UNIT 2 NUTRITION DURING PREGNANCY AND LACTATION

Structure

2.0 INTRODUCTION

In any society, for all families, bearing a healthy child and rearing it to grow into a healthy adult is a prime focus. Accordingly, our government has always given major importance to health of the women in general and during pregnancy and

lactation in particular. Even now mortality and morbidity in this group is high. All said and done their adequate nutrition is imperative for uneventful course and outcome of pregnancy. Given the low status of women in Indian society, active support and guidance from health system is of vital importance. In this context being a female health worker, your role is of great significance.

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

2.1 OBJECTIVES

After completing this unit, you should be able to:

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

2.2 PHYSIOLOGICAL CHANGES IN BODY DURING PREGNANCY

Right from the conception, there are initially subtle and later on obvious changes in the body that prepare woman to bear a child. Various hormones prepare her body for this purpose. Let us now go through various changes which takes place during preganncy.

2.2.1 Changes in Uterus and Breasts

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

2.2.2 Weight Gain

In normal pregnancy, variable amount of weight gain occurs. Woman may lose weight in the early months because of nausea or vomiting. But subsequently she starts gaining weight progressively until the last weeks of pregnancy. The total

weight gain during pregnancy ranges from 9–12 kg. (1 kg in first trimester and 5 kg each in second and third trimester). Nutrition during pregnancy is often equated with weight gain because weight is easily measured. Regular gain in weight is considered the best indicator of a successful pregnancy. Low weight gain is associated with increased risk of intrauterine growth retardation (IUGR) and perinatal mortality.

2.2.3 Changes in Body Fluids

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

2.3 INCREASED NUTRITIONAL REQUIREMENTS DURING PREGNANCY

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

2.3.1 Calories

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

2.3.2 Proteins

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

2.3.3 Micronutrients

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

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

a) **Minerals:**

i) **Iron:** Its requirement increases from 21 mg/day to 35 mg/day during pregnancy. This is due to – i) expansion of maternal tissues including red cell mass, ii) iron content of placenta, iii) blood loss during parturition and iv) to build the iron store in foetal liver to last for atleast 4–6 months after birth. Total iron requirement during pregnancy is estimated to be approximately 1,000 mg. This is distributed in foetus and placenta (300 mg) and expanded red cell mass (400 mg). If this increased demand is not met with diet and supplementation, it results in anaemia. It leads to fatigue, and irritability in the mother. Also it may impair foetal growth. Hence, iron supplements are given to pregnant women.

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

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

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

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

b) **Vitamins:**

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

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

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

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

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

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

Check Your Progress 1

Fill in the blank:

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

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

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

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

2.4 DIET DURING PREGNANCY

Child bearing imposes a great physical and psychological strain on the mother. During pregnancy all women need more food, a varied diet, and micronutrient supplements. If this is not met with, the body's own reserves are used, leaving a pregnant woman weakened. Table 2.1 shows belowed diet for a non pregnant and not lactating women as per activity level.

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

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

Table 2.2 Shows additional allowances during Pregrancy and lactation.

Table 2.2: Additional* Allowances during Pregnancy and Lactation

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

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

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

2.4.1 Meal Planning for a Pregnant Woman

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

- She can derive maximum energy (about 60%) from cereals like rice, wheat and millets. (9 portions-30 g each)
- Cooking oil is a concentrated source of both energy and polyunsaturated fatty acids. (Fats/Oils-6 portions-5 gm each)
- Good quality protein is derived from milk, fish, meat, poultry and eggs. However, a proper combination of cereals, pulses and nuts also provides adequate proteins. (2 portions pulses and 1 portion of non-veg-30 gm each)
- Mineral and vitamin requirements are met by consuming a variety of seasonal vegetables particularly green leafy vegetables, milk and fresh fruits. (vegetables- 3.5 portions and fruits- 2 portions- 100 gm each)
- Bioavailability of iron in pulses can be improved by fermentation and sprouting and eating foods rich in vitamin C such as citrus fruits.
- Milk and milk products are the best sources of biologically available calcium.(5 portions-100 gm each)

Though it is possible to meet the requirements for most of the nutrients through a balanced diet, pregnant women are advised to take regular daily supplements of iron, folic acid, vitamin B and calcium as prescribed by the health care provider.

Tips:

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

- To meet increased requirements the mother should consume extra food. The mother can be given nutritious snacks (e.g. *poha*, biscuits, mix of roasted peanuts, *murmura* (puffed rice) and Bengal grams, sprouts, fruits, egg, yogurt etc) in between meals rather than three meals a day.
- Include a variety of foods, focusing on nutrient dense food choices.
- To meet additional iron needs, whole grain cereals, rice flakes, puffed rice; dried fruits, green leafy vegetables, eggs, enriched cereals and organ meats can be given.
- Foods rich in dietary fiber (around 25 g/1000 kcal) like whole grain cereals, pulses, fresh fruits, and vegetables need to be included in the diet to ward off constipation which is a common problem during pregnancy.
- Sufficient fluid intake including 8–12 glasses of water per day.
- Salt intake should not be restricted even to prevent pregnancy-induced hypertension and pre-eclampsia.
- Excess intake of beverages containing caffeine like coffee and tea adversely affect foetal growth and hence, should be avoided.
- Avoid contaminated/stale foods to protect against food borne illness.

2.4.2 Food Pyramid

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

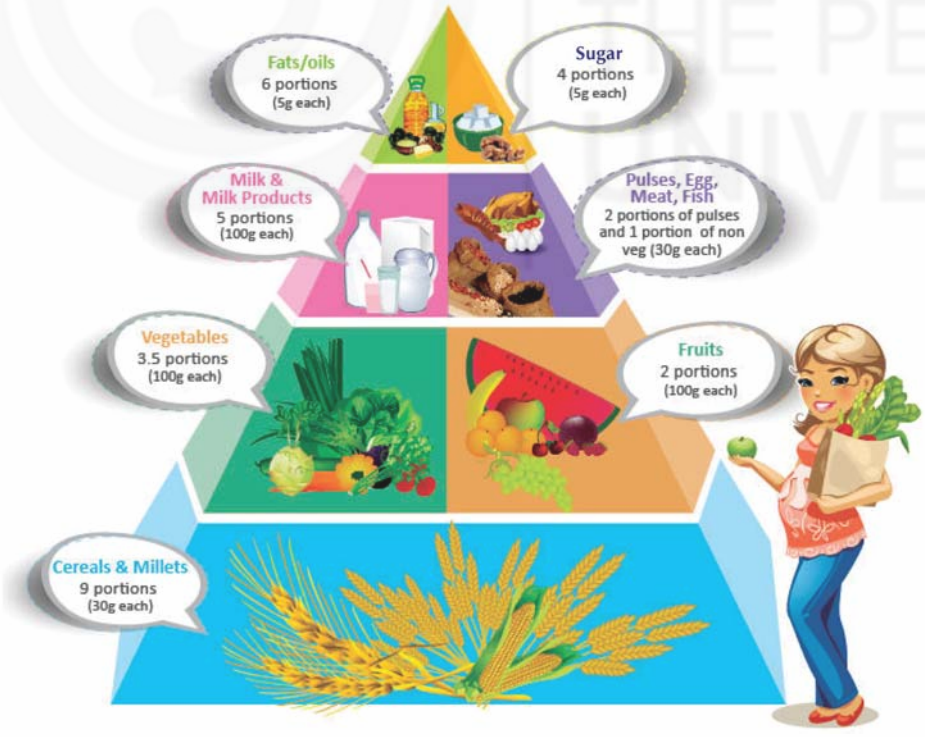

Fig 2.1 : Food Pyramid for pregnant adult women (Sedontry activity)

Source: National Institute of Nutrition (NIN) 2010. Dietary Guidelines for Indians, 2nd Ed.

2.4.3 Model Menu during Pregnancy

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

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

ii) **Breakfast:**

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

iii) **Mid Morning:** Buttermilk 1 glass or fruit – 1 medium

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

Or

Rice (100 gm)- 4 servings

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

Fruit: 1–2 servings any time during the day

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

Milk 200 ml (1 glass)

Cheese sandwich (1 small) or Poha (1 bowl) or Upma (1 bowl) or Vada (1 large)

vi) **Dinner:** Same as Lunch with variations according to liking

Bed Time: Milk 200 ml (1 glass)

Dos and Don'ts of Nutrition for pregnant women:

Do's	Don'ts
1. Small, frequent foods, with intermittent nutritious snacks	1. Avoid bulky food.
2. Take biscuits, rusks or other carbohydrate rich foods early in the morning to avoid morning sickness.	2. Avoid stale, spicy and fatty foods.
3. Make your diet rich in whole grains, fruits, vegetables and lean protein.	3. Avoid taking medications without consultation.
4. Go light on the saturated fat.	4. Keep caution when you are eating out. Avoid raw vegetables, fruits, juices, etc. if you are eating out.
5. Include fibre rich food in diet.	5. Avoid fast food and caffeinated drinks.
6. Take in plenty of water.	6. Avoid Alcohol intake.
7. Use iodised salt for cooking	7. Don't do strenuous work.

Check Your Progress 2

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

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

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

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

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

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

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2.5 ANAEMIA DURING PREGNANCY

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

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

2.5.1 Causes

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

i) **Pre-pregnancy Causes:**

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

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

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

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

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

2.5.2 Diagnosis of Anaemia

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

- **Investigations:**

i) **Haemoglobin Estimation:** It is the easiest method to diagnose and confirm anaemia. It can be done at Sub Centre (SC) or at the outreach level by Sahil's method. The first Hb level will serve as a baseline reading, with which the later estimations at subsequent antenatal visits can be compared to see the effectiveness of treatment. Pregnant woman having Hb level **below 11 g/dl** at any time during the pregnancy is considered to be suffering from anaemia.

Table 2.3: Levels of Anaemia in Pregnancy

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

2.5.3 Signs and Symptoms

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

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

2.5.4 Effects of Anaemia on Pregnancy and its Outcome

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

2.5.5 Iron Folic Acid Supplementation

- While talking to the pregnant woman, stress the need for increased intake of iron during pregnancy. This helps in preventing anaemia and its complications.
- Besides recommending IFA, counsel the woman to increase her dietary intake of iron-rich foods, such as green leafy vegetables, whole pulses, jaggery, meat, poultry and fish.
- Ensure that you have adequate supplies of IFA in your stock to meet the requirements of all pregnant women registered with you.
- **Prophylactic dose:** All pregnant women need to be given one tablet of IFA (100 mg elemental iron and 0.5 mg folic acid) every day for atleast 100 days, starting after the first trimester, at 14–16 weeks of gestation to prevent occurrence of anaemia (prophylactic dose). This dosage regimen is to be repeated for three months post-partum.
- **Therapeutic dose:** If a woman is anaemic (haemoglobin less than 11 g/dl) or has pallor, give her two IFA tablets per day (one morning and one evening) for three months. This means that a pregnant woman with anaemia needs to take atleast 200 tablets of IFA for correction of anaemia (therapeutic dose). This dosage regimen is to be repeated for three months post-partum in women with moderate to severe anaemia. The haemoglobin should be estimated again after a month. If the Hb level has improved, continue with two tablets of IFA daily till it comes up to normal. If it does not rise in spite of the administration of two tablets of IFA daily and dietary measures, refer the woman to the MO at the PHC. Women with severe anaemia (Hb of less than 7 g/dl), or those who have breathlessness, palpitations and increased heart rate (more than 100 beats per minute) due to anaemia, should be started on the therapeutic dose of IFA and referred immediately to the MO in the FRU for further management.

2.5.6 Counselling for Anaemia

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

the necessity of taking IFA and the dangers associated with anaemia during pregnancy.

The woman should be counselled on the issues mentioned below:

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

Check Your Progress 3

1) What is the prevalence of anaemia in pregnancy in India according to NFHS-3?

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

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

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

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

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

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

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2.6 LACTATION

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

2.6.1 Anatomy and Physiology of Breastfeeding

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

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

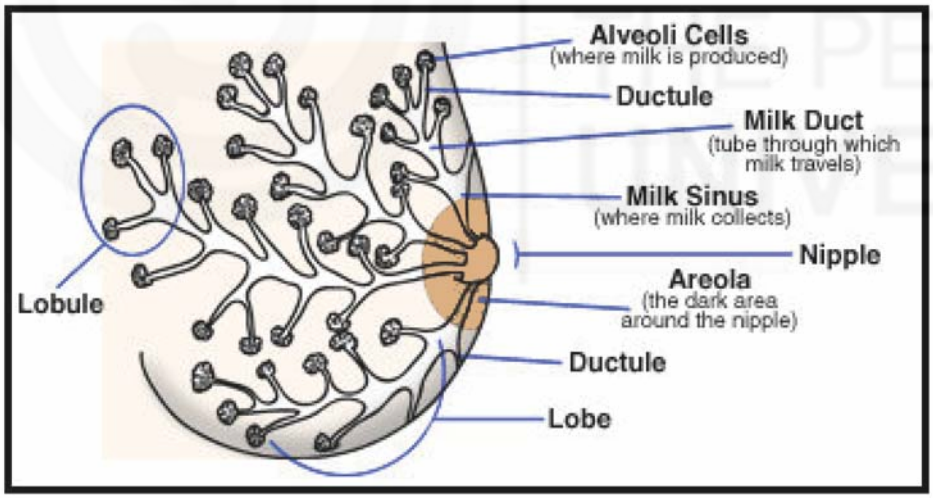

Fig. 2.2: Anatomy of Breast

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

secretion of milk. The process of milk production and secretion occurs in two distinct stages as given below:

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

ii) **Let down reflex** (Milk ejection reflex)**:** When the baby sucks, nerve impulses are also passed to the posterior pituitary producing another hormone, oxytocin. It contracts the muscle cells around the alveoli, squeezing out milk and propelling it down to the nipples and in baby's mouth. Oxytocin also makes the uterus to contract, helps in involution of uterus and controls the post-partum bleeding.The letdown reflex is highly sensitive to emotional and psychological disturbances as well as physical contact. The mother's emotions, the baby's cry or even the baby's thought might initiate this reflex. On the other hand, anxiety, fear and tension may inhibit this reflex. Hence the mother should be comfortable and relaxed while feeding the baby.

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

2.6.2 Position and Technique of Feeding

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

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

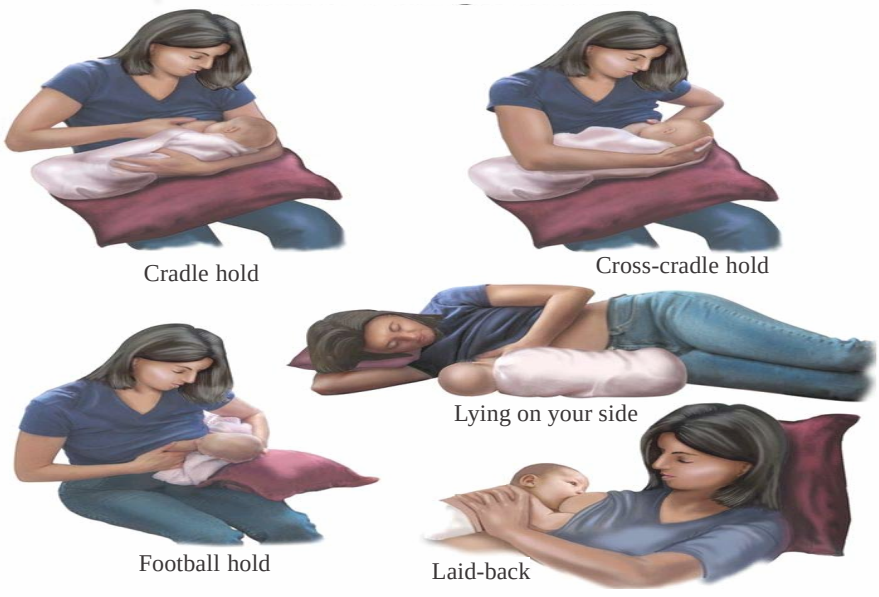

Fig. 2.3 : Position and Technique of Breastfeeding

Signs of Good Attachment:

- Baby's chin is close to the breast as shown Fig. 2.4
- Baby's tongue is under the lactiferous sinuses and nipple against the palate as shown in Fig. 2.5
- Baby's mouth is wide open and the lower lip turned outwards
- More areola is visible above the Baby's mouth than below it
- No pain while breastfeeding.
- Fig. 2.6 shows signs of poor attachment where nose is pressed against areola and lips not holding nipple with grip.

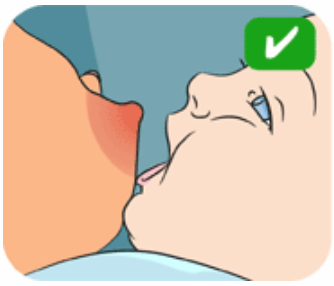

Fig. 2.4: Good attachment

Fig. 2.5: Good attachment

Fig. 2.6: Poor attachment

2.6.3 Composition of Breast Milk

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

Table 2.4: Composition of mother's milk

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

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

2.6.4 Key to Successful Breastfeeding

Following tips can prepare your client for a successful motherhood:

- Prepare the expectant mother for breastfeeding before delivery.

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

2.6.5 Advantages of Breastfeeding to the Baby

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

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

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

Advantages to the Mother: Early initiation of breast feeding helps in quick and early involution of uterus and reduces post-partum bleeding.

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

Check Your Progress 4

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

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

.....

.....

3) How breastfeeding acts as natural contraceptive?

.....

.....

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

.....

.....

2.7 NUTRITIONAL REQUIREMENT DURING LACTATION

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

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

Table 2.5: RDA for a Sedentary Lactating Woman

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

Calories

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

Protein

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

Fats

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

Micronutrients

MINERALS:

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

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

VITAMINS

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

ii) **Folic acid:**The recommendation for folic acid during lactation is 300 µg/ day i.e. an additional allowance of 100 µg /day.

iii) **Vitamin C:** An additional intake of 40 mg/day is recommended (80 mg per day)

2.8 DIET DURING LACTATION

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

- As the nutrient needs are enhanced, the meal pattern may be changed to 5–7 meals a day by introducing in between snack between the meals (just like pregnancy)
- No food needs to be restricted for lactating woman, except spicy and strong flavoured foods as they may cause gastric distress to the mother and may be distasteful for baby.
- Adequate fluids such as water, milk, milk based beverages and fruit juice based on affordability should be encouraged as it facilitates production of milk. Taking extra fluid half an hour before the feed is beneficial.
- Any medicine during lactation must be avoided or taken under strict medical supervision as almost all medicines are secreted in the milk and might affect the baby.
- When a mothers diet is inadequate, her milk yield is usually well maintained by drawing on her own reserve of nutrients and evidence of malnutrition is likely to appear in the mother before it does in her child. An adequate diet during lactation will not only help the mother to maintain a sound health but also ensure good milk supply for a healthy infant.

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

Table 2.6: Balanced Diet for a Lactating Woman

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

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

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

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

2.9 IMPORTANCE OF COMPLEMENTARY FEEDING/WEANING

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

Weaning means introducing a range of semisolid foods gradually, until the baby is eating the same foods as rest of the family. It is an important period as the baby is slowly switched over from only breast milk to other food. Delayed or faulty weaning (quality / quantity) leads to malnutrition of the baby.

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

Principles in preparing complementary food supplements:

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

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

2.10 LOCAL DIETARY HABITS AND NUTRITION PROBLEMS

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

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

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

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

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

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

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

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

Check Your Progress 5

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

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

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

.....

.....

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

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

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

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

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

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

2.11 LET US SUM UP

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

2.12 MODEL ANSWERS

Check Your Progress 1

1) 11 kgs

2) Blood volume

3) Energy +350 kcal/day and proteins +23 gm /day

4) 200 µg, 500 µg

Check Your Progress 2

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

Check Your Progress 3

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

   Give nutrition education- explain iron rich diet.

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

Check Your Progress 4

1) Oxytocin
2) E- 65 kcal and P- 1.1 gm/ 100 ml
3) Suckling of breast by infant leads to production of Prolactin and Oxytocin hormones from pituitary. As long as these lactogenic hormones are produced, it cannot produce sufficient Follicle Stimulating Hormone (FSH) and Leutenizing Hormone (LH) which bring about ovulation. Thus lactation brings about natural contraception, if mother is practicing exclusive breast feeding.
4) **Baby**
   - Breast milk is easily digestible and assimilable.
   - Contains protective antibodies which boost immunity and prevent infection.
   - Improves the intelligent quotient (IQ) of the child.

Mother

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

Check Your Progress 5

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

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