI tract
Dumping syndrome	Low regulation on emptying
Steatorrhoea	Fat in stools
Lactose intolerance	Low -? glucosidase lactase
Coeliac disease	Gluten sensitive enteropathy
Tropical sprue	Reaction to gliadin
Irritable bowel syndrome	Change in life cycle
Inflammatory bowel disease	Inflammation of mucus
Ulcerative colitis	Bloody diarrhea
Intestinal gas and flatulence	High fibre
Diverticular disease	Sac like herniations
Diarrhea	Loose, watery stools
Constipation	Difficulty in emptying the bowels, usually hardened faeces.

## CONSTIPATION

### LECTURE 2

#### Objectives

1. To discuss the importance of constipation as gastrointestinal disorder
2. To recognize the causes and dietary management of constipation and manage the same.

#### Definitions:

- **Atonic** - Lacking muscular tone.
- **Acute** - Of short duration
- **Chronic** - Persisting for a long time or constantly recurring.
- **Colonic** -Relating to or affecting the colon
- **Constipation** - A condition in which there is difficulty in emptying the bowels, usually associated with hardened faeces.
- **Spastic** - Relating to or affected by muscle spasm
- **Spasm** - An involuntary and abnormal muscular contraction.

## CONSTIPATION

Constipation is a symptom, not a disease. Most people have experienced an occasional brief bout of constipation that has corrected itself with diet and time.

Constipation is defined as having a bowel movement fewer than three times per week.

- The frequency of bowel movements among healthy people varies greatly, ranging from three movements a day to three a week
- Stools in constipation are usually hard, dry, small in size, and difficult to eliminate.

- Painful bowel movement and often experiencing strain during defecation, bloating, and sensation of a full bowel
- Coated tongue, foul breath and lack of appetite

Constipation is a condition resulting from insufficient frequency of defecation, deficient quantity of stool or production of abnormally hard and dry stools.

### **TYPES: There are three main types of constipation**

1. Atonic
2. Spastic
3. Obstructive

#### **1. Atonic constipation is due to**

- a) Lack of fluids: When there is excessive perspiration and an adequate amount of fluid is not taken. Water from the colon is completely absorbed and this leaves a small quantity of hard dry faeces which does not produce enough distension to initiate a reflex for its evacuation.
- b) Lack of roughage: Faulty food habits which include irregular hours of meals, fasting or avoiding foods leaves little residue for evacuation.
- c) Vitamin B Deficiency: Deficient intake of vitamin B produces loss of tone of the bowel wall.
- d) Lack of potassium: Deficient intake of potassium or excessive loss by use of laxatives may result in loss of bowel tone.
- e) Irregular habits: Irregular bowel habits due to getting up late in the morning, or unhygienic condition prevailing may make a visit to the bathroom undesirable.

#### **2. Spastic constipation results from excessive tone of the colonic muscles.**

### 3. Obstructive constipation is due to malignancy (cancer) of the colon.

#### Common causes of constipation

Constipation occurs when the colon absorbs too much water from the digested residue or if the colon's muscle contractions are slow and sluggish, causing the stool to move through the colon too slowly. As a result, stools can become hard and dry.

Low fiber in the diet

1. Lack of physical activity (especially in the elderly)
2. Medications
  - Pain relieving medications ( especially narcotics)
  - Antacids that contain aluminum and calcium
  - Blood pressure medications (calcium channel blockers)
  - Anti-parkinson drugs
  - Antispasmodics
  - Antidepressants
  - Iron supplements
  - Diuretics
  - Anticonvulsants
3. Milk
4. Irritable bowel syndrome
5. Changes in life style or routine such as pregnancy, aging, and travel
6. Abuse of laxatives
7. Ignoring the urge to have a bowel movement
8. Dehydration
9. Specific diseases or conditions, such as stroke (most common)
  - **Neurological disorders**
    - Multiple sclerosis
    - Parkinson's disease
    - Chronic idiopathic intestinal pseudo obstruction
    - Stroke
    - Spinal cord injuries

- **Metabolic and endocrine conditions**
  - Diabetes
  - Uremia
  - Hypocalcaemia
  - Poor glycemic control
  - Hypothyroidism

### **Problems with the colon and rectum**

Intestinal obstruction, scar tissue-also called as adhesions diverticulosis, tumors, colorectal stricture, or cancer can compress, squeeze, or narrow the intestine and rectum and cause constipation.

Problems with intestinal function (chronic idiopathic constipation)

### **SYMPTOMS**

- Infrequent or insufficient emptying of the bowel
- Headache,
- Coated tongue,
- Foul breath
- Lack of appetite.
- These symptoms usually disappear after evacuation has taken place.

### **Treatment of constipation**

Although treatment depends on the cause, severity, and duration of the constipation, in most cases dietary and lifestyle changes will help to relieve symptoms and also help prevent them from recurring.

#### **1. Diet**

- Eating a well-balanced, high-fiber diet that includes beans, bran, whole grains, fresh fruits, and vegetables
- A diet with enough fiber (20 to 35 gms/day) helps the body form soft, bulky stool.

## DIETARY MODIFICATIONS:

### 1. HIGH FIBRE DIET

- **Energy:** Normal calories according to age, sex and occupation are advised.
- **Proteins:** About 60 to 80g protein is advised.
- **Fats:** Fats stimulate the flow of bile and lubricate the bowel. Fried foods should be avoided.
- **Carbohydrates:** Adequate bulk should be supplied in the form of vegetables and whole fruits which are rich in unabsorbable cellulose.
- **Vitamins:** B group vitamins help individuals to regulate the bowel function.
- **Minerals:** Acutely ill or bed ridden patients require potassium in the form of vegetable soup and fruit juice to prevent constipation.
- **Fluids:** A liberal amount of fluids, about 10 glasses per day is advised. Warm fluid taken early morning on an empty stomach helps people to evacuate the bowel.
- **Fibre:** The intake of dietary fibre should be increased by eating whole cereals and increasing consumption of fruits and vegetables. The most important factor is the water holding capacity of the fibre.
- Bran may be taken in the first week. It is made more palatable by adding cooked fruits and vegetables. Oranges, carrots and cabbage fibres hold water more effectively. Whole grain breads and cereals should be used instead of refined cereals e.g. whole wheat flour instead of maida.
- Foods included are high fibre foods like bran, vegetables, fruits whole grain bread. Low fibre foods like refined cereals have to be avoided.

### 2. Lifestyle changes

- Drinking sufficient water and other liquids
- Engaging in daily exercise
- Having enough time for bowel movement.

- Not ignoring the bowel movement.

### 3. Laxative

- Laxatives taken by mouth are available in liquid, tablet, gum powder, and granule forms. They work in various ways

### Complications of constipation

Sometimes constipation can lead to complications. These complications include hemorrhoids, caused by straining for bowel movement, or anal fissures, tears in the skin around the anus caused when hard stool stretches the sphincter muscle.

### Points to Remember

- Constipation affects almost everyone one time or the other
- Many people think they are constipated when, in fact, their bowel movements are regular
- The most common causes of constipation are poor diet and lack of exercise
- Other causes of constipation include medications, irritable bowel syndrome, abuse of laxatives, and specific diseases
- A medical history and physical examination may be the only diagnostic test needed before the doctor suggests treatment.
- In most cases, following simple tips will help relieve symptoms and prevent recurrence of constipation:
  - Eating a well-balanced, high-fiber diet that includes beans, bran, whole grains, fresh fruits, and vegetables.
  - Drinking plenty of liquids.
  - Exercising regularly.
  - Setting aside time after breakfast or dinner for undisturbed visits to the toilet.
  - Not ignoring the urge of bowel movement.
  - Understanding that normal bowel habits vary.

- Checking with a doctor whenever a significant or prolonged change in bowel habits occurs, checking with a doctor.

## DIARRHEA

### LECTURE 3

#### Objectives

1. To discuss the importance of diarrhea as gastrointestinal disorder
2. To acquire the knowledge about causes of diarrhea and its dietary management

#### Definitions:

- **Celiac disease:** A condition in which the small intestine absorptive surface is damaged owing to an intolerance to gluten. It may lead to impaired digestion and absorption of foods and may be associated with diarrhea.
- **Dehydration:** Condition that occurs when the bloodstream and the cells of the body contain less fluid than normal, often due to vomiting or diarrhea. The body's mineral balance may also be affected.

## DIARRHEA

- Diarrhea refers to the frequent passage of loose or watery unformed stools. It may be acute or chronic. Commonly known as "loose motions", it is perhaps the most common disease in India.
- It may be secretory diarrhea which results when excess water and electrolytes are actively transported into the lumen of the intestines.
- Osmotic diarrhea results when water is retained in the intestinal lumen by osmotically active agents. The rate of transit through the gut determines the time available for intestinal absorption of water and very rapid transit can result in diarrhea.



## Normal and Therapeutic Nutrition

- The maximum absorptive capacity of the colon is only 4 l/day, so if volumes of fluid greater than this enter the small intestine, diarrhea will result even though the colonic function is normal. The small intestine secretes about 1 l/day of fluids, but this can increase to as much as 20 l/day under certain conditions. Thus large volume diarrhea indicates dysfunction of the small intestine.
- Loss of excessive body water through diarrhea could lead to dehydration and electrolyte loss, especially loss of potassium. Both need to be replaced in order to avert a life threatening situation.

### CAUSES

- Overeating or eating of wrong foods
- Putrefaction in the intestine tract,
- Fermentation caused by incomplete carbohydrate digestion,
- Nervous irritability
- Excessive intake of laxatives.
- Infection by parasites, germs, virus, bacteria or a poison which has entered into the body through food, water or air, allergies to certain substances or even common foods such as milk, wheat, eggs, and sea foods
- Emotional strain or stress in adults
- Fright in children.
- It may also result from the use of antibiotic drugs. This is due to the destruction of the beneficial bacteria in intestines along with pathogenic bacteria at which the antibiotic treatment was aimed.
- It may also be a result of the irritation of the mucous membrane by impacted hard faeces.

### Physiological Changes in the body

- Water constitutes about 75% at birth and 60% in later age of body weight.

- Diarrhea losses comes from ECF and replacement should be with sodium rich and low potassium solutions
- Loss of the water from the body causes a reduction or shrinkage in the volume of extracellular compartment

#### 1. Excessive loss of sodium in diarrheal stools

- Causes decline in serum and ECF sodium level (hyponatremia)
- Osmolality of ECF fall causing movement of water from extra cellular to intracellular compartment
- Decrease in blood volume due to depletion of extracellular compartment
- Results in weak thready pulse and fall in blood pressure
- Extremities appear cold due to low hydrostatic pressure in the renal glomeruli
- Filtration of urine reduced
- The quantity and frequency of urination falls down

#### 2. Excessive potassium lost through stools

- Abdominal distension and hypotonicity of muscles

#### 3. Excessive bicarbonates loss

- Breathing will be deep and rapid if base level of bicarbonates fall to 12 m mol/l

#### 4. Diarrhea with malnutrition

#### 5. ( Malabsorption of nutrients in viral diarrhea

### Fluid management

To maintain renal function with electrolyte and pH balance

- Early replacement of fluid losses at the first sign of liquid stool
- Giving plenty of fluids during illness to prevent dehydration
- Small sips to prevent hyperactive gastro-colic reflex

Initial management with any fluid:

- Offering ample fluids as the child can take orally without vomiting

- Coconut water, butter milk, rice kanji with salt,
- Lemon-sugar-salt beverage, weak tea.

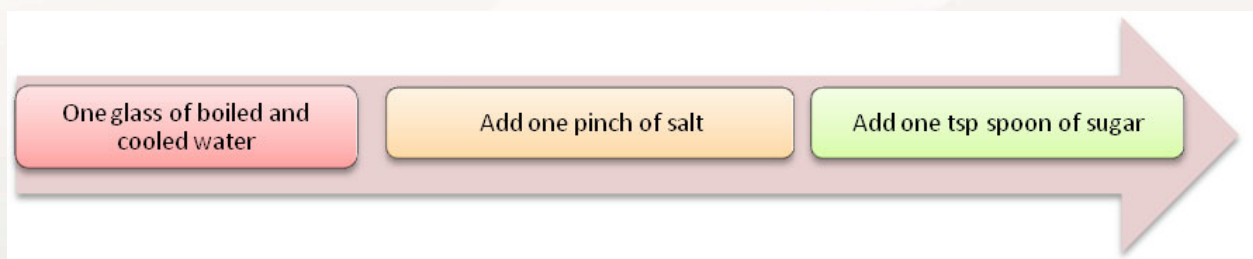
### DIETARY CURE:

- In severe cases of diarrhea, it is advisable to observe a complete fast for two days to give rest to the gastro-intestinal tract.
- Warm water only may be taken during the period to compensate for the loss of fluids.
- Juices of fruits like orange or pomegranate, butter-milk, or coconut water may be taken after the acute symptoms are over.
- Barley water mixed with an equal quantity of milk, with added sugar, can also be given.
- In mild cases, well-boiled rice or khichdi (rice and mung dal cooked with a pinch of salt), with curd and ripe bananas are permitted.
- After the condition improves, meals can be enlarged gradually to include raw juices like papaya juice, lemon juice and fresh pineapple juice, cooked vegetables, whole rice, soured milks such as yogurt and butter-milk.
- Raw foods should be taken only after the patient completely recovers.
- Certain natural remedies have been found effective in curing diarrhea and these are carrot soup, banana, turmeric powder, the cultured or sour milk and garlic.
- Carrot soup supplies water to combat dehydration, replenishes sodium, potassium, phosphorous, calcium, sulphur and magnesium, supplies pectin and coats the intestine to allay inflammation. It checks the growth of harmful intestinal bacteria and prevents vomiting. One pound of carrot may be cooked in five ounces of water until it is soft. The pulp should be strained and boiled water added to make a quart. Three-quarter table-spoon of salt may be mixed. The

soup should be given in small amounts to the patient every half an hour.

- Bananas contain pectin and encourage the growth of beneficial bacteria.
- Turmeric, a yellow vegetable powder used as a condiment has proved beneficial.
- Acidified milk such as yogurt or butter-milk help overcome the harmful intestinal flora and re-establish the benign or friendly flora. The acid in the soured milk also fights germs and bacteria. Garlic is yet another natural remedy which fights diarrhea and routs parasites. It is a powerful , effective and harmless antibiotic and aids digestion

Oral rehydration therapy with homemade solutions:



Oral rehydration salt solution for prolonged diarrhea and dehydration

## Composition of ORS (WHO)

Components	Amount g/lit
Glucose	20 (90 mEqNa )
Sodium chloride	3.5 (20mEqK)
Citrate	2.9 (80 mEq Cl)
Sodium carbonate	2.5 (30 mEq CO <sub>3</sub> )
Potassium chloride	5

For 1 yr child 1000 ml/24 hrs

1. Continue breast feeding during attack of diarrhea as it
  - Aids in recovery of nutrients and rehydration capacity
  - Prevents further infection
2. The bowel should not be rested
3. Avoid milk and other lactose containing products for a day or two
4. Milk should be diluted with equal volume of boiled and cooled water and feed along with ORS till diarrhea stops
5. Fermented milk with *S. haemophilus* and *L. bulgaricus* reduces growth of bacteria
6. As the child develops PEM, give easily digestible, nutritionally balanced diet
7. Rice based solutions potato, millet, maize and other cereal flours
8. For older infants well-cooked milled cereal with lentils preferred
9. Mashed bananas
10. Iso osmolar diets
11. Little oil and fats

## 12. Precooked and amylase rich food

### In chronic diarrhea

- Low milk- milk free- starch free diet in succession
- Usage of ORT
- Avoiding inappropriate antibiotics
- Supplementation of vitamin A, zinc and folic acid

### FOODS THAT MAY PRODUCE LOOSE STOOLS

- Dried beans, corn, vegetables, and cabbage family vegetables are all high in fiber, which may worsen diarrhea
- Fruits and juices contain fructose, which can worsen diarrhea
- Caffeine-containing beverages such as coffee and tea can have a laxative effect
- Alcoholic beverages such as beer, wine and liquor can worsen diarrhea
- Fatty meats such as bacon, lunch meats, and heavily-marbled meats can worsen diarrhea
- Fried foods, pastries, and chips are high in fat which can worsen diarrhea
- Large quantities of nuts or nut butters may worsen symptoms
- Concentrated sweets can worsen symptoms
- Milk and milk-drinks
- Dried fruits such as figs, dates, raisins, and prunes can have a laxative effect
- Sugar-free gums and mints contain the sugar alcohols sorbitol, mannitol, and/or xylitol, which can have a laxative effect.
- Eat lower fiber foods such as yogurt, rice noodles, white bread etc.

## PEPTIC ULCER

### LECTURE 4

#### Objectives

- To discuss about the peptic ulcer
- To gain understanding about the causes of peptic ulcer and its management.

#### Definitions

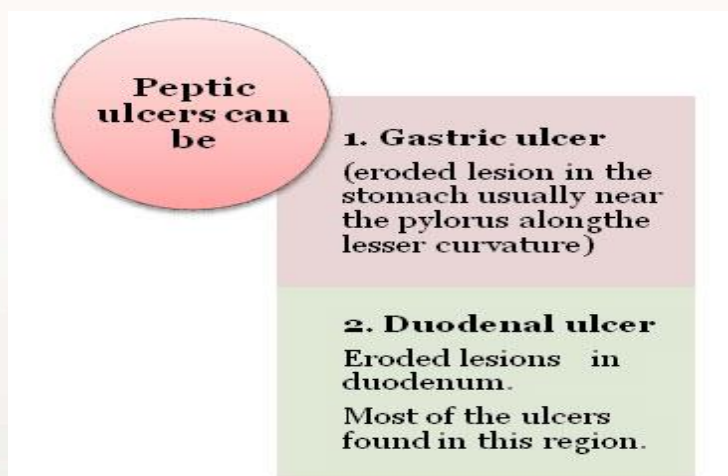
- **Peptic** - related to the stomach and the upper part of the small intestine (duodenum).
- **Peptic ulcer** - a sore in the lining of the esophagus, stomach, or duodenum (beginning of the small intestine); often caused by a bacteria called *Helicobacter pylori*.
- **Pylorus** - where the stomach connects to the small intestine.
- **Reflux** - digestive juices, food, and liquids moving backward from the stomach into the esophagus, and possibly into the mouth.
- **Ulcer** - a sore in the lining of the digestive tract.

#### PEPTIC ULCER

An ulcer is a sore or erosion that forms when the lining of the digestive system is corroded by the acidic digestive juices, if neglected, leads to formation of a hole. It is estimated that between 5% to 10% of adults globally are affected by peptic ulcer at least once in their lifetime

- Peptic ulcers are defects in gastrointestinal mucosa extending through the muscularis mucosae that persists as a function of the acid peptic activity in the gastric juice.
- A peptic ulcer (stomach or duodenal) is a break in the inner lining of the esophagus, stomach, or duodenum.

- A peptic ulcer of the stomach is called a gastric ulcer; of the duodenum, a duodenal ulcer; and of the esophagus, an esophageal ulcer.
- Peptic ulcers occur when the lining of these organs is corroded by the acidic digestive (peptic) juices which are secreted by the cells of the stomach.
- A peptic ulcer differs from an erosion because it extends deeper into the lining of the esophagus, stomach, or duodenum and incites more of an inflammatory reaction from the tissues that are involved.



### Symptoms and Clinical Findings

- Epigastric pain, heart burn etc., due to reflux of acid into esophagus occurring as deep hunger contraction 1 to 3 hours after meals is often the chief complaint. The pain may be described as dull, piercing, burning or gnawing and is usually relieved by taking food or alkalis.
- Discomfort and flatulence in upper part of abdomen. The basis for the pain may be the action of un-neutralised hydrochloric acid on exposed nerve fibres at the site of the ulcer.
- Pain is also associated with hypermotility of the stomach or gastric distension following ingestion of large amounts of food or liquids.
- Low plasma protein levels are often present and delay rapid and complete healing of the ulcer.



- Weight loss and iron deficiency anaemia are common.
- The intake of iron, ascorbic acid, and B-complex vitamins, particularly thiamine may be less than desirable because of self imposed limitation of green leafy vegetables and other good sources of these nutrients.
- In some instances, haemorrhage is the first indication of an ulcer and requires surgical intervention. Other complications such as obstruction, perforation and carcinoma are treated surgically.
- Bleeding ulcers can result in vomiting known as haematemesis (dark brown in color).
- There are spasms of pyloric canal and this may give rise to a feeling of sickness, distension and prevent taking food.

### CAUSES

- **Bacterial infection:** Helicobacter pylori is the chief cause of ulcer. It is spiral shaped, unipolar flagellum and is associated with astral gastritis and duodenitis in the presence of gastric metaplasia. If Helicobacter pylori is cleared by antibiotic treatment especially with colloidal bismuth and amoxicillin, the associated gastritis improves ulcer healing and recurrence rates may be lower.
- **Genetic factors:** It is common in persons with blood group 'O' than in those of other groups and possibly in those with HLA-B5 antigens. People who are first degree relatives of patients with duodenal ulcer have an increased risk of developing duodenal ulcer.
- **Sex:** Men are affected two to three times more frequently than women.
- **Age:** The incidence is high between 20 and 40 years though the average age of incidence has increased. During these years career and personal strivings are at a peak.
- **Stress:** People who are highly nervous and emotional and who worry, fear and feel anxiety are particularly susceptible. These emotional and nervous factors in turn may lead to hyper-secretion and

hypermotility of the stomach. The nervous control of the vascular system in the gastric or duodenal walls may be so disturbed that there is diminution in the blood supply to the mucosa of the stomach and duodenum making it susceptible to acid secretion.

- **Potentially irritant substances:** Caffeine, ethanol, aspirin and nicotine may delay healing but there is little evidence to show that these substances induce ulcer. Chillies, pepper, ginger, garam masala, meat soups, strong tea or coffee and protein rich foods increase the secretion of hydrochloric acid and aggravate the condition.
- **High fibre diet:** In India the incidence of peptic ulcer is low where the staple diet is millet or wheat compared to rice eating areas. This theory is yet to be confirmed.
- **Emergency injuries:** Stress ulcers occur in conjunction with emergency injuries such as burns or long-term rehabilitation processes.
- Chronic use of nonsteroidal anti-inflammatory medications or NSAIDs, including aspirin, ibuprofen.
- Cigarette smoking also is an important cause of ulcers. It also increases the risk of complications from ulcers such as ulcer bleeding, stomach obstruction, and perforation. Cigarette smoking also is a leading cause of failure of treatment for ulcers.

### Treatment

#### Therapeutic goal:

- To relieve the symptoms
- To allow healing of ulcer
- To prevent complications like surgery.

### Drugs

It is important to neutralize the excess acid produced.

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- Antacids were the earliest and most logical method of providing relief. They continue to be effective but have fallen out of routine use because they are cumbersome to prescribe, large quantities have to be taken several times a day.
- A group of chemicals are available that block certain vital steps in acid production by the stomach called H<sub>2</sub> blockers. They are effective, devoid of major side effects and are given once or at the most twice daily.
- A third group of drugs, instead of attempting to lower or neutralize acid, they block the resistance of the lining of the stomach and prevent breakdown.

## DIETARY MODIFICATIONS

- Bland diet is given for ulcer patients. Bland diet is a diet which is mechanically, chemically and thermally non-irritating.
- Mechanically irritating foods include those with indigestible carbohydrate such as whole grains, raw fruits and vegetables.
- Foods that stimulate gastric secretion are chemically irritating foods and these include meat extractives, caffeine, alcohol, spices.
- Thermally irritating foods are those foods served either very hot or iced.
- The diet must be nutritionally adequate in order to correct any preexisting deficiencies and to promote healing. This must be based on individual needs and food tolerances.
- Milk should be included as protein provides the necessary amino acids for synthesis of tissue protein to heal the ulcer.
- Moderate amounts of fat help to suppress gastric secretion.
- Fried foods are not advised as they are difficult to digest and aggravate the symptoms.
- Ascorbic acid helps in wound healing; hence citrus fruit juice and tomato juice can be given.

**Dietary management:**

Energy	Consumption of food should increase to overcome weight loss and achieve ideal body weight.
Proteins	Ulcer is a wound which if not healed on time may get perforated. It can also bleed. In order to heal it and help in the formation of new tissues, adequate amounts of proteins are required. Milk is one good option, since it neutralizes the acidic effect in the gastric juice. But the intake should be restricted since high calcium intake can be hazardous for the inflamed part. Other protein sources such as egg, fish, cheese etc. are preferred.
Fats	Fats help in delaying the gastric emptying. Fats also play a role in inhibiting gastric juice secretion and thus are effective in reducing ulcers. Around 25-30 gm (5-6 tsp) of visible fats can be given freely. They include oils, ghee, butter etc.
Carbohydrates	Around 55 to 65 percent of the total daily intake should come from carbohydrates. Well-cooked and soft foods should be consumed. Soluble fibre is more acceptable and beneficial than insoluble fibre. Foods rich in soluble fibre are: fruits, vegetables etc.

**Other factors that have to be considered are:**

PH (acidity) of the food	Avoid excessive acid production by starvation or fasting. Most of the fruits are alkaline and can be consumed.
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Foods that damage the mucosa	Spices, herbs, caffeine, meat extracts, black pepper and other condiments which cause irritation should be avoided.
Alcohol	Alcohol damages the intestinal mucosa and hence high amounts are not advised.
Cigarette smoking	Smoking is hazardous, especially in case of gastric ulcers, since it contains nicotine which causes reflux of duodenal juice into the stomach and thus smoking is restricted in case of peptic ulcers.
Gas formers	Foods that form gases are also restricted in peptic ulcers according to a few recent studies. These include: cabbage, soyabean, pulses, onion, peas, watermelon etc.
Food texture	Fibre rich food not only prevents the occurrence of ulcers, but also controls the disease.

**Quick tips to prevention:**

1. Consume more than three meals.
2. Eat small portions frequently.
3. Avoid consuming alcohol.
4. Eat meals in a relaxed way.
5. Take adequate rest and sleep.
6. Avoid excessive consumption of caffeine.

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7. Take antacids after meals and before bedtime if needed.
8. Cut down or quit smoking.
9. Avoid aspirin, analgesics and Non-Steroidal Anti Inflammatory Drugs (NSAIDs),
10. Avoid spicy and fried foods.
11. Avoid stress
12. Exercise daily
13. Avoid over-eating and eating out.
14. Avoid eating 2 hours prior to bedtime.
15. Avoid consumption of citrus fruit juices.
16. Avoid drinking aerated/carbonated drinks.
17. Frequent consumption of milk is not encouraged.
18. A light and bland diet is recommended.

### Dietary Guidelines

1. Whether a patient is on bland or regular diet, a balanced diet should be taken.
2. Regularity of meal times is essential. Small frequent meals are beneficial.
3. Instead of heavy meals moderate amounts of foods should be eaten.
4. In between meals, protein rich snacks should be taken.
5. Meals should be eaten in a relaxed atmosphere. Personal and family problems should be forgotten while eating.

6. Food should be eaten slowly and chewed well. Fast eating provokes gastric feeding reflex.
7. Smoking, drinking coffee and alcohol should be avoided particularly on an empty stomach.
8. Adequate physical and mental rest is basic.

### Assignment

Prepare one day diet for patient suffering from constipation, diarrhea and peptic ulcer.

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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 10

## Liver Disorders

### Content

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NAHEP Component-2 Project "Investments In ICAR Leadership In Agricultural Higher Education"  
Division of Computer Applications  
ICAR-Indian Agricultural Statistics Research Institute



<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 10</b>	<b>Liver Disorders</b>
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## Objective

- To describe the numerous functions of the liver
- To discuss about various disease conditions.

## Definitions

- **Gluconeogenesis:** Gluconeogenesis is a metabolic pathway that results in the generation of glucose from certain non-carbohydrate carbon substrates.
- **Haematopoiesis:** Hematopoiesis is the production of all of the cellular components of blood and blood plasma.

## Introduction

- The liver is a vital organ, which, through its network of biochemical reactions controls the internal environment of the body.
- When the liver is diseased and does not function normally, various metabolic difficulties and clinical symptoms are observed.
- It is important to have a clear understanding of the normal metabolic functions of the liver before suggesting nutritional modifications in liver disease.

## Functions of Liver

Intermediary metabolism	Gluconeogenesis from amino acids. Conversion of glucose into fatty acids, ketone body formation, interconversion of monosaccharides.
Synthetic	Plasma albumin, alpha globulins, lipoproteins, transferring and other carrier proteins, coagulation factors.

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Excretory	Cholesterol and other steroids, including steroid hormones, bile salts and pigments many drugs and toxins.
Storage	Glycogen, vitamin A and D, vitamin B12, iron.
Immunological	As an important part of the lymphoreticular system.
Haematopoiesis	Main site of formation of erythrocytes in early foetal life, after birth a potential but rarely used site.

**Source:** Passmore R.M.A. Eastwood, 1986 Davidson and Passmore Human Nutrition and Dietetics ELBS/Churchill Livingstone.

### AGENTS WHICH CAUSE DAMAGE TO THE LIVER

#### Dietary deficiencies

- A. A low protein intake and reduced capacity to secrete beta lipoproteins as seen in kwashiorkor cause fatty changes in the liver.
- B. Fatty changes in the liver are also common in uncontrolled diabetes, in starvation, and obesity. These changes are reversible.

#### Infective agents

- A. Virus can cause infection and damage to the liver. Hepatitis A virus is excreted in the stools and spread by the faecal- oral route. The patient suffers from jaundice and the liver is enlarged and tender.
- B. Improperly sterilized needles used in blood transfusion can transmit Hepatitis B virus which causes homologous serum jaundice.

#### Toxic agents

- A. Alcohol: Consumption of alcohol produces acute liver damage and jaundice.

- B. Drugs and Chemicals: Drugs like paracetamol may damage the liver. Excess stores of iron, copper, galactose and glycogen may accumulate in the liver and lead to cirrhosis.

### Damages of liver

1. **Fatty globulation:** It is the deposition of droplets of fat in the cells. This process is completely reversible, but if the damage is severe or long lasting it may be followed by necrosis or fibrosis.
2. **Necrosis** or death of the cells may be slight and only involve part of the lobule, e.g. ischaemia due to heart failure causes central necrosis around the hepatic vein, or it may be massive and cause widespread destruction of the organs.
3. **Cirrhosis:** Fibrosis, the end result of any liver damage which leads to necrosis and also occurs in the absence of obvious necrosis gives rise to the condition cirrhosis.
4. Jaundice

## INFECTIVE HEPATITIS - SYMPTOMS AND DIETARY MANAGEMENT

### LECTURE 2

#### Objective

- To describe the pathophysiology of infective hepatitis
- To understand the causes, symptoms and dietary management of the disease.

#### Definitions

- **Congestive:** An abnormal or excessive accumulation of a body fluid.
- **Anorexia:** Anorexia is a general loss of appetite or a loss of interest in food.

## INFECTIVE HEPATITIS - SYMPTOMS AND DIETARY MANAGEMENT

Infective hepatitis is known as viral hepatitis.

### SYMPTOMS:

1. Anorexia,
2. Fever,
3. Headache,
4. Rapid weight loss,
5. Loss of muscle tone and abdominal discomfort precede the development of jaundice.

Neglected viral hepatitis leads to cirrhosis of liver. Treatment consists of adequate rest, nutritious diet and avoidance of further damage to the liver.

### DIETARY MANAGEMENT:

The objectives of dietary treatment are to aid in the regeneration of liver tissue and prevent further liver damage.

- A high protein, high carbohydrate, moderate fat is recommended. Small attractive meals at regular intervals are better tolerated. Over feeding should be avoided.

### Energy:

- Sufficient calories should be given to maintain weight and reduce protein catabolism
- A diet which supplies 1600 kcals to 2000 kcals is suggested.

### Proteins:

- 1 g protein per kilogram of body weight daily is needed to overcome negative nitrogen balance, for liver cells to regenerate and prevent fatty infiltration of the liver.

- With severe jaundice 40 g and in mild jaundice 60 - 80 g of protein is permitted. In hepatic coma protein containing foods are avoided and high carbohydrate containing foods are given.

### Fats:

- In severe jaundice 20 g and moderate jaundice 20-30 g is given. Fat needs to be restricted when there is obstruction to bile flow and in hepatic coma when fats are not metabolized by the liver.

### Carbohydrates:

- High intake of carbohydrate is essential to supply enough calories so that tissue proteins are not broken down for energy.
- Fruits, fruit juices, vegetable juices, sugar, jaggery and honey are given to supply adequate electrolytes.

### Vitamins:

- Vitamins are essential to regenerate liver cells. 500 mg of vitamin C, 10 mg of vitamin K, and B-complex vitamins are essential to meet the daily needs.
- If anorexia, nausea or vomiting are present, the vitamins may be given by injection.

### Minerals:

- Oral feeds of fruit juice, vegetable and meat soups with added salt given orally or through a nasogastric tube help in maintaining the electrolyte balance.

### FOODS TO BE INCLUDED:

Cereal porridge, soft chapathis, bread, rice, skimmed milk, potato, yam, fruit, fruit juices, sugar, honey, soft biscuits, custards without butter, and cream.

## FOODS TO BE AVOIDED:

Pulses, beans, meat, fish, chicken, egg, sweets with ghee, butter or oil, bakery products, dried nuts and fruits, alcoholic preparation, whole milk and cream.

## ASCITES

- Ascites is the accumulation of fluid (usually serous fluid which is a pale yellow and clear fluid) that accumulates in the abdominal (peritoneal) cavity.
- The abdominal cavity is located below the chest cavity, separated from it by the diaphragm.
- Ascitic fluid can have many sources such as liver disease, cancers, congestive heart failure, or kidney failure.

## CAUSES

1. **Advanced liver disease or cirrhosis.** Formation of edema elsewhere in the body due to an imbalance of pressure between inside the circulation (high pressure system) and outside, in this case, the abdominal cavity (low pressure space). The increase in portal blood pressure and decrease in albumin (a protein that is carried in the blood) may be responsible in forming the pressure gradient and resulting in abdominal ascites.
2. **Salt and water retention.** The circulating blood volume may be perceived as low by the sensors in the kidneys as the formation of ascites may deplete some volume from the blood. This signals the kidneys to reabsorb more salt and water to compensate for the volume loss.
3. **Increased pressure gradient** such as congestive heart failure and advanced kidney failure due to generalized retention of fluid in the body.
4. In rare cases, increased pressure in the portal system can be caused by internal or external obstruction of the portal vessel, resulting in

portal hypertension without cirrhosis. Examples of this can be a mass (or tumor) pressing on the portal vessels from inside the abdominal cavity or blood clot formation in the portal vessel obstructing the normal flow and increasing the pressure in the vessel.

5. Ascites can also manifest as a result of cancers, called malignant ascites. This type of ascites is typically a manifestation of advanced cancers of the organs in the abdominal cavity, such as, colon cancer, pancreatic cancer, stomach cancer, breast cancer, lymphoma, lung cancer, or ovarian cancer.
6. Pancreatic ascites can be seen in people with chronic (long standing) pancreatitis or inflammation of the pancreas. The most common cause of chronic pancreatitis is prolonged alcohol abuse. Pancreatic ascites can also be caused by acute pancreatitis as well as trauma to the pancreas.

### RISK FACTORS FOR ASCITES

- The most common cause of ascites is cirrhosis of the liver.
- Many of the risk factors for developing ascites and cirrhosis are similar.
- The most common risk factors include hepatitis B, hepatitis C, and long standing alcohol abuse.
- Other potential risk factors are related to the other underlying conditions, such as congestive heart failure, malignancy, and kidney disease.

### SYMPTOMS

- There may be no symptoms associated with ascites especially if it is mild (usually less than about 100 – 400 ml in adults). As more fluid accumulates, increased abdominal girth and size are commonly seen.



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- Abdominal pain, discomfort, and bloating are also frequently seen as ascites becomes larger. Shortness of breath can also happen with large ascites due to increased pressure on the diaphragm and the migration of the fluid across the diaphragm causing fluid around the lungs.
- A cosmetically disfiguring large belly, due to ascites, is also a common concern of some patients.

### Treatment:

#### DIET

- Managing ascites in patients with cirrhosis typically involves limiting dietary sodium intake and prescribing diuretics (water pills).
- Restricting dietary sodium (salt) intake to less than 2 grams per day is very practical, successful, and widely recommended for patients with ascites.
- In the majority of cases, this approach needs to be combined with the use of diuretics as salt restriction alone is generally not an effective way to treat ascites.
- Consultation with a nutrition expert in regards to daily salt restriction can be very helpful for patients with ascites.

## JAUNDICE: CAUSES, SYMPTOMS, AND TREATMENT

### LECTURE 3

#### Objective:

- To describe the pathophysiology of jaundice
- To understand the causes, symptoms and dietary management of the disease.

## Definitions:

- **Bilirubin:** Bilirubin is a yellow compound which occurs in the normal catabolic pathway that breaks down heme in vertebrates.
- **Inflammation:** A localized reaction that produces redness, warmth, swelling, and pain as a result of infection, irritation, or injury. Inflammation can be external or internal.

## JAUNDICE: CAUSES, SYMPTOMS, AND TREATMENT

Jaundice is a symptom common to many diseases of the liver and biliary tract and consists of a yellow pigmentation of the skin and body tissues because of accumulation of bile pigments in the blood.

### Jaundice may be produced due to the following factors / reasons

1. Obstructive jaundice results from the interference of the flow of bile by the formation of stone and tumors.
2. Hemolytic jaundice results from an abnormally large destruction of blood cells as in pernicious anemia.
3. Toxic jaundice originates from poisons, drugs or virus infection.

- Jaundice, also known as icterus, is a term used to describe a yellowish tinge to the skin and sclerae (the white part of the eye) that is caused by an excess of bilirubin in the blood (hyperbilirubinemia). Body fluids may also be yellow.
- The color of the skin and sclerae varies depending on levels of bilirubin; mildly elevated levels display yellow skin and sclerae, while highly elevated levels display brown.
- A yellow tinge to the whites of the eyes is a common symptom of jaundice. Bilirubin is a yellow-colored substance that is responsible for the yellowing of the skin in jaundice.
- Bilirubin is a waste product that remains in the bloodstream after iron is removed from haemoglobin in red blood cells. When there is an excess of bilirubin, it can leak out into surrounding tissues,

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saturating them with this yellow substance. Bilirubin that is circulating freely in the blood is called unconjugated bilirubin.

- One of the liver's functions is to filter out waste, such as bilirubin, from the blood.
- Once bilirubin is in the liver, other chemicals are latched on to it, creating a substance called conjugated bilirubin, which is secreted in bile (a digestive juice released by the liver) and then excreted. A product of bilirubin is what gives faeces its brown color.

### CAUSES OF JAUNDICE

Jaundice most often occurs as a result of an underlying disorder that either causes overproduction of bilirubin or prevents the liver from disposing of it, both of which result in bilirubin being deposited in tissues.

Some underlying conditions that may cause jaundice are:

- Acute inflammation of the liver:** May impair the ability of the liver to conjugate and secrete bilirubin, resulting in a buildup.
- Inflammation of the bile duct:** May prevent the secretion of bile and removal of bilirubin, causing jaundice.
- Obstruction of the bile duct:** Prevents the liver from disposing of bilirubin.
- Hemolytic anemia:** Production of bilirubin increases when large quantities of red blood cells are broken down.
- Gilbert's syndrome** - An inherited condition that impairs the ability of enzymes to process the excretion of bile.
- Cholestasis:** A condition where the flow of bile from the liver is interrupted. The bile containing conjugated bilirubin remains in the liver instead of being excreted.

## SYMPTOMS OF JAUNDICE

Symptoms of jaundice include:

- (i) Yellow tinge to the skin and the whites of the eyes, normally starting at the head and spreading down the body
- (ii) Pruritis (itchiness)
- (iii) Fatigue
- (iv) Abdominal pain - typically indicates a blockage of the bile duct
- (v) Weight loss
- (vi) Vomiting
- (vii) Fever
- (viii) Paler than usual stools
- (ix) Dark urine

## TYPES OF JAUNDICE

There are three main types of jaundice:

1. **Hepatocellular jaundice:** Occurs as a result of liver disease or injury.
2. **Hemolytic jaundice:** Occurs as a result of hemolysis (an accelerated breakdown of red blood cells) leading to an increase in production of bilirubin.
3. **Obstructive jaundice:** Occurs as a result of an obstruction in the bile duct (a system of tubes that carries bile from the liver to the gallbladder and small intestine), which prevents bilirubin from leaving the liver.

Jaundice, not to be confused with infant jaundice, is usually a sign of an underlying disorder.

## TREATMENTS FOR JAUNDICE

Treatment of jaundice typically requires a diagnosis of the specific cause in order to select suitable treatment options. Treatment would then target the cause, rather than the jaundice itself.

- Anaemia-induced jaundice may be treated by increasing the amount of iron in the blood; either by taking iron supplements or eating more iron-rich foods.
- Hepatitis-induced jaundice may be treated with anti-viral or steroid medications.
- Obstruction-induced jaundice may be treated via surgery to remove the obstruction.
- Medication-induced jaundice is treated by selecting an alternative medication and by discontinuing medications that caused jaundice.

## Diagnosis of jaundice

Doctors will most likely **diagnose jaundice** based on the patient's history and a physical exam, paying close attention to the abdomen. Doctors will be feeling for masses (tumors) in the abdomen and/or checking the firmness of the liver; a firm liver indicates **cirrhosis**, while a rock-hard liver indicates **cancer**.

The severity of jaundice is determined by several tests, the first of which is a liver function test to find out whether or not the liver is functioning properly.

If the cause of the symptoms cannot be identified, a doctor may require blood tests to check levels of bilirubin and evaluate the composition of the blood. Some of these tests include:

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- Bilirubin tests:** A high level of unconjugated bilirubin relative to levels of conjugated bilirubin indicates hemolysis (accelerated breakdown of red blood cells).
- Full blood count (FBC), or complete blood count (CBC):** Measures levels of red blood cells, leukocytes (white blood cells), and thrombocytes (platelets)
- Hepatitis A, B, and C tests**

If an obstruction of the liver is suspected, the liver's structure will be looked at with the help of imaging tests.

### PREVENTION OF JAUNDICE:

Jaundice is related to the function of the liver, so it is essential that individuals maintain this vital organ's health by eating a balanced diet, exercising regularly, and refraining from exceeding recommended amounts of alcohol.

## CIRRHOSIS OF LIVER

### LECTURE 4

#### Objective

- To discuss about the cirrhosis of liver.
- To elaborate on the principle involved in the nutritional and dietary management of liver cirrhosis

#### Definitions

- **Ascites:** Ascites is the abnormal buildup of fluid in the abdomen
- **Cirrhosis:** Chronic liver damage from a variety of causes leading to scarring and liver failure.
- **Nausea:** Stomach discomfort and the sensation of wanting to vomit.

## CIRRHOSIS OF LIVER

- Cirrhosis is a condition in which there is destruction of the liver cell due to *necrosis*, fatty infiltration and *fibrosis*.
- It is a serious and irreversible disease.
- It occurs after years of excessive alcohol intake in individuals whose diets are deficient in nutrients.
- Malnutrition aggravates injury to the liver and can lead to childhood cirrhosis seen between the age of 1 to 3 years.

### SYMPTOMS

- The onset of cirrhosis may be gradual with gastrointestinal disturbances such as anorexia, nausea, vomiting and pain.
- The patient may suffer from weakness, muscle cramps, weight loss and fever. As the disease progresses jaundice occurs.
- Ascites which is the accumulation of abnormal amounts of fluid in the abdomen develops.

### PRINCIPLES OF DIET

- A high calorie, high protein, high carbohydrate, moderate or restricted fat, high vitamin diet helps in the regeneration of liver and helps to prevent the formation of ascites.
- Low fat with supplementation of fat soluble vitamins and minerals should be given.
- Sodium should be restricted only when there is ascites. The diet should be attractive and palatable.

### DIETARY MANAGEMENT

#### Energy:

- Since anorexia and ascites are present consumption of food is difficult.
- A highly nutritious high calorie diet is necessary because of prolonged undernourishment.
- The calorie requirement should be between 2000 - 2500 kcals.

### Proteins:

- A high protein diet is helpful for regeneration of the liver. It also helps to compensate for the considerable loss of albumin in the ascitic Fluid.
- In the absence of hepatic coma, a high protein intake of 1.2 g/kg of body weight is recommended.
- The protein content of the diet varies according to the symptoms.

### Fats:

- About 20 g of fat is given provided adequate amounts of protein is supplied.

### Carbohydrates:

- Carbohydrates should be supplied liberally so that the liver may store glycogen.
- Liver function improves when an adequate store of glycogen is present.

### Vitamins and Minerals:

- The liver is the major site of storage and conversion of vitamins into their metabolically active form.
- In cirrhosis the liver concentration of folate, riboflavin, nicotinamide, vitamin B<sub>12</sub> and vitamin A are decreased.
- Vitamin supplementation especially of B vitamins is required to prevent anaemia.
- Choline and methionine are useful if fatty infiltration is present.
- Sodium is restricted to 400-800 mg/day in oedema and ascites. If there is no ascites very little salt is permitted to make the food more appetizing. Potassium salt is given for ascites and oedema to prevent hypokalemia.
- Iron supplementation is essential as anaemia is common. A daily dose of 0.3 g of ferrous sulphate tablet 3 times after meals would also be beneficial. Folic acid 1 mg / day orally is given to treat macrocytic anaemia.



### Assignment:

- Plan a day's diet for patient with jaundice.
- Suggest dietary modifications for a patient suffering from hepatitis.

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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

## Lesson 11

## Cardio Vascular Disease

### Content

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Division of Computer Applications  
ICAR-Indian Agricultural Statistics Research Institute

<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 11</b>	<b>Cardio Vascular Disease</b>
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## Objectives

- To acquire knowledge about the Cardiovascular disease
- To learn the about the importance of diet therapy in CVD.

## Definitions:

- **Dyslipidemia:** Abnormal lipid levels in blood.
- **Atherosclerosis:** A thickening and narrowing of the walls of the large and medium sized blood vessels caused due to elevated lipids and cholesterol.
- **Congestive cardiac failure:** A clinical syndrome caused by heart disease characterized by breathlessness, chest pain and abnormal sodium and water retention.
- **Rheumatoid heart disease (RHD):** A complication of rheumatic fever and occurs after attacks of this fever.

## Introduction

- Heart disease or cardiovascular diseases is the class of diseases that involve the heart or blood vessels (arteries and veins).
- While the term technically refers to any disease that affects the cardiovascular system, it is usually used to refer to those related to atherosclerosis (arterial disease).
- These conditions have similar causes, mechanisms, and treatments.

## Etiology/risk factors:

**Various risk factors have been classified into four categories:**

**Category 1: Risk factors for which interventions have been proven to lower CVD risk**

**Cigarette smoking:** Cigarette smoking enhances endothelial damage, increases heart rate and blood pressure, lowers high density lipoprotein

cholesterol, increases LDL, constricts blood vessels and promotes thrombus formation. There is reduction of cardiovascular risk of those who quit smoking after a myocardial infarction compared with those who continue to smoke.

**High saturated fat, high cholesterol diet:** High intake of saturated fatty acid increases plasma cholesterol and so promotes formation of atheroma.

**Saturated fats reduce the formation of LDL receptors or VLDL receptors:** Animal fat like egg yolk, butter, meat fat have not only high amount of saturated fatty acids but also contain high amount of cholesterol. Margarine, ghee, hydrogenated fat and coconut oil also contain high amount of saturated fat.

**Elevated low-density lipoprotein cholesterol:** It is associated with the development of atherosclerosis.

**Hypertension:** HTN is an independent risk factor for both CVD and stroke. High BP leads to enhanced endothelial cell damage and target organ involvement including retinopathy and renal insufficiency. In addition, HTN is often associated with other risk factors such as obesity, blood lipid abnormalities, insulin resistance and glucose intolerance.

**Left ventricular hypertrophy:** LVH develops in response to chronic pressure, volume overload, or a combination of both. Although elevated blood pressure is accepted as one of the primary determinants of LVH, other factors contributing to its development include age, obesity and probably dietary and other lifestyle factors.

**Thrombogenic factors:** The final event precipitating a myocardial infarction is usually the development of an intracoronary thrombosis. High circulating fibrinogen concentrations appear to increase CVD risk in a graded fashion.

## Category 2: Risk factors for which interventions are likely to lower CVD risk

**Diabetes mellitus:** Diabetes eliminates the protection against CVD afforded by female gender. People with diabetes have metabolic alterations like insulin resistance, blood lipid abnormalities, hypertension and central obesity.

**Physical inactivity:** A sedentary life style and low cardio respiratory fitness are each associated with a two-fold or more increase in CVD risk. Regular aerobic exercise reduces BP, lower triglycerides concentration, increases HDL-c, aids in weight control and improves insulin sensitivity.

**Low high-density lipoprotein cholesterol:** There is a strong inverse relationship between HDL-c concentration and coronary events. Cigarette smoking, obesity, and post-menopausal status are associated with lower HDL-c concentrations, whereas moderate alcohol consumption and aerobic exercise raise HDL-c concentrations.

**Obesity:** Increased adiposity is associated with several other CHD risk factors such as, HTN, sedentary lifestyle, glucose intolerance, low HDL-c concentrations and high triglyceride concentrations. Excess deep abdominal fat is associated with marked disturbances in lipoprotein and carbohydrate metabolism.

**Post menopausal status:** Menopause is associated with potentially pro-atherogenic changes in the blood lipid profile. LDL-c increases by approximately 20% to 30% whereas HDL-c declines by approximately 10%.

## Category 3: Risk factors for which interventions may lower CVD risk

**Psychological factors:** Depression, hostility and social isolation have been associated with CVD incidence.

**Elevated triglycerides:** Increased triglyceride levels are associated with elevated CVD risk, when considered in isolation but triglyceride levels lose their predictive power when an adjustment is made for other risk factor

especially HDL-c. Elevated triglyceride levels are often associated with obesity, diabetes, HTN, low HDL-c and small dense LDL particles.

**Elevated lipoprotein (a):** Apolipoprotein (a) is a large protein structurally similar to plasminogen, an important contributor to clot lysis, and lipoprotein (a) concentration greater than 30 mg/dl doubles the risk of CHD.

**Elevated homocysteine:** Hyperhomocysteinemia is atherogenic by causing oxidative damage to LDL. It modifies apolipoprotein and impairs uptake by LDL receptors. Hyperhomocysteinemia cause loss of vasodilation. Homocysteine is a possible marker for the development of vascular disease.

**Oxidation and antioxidants:** Blood concentration of antioxidant affects the susceptibility of LDL and lipoprotein (a) to oxidation, because it is the oxidized LDL that attracts circulating monocytes which then adhere to the arterial wall forming atherosclerotic plaques. Decreased levels of these substances that protect against oxidation increases atherosclerotic risk.

**Alcohol consumption:** Individuals who consume moderate amounts of alcohol (1 to 3 drinks per day) have 40 to 50% lower rate of CHD than those who abstain.

### **Category 4: Risk factors that are not generally amenable to modification**

**Age:** The incidence of the disease increases with age having peak at middle age around 50-500 years.

**Sex:** CVD morbidity is twice as high in men as in women. After menopause the incidence is increased in women, by the age of 70 there is no difference between the sexes. Relative immunity of women during their reproductive life is due to secretion of ovarian hormones. There is increase risk of CVD with oral contraceptive.

**Family history:** In some families there is early onset of CVD. Some families are susceptible for hyperlipidemia. If there is history of heart attack before

55 in father and before 65 in mother, the offspring are likely to get a heart attack at an earlier age.

### Pathophysiology of CVD:

- The process of developing atherosclerosis lesions can begin as early as during infancy and that it may take several decades for the lesions to develop into fatty streaks and fibrous plaques that ultimately cause stenosis (complete blockage) of the arteries.
- Diffuse intimal thickening during infancy which is considered to be normal physiological and not a pathological process can result in the initialization of early clinical manifestation which may appear in the smooth muscle cell layer between the endothelium and the internal elastic lamina.
- These lesions may progress and develop into fatty streaks to reach their maximum extent in the aortas over a period of two decades among individuals having elevated cholesterol and/or triglycerides levels.
- There is also focal proliferation of smooth muscle cells which are termed as gelatinous lesions because they have a low lipid but high-water content.
- Some of these lesions may become large and develop a greyish opaque centre while remaining softy and translucent around the edges. These are referred to as transitional lesions.
- These lesions at times develop a fibrous cap with atheromatous lipids in the centre and are known as fibrous plaques. Such fibrous plaques may coalesce together resulting in blockage of the arteries and hence reduced flow of blood to the tissues.
- The irritating presence of plaques may cause injury to the intimal of the arteries which may result in thrombosis.
- Myocardial infarction/ stroke is the ultimate result of stenosis in the arteries.



## ATHEROSCLEROSIS

### LECTURE 2

#### Objectives

- To discuss about the atherosclerosis
- To understand the common dietary guidelines for atherosclerosis.

#### Definitions

- **Angina pectoris:** A characteristic pain or discomfort in the chest.
- **Myocardial infarction:** An area of necrosis (drying/dead cells) of the myocardium in a tissue.

#### Atherosclerosis:

It is an arterial lesion characterized by patchy thickening of the intimal (inner most coat of artery) comprising of fat and layers of collagen like fibers.

Slow/progressive/degenerative disease



Affect small and large arteries



Weakening the arteries



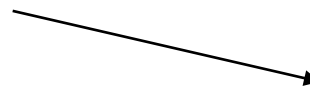
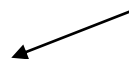
Leading to proliferation



Hinders the smooth blood flow



Plaque formation



Reduced blood flow, nutrient and oxygen supply

↓  
Ischemia

Chest pain called angina pectoris

## Normal and Therapeutic Nutrition

Lumen narrows so much so that a blood clot occurs in coronary artery and blood flow is cut off



Can cause heart attack or dead tissue leads to infarct



Heart muscles receives the blood is called myocardium, attacks on the muscles is called myocardial infarction (MI)

Atherosclerosis is thus categorized as a continuum of as fatty streaks, intermediate lesions, fibrous plaques and complicated lesions. There are 5 phases to atherosclerosis:

**Phase 1:** Asymptomatic phase consists of fatty streaks which are non-obstructive, lipid filled cells.

**Phase 2:** Consist of plaque with high lipid content and prone to rupture usually the type of lipid in LDL's.

**Phase 3:** Acute complicated phase with rupture and non-occlusive thrombus.

**Phase 4:** Acute complicated lesions with occlusive thrombus, which are associated with angina/myocardial infarction and even sudden death.

**Phase 5:** Fibrotic or occlusion lesions, large thrombi can cause serious acute defects.

### Etiology:

Various factors are responsible for the atherosclerosis. They include:

1. **Hyperlipidemia:** Excess circulating fats in blood especially the LDL and low levels of HDL can predispose to atherosclerosis.
2. **Hypertension:** HTN can accelerate atherosclerosis and cause complications.
3. **Diabetes mellitus:** An important risk factor commonly associated with HTN, due to abnormalities of coagulation, platelet adhesions and aggregation, increased oxidative illness and abnormalities in vessel vasomotor can be a high risk for atherosclerosis.

4. **Obesity:** Excessive triglycerides (hyperglyceridemia) and LDL levels are commonly present in obese and lower HDL levels are a great independent risk factors for atherosclerosis.
5. **Lifestyle:** Low physical activity, cigarette smoking could affect the rate of atherosclerosis, increased CHD risk. On the other hand, regular exercise is seen to be protective.
6. **Factors causing endothelial damage:** Elevated blood homocysteine and viral infections of lungs could damage the endothelial and cause injury and hence leads to atherosclerosis.

### **Clinical manifestations:**

- Excessive weight
- Hypertension
- High levels of cholesterol and triglycerides
- Xanthoma (is a yellow swelling, nodule to plaque in the skin resulting from deposits of fat)

### **Complications:**

- Myocardial infraction
- Systolic and diastolic dysfunction
- Inflammatory problems (pericarditis)
- Stroke
- Gangrene (death and decay of body tissue)
- Aneurism (blood filled dilation of a blood vessels)

### **Other complications include:**

- Pancreatitis
- Progressive atherosclerosis or asymptomatic coronary disease

### **The possible cause of elevated triglycerides:**

- Obesity
- Alcohol

- Uncontrolled diabetes
- Hypothyroidism
- Genetic
- Liver disease
- Drugs

### **Possible cause of elevated cholesterol**

- Excess fat in the diet (saturated and cholesterol)
- Overweight/obesity

### **Possible cause of reduced serum HDL levels:**

- Cigarette smoking
- Obesity
- Lack of exercise
- Uncontrolled diabetes
- Hypothyroidism
- Hypertriglyceridemia
- Genetic factor
- Drugs
- Liver disease

### **Nutritional management goals:**

- Reduction of weight if overweight or obese.
- Reduction in the intake of total fat, saturated fat and cholesterol.
- Medication if required for treating lipid disorders and controlling BP.
- Lifestyle changes- increase in physical exercise, moderation in alcohol intake, no smoking, restricting coffee.
- Consuming a balanced adequate diet, rich in calcium, chromium, iron and zinc.
- Medical management is through various lipid lowering drugs.

## Dietary management:

**Dietary fat:** It has largely been observed that high intake of fat particularly saturated fat results in elevation of serum total cholesterol particularly LDL's.

1. **Cholesterol:** It is a natural component of foods such as mutton, pork, ham, sausages, lamb, chicken, eggs (yellow), whole milk, cheese, ice cream, butter and desi ghee. Cholesterol is present only in animal kingdom and does not exist in vegetable kingdom. Increased cholesterol in blood is called hypercholesterolemia which leads to atherosclerosis.

**Sources:** mutton, pork, ham, sausages, lamb, chicken, eggs (yellow), whole milk, cheese, ice cream, butter and desi ghee.

2. **Saturated fatty acid (SFA):** These are found mostly in animal fats as white marble like solid at room temperature. Red meats are rich in SFA. Other sources of saturated fats are milk fat, butter, ghee, coconut oil, palm oil, margarine and hydrogenated fats (vanaspati) these saturated fats in the diet also give rise to high LDL, thus leading to atherosclerosis. The 3 SFA lauric acid, myristic acid and palmitic acids increase cholesterol levels. The energy provided from saturated fats should always be less than 10% of the total calories.

3. **Mono unsaturated fatty acids (MUFA):** These are liquid at room temperature, the highest food sources being olive oil, canola oil, rapeseed oil, to some extent mustard oil. MUFA is an excellent fat as it reduces that LDL levels and increases the good HDL levels and cholesterol, thus preventing atherosclerosis oleic acid is a monounsaturated fatty acid of great clinical relevance.

4. **Polyunsaturated fatty acid (PUFA):** These are also liquid at room temperature. There are two main types of dietary PUFA's of significance:

5. **Linoleum acids (la/n6)** present in good amounts in safflower, sunflower, corn and sesame oil.
6. **Alpha linolenic acid (alna/n3)** fish oils, to some extent olive oil, mustard and rapeseed oil.

The ratio of n6:n3 between 5-10 is considered healthy. This can be obtained by using a mixture of two oils.

Combination of safflower, corn, sunflower or sesame oil (rich in n6) with equal portions of mustard oil or rapeseed oil (n3) can be given a ratio between 5-10.

### Hydrogenated fat:

- All vanaspati preparations are the result of hydrogenation of oils, where unsaturated fat is converted to saturated fat for its flavour and long shelf life.
- It is saturated in nature and contains trans fatty acids. Trans fatty acids, are known to raise LDL in blood thus enhancing atherosclerosis. This is the reason why hydrogenated fats are harmful to heart.

### Carbohydrates:

- Monosaccharides get absorbed the fastest and polysaccharides get absorbed the slowest. This is because polysaccharides contain more fibre. Fibre is beneficial for CVD and is found as water insoluble and water soluble type.
- Soluble fibres like pectin, gums, and mucilages have shown reduction in cholesterol levels. Intake of about 20-40 gm of soluble fibre has proven to be beneficial.
- Legumes, oats, whole grains, fruits (apple, pears, citrus fruits) and vegetables along with psyllium (isabgol) are a rich source of soluble

fibre. Soybean are a good source of fibre and soya proteins have estrogenic effect, which causes of lipid lowering.

### Proteins:

- While the quantity of proteins does not impose any significant impact on the serum lipoproteins, it is the quality of protein, which may be of significance.
- Patients should be advised to consume plant origin proteins over those of animal origin.
- Plant protein is preferred as they are less in SFA, other fat than those in animal products.

### Vitamins:

- Antioxidant and flavonoids, natural vitamin E, vitamin C, and A are nutrients that scavenges cell damaging free radicals and act as antioxidants.

### Minerals:

- Three most important minerals are chromium, zinc, and magnesium. These minerals play a critical role in maintaining proper insulin function.
- Excess of sodium intake and lack of potassium have been seen to play an important role in hypertension.
- Low intakes of calcium can also be a risk for cardiac disorder. Sodium added to the food or sodium rich foods need to be restricted in CVD.

**Antioxidants and flavonoids:** The body makes use of a great variety of antioxidants and free radicals scavenges for different purposes and to protect tissues with different needs.

## Dietary guidelines for hyperlipidemic patients:

- Calories: To maintain IBW.
- Carbohydrates: Should constitute 55-65% of calories with emphasis on polysaccharides (complex carbohydrates)
- Sugar less than 10% of total calories.
- Dietary fibre: > 40 g/ day.
- Proteins: 15-20 % of modified energy.
- Fat: <15-20% of total energy.
- Dietary cholesterol: <200-300 mg/day.

## HYPERTENSION (HTN)

### LECTURE 3

#### Objectives

- To discuss about the hypertension
- To learn about the common dietary guidelines for hypertension.

#### Definitions:

- **Hypertension:** Higher than normal blood pressure.
- **Oedema:** Oedema is swelling caused by the accumulation of fluid in a part of the body. It is often accompanied by inflammation.

#### Hypertension (HTN)

- The systolic sound which occurs when the heart contracts and pushes out the blood into various parts of the body. This denotes the higher range of pressure called systolic blood pressure (SBP) which is measured as (mmhg).



## Normal and Therapeutic Nutrition

- The sound “drop” is the relaxation period of the heart when the blood enters the heart chambers. This is the diastolic blood pressure (DBP) and denotes the lower blood pressure.
- “WHO defines hypertension is a condition in which systolic pressure exceeds 160 mm Hg and diastolic pressure exceeds 95 mm Hg. With diastolic pressures of 100 or more therapy should be initiated with drugs as well as diet.

### Classification of HTN:

Classification	Systolic (mmhg)	Diastolic (mmhg)
Normal	< 120	< 80
Elevated	120-129	< 80
Stage 1	130-139	80-89
Stage 2	140	90
Hypertensive crisis	>180	120

### Types of HTN:

1. **Primary HTN:** High blood pressure in the absence of any underlying disease.
  - Benign HTN
  - Malignant HTN
2. **Secondary HTN:** Elevated blood pressure due to some underlying disease.
  - Cardiovascular HTN
  - Endocrine HTN
  - Renal HTN
  - Neurogenic HTN

- Pregnancy HTN

HTN develops insidiously when the cause is unknown. This condition is called “essential hypertension” or “primary hypertension”

HTN that develops with the identifiable cause is called “secondary hypertension”

### Clinical manifestation:

- Renal failure
- Left ventricular failure
- Myocardial infarction
- Cerebral haemorrhage

### Aetiology:

- 1. Genetic factors:** It is believed that there is polygenic inheritance and when environmental factors are not healthy, hypertension is precipitated.
- 2. Body weight and height:** HTN increases with increase in the weight and height. Hence those who are obese have higher blood pressure values. Increase in BMI increase HTN.
- 3. Age:** Increases steeply with age. Now scientists have found shifts in blood pressure. It is found in adolescents and the young as well.
- 4. Gender:** Rise is greater in men than women but after menopause, the difference decrease.
- 5.** Factors that may increase reabsorption of sodium can cause hypertension such slow albumin level.
- 6. Changes in renin angiotensin:** Aldosterone system and exception of adrenocorticoids and prolactin may affect blood pressure.
- 7. Hyperinsulinemia** of obese may influence blood pressure susceptibility through renal sodium reabsorption and transport.
- 8. Dietary factors:** Excess calorie, fat especially saturated fat and cholesterol in large quantities can increase blood pressure. Refined carbohydrates (sugars) could have an effect but studies in human are

inconclusive. High fibre intakes are beneficial (soluble fibre). Possible role of chlorides, low potassium (k) and high sodium diets in a suspect. Less calcium and magnesium in diet could cause HTN.

**9. Modern lifestyle:** Sedentary life devoid of exercise, stress, smoking, tobacco intake, alcohol is pointing towards increase in blood pressure.

### **Objectives of nutritional management:**

- To achieve gradual weight loss in overweight and obese individuals and maintain weight slightly below the normal levels.
- To reduce sodium intake and maintain fluid and electrolyte balance.
- To maintain adequate nutrition.
- To lead a healthy lifestyle (no smoking, alcohol consumption but a high physical activity)
- To slow down the onset of complications.

**Energy:** Calorie requirement should be based on the concept of maintaining an ideal body weight. Excess calorie through fats and carbohydrates has to be reduced so that the weight is maintained.

**Proteins:** A normal protein intake is recommended. Protein should contribute 15-20% of total energy needs. Excess non-vegetarian foods especially red meat and off yolk could be avoided as it has greater proportion of saturated fatty acids.

**Fats:** the fats incorporated in the diet should be provided from carbohydrates which are polysaccharides (complex carbs) rather than simple sugar (monosaccharides and disaccharides).

**Minerals and electrolytes:** This clinical significance include calcium, sodium and potassium.

**Calcium:** Adequate calcium intake is an essential part of the treatment and this could be ensured through intake of milk and milk products and green vegetables as well as adequate cereals and pulses intake.

**Sodium:** Studies have shown that sodium restriction along with weight reduction is effective in controlling mild to moderate HTN (1-2 g/day) along with diuretics are recommended. Depending on the severity of HTN, different levels of sodium intake can be recommended. These include

- **Mild sodium restriction:** 2-3 g sodium (2000-3000 mg) salt may be used lightly in cooking, but no salt at the table is allowed. There is no restriction on naturally occurring fresh foods but processed foods should be avoided.
- **Moderate sodium restriction:** 1 g sodium (1000 mg). In addition to the above restrictions, some control in naturally occurring fresh foods and no salt in cooking is added. Vegetables with high sodium content are limited in use, canned vegetables and baked products are avoided. Meat and milk products are used in moderate amounts.
- **Strict sodium restriction:** 0.5 g sodium (500 mg), apart from the restrictions stated above, meat, milk and eggs are allowed in small portions and vegetables with higher sodium content are avoided.
- **Severe sodium restriction:** 0.25 g sodium (250 mg), this level is too restrictive and nutritionally inadequate and realistic to be used practically. Restricted quantities of meat and eggs are used only occasionally.

**Potassium:** Increasing the potassium content in the diet lowers the blood pressure and improves hypertension. This could be done by increasing fruits and vegetables in the diet, which are rich in both potassium and fibre content.

**Fluids:** Fluid restriction is necessary only if oedema is present. Dehydration may be observed in some patients on diuretics. Thus, normal amount of fluids especially in the form of plain drinking water can be taken.

**Dietary guidelines:**

- Lifestyle changes: Avoiding smoking, use of tobacco, and excess alcohol intake. Physical activity like walking, 4 times a week for 40 min, is beneficial.
- Medication: Diuretics, calcium channel blockers and others should be consumed regularly.
- Nutritious balanced diet: The diet of a hypertensive should be nutritious. It should be low in calories. And fat with a normal protein content. It should be low in sodium but rich in potassium, calcium, magnesium and fibre. Currently dash diets are recommended. These are rich in fruits and vegetables, non-fat dairy products and low in total as well as saturated fats.

**Lifestyle modifications to manage hypertension**

<b>Modifications</b>	<b>Recommendation</b>
<b>Weight reduction</b>	Maintain normal body weight (BMI= 18.5 to 24.9)
<b>Adopt dietary approach to stop hypertension (DASH)</b>	Consume diet rich in fruits, vegetables and low fat dairy products with a reduced content of saturated and total fat
<b>Dietary sodium reduction</b>	Reduce sodium intake to no more than 6 gm sodium chloride
<b>Physical activity</b>	Engage in regular aerobic physical activity such as brisk walk (at least 30 min/ day)
<b>Alcohol consumption</b>	Limit to no more than 2 drinks/ day

## Assignment

Plan one-day diet for patient suffering from hypertension.

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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

**Lesson 12**

**Diabetes Mellitus**

**Content**

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<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 12</b>	<b>Diabetes Mellitus</b>
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- **OBJECTIVES**

- To create awareness regarding diabetes as a metabolic disease
- To learn about its different types of diabetes.

- **DEFINITIONS**

- Metabolism:** Metabolism is the sum of physical and chemical changes taking place in living cells. It includes all the reactions by which the body obtains energy from food and spends it.
- Metabolic diseases:** The diseases in which the various reactions in the cells are affected due to abnormal production of one or more hormones, or a deficiency of an enzyme are termed as metabolic diseases.

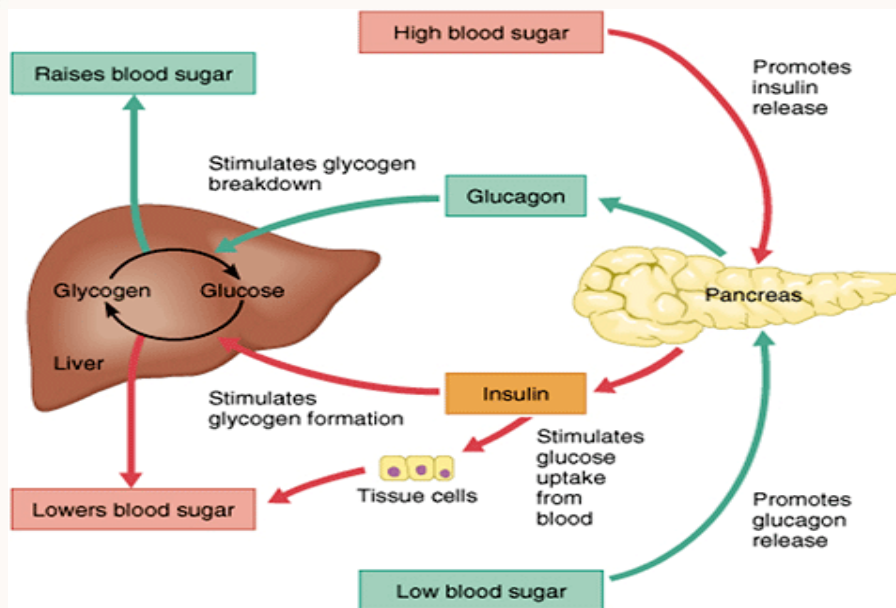
- **INTRODUCTION**

Diabetes Mellitus is a metabolic disorder characterized by high blood glucose levels due to a decreased ability or complete inability of tissues to utilize carbohydrates, accompanied by changes in the metabolism of fat, protein, water and electrolyte.

### **Mechanism**

Under normal circumstances, food is consumed and digested to give glucose, amino acids and fatty acids which enter the blood stream. The pancreas to the hormone insulin and release it into the bloodstream. Glucose is carried to the target cells and enters the cell with the help of insulin which is then utilized by the cell to give it energy thus the levels of glucose in blood decreases. Glucose is carried to the target cells and enters the cell with the help of insulin. The glucose is then utilized by the cell to give it energy thus the levels of glucose in blood decrease.

## Normal and Therapeutic Nutrition



**Fig. Insulin production and glucose metabolism**

The disorder is due to a deficiency or diminished effectiveness of the hormone insulin produced by beta cells of islets of langerhans of pancreas. The metabolic rearrangement in long standing cases is frequently associated with permanent and irreversible, functional and structural changes in the vascular system of the body characteristically affecting the eye, kidney, nervous system.

### • CLASSIFICATION

There are two main types of diabetes-

- i. Type 1- Insulin Dependent Diabetes Mellitus (IDDM)
- ii. Type 2- Non-Insulin Dependent Diabetes Mellitus (NIDDM)

Other types include-

- i. Malnutrition Related Diabetes Mellitus (MRDM)
- ii. Impaired Glucose Tolerance (IGT)
- iii. Gestational Diabetes

### 1. Type 1- Insulin Dependent Diabetes Mellitus (IDDM)

This type of diabetes usually affects children or adolescents and is known as juvenile onset diabetes. There is little or no production of insulin and as a result, such individuals require daily insulin injections.

There is usually a sudden onset. The symptoms get severe, when insulin injections are discontinued. The diabetic develops a life-threatening metabolic complication referred to as ketoacidosis.

## **2. Type 2- Non-Insulin Dependent Diabetes Mellitus (NIDDM)**

This usually affects overweight or obese adults and is known as adult onset diabetes. Non insulin dependent diabetes, develops slowly and is usually milder and more stable.

The insulin production may be normal or even high. However the insulin produced is not as effective as normal insulin. In subjects with this type of diabetes, diet, exercise or oral anti-diabetic drugs may be enough to control the raised blood sugar.

## **3. Malnutrition Related Diabetes Mellitus (MRDM)**

This type of diabetes is mainly seen in some tropical countries like India and it occurs in young people between 15-30 years of age. Generally people with MRDM are lean and undernourished. In this type of diabetes, the pancreas fails to produce adequate insulin. As a result, these diabetics require insulin. In contrast to type 1 diabetics, these patients generally do not develop ketoacidosis, when insulin injections are discontinued.

## **4. Impaired glucose tolerance (IGT)**

Glucose tolerance is assessed by taking the fasting blood sugar value. An oral glucose load of 75 g glucose is administered and blood sugar value checked again after 1 ½ - 2 hours. The value of sugar obtained is checked against the normal or fasting value. If values are above normal, then the condition is described as impaired glucose tolerance. In this type, the patients are free from the symptoms of diabetes but they could develop diabetes at a later stage if they are unable to control the diet and avoid obesity. Regular exercise also helps in maintaining normal blood sugar levels.

## 5. Gestational Diabetes

Diabetes developed during pregnancy is described as gestational diabetes. It occurs in about 1% of pregnant women. Gestational diabetes increases the diabetes related complications during pregnancy and also the subsequent development of diabetes after the delivery.

### SIGNS, SYMPTOMS AND FACTORS AFFECTING DIABETES MELLITUS

#### LECTURE- 2

##### • OBJECTIVES

- i. To understand the etiological factors of diabetes
- ii. To know about the clinical signs and symptoms.

##### DEFINITIONS

- i. **Insulin resistance:** The condition in which the body fails to respond to insulin as they do in healthy people is termed as insulin resistance.
- ii. **Polyurea:** Excessive urination due to glucose in urine is referred as polyuria.
- iii. **Polyphagia:** Increased appetite due to inadequate utilization of glucose is referred as polyphagia.
- iv. **Polydipsia:** Excessive thirst due to loss of water from the body is referred as polydipsia.

##### • ETIOLOGICAL FACTORS

1. **Heredity:** The strongest predisposing factor is family history. Offspring of diabetics have insulin resistance and decreased insulin sensitivity. Children of both diabetic parents have 99% chance of developing this disease.
2. **Obesity:** The chances of developing diabetes in obese individuals is 3 times higher than in non-obese individuals.

3. **Waist circumference:** It is a reliable method of identifying people with a higher risk of developing diabetes. Waist circumference expands with increasing body waist. If waist circumference is greater than 94 cm in women and 80 cm in men, the person is twice as likely to have more than 2 risk factors. Diabetics have a higher waist to hip ratio (WHR). If the WHR is greater than 1.0 in men and greater than 0.8 in women, there is a greater risk to develop diabetes mellitus.
4. **Age and sex:** Individuals over 35 years of age have a 2-3 fold increase in developing diabetes especially if they are 50% above desirable weight. The prevalence of diabetes is more in men in India and more in females in western countries.
5. **Physical Activity:** Lack of physical activity increases the chance to develop obesity which increases the risk for developing diabetes. Physically inactive individuals have a 40% chance of developing diabetes mellitus.
6. **Under nutrition:** Under nutrition impairs Beta cell function by increasing the susceptibility of individuals to genetic and environmental influences.
7. **Stress:** Stress precipitates diabetes in susceptible individuals. In stress the body releases adrenaline, noradrenaline, cortisone that raise blood glucose levels and counteract available insulin.
8. **Intake of simple sugars:** A high intake of sugar is associated with a prevalence of obesity and hence diabetes mellitus.
9. **Alcohol:** Short term risk of heavy or continuous alcohol intake can lead to hypoglycemia, glucose intolerance and ketone accumulation.

• **CLINICAL SYMPTOMS**

1.	Polyurea	Excessive urine output especially at night. In very small children bed wetting may be commonly seen.
2.	Polydipsia	Excessive thirst due to loss of water from the body.
3.	Polyphagia	Increased appetite, urge for sweet items of food due to heavy loss of sugar in urine.
4.	Loss of weight	Inspite of eating more there is loss in weight.
5.	Lack of energy	Untreated diabetes can cause easy tiredness, drowsiness and even coma at later stages.
6.	Pruritis vulvae	Irritation in the genitalia caused by local deposition of sugar from urine. It can also cause disrupted sleep.
7.	Paraesthesia	A tingling sensation felt in the hands and feet.
8.	Blurring of vision	Excess sugar deposits on the eye lens causing refraction changes resulting in the blurring of vision.
9.	Delay in wound healing and minor infections	Lack of nutrients to the wounds delays healing. Minor recurrent infections occur.

## DIAGNOSIS OF DIABETES MELLITUS

### LECTURE- 3

#### OBJECTIVE

- To learn about diagnostic tests of diabetes
- To understand about acute and chronic complications of diabetes mellitus.

#### DEFINITIONS

- Somogyi effect:** Hyperglycemia in the morning as a feed back response of counter- regulatory hormones to nocturnal hypoglycemia.
- Dawn phenomenon:** Reduced tissue sensitivity early morning resulting in mild hyperglycemia.
- Acidosis:** Depletion of the body's alkali reserve resulting disturbance of acid- base balance is known as acidosis. Excess acid is found in blood and body fluids.
- Ascites:** It is a type of oedema characterized by the accumulation of fluid in the abdominal cavity.

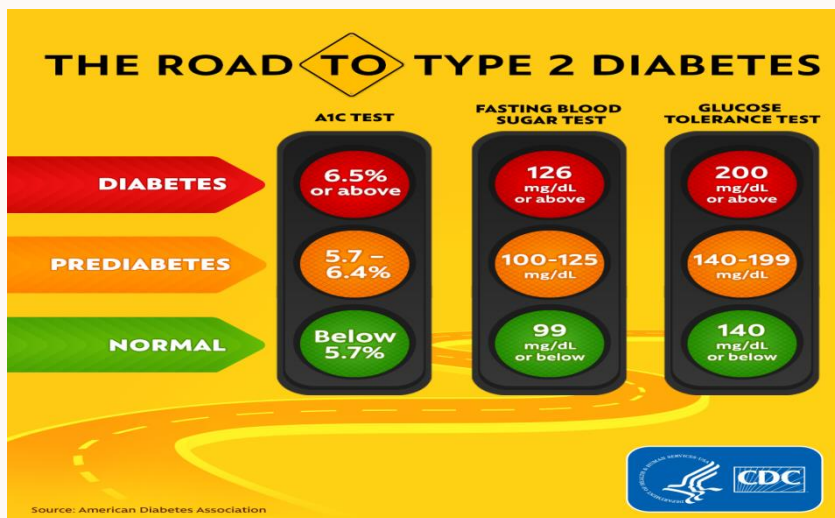
- **DIAGNOSIS**

Screening of Diabetes mellitus is advised for all individuals above 45 years of age, and youth who are overweight or obese and have two or more risk factors.

Diagnosis is on the basis of symptoms combined with lab tests.

1. **Blood glucose levels-** In normal persons without diabetes the fasting sugar levels vary between 80 - 110 mg / 100 ml. The blood sugar levels increase after the glucose load and come down to basal level within two hours.

Fasting - IGT : < 120      Diabetes : >120



- Urinary Sugar:** Glucose is excreted into the urine when the blood glucose levels are elevated beyond 180 mg / 100 ml. Diabetics lose varying amounts of glucose depending on the severity of disease and the dietary intake of carbohydrates. The approximate amount of urinary sugar can be easily monitored by the available diagnostic strips (uristix). The changes in the colour of the reagent or strip indicate sugar levels in the urine.
- Glycosylated hemoglobin (Hb A1C):** As the concentration of glucose in blood rises, more glucose gets attached to hemoglobin (a pigment present in RBC) and the combined molecule is chemically estimated as glycosylated hemoglobin. It reflects the general trend of glucose levels in the blood during the previous 2 - 3 months. In normal individuals the glycosylated hemoglobin concentrations vary from 4-7% while in diabetics it is 8 - 18% of the total hemoglobin depending on the blood sugar level.

- ### COMPLICATIONS

There are major two types of complications, namely-

1. Acute complications



## 2. Chronic complications

### A. Acute complications of diabetes

#### i Hypoglycemia or low blood sugar-

- a. The most frequent cause of low blood sugar is poor timings of snacks and meals. Decreasing the food intake, skipping or delaying a meal or snack, lead to less production of blood sugar whereby the insulin secreted is more leading to hypoglycemia..
- b. The second cause could be exercising more than usual without adding an extra meal or snack in the diet. So the usual amount of insulin and increased exercise can lower the blood sugar levels further.

The treatment programme is based on proper balance of insulin, food consumption and exercise

#### ii Hyperglycemia or abnormally high blood sugar:

- a. This condition occurs when there is not enough insulin to meet the body needs and the deficiency is allowed to continue uncorrected.
- b. With high sugar levels in the blood, the sugar in the urine is excreted at high levels. In addition, the body breaks down fat for energy and ketones are produced.
- c. Increased production of ketones is known as ketosis and their elevated levels in blood is referred to as ketonemia. Their increased excretion in urine is referred to as ketonuria and the term ketoacidosis include all the above mentioned disorders associated with enhanced fat break down.

### B. Chornic complications

- i **Atherosclerosis:** Degeneration of walls of the arteries due to deposition of fatty plaques on arterial walls. Diabetics are more prone to myocardial infraction, stroke and deep artery blockages in

- extremities. Atherosclerosis is a common complication in the diabetics.
- ii **Nephropathy:** Changes occur in nephrons of the kidneys due to thickening of capillary basement membrane, leading to glomerulonephrosis. These changes lead to defects in filtration increasing the proteins in urine and causing uraemia and finally renal failure.
  - iii **Retinopathy:** Long duration diabetes with uncontrolled sugar may affect the small blood vessels of the eyes. This can result in rapid deterioration of the eyesight.
  - iv **Neuropathy:** Lesions of peripheral nervous system could cause tingling, burning or numbness sensation in the of the upper or lower limbs.
  - v **Infections-** Diabetics are also prone to various bacterial, viral and fungal infections. Cuts and wounds heal slowly. Individuals are prone to tuberculosis, infections of the skin, urinary tract and foot.

## MANAGEMENT OF DIABETES

### LECTURE- 4

- **OBJECTIVES**

- i To understand the role of diet for the management of diabetes.
- ii To create awareness about the good synchronization between diet, lifestyle and drugs for preventing/ delaying the onset of complications of diabetes.

- **DEFINITIONS**

- i **Glycemic Index (GI):** Glycemic index is the numerical index given to a carbohydrate rich food that is based on the average increase in blood glucose level occurring in blood after the food is eaten. The higher the number, the greater the blood sugar response.

$$GI = \frac{\text{Area under 2 hrs blood response curve to test food}}{\text{Area under 2 hrs blood response curve to reference food}} \times 100$$

Area under 2 hrs response for equivalent glucose

- ii **Glycemic load:** The glycemic load of a food is the glycemic index divided by hundred and multiplied by its available carbohydrate content in grams.

$$GL = GI/100 \times \text{CHO content (g)}$$

- **MANAGEMENT OF DIABETES**

Diabetes can be treated by diet alone or diet and hypoglycaemic drugs or diet plus insulin depending on the type and severity of the condition.

**The main modes of treatment of diabetes are:**

1. Diet
2. Exercise
3. Drugs
4. Education

**A. Diet**

**Objectives of diet therapy in the management of diabetes are:**

1. Reduce the sugar in blood and urine
2. Maintain ideal body weight
3. Treat the symptoms
4. Reduce serum lipids
5. Provide adequate nutrition
6. Avoid acute complications
7. Prevent vascular complications

Diabetic diet need not be a complete deviation from the normal diet. Indian diets are generally high in carbohydrate and low in fat, with carbohydrates providing 60 - 65% of total calories and fat providing 15 - 25% of total calories. The rest of the calories 15-20% is derived from proteins. The nutrient content of a diabetic diet has to be planned based

on the age, sex, weight, height, physical activity and physiological needs of the patient. Diet for a diabetic can be planned using

1. Food exchange lists and
2. Glycaemic index of foods.

### Food exchange lists

The diet for a diabetic patient is prescribed in terms of exchange lists. Food exchange lists are groups of measured foods of the same caloric value and similar protein, fat, carbohydrate and can be substituted one for another in a meal plan. None of the exchange groups can itself supply all the nutrients needed for a balanced diet.

The food exchange lists help the patient to restrict the foods intake according to the insulin prescription so that hyperglycemia and hypoglycaemia can be prevented and to have variety in the diet.

### Glycaemic Index

The glycaemic index indicates the extent of rise in blood sugar in response to a food in comparison with the response to an equivalent amount of glucose. The ability of the food item to raise the blood sugar is measured in terms of glycaemic index.

**Glycaemic Index = (Blood glucose area of test food/Blood glucose area of reference food) x 100**

Factors that affect the glycaemic response to food are

1. Rate of ingestion of food
2. Food form
3. Food components - fat content, fibre content, protein content
4. Method of cooking and processing food.

The glycaemic index is therefore useful in planning diet for diabetics.

- Cereals like wheat, rice, root vegetables like potato and carrot have a high glycaemic index (65 - 75%).

- Fruits have an intermediate glycaemic index (45 - 55%).
- Legumes have a low glycaemic index (30 - 40%) and are beneficial to diabetics.

Since the blood sugar level depends mainly on the intake of carbohydrate it is important to distribute the intake of carbohydrates. The total amount of carbohydrates is divided into 4-5 equal parts. One third (33%) is served during lunch, one third (33%) during dinner. Of the remaining one third (33%), 25% is served during breakfast and 9% at tea or bed time.

### a) Energy

The calculated calorie requirement should allow the patient to lose or gain weight as required and maintain body weight 10% lower than the ideal / desirable body weight. Dietary calories should be 60 - 70 per cent from carbohydrate 15 - 20 per cent from protein and 15 - 25 percent from fat.

The recommended calorie intake for a diabetic based on body weight is as follows:

Over weight - 20 kcal / kg.wt/day.

Ideal weight - 30 kcal / kg.wt./day

Underweight - 40 kcal / kg.wt/ day.

### b) Carbohydrate

- Complex carbohydrate (cereals and pulses) high fibre diet is given as it improves insulin binding.
- Refined carbohydrates such as sugar, honey, jaggery and jam contain simple sugars which are directly absorbed are not recommended for diabetics, as they cause a rapid rise in blood sugar.
- Sugar present in fruits and milk raise the blood sugar at a slightly lower rate. Whole apple is better than apple juice because of its high fibre content and low glycaemic index.

**c) Protein**

- 15- 20% of total calories should be derived from proteins. Proteins supply essential amino acids needed for tissue repair. Proteins do not raise blood sugar during absorption and do not supply as many calories as fats.
- In patients with NIDDM, consumption of protein along with carbohydrate will lower the blood glucose concentration.

**d) Fat**

- Low fat diet increases insulin binding and also reduces LDL and VLDL levels and reduces the incidence of atherosclerosis which is more common in diabetics. Fat content should be 15 - 25% of total calories and higher in polyunsaturated fatty acids.

**e) Vitamins and Minerals**

- These are protective factors which are essential for the body. They are present in fruits and vegetables.

**f) Dietary fibre**

- Intake of 25g of dietary fibre per 1000 calories is considered optimum for a diabetic.
- High fibre foods have a low caloric value and low glycaemic index and therefore diabetics should consume such foods liberally.
- Fibre present in vegetables, fruits, legumes and fenugreek seed is soluble in nature and more effective in controlling blood sugar and serum lipid than insoluble fibre present in cereals.

**High fibre diets**

1. Promote weight loss
2. Lower insulin requirements
3. Decrease serum cholesterol and triglyceride values and lower blood pressure.

Other dietary guidelines to be remembered are.

1. Timely intake of in between meal snacks should be stressed to avoid hypoglycaemia.
2. Patients should avoid fasting and feasting.
3. Alcohol makes a person obese and stimulates appetite. The diabetic should avoid alcohol.

### Diabetic Diet

This diet should be as close to the normal diet as possible so as to meet the nutritional needs and the treatment of the individual patient. This diet is slightly low in carbohydrates, but adequate in other food principles.

### Sweeteners

- i **Nutritive sweeteners:** Like glucose, honey, molasses, fruit juice, dextrose, maltose, mannitol, sorbitol are nutritive sweeteners. Fructose through natural foods in the form of fruits and vegetables can be given in moderate amount. Restriction of these nutritive sweeteners is because of its caloric content.
- ii **Non- nutritive sweeteners:** These are characterized by an intense sweet taste. They are needed in small quantities and do not make any nutritive contribution which is significant. Three non- nutritive sweeteners available are saccharin, aspartame and acesulfame K.

### B. Exercise

Regular exercise should be an integral part of the daily routine of the diabetic.

### Benefits of exercise for Diabetics

#### 1. Metabolic effects: Exercise Increase

1. Insulin sensitivity
2. Oxidative enzymes
3. Amino acid uptake

4. Storage of glycogen
5. Maximal oxygen uptake

### 2. Cardio vascular effects

1. Decrease in triglycerides
2. Increase in HDL - Cholesterol
3. Lower resting Blood pressure
4. Increase in oxygen transport (decreases blood viscosity)
5. Increases stroke volume and increases cardiac output

### C. Drugs

When diet, exercise or even weight reduction do not improve the diabetic symptoms and blood sugar levels, the use of hypoglycemic drugs become necessary.

- Sulphonylureas:** Tolbutarnide is the mildest and its effect remain for 8 hours hence 2-3 doses need to be taken. They stimulate the pancreas to release more insulin. Tolbutamide and talzamide are first generation sulphonylureas while glyburide, glopizide, glimepride belong to category of second generation sulphonylureas.
- Bigunnides:** They are anti- diabetic drugs which do not affect the output of insulin. They are preferred to sulphonylureas because they do not cause weight increase. Metformin is from this group and generally prescribed to obese subjects.
- Insulin-** three types of insulin are available. The types varies in how quickly it starts working, time of peak activity and how long it works. The three types of insulin are short acting, intermediate and long acting.



#### D. Education

It is very important for diabetics because it is lifelong disorder. In order to enable the patients to lead a healthy and good quality life free from complications, the diabetics must be educated sufficiently in the areas given below-

- i The nature of disease
- ii Its acute and chronic complications
- iii Self monitoring at regular interval for sugar and serum lipids or any weight alterations and importance of weight maintenance.
- iv Adequate information on diet.
- v Knowledge about insulin and drugs in relation to carbohydrates.
- vi Importance of management by diet, drugs and exercise.
- vii Clarification of common food fads and misbeliefs.

### FACTS AND MYTHS RELATED TO DIABETES MELLITUS

#### LECTURE- 5

- **OBJECTIVES**

- i To know the common facts and myths related to diabetes
- ii To know about the prevention of diabetes.

- **DEFINITION**

- i **Fad diet:** A fad diet is a diet that is popular for a time, similar to fads in fashion, without being a standard dietary recommendation and often promising unreasonable fat and weight loss or nonsensical health improvements.

• **FACTS AND MYTHS**

Myths	Facts
<ul style="list-style-type: none"> <li>* Diabetics can eat wheat but not rice.</li>   <li>* Any amount of wheat can be consumed.</li>   <li>* Fasting can be compensated by next meal.</li>   <li>* Feasting can be done by fasting the next meal.</li>   <li>* Diabetic diet is a special diet.</li>   <li>* Fruits can be eaten in unlimited quantities.</li> </ul>	<ul style="list-style-type: none"> <li>• Both have similar glycemic index and raise the blood sugar to a similar extent.</li>   <li>• Many diabetics feel it convenient to count and limit the number of <i>chapatis</i> and chew count is more and satiety is better.</li>   <li>• Wheat is more nutritious as it is richer in protein, fibre, and B-vitamins.                             <ul style="list-style-type: none"> <li>* Large quantities of wheat increases blood sugar.</li> </ul> </li>   <li>* Fasting can lead to hypoglycaemia. It is dangerous particularly for those who are on oral drugs or insulin.</li>   <li>* It can lead to hyperglycemia.</li>   <li>* It's a normal diet eaten in moderation with avoiding certain foods.</li>   <li>* Citrus fruits and apples can be taken. Banana and mango are high in fructose when eaten in</li> </ul>

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<ul style="list-style-type: none"> <li>* Vegetables can be eaten in unlimited quantities.</li> <li>* Liquids are easily digestible.</li> <li>* Fruit juices/cola drinks can be taken.</li> <li>* Bitter foods like fenugreek and bitter gourd are good.</li> <li>* Sugar is to be totally avoided</li> </ul>	<ul style="list-style-type: none"> <li>unlimited quantities</li> <li>cholesterol levels may increase.</li> <li>* If eaten raw or with little fat or no coconut.</li> <li>* Preparations like gruel are not preferred as they have high GI. Chapathis/rotis are preferred.</li> <li>* It is better to avoid empty calories like cola drinks. It is better to eat the fruit as its glycaemic index and nutritive value is better.</li> <li>* Fenugreek seed (not leaves) to be taken 25 g/day to have an impact. This may not apply to all other bitter foods.</li> <li>* Sweets where concentrated sugar and fat are used like mysorepak are avoided totally. Permitted levels of 10g of sucrose can be taken. Artificial sweeteners can be added in coffee and tea like aspartame. Best is to appreciate bitterness in tea or coffee.</li> </ul>
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#### ● PREVENTION

Diabetes can be prevented by encouraging patients to-

- a. Maintain ideal body weight.
- b. Avoid high sugar, salt and fat foods.
- c. Take small bites and chew food thoroughly. Eat and drink slowly.
- d. Eat protein rich foods at each meal.
- e. Eat wisely at social gatherings and restaurants.
- f. Do physical activity. Walk daily.
- g. Avoid aerated and excessive alcohol drinks.
- h. Minimise use of tobacco and other harmful drugs.
- i. Use artificial sweeteners if you have a sweet tooth.
- j. Read and educate yourself on various aspects of diabetes.
- k. Avoid stress.

### Assignment:

1. Plan a diet for a type 2 diabetic vegetarian female patient with a body weight of 74 kg and height 162 cm.
2. Collect the information on home remedies followed at your community and study their correctness

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**NAHEP**  
Component 2



# Normal And Therapeutic Nutrition

**Lesson 13**

**Obesity**

**Content**

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<b>Course Name</b>	<b>Normal and Therapeutic Nutrition</b>
<b>Lesson 13</b>	<b>Obesity</b>
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## Objective

- To discuss about obesity and the parameters to access the level of obesity
- To gain knowledge about the dietary management to deal with obesity.

## Definitions:

- **Obesity:** Obesity can be defined as the generalized accumulation of excess adipose tissue in the body resulting in an increase of more than 20 percent of the desirable weight
- **Body mass index:** Obesity is expressed in terms of BMI-Body Mass Index, and can be represented as

$$\text{BMI} = \text{Weight (Kg)} / \text{Height (m)}^2$$

## Obesity

- One of the most common problems related to lifestyle today is overweight and obesity. Severe overweight or obesity is a key risk factor in the development of many chronic diseases such as heart and respiratory diseases, non-insulin-dependent diabetes mellitus or Type 2 diabetes mellitus, hypertension and some cancers, as well as early death.
- Obesity can be defined as the generalized accumulation of excess adipose tissue in the body resulting in an increase of more than 20 percent of the desirable weight.
- Over weight is a condition where the body weight is 10-20 per cent greater than the mean standard weight for age, height and sex.

- Obesity is due to positive energy balance where the intake of calories (from the diet) is more than the expenditure of calories (physical activity).

### Theories on obesity

1. **Fat cell theory:** The number of fat cells is determined during early years in life to provide space to store fat. Juvenile obesity - increase in the number of fat cells, increase adult obesity due to increase in size of fat cells.
2. **Set point theory:** Once the body reaches ideal body weight or set point, body gets signals for food intake.
3. **Leptin:** Obesity gene called ob codes for protein, leptin, acts as a hormone of hypothalamus to promote negative energy balance.

### Assessment

- **Body weight:** An adult weighting 10 percent more than the standard weight is overweight and 20 percent more is obese.
- **Body mass index:** Obesity is expressed in terms of BMI-Body Mass Index, and can be represented as  

$$\text{BMI} = \text{Weight (Kg)} / \text{Height (m)}^2 = W/H^2$$

BMI classification given by WHO (2004):

Range of BMI for Asians	Nutritional Status
<18.5	Underweight
18.5-22.9	Normal
23-24.9	Overweight



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25-29.9	Pre-Obese
≥30	Obese
30-40	Grade I
40.1-50	Grade II
>50	Grade III

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- **Waist circumference:** It is the most practical tool to evaluate a patient's abdominal fat.
- High risk waist circumference: Men > 40 in (>102 cm) Women > 35 in (>88 cm)

- **Waist to Hip ratio (WHR)**

This is the most frequently used measure of adiposity. It is also called abdominal / gluteal ratio.

The normal ratio  $\frac{\text{Waist}}{\text{Hip}} = 0.7$

A WHR of 1.0 or greater in men and 0.8 or greater in women is indicative of android obesity and increased risk for obesity related diseases.

- **Broka's Index:** In order to calculate ideal body weight Broka's index is used. This measurement is easy to calculate and accurate.  
Brokas's Index = Height (cm) - 100 = Ideal weight (Kg)

## Types of obesity:

**Grade 1 obesity:** These people have BMI more than 25 but less than 29.9. Overweight does not affect their health, they lead normal health and life expectancy is above normal.

**Grade 2 obesity:** The BMI is between 30-39.9. Although they appear to be in good health, they have reduced tolerance to exercise with shortness of breath on exertion and they are unduly fatigued. For mechanical and metabolic reasons these patients are at increased risk of diabetes, arteriosclerosis, hypertension, fatty liver, hernia etc.

**Grade 3 obesity:** The BMI is above 40 and these patients are in pathetic condition. Their day to day activities are restricted due to their enormous mass and more susceptible to disease mentioned in grade 2.

## Factors that contribute to obesity:

1. **Genetic factors:** Genetic inheritance influences 50-70 percent a person's chance of becoming obese. If both parents are obese the chance in children is 80 percent and 70 percent if neither parent is obese.
2. **Age and sex:** It can occur at any age and in either sex as long as the person is in a positive energy balance.
3. **Eating habits:** Nibbling between meals is a potential cause for obesity. Excessive consumption of relatively cheap carbohydrate rich foods such as rice and potato is another predisposing factor (rather than low calorie fruits and vegetables). It is the total intake of calories rather than the frequency of meals that causes obesity.
4. **Physical activity:** Obesity is more common after the age of 35 when physical activity decreases and food consumption either remains the same or may increase with improved economic status.

5. **Endocrine factor:** Dysfunction of the thyroid and pituitary may result in obesity.
6. **Trauma:** Obesity may follow due to damage to hypothalamus after head injury because it is not able to regulate appetite or satiety.
7. **Psychological Factors:** These affects our taste and appearance of food rather than hunger and satiety and tend's to eat more than the body's need.

### DIETARY MODIFICATION AND EXERCISE PATTERN

Prevention of obesity is most desirable and should start from infancy. Three essential principles to be remembered in diet therapy are

1. Adherence to the diet plan
2. Maintenance of the diet and
3. Maintenance of Energy balance

### Diet therapy

Diet to promote weight loss are generally divided into four categories: low-fat, low-carbohydrate, low-calorie, and very low calorie.

### Very low-calorie diets

- Very low calorie diets provide 200-800 Kcal/day while maintaining normal protein intake and limiting calories from both fat and carbohydrates.
- They subject the body to starvation and produce an average weekly weight loss of 1.5-2.5 kilograms.
- These diets are not recommended for general use as they are associated with adverse side effects such as loss of lean muscle mass, increased risks of gout, and electrolyte imbalances.
- People attempting these diets must be monitored closely by a physician to prevent complications.

## Low-calorie diets (Reducing diet)

Low-calorie diets usually produce an energy deficit of 500-1000 calories per day, which can result in a 0.5 kilogram weight loss per week.

## Low-carbohydrate diets (weight maintenance diet)

- Provides 1500-1800 Kcal.
- Introduced when body weights are reduced to optimal level due to reducing diets. Low carbohydrate diets such as Atkin's and protein power are relatively high in fat and protein.
- They are very popular in the press but are not recommended by the American Heart Association.
- A review of 94 trials found that weight loss was associated with increased satiety and thus decreased calorie consumption.
- No adverse-affect from low carbohydrate diets were detected.

## Low-fat diets

Low-fat diets involve the reduction of the percentage of fat in one's diet. Calorie consumption is reduced but not purposely.

## Principles of dietetic management

**Low calorie:** Restricted carbohydrate, restricted fat but with normal protein, vitamins and minerals (except sodium) liberal intake of fluid and high in fibre is given.

**Energy:** 20 Kcal per Kg ideal body weight is prescribed for a sedentary worker and 25 Kcal for moderately active worker.

**Proteins:** 0.8 to 1 g of protein / kg body weight is prescribed for tissue repair.

**Carbohydrates:** High carbohydrate content foods like potatoes and rice are restricted. Sugar which gives empty calories should be totally avoided. Fruits rich in carbohydrate like banana should be avoided. To produce a feeling of satiety and regular bowel movements, bulk-producing carbohydrates like green leafy vegetables and fruits are given.

**Fat:** Low fat or no fat should be given as calories are reduced. Foods rich in fat like nuts and oil seeds are avoided. Skim milk should be given.

**Vitamins:** With prolonged restriction of fats, there is likely to be a restriction of fat soluble vitamins A and D which may be supplemented.

**Minerals:** Sodium intake is to be restricted as excess sodium predisposes to retention of fluid.

**Fluid:** If salt is restricted then fluids can be taken liberally as extra fluids are excreted by the healthy kidneys. A glass of water taken before meals may help to cut down the intake of food.

**High fibre:** High fibre, low calorie food like green leafy vegetables, fruits, vegetable salads, whole grain cereals and pulses can be included in the diet. The advantages of using high fibre foods are.

1. They are low in calorie.
2. Foods like greens provide vitamins and minerals.
3. High fibre diets give satiety.
4. Help in regulating bowel movements.
5. Reduce blood cholesterol.

### Stress management

- Diaphragmatic breathing
- Deep muscle relaxation

- Meditation, yoga and physical activity

### Pharmacotherapy: (BMI>30)

- Drug therapy may be used as part of comprehensive weight loss programme along with diet therapy, physical activity
- Not preferred without changing the life style

### Behaviour therapy:

- This involves changing diets (by eating smaller meals), habits (by cutting down certain types of food)
- Physical activities (by making a conscious effort to exercise for a longer period) to new behaviour that encourage weight loss

### Weight loss surgery

- Bariatric surgery (“weight loss surgery”) is the use of surgical interventions in the treatment of obesity.
- As every operation may have complications, surgery is only recommended for severely obese/ morbid obese people (BMI>40) who have failed to lose weight by dietary modification and pharmacological treatment.

### Dietary Guidelines

1. Soups prepared from vegetables/pulses without the addition of fats or starch should be included in the diet.
2. Salads prepared using raw tomato, cucumber, cabbage, capsicum, radish, lettuce, carrots, sprouted green gram or bengal grams can be included.
3. Root vegetables, like potato, beetroot and carrot should be avoided.
4. High calorie fruits like mangoes, bananas and dry fruits should be avoided.

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5. Lean mutton/chicken/fish should be steamed and not fried.
6. Cottage cheese to be used for processed cheese.
7. All fried foods like puri, parathas etc., should be avoided.
8. Avoid concentrated sweets like sugar, honey, ice cream, puddings, chocolate, candy etc.
9. Alcoholic beverages to be avoided.

**Management after reduction:** During weight reduction and after achieving normal weight, individuals are advised to follow the following instructions for the future control of obesity.

- i) Avoid snacks between meals and restrict having of cereal products
- ii) Fried foods and foods to which fat is added liberally for cooking
- iii) Milk products prepared from cream or butter
- iv) Nuts
- v) Desserts
- vi) Decrease consumption of meat and fatty poultry
- vii) Coconut
- viii) Increase consumption of fruits and vegetables except tubers
- ix) Increase consumption of fish
- x) Check the weight at least every week on a reliable scale
- xi) Daily exercise with the same zeal as during the reducing program
- xii) Three regular meals should be taken
- xiii) Avoid skipping breakfast as it increases food intake during lunch.

**Physical Exercise:** A low calorie diet accompanied by moderate exercise is effective in causing weight loss. Aerobic exercises for 15-30 minutes in which speed and resistance is constant for e. g. in walking, running and swimming can be performed as it directly increases the daily energy expenditure and is useful in long term weight maintenance. Further 50% of glucose and 50% of fat is metabolised to give energy when such exercise are performed. Exercise also preserves lean body mass and prevents the decrease in basal energy expenditure. Anaerobic exercise in which speed

and resistance are not constant for e.g. climbing stairs uses 100% glucose to give energy and does not use fat. Anaerobic form of exercise is not very effective in weight reduction. Passive exercise devices such as mechanical vibrators are ineffective methods of achieving loss of body fat.

Some benefits of regular sustained exercise include

1. Increased work capacity
2. Cardiovascular efficiency
3. Reduction in total fat stores
4. Increased HDL-cholesterol and
5. Improved muscle tone.

**Complications**

Medical field	Condition	Medical field	Condition
Cardiovascular	<ul style="list-style-type: none"> <li>• Ischemic heart disease: angina and myocardial infarction</li> <li>• Congestive heart failure: 12% attributable to obesity</li> <li>• High blood pressure: present in 85% of those with BMI&gt;25</li> <li>• High cholesterol</li> </ul>	Gastrointestinal	<ul style="list-style-type: none"> <li>• Gastroesophageal reflux disease</li> <li>• Fatty liver disease</li> <li>• Cholelithiasis (gallstones)</li> <li>• Hernia</li> </ul>



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	<ul style="list-style-type: none"> <li>• Thrombosis and pulmonary embolism</li> </ul>		
Endocrine and reproductive	<ul style="list-style-type: none"> <li>• Diabetes mellitus</li> <li>• Polycystic ovarian syndrome</li> <li>• Menstrual disorders</li> <li>• Infertility</li> <li>• Complications from pregnancy</li> <li>• Birth defects</li> </ul>	Respiratory	<ul style="list-style-type: none"> <li>• Obstructive sleep apnea</li> <li>• Obesity hypoventilation syndrome</li> <li>• Asthma</li> <li>• Complications from general anaesthesia</li> </ul>
Musculoskeletal	<ul style="list-style-type: none"> <li>• Gout</li> <li>• Immobility</li> <li>• Osteoarthritis</li> <li>• Low back pain</li> </ul>	Psychological	<ul style="list-style-type: none"> <li>• Depression in women</li> <li>• Low self esteem</li> <li>• Body dysmorphic disorder</li> <li>• Social stigmatization</li> </ul>
Neurologic	<ul style="list-style-type: none"> <li>• Stroke</li> <li>• Meralgia paresthetica</li> <li>• Headache</li> </ul>	Skin	<ul style="list-style-type: none"> <li>• Stretch marks</li> <li>• Acanthosis nigricans</li> <li>• Lymphedema</li> </ul>

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	<ul style="list-style-type: none"> <li>• Carpal tunnel syndrome</li> <li>• Dementia</li> <li>• Idiopathic intracranial hypertension</li> </ul>		<ul style="list-style-type: none"> <li>• Cellulitis</li> <li>• Carbuncles</li> <li>• Intertrigo</li> </ul>
Cancer	<ul style="list-style-type: none"> <li>• Breast</li> <li>• Esophageal</li> <li>• Colorectal</li> <li>• Liver</li> <li>• Gallbladder</li> <li>• Pancreatic</li> <li>• Stomach, prostate</li> <li>• Endometrial, cervical</li> <li>• Ovarian</li> <li>• Kidney</li> <li>• Non-Hodgkin's lymphoma</li> <li>• Multiple myeloma</li> </ul>	Genitourinary	<ul style="list-style-type: none"> <li>• Erectile dysfunction</li> <li>• Urinary incontinence</li> <li>• Chronic renal failure</li> <li>• Hypogonadism</li> <li>• Stillbirth</li> </ul>

### Advantages of weight loss

- Reduction in blood pressure
- Reduction in total cholesterol and LDL cholesterol

- Increase in physical activity improving HDL levels
- Lowering of elevated blood glucose level

Weight loss reduces the risk factors for diabetes mellitus and coronary heart disease and cancer.

## UNDERWEIGHT

### LECTURE 2

#### Objective

- To understand the parameters to access the level of underweight
- To describe the common dietary guidelines for weight management.

#### Definitions:

- **Underweight:** It is a condition when the body weight is 10-20% less than the average expected for one's height, age and sex.
- **Ideal Body Weight:** Ideal body weight is the optimal weight associated with maximum life expectancy for a given height. Before the use of BMI to quantify obesity, TBW above 20% of IBW was defined as being obese.

#### Introduction:

- Underweight is a condition when the body weight is 10-20% less than the average expected for one's height, age and sex.
- If the body weight is less than 20% or more than IBW, individual is grossly underweight and it is a matter of concern. In some people, underweight is because of a physiological difficulty in gaining and maintaining weight.
- Such persons eat less and feel full with less food than normal weight persons.

### Etiology:

Underweight may be attributed to inadequate food intake, both in quantity and quality. It is a very common cause for underweight as it fails to meet the body's nutritional needs. This may be due to:

- Poverty and ignorance whereby people cannot afford adequate food or are unaware of cheap, nutritious foods.
- Psychological factors like in patients with mental illness or anorexia nervosa who refuse to eat adequately.
- Irregular habits of eating and poor selection of foods leading to inadequate calorie and nutrient intake. Increased physical activity without an increase in food intake leading to energy deficit. This commonly occurs in people who are active, tense, nervous and get too little rest.
- Malabsorption due to vomiting and diarrhea leads to poor nutrient absorption. This may be due to GIT disturbances or prolonged use of laxatives.
- Pathological conditions such as chronic fevers, in which appetite is poor and energy needs are greatly increased may lead to loss of weight due to inadequate nutrient intake.
- Cancer and infections are also increase metabolic demands on the body and drain away the nutrient resources leading to underweight.
- Hormonal imbalance like hyperthyroidism increase the metabolic rate and hence the energy needs of the body, which if not met, is a cause of underweight.
- Eating disorders like anorexia nervosa and bulimia nervosa are a cause of underweight and undernutrition in youngsters, especially girls.

## Nutritional management

The objectives of dietary modifications are:

- Restore body weight to normal
- Rebuild body tissues and nutrient stores and restore health
- Maintain desirable body weight and a good nutritional status.
- Principles of dietetic management
- Low calorie, normal protein, vitamin and mineral (except sodium), restricted carbohydrate, fat liberal fluid, and high fiber.

### Energy:

- An increase of about 500 kcal per day results in a weight gain of 0.5 kg per week.
- If weight gain desired is more, daily energy intake may be increased by 1000 kcal.
- If fever or GIT disturbances are interfering with absorption, higher level of energy may be given.

### Protein:

- A high intake must be accompanied by a high intake of protein to build up the muscle tissue.
- A daily intake of 1.5-2 g protein per kg is recommended.
- Easily digestible protein foods of high biological value should be included in the diet.

### Carbohydrate:

- A high carbohydrate intake helps meet the high energy needs as well as have a protein sparing action.
- Sugar, honey, cereals, starchy vegetables and fruits must therefore be included in plenty in the diet.

- Fiber intake should be only sufficient enough to regulate bowel movement.

### **Fats:**

- Although fats are energy dense and help reduce the bulk of the diet, they must be provided only in moderation so as to partly meet energy needs but not exceed tolerance limit.
- Emulsified fats like butter, cream are better tolerated.

### **Minerals and vitamins:**

- The diet must be liberal in minerals and vitamins to help regain health. Supplements may be given to combat any accompanying nutritional deficiency.
- Including plenty of veg, fruits, whole grain cereals and pulses, particularly in sprouted form help ensuring an adequate intake of mineral and vitamin.

### **Fluid:**

- Fluids should not be taken before or with a meal but only after a meal so that food intake is not reduced.
- Enough fluids should be taken to avoid constipation.

### **Dietary guidelines:**

- Underweight person has to be on positive energy balance. Calorie intake should be more than the energy expended.
- Energy dense foods hold key to weight gain.
- Underweight person should have regular meals. He should make meals a priority and take the time to plan, prepare and eat each meal.

## Normal and Therapeutic Nutrition

- They should at least eat three major meals a day and snack in between. Underweight person should learn to eat more food at each meal. Serving size can be increased, for example, drinking milk from a large glass. Dietary supplements can be given. Food should be appetizing.
- Diet can be varied and new foods and recipes can be tried.
- Eating can be made in different locations and ambience and with friends and family members.
- A walk before taking meals can make an individual more hungry.

### Assignment

- Plan one day diet for person with height 162 cm and weighs 75 kg. Also calculate his IBW and BMI.
- Prepare a table having high fiber and low fat foods

### Reference

1. Khanna K, Gupta S, Passi S J, Seth R, Mahna R and Puri S (2001) Textbook of Nutrition and Dietetics. Institute of Home Economics, University of Delhi.
2. Michael J Gibney et al. (2005). Clinical Nutrition. (pp 30-60). Oxford, Published by Black well Science.