

## 11. NUTRITION DURING INFANCY

Period until 1 year after child birth is called period of infancy. He is called a newborn for the first 30 days of birth and subsequently infant. It is the second important stage of development after pregnancy, in which speed of growth and development is intense. There are mainly three stages in the lifetime of each individual, which show the highest physical and mental growth. These stages are of pre-natal, infancy and early adolescence.

According to the physical growth and development during the infancy, the birth weight of a healthy baby is up to 3.2 kg. Birth weight depends on the nutritional status of the mother during pregnancy. The weight of the child becomes twice the birth weight in six months and is tripled in 1 year. The length of a healthy infant is between 50 to 55 cm at birth, which is increased by 23 to 25 cm by the time one year is completed. According to the changes in the length of the baby, the proportion of the body of the baby also changes which indicates the proper growth and development of the infant.

The amount of water in the body at the time of birth of the baby is 75 percent and 12 to 15 percent fat found. The amount of water in the body of the baby decreases to 60 percent and the amount of fat increases to 24 percent by the end of the 1st year. The development of the baby's muscles is completed by the end of 1 year. Development of brain is 90% completed during infancy and there is maximum increase in the circumference of the head. The ratio of chest and head circumference at birth is less than 1 and at the completion of infancy is increased to more than one indicates the proper growth and development

of the infant. The heart rate of the newborn is maximum 120 to 140 per minute. The amount of haemoglobin in the blood of the baby is 17 to 20 grams per 100 ml at the time of birth. The red blood corpuscles of the baby breaks quickly and within 2 months the haemoglobin level falls to 12 grams per 100 ml, but the haemoglobin which is released from the breakdown of red blood cells is re-used to make new blood corpuscles. As the growth and development of baby occurs and the volume of blood fluid in the body increases, the level of the haemoglobin decreases. The food pipe of the infant is not fully matured. Newborn's food pipe is able to digest only mother's milk protein, emulsified fat and simple carbohydrates. Secretion of enzymes for digestion of these nutrients starts in just a few months. Neonatal excretory system and kidneys are immature. Their kidneys can not filter more saline blood and can not even concentrate urine, but with the end of infancy period, kidneys of infant begin to work like adults.

### Nutrient requirements in infancy :

In infancy the nutritional status is affected by three factors :

1. Nutritional status of the mother during pregnancy and lactation
2. Adequacy of breastfeeding or upper milk (formula or from cow, goat and buffalo etc.) and supplementary meal
3. Congenital characteristics received from parents, for example the children of short height parents are more likely to be small and children of obese parents will be more likely to be obese in future.

## Energy :

Researches show that the need for energy per unit body weight is maximum as compared to the adults. The requirement of energy is 92 Kcal/kg in the first 6 months after birth of body weight, which is reduced after six months to 80 Kcal/kg of body weight. The rate of increase in infant weight is highest

in the first 6 months, which gradually decreases after 6 months. Infant receives this energy from the protein, fat and carbohydrate present in the mother's milk and supplementary diet .

The need for protein is more than a normal person in infancy. The requirement for protein is 1.16 gm per kg in first 6 months and 1.69 gm per kg in 6-12 months for the growth of the body.

**Table 11.1 : Nutritional requirement during infancy**

Nutrients	Age of infant	
	0-6 month	6-12 months
Energy (Kcal/Kg)	92	80
Protein (gm/Kg.)	1.16	1.69
Visible fat (gm)	-	19
Calcium (mg.)	500	500
Iron (mg.)	46	5
Zinc (mg.)	-	-
Magnesium (mg.)	30	45
Retinal (mg.)	350	350
B-carotene (mg.)	-	2800
Thiamin (mg.)	0.2	0.3
Riboflavin (mg.)	0.3	0.4
Niacin (mg.)	710	650
Vitamin B (mg.)	0.1	0.4
Vitamin C (mg.)	25	25
Folate (mg)	25	25
Vitamin B (mg.)	0.2	0.2

RDA-2010(NIN)

The body weight of infants is increased due to all over growth of muscles, development of brain, and growth in width and length of bones.

**Fat :** The infant gets sufficient fat from the mother's milk. The infant needs linoleic acid for best nutrition, that is available in simple amounts in mother's milk. Their growth and development get affected and white spots appear on body if the fatty acids are not available in sufficient amount.

**Minerals :** The infant needs mainly calcium, phosphours, iron and magnesium. The calcium and phosphorus helps in formation of bone and teeth, while

iron helps in formation of haemoglobin in blood. Requirement of all other minerals is fulfilled by mother's milk except iron.

**Vitamins :** All types of vitamins are present in mother's and animal's milk. The infant get all the needful vitamins from mother's milk.

**Vitamins-A :** The mother's milk has sufficient amount of vitamin-A. Vitamin-D is important for the absorption of calcium and phosphorus. Though it is found in mother's and cow's milk, but milk cannot fulfill the necessity of vitamin-D for infants. That's why it is necessary to provide vitamin-D externally to the infant.

**Vitamin C :** The infant fulfills the requirement of vitamin-C from mother's milk, but after the age of 6 months drops of vitamin-C are given to fulfill the requirements.

**Vitamin B :** It is present in good amount in mother's and cow's milk. Therefore, the need of Vitamin- B group gets fulfilled by mother's milk. But the infants whose mothers are weak or who are born weak, need extra B group vitamins.

**Diet management :** According to the nutritional needs of infants, the dietary management is divided into 2 parts – i.e. 0-6 months and 6-12 months.

**(a) 0-6 months :** The mother's milk is very beneficial for a new born. No other product is comparable to mother's milk. The infant at this time should be kept only on breast feeding and no other food item should be given., such as the cows milk, honey, juice, water etc.

**Colostrum :** The first light yellow thick milk secreted from the breasts of mother after the birth of infant should be given to him. It is a alkaline fluid that have sufficient protein, immunity boosters, which protect the infant from many infections. This is called khees or colostrum. The secretion of colostrum from mother's breast is approx 10-40 ml during first 2-3

days, and afterwards converts into white , thin milk and within 10 days secretion of completely matured milk starts.

The colostrum should not be discarded considering it as dirty milk. It should be definitely given to the infant. Colostrum is rich in protein, but contain less fat as compared to matured milk. It also contain a good amount of vitamin A & K. The amount of Zinc is 20 mg in colostrum, while in matured milk it is 2.6 mg/l. The nutritive value of Colostrum is given in table 11.2

Colostrum is completely digestible by the immature elementary canal and is also helpful in excretion of first faeces. The composition and amount of secreted matured milk is also according to the nutritional requirements and acceptability of the infant.

**Table – 11.2 Nutritive value of Colostrum**

Nutrition	Amount
Energy (Kcal)	58
Fat (gm)	2.9
Calcium (mg)	31
Phosphorus (mg)	14
Iron (mg)	0.09
Protein (gm)	27
Lactose (gm)	5.3

**Table 11.3 : Composition of different types of milk/100 ml**

Nutritients	Human	Cow	Buffalo
Water (gm)	88	87.5	81
Energy (kcal)	65	67	117
Protein (gm)	1.1	3.2	4.3
Carbose (gm)	7.4	4.4	5
Fat (gm)	3.4	4.1	6.5
Calcium (mg)	28	120	210
Phosphorus (mg)	11	90	130
Iron (mg)	-	0.2	0.2
Carotene (ug)	137	174	160
Thiamin (mg)	0.02	0.05	0.04
Ribafavin (mg)	0.02	0.19	0.1
Vitamin-C (mg)			
Caseinogen and lactalbumin	1.2	3.1	-

## **Breastfeeding and Composition of Breast Milk :**

The mother's milk is the best milk. It is equivalent to amrit or elixir for infant. The digestive organs are immature in the initial months of infancy, they can only digest the mother's milk easily and no other food. That is why breast feed is the best option for infants.

Mother's milk is thin during the initial stage, but as the infant's digestive organs get matured, milk also become thicker. The infants of the mothers who do not breast feed are usually weak and fall ill easily. Table 11.3 compares the composition of milk with human, cow's and buffalo's milk, that are generally given in the absence of breast milk.

## **Benefits of Breastfeeding :**

1. The mother's milk contains higher amount of lactose, which is helpful for absorption of magnesium, calcium and amino acids.
2. The mother's milk is clean and free from microorganisms, due to which there is no fear of toxicity.
3. All the nutrients are easily available for infant via mother's milk.
4. It is easily available at perfect temperature and there is no need of heating.
5. It has a protein "Lactoferrin" that gives protection to intestine against diseases.
6. It has high amount of protein and antibodies, that protect infant from malnutrition and serious diseases.
7. Problem of constipation doesn't occur due to presence of good amount of lactose.
8. Breastfeeding helps muscles of uterus and breasts in mother's body to contract and comes back, to shape that get expanded during pregnancy.
9. Breastfeed satisfies the 'Sucking Reflex' in infants, and is an exercise of mouth for which develops the muscles of jaws, throat and teeth eruption is also proper.
10. It gives mental satisfaction to mother. The infant also feels satisfied so the emotional bonding of both become strong.

11. Mother neither need to prepare milk nor to spend money.
12. It decreases infant mortality (death) rate.
13. The concentration of salts is less in breast milk but is as per the requirements of infant. Excretion of salt does not affect the immature kidney of the infant.

## **Preparation for Breast Feeding and Adequacy :**

The mother should clean her breasts properly before and after breast feeding. The milk producing ducts get activated when the infant sucks the breast and start secreting more milk. The stomach of new born is too small and it can store only 10-12 ml of milk at a time. It can store 100 ml upto one month and upto 200 ml of milk till 12 months with an increasing age and capacity of stomach.

That's why at initial stage the infants needs to get feed at every one hour interval, and this interval increases slowly upto 2-3 hours and thus reduces the frequency of feeding milk.

## **Time of breast feeding**

Generally the time of breast feeding is decided by two factors :

- (a) According to Need
- (b) According to time

### **(a) Breast feeding according to need :**

It means, breastfeed the infant when he needs or cries. So whenever the infant cries, he is breastfed. This becomes problematic when the infant cries due to some another reasons like pain in ear, stomach ache, urination etc and the mother gets confused.

### **(b) Breast feeding according to Time :**

It means, the infant get fed according to time, and generally after some days, the infant himself sets his time and interval of feed.

## **Methods of Breastfeeding :**

1. The mother should clean her breasts properly before and after breast feeding.
2. The mother should always feed her infant in sitting position, supporting his head little upwards so that he can easily reach upto breasts.

3. Breastfeeding should always be done in relaxed state without any stress, so that secretion of milk is appropriate.
4. Some nearby portion should also be given in the mouth of infant during breastfeeding, along with nipples so that the effect of sucking reflex works properly on breasts.
5. Infant should be breastfed from both the breasts.
6. The infant feeds the breast at a normal speed. After filling of stomach he himself stops feeding. If the infant sleeps after feeding and keep on sleeping for sometime, and if proper body development occurs every week, this indicates that the infant is getting sufficient milk.
7. The mother should tap the back of infant after feeding the infant until he gets a burp, so that air he inhales during sucking is released.
8. Sometimes the milk is secreted in excessive amount or due to some reason the mother is unable to feed the child, causes heaviness of breasts. Therefore, the mother should herself squeeze out the milk from breasts and empty them in this condition, otherwise the milk gets deposited into milk ducts.

### **Limitations of breastfeeding :**

The mother's milk is very beneficial, priceless, complete and best diet for infant. It is very important for his growth and development, but sometimes due to some reasons, the infant is unable to get breast feed, such as :

1. Mother suffering from serious illness, like hepatitis, heart disease, nephritis etc.
2. Early pregnancy of mother.
3. Very low body weight of infant, or impaired lips, cleft etc.
4. Insufficient formation or secretion of milk from breasts.
5. Absence of mother.
6. Death of mother.

In such situations, supplementary milk with the help of spoon or cup, bottle becomes essential for the survival of infant. The milk can be from cow, goat, buffalo or formula milk prepared for infant.

### **Animal milk :**

The animal milk differs from mother's milk. The cow's milk is best for infant after mother's milk. The animal milk contains high amount of protein and minerals and there is lack of lactose sugar. That's why some water and sugar should be added in animal's milk before feeding the infant and it should be boiled properly, so that all harmful bacterias get killed.

### **Powder milk :**

This is also called formula milk. Many infants cannot digest cow, goat or buffalo's milk. In such condition milk powder that is available in the market should be given. The composition of formula milk is almost similar to mother's milk. The amount of milk powder should be given according to age and weight of infant. The quantity of mother milk and the frequency of breast feeding decreases slowly while age of infant is increasing continuously. The method of preparation of formula milk is indicated on the container.

### **Diet plan for 6-12 months infant :**

Mother's milk is sufficient to meet the requirements of the infant during initial 0-6 months. Supplementary feed becomes essential to meet the growing nutritional needs of infant.

**Table : 11.4 Ratio of Milk and Water**

Age	Ratio of Milk and water
0-15 days	1 part milk + 1 part water
2-6 weeks	2 part milk + 1 part water
1½-3 months	3 part milk + 1 part water
Above 3 months	Milk without water

### **Weaning :**

Weaning means to withdraw the supply of mother's milk and gradually introduce mixed supplementary diet in small quantities. With an increase in rate of growth and development of infant, food from other sources becomes essential and this is known as supplementary food.



The weaning should be start gradually upto the age of 6 months of infant. It is also an art in which the mother has to work hard. If the breastfeeding is stopped suddenly, then the infant can become irritated and mother also feels pain in breasts. The mother should not apply any bitter, things like Neem, tablets of Kunen on the breasts to cease feeding.

### Supplementary food :

It is a sequential process to give supplements to the infant, by which the infant starts to feed on diversified family food in the place of milk diet. In the form of supplements, liquid food items, fruit juice, dal water etc should be given initially and later on get converted into semi solid food items like suji kheer, thin khichdi, daliya etc and solid soft foods like

mashed banana, boiled potato, mashed dal rice, mashed vegetable and chapatti and completely solid foods like chapatti, biscuits, mathri, toasts, etc.

Table 11.5 shows a list of food that can be items given to the child in balanced form to meet his nutritional requirements.

Following points should be kept in mind while supplementing the infant :

1. The diet or food should be prepared according to nutritional needs and amount given to child.
2. Initially, the infants spit out the food from mouth, but this does not mean that he completely dislikes the food. The reason is that the infant doesn't know how to swallow the food.

**Table - 11.5 List of supplements**

Age	Supplements
5-6 months	Fresh fruits - orange, Mausambi, Coconut water, milk, tomato, carrot juice, dal, rice water etc.
6-7 months	Thin suji kheer, dal/veg soups, thin khichdi / daliya, curd, boiled mashed potato, banana , papaya, supplements available in market.
7-8 months	Home cooked foods - dal, vegetable, raiyta, soft mashed chapati, rice along with boiled egg, biscuits, toasts, mathri etc.
8-10 months	Non vegetarians can give boiled eggs, chicken soups, along with above mentioned foods.
10-12 months	All home cooked foods soft and cooked fish chicken etc

3. In the begining the amount of new food should be very small.
4. Food should be served to the infant at a regular time and in a pleasant environment.
5. The baby should be given liquid food items initially and then gradually semi solid and solid substances.
6. Fruit juice should be given in cup not in bottle.
7. Baby's food should always be fresh.
8. If the child tries to eat himself then a spoon or a piece of bread should be given in his hand and let him eat himself.
9. Supplements should be given along with breastfeeding.
10. Add a little bit of ghee and oil to the diet to increase the energy value of the food product.
11. The taste buds of the infant are not much developed. Therefore, more new food items are given to him, variety of foods be consumed daily he will grow and eat as much diversified food.
12. The quantity of salt and sugar should be kept low and don't give too much sweet dishes.
13. Infant should be fed food at normal temperature, not to hot or too cold.
14. If it seems that the infant is showing disinterest in any food item, then it should be discontinued for a few days and tried after some time in a changed form.

15. The infant's food should also be cooked and served in very clean utensils.
16. The economic condition should also be kept in mind while planning diet.
17. The baby should be given food in separate plate, cups etc. Keep in mind that the cups or plate are not of glass or ceramic and their corners and edges are not sharp.
7. Mother's milk is clean, free from microbe, digestible, nutritious, at appropriate temperature, fresh and tailor-made as compared to other milk.
8. Breast feeding is determined by need and time.
9. Mothers should clean their breasts before and after breastfeeding.
10. Always breastfeed the baby in a sitting position.
11. The ability of a new born baby to ingest milk is very less, which gradually increases 200 to 250 ml by the end of 12 months.
12. Weaning is the process of withdrawing mother's milk and gradual introduction of mixed supplementary food such foods are called weaning foods.
13. Foods given to the infant in addition to breast milk, in order to maintain the growth and development rate of the baby are called supplementary foods.

### **Important points :**

1. The period of 1 year after the birth of the baby is called infancy. After pregnancy, infancy is the second significant stage of development when the place of growth and development is intense.
2. Various changes occur in the body of the baby during infancy :
  - a) The birth weight of the normal infant is around 3.2 kg which is doubled in 4 to 6 months and reaches 3 times in a 1 year.
  - b) Food pipe of the new born is not completely mature but in a few months gradually. The secretion of digestive enzymes begins.
  - c) The level of hemoglobin decreases after the birth.
  - d) The neonatal's excretory system and the kidneys are immature but by the time infancy complete the kidneys of infant start functioning similar to that of adults.
3. Nutrition status of infant depends on nutrition, nutritional status of mother during pregnancy and lactation, adequacy of milk, supplementary food and congenital characteristic acquired from the mother and father.
4. Requirements of all nutrients is maximum during infancy due to intense rate of growth and development.
5. Supplementary diet becomes essential after 6 months to meet the requirements along with breast feed.
6. Requirement of infant between 0 to 6 months are full filled with breast milk even water is not needed.

### **Questions :**

1. Choose the correct answer for following question
  - (i) The condition of one year after birth of the baby is called :
 

(a) Childhood	(b) Adulthood
(c) Infancy	(d) Pregnancy
  - (ii) The height of a healthy infant at the time of birth
 

(a) 50-55 cm	(b) 30-40 cm
(c) 42-45 cm	(d) 55-60 cm
  - (iii) The amount of water present in infant's body as compared to fat is :
 

(a) Less	(b) More
(c) Equal	(d) None of the above
  - (iv) Requirement of protein in first six months of infancy is:
 

(a) 1.16 gm/kg body weight
(b) 2.5 gm/kg body weight
(c) 2.0 gm/kg body weight
(d) 1.0 gm/kg body weight

- (v) Food given to discontinue the breastfeeding is called :  
 (a) Food to stop breastfeeding.  
 (b) Supplementary food  
 (c) Weaning food  
 (d) All of these
2. Fill in the blanks :  
 (i) The heart beat of neonatal/infant is .....  
 (ii) Haemoglobin level of infant at birth .....  
 (iii) .....calcium is required for 0-12 months infant.  
 (iv) The first secretion from the breast just after deliver the baby is called .....  
 (v) The protein content in colostrum is ..... than the mature milk.  
 (vi) ..... and ..... concentration is higher in animal milk where as ..... is low.
- (vii) ..... content is higher in mother's milk.
3. Write in brief :  
 (a) Demand breastfeeding  
 (b) Colostrum  
 (c) Supplementary food
4. Plan a days diet for a six months old infant ?
5. Write down the importance of nutritious food for infant.
6. "Mother's milk is best food." Explain.
- Answers :**
1. (i) c (ii) a (iii) b (iv) a (v) a  
 2. (i) 120-140 min. (ii) 17-20 gm/100 ml.  
 (iii) 500 mg. (iv) colostrum (v) high  
 (vi) protein, minerals, lactose (vii) lactose