TECHNICAL MODULE ON MATERNAL INFANT AND YOUNG CHILD NUTRITION (MIYCN) FOR UNDERGRADUATE MEDICAL STUDENTS

OCTOBER 2018

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Abbreviations

AA	Arachidonic Acid
ALA	alpha- linolenic acid
ANC	Antenatal Care
BCG	Bacillus Calmette Guerin
BMR	Basal Metabolic Rate
BMI	Body Mass Index
C-section	Caesarean section
DHA	Docosahexaenoic Acid
DOT	Directly Observed Treatment
IFA	Iron Folic Acid
IOM	Institute of Medicine
IU	International Units
IYCF	Infant and Young Child Feeding
Kcal	Kilo calories
KMC	Kangaroo Mother Care
g	Grams
GWG	Gestational Weight Gain
GI	Glycemic Index
GoI	Government of India
Hep B	Hepatitis B
LA	Linoleic Acid
LBW	Low Birth Weight
MIYCN	Maternal, Infant and Young Child Nutrition
LCPUFA	Long-chain polyunsaturated fatty acids
m	metre
mcg	micro gram
MCP	Mother Child Protection
MDD	Minimum Dietary Diversity
MNT	Medical Nutrition Therapy
mg	Milligram
MUAC	Mid-upper arm circumference
NRC	Nutrition Rehabilitation Centre
OPD	Out-patients Department
OPV	Oral Polio Vaccine
ORS	Oral Rehydration Salts
PNC	Postnatal Care
ppm	parts per million
RMNCH	Reproductive Maternal Neonatal and Child Health
RDA	Recommended Dietary Allowances
SAM	Severe Acute Malnutrition
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Foreword

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Dated : 12/10/2018

FOREWORD

Globally, there is evidence that substantiates increased rates of morbidities and mortalities in undernourished populations especially in the most vulnerable population of women and children. Under-nutrition accounts for half of under-five child deaths and a third of maternal deaths in the world. The 1000-day window from conception till the child is two years of age is a critical period during which good nutrition and healthy growth have lasting benefits throughout life.

Despite sustained efforts by the Government of India to improve women and child health and nutrition through various schemes and programs such as MAA (Mother's absolute affection), Pradhan Mantri SurakshitMatritva Abhiyan (PMSMA), Janani Suraksha Yojna (JSY) and Pradhan Mantri Matritva Vandana Yojana (PMMVY) the nutritional status of women and children continues to remain compromised in the country and is amply exemplified by recent data as under:

- Under-five mortality rate (U5MR) is 43/1000 live births (SRS 2015)
- 38% of children under 5 years are stunted (NFHS 4, 2015-16)
- 36% of children under 5 are underweight (NFHS 4, 2015-16)
- One in every two pregnant women are anaemic (NFHS 4, 2015-16)
- 45% of adolescent girls have low Body Mass Index(BMI) < 18.5 (RSoC, 2013-14)

The recent launch of POSHAN Abhiyan demonstrates political will and commitment at highest levels of policy making to address the burden of undernutrition in the country and presents a historic moment for public health and nutrition in the country. To meet the targets set for reduction in malnutrition and anemia requires a comprehensive and collaborative approach, and inclusive participation of local bodies, government departments of the state, social organizations and the public and private sector. Medical Colleges, by virtue of their unique position in the health care delivery system through their tertiary care services and academics, research & public health linkages play a significant role in influencing the maternal, infant and young child nutrition (MIYCN) agenda in the country.

To strengthen foundational knowledge and skills of future generations of practitioners on MIYCN and set strong benchmarks for MIYCN service delivery, a package of integrated MIYCN curriculum and protocols for delivering recommended Maternal Infant and Young Child Nutrition (MIYCN) services in medical colleges and associated hospitals has been developed. The curriculumconstitute of a mix of theory and practical sessions which are spread throughout the course period and transacted by the Paediatrics, Obstetrics &Gynaecology, and Community Medicine departments in an integrated manner. The protocols document attempts to provide a step by step process of delivering recommended, evidence based MIYCN interventions at critical contact points during the 1000-day window of opportunity, from conception till child is two years.

I wish to express by best wishes to the Medical Colleges for successful and effective adoption of this "Integrated Maternal Infant and Young Child Nutrition teaching learning and service delivery package" and succeed in this endeavor to entrench nutrition knowledge and skills in academic studies of all health care professionals to ensure improved understanding and application to all aspects of health care.

Dr. K. K. Gupta

Foreword

SANJAY KUMAR, IAS
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Foreword

Among the undernourished population, women and children are more vulnerable to morbidities which increase their mortality rate. The first 1000 days of a child, since its conception, is a critical time period during which good nutrition plays pivotal role in healthy growth of a child and have life-long benefits.

The recent launch of "POSHAN Abhiyan" demonstrates commitment of the Government to address the issue of undernutrition in the country. Meeting the targets set for reduction in malnutrition and anemia requires a comprehensive and collaborative approach and active participation of local bodies, different departments of the state government different social organizations and the private sector as well.

Medical Colleges, by virtue of their unique position in the health care delivery system, through their tertiary care services and academics, research & public health linkages, play a significant role in influencing the maternal, infant and young child nutrition (MIYCN) agenda in the country.

To strengthen foundational knowledge and skills of future generations of practitioners on MIYCN and set strong benchmarks for MIYCN service delivery, a package of integrated MIYCN curriculum and protocols for delivering recommended Maternal Infant and Young Child Nutrition (MIYCN) services in medical colleges and associated hospitals has been developed. The curricula constitute of a mix of theory and practical sessions which are spread throughout the course period and transacted by the departments of Paediatrics, Obstetrics & Gynaecology, and Community Medicine in an integrated manner. The protocols document attempts to provide a step by step process of delivering recommended, evidence based MIYCN interventions at critical contact points during the 1000-day window of opportunity, from conception till child is two years.

I express my best wishes and hope that Medical Colleges shall successfully and effectively adopt this "Integrated Maternal Infant and Young Child Nutrition teaching learning and service delivery package" and wish success in this endeavor to entrench nutrition knowledge and skills in academic studies of future health care professionals of the state, thus, leading to achievement of the ubiquitous goal of "Health for All".

31/10/2018
(Sanjay Kumar)

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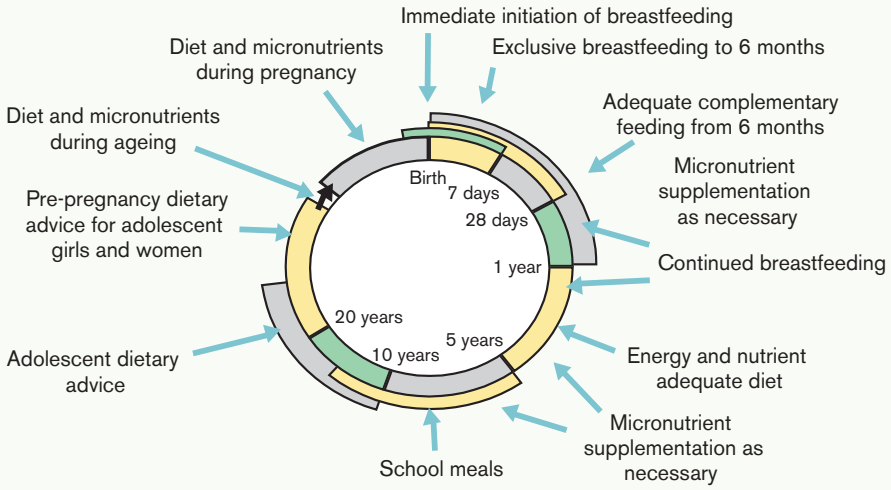
1 Nutrition through the life cycle: Significance of first 1000 days and MIYCN

Nutrition is critical through the life cycle. Infants and young children require breastmilk and energy rich foods to support rapid growth and attainment of physical and cognitive milestones. They continue to need energy rich, body building and protective foods throughout childhood for continuing growth and protection from infections. In adolescence, food intake and diversity need to match requirements for growth spurt, maturation and bone development. Periods of physiological stress-pregnancy and lactation require extra care and nutrition. Nutrient dense low-fat food is needed to remain physically active and healthy and for healthy ageing (Figure 1).

FIGURE 1.1: Nutrition through the life cycle

(WHO 2013)



Women's nutrition before and during pregnancy and through lactation is critical for optimal child nutrition and well-being of women. Undernutrition in the womb owing to poor maternal undernutrition manifests as intrauterine growth retardation, prematurity, low birthweight (LBW). The effects of poor foetal nutrition are long term, intergenerational and irreversible. Among chronically undernourished or stunted children 50% of impairment occurs before birth, in womb. Physiological adaptations during pregnancy partly shield the foetus from inadequacies in the maternal diet, but even so these inadequacies can have consequences for both the short and long-term health and development of the foetus and infant. The foetus is particularly vulnerable during the early days of pregnancy, often before most women know they are pregnant. Many pregnancies are unplanned and the key concerns for unplanned pregnancies are early age of conception or short inter-pregnancy interval, insufficient quantity of food intake and limited dietary diversity, lack of folic acid supplementation and the use of drugs and medications. Maternal stores laid down during pregnancy are important in supporting breastfeeding; also, if the woman is planning another pregnancy.

The first two years of life provide a critical window of opportunity for ensuring children's appropriate growth and development through optimal feeding. Achievement of universal coverage of optimal breastfeeding could prevent 13% of deaths occurring in children under 5 years of age globally, while appropriate complementary feeding practices would result in an additional 6% reduction in under-five mortality. Growth faltering is most evident in the 6 to 11-month age group when low nutrient density foods begin to replace breastmilk and rates of diarrheal illness due to food contamination peak[1]. Prevalence of underweight increases consistently in the first 24 months; there is not much difference in stunting among children under-two and those under-five[2].

The next window of opportunity arises in adolescence. Some argue that the potential exists for height catch-up during adolescence for children stunted in early childhood, provided there is marked improvement in nutritional and health status as well as delayed pregnancy[3].

1 WHO. Essential Nutrition Actions. Improving Maternal, Infant and Young Child Feeding. 2013

2 National Institute of Medical Statistics (NIMS) and Public Health Nutrition and Development Centre, 2013. Undernutrition in Children Under Two Years (U2) in India: An Analysis of Determinants NIMS (ICMR), New Delhi.

3 USAID-Spring. Nutrition of Adolescent Girls and Women of Reproductive Age in Low- and Middle-Income Countries: Current Context and Scientific Basis for Moving Forward. 2015

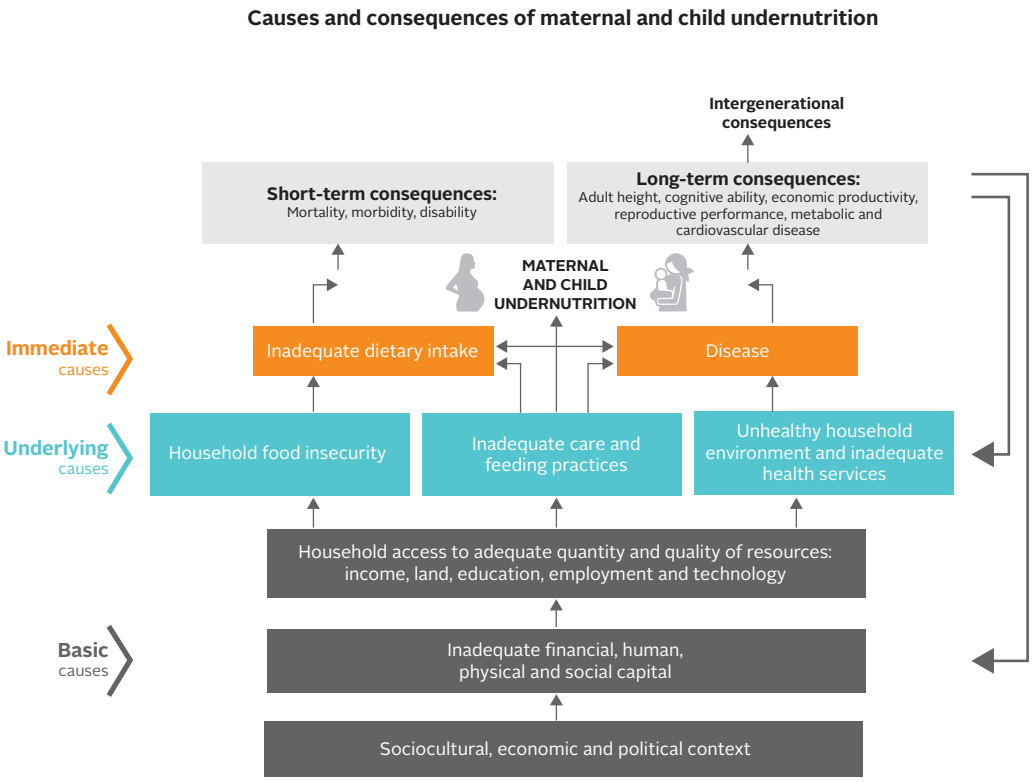
KEY POINTS

- Pre-pregnancy, pregnancy and post-partum nutrition is critical for women and children's well-being.
- The 1000-day window refers to the time from conception till the child is two years of age which aligns with the periods of most rapid growth, physical and cognitive development.
- Adolescence is the second window of opportunity after the first two years of life when "catch-up" growth is likely.
- Among children short for age (stunted), nearly 50% of the impairment occurs in-utero.
- In India, prevalence of underweight increases consistently in the first two years of life.

2 PART 1: NUTRITION IN PREGNANCY AND LACTATION

Maternal diet, health and physical activity, during and in between pregnancies, in addition to optimal pre-pregnancy nutrition and repletion of maternal stores between pregnancies, have direct consequences on maternal outcomes. The causes and consequences of maternal undernutrition are well established[4] (Figure 2.1).

FIGURE 2.1: Conceptual framework: Causes and consequences of maternal and child undernutrition



Source: UNICEF conceptual framework (adapted), Lancet series 2008

KEY POINTS

Maternal short stature (height <145 cm), low or high pre-pregnancy body mass index (BMI, < 18.5 kg/m² or >=25 kg/m², Misra etal 2009), inadequate gestational weight gain and micronutrient deficiencies are strong predictors of child under/ overnutrition.

These determinants are influenced by a mother's nutritional status when she herself was a foetus as well as nutrition before, during and in between pregnancies.

Maternal stores laid down during pregnancy are important in supporting breastfeeding; also if the woman is planning another pregnancy.

Up to 20% of child mortality can be prevented by achieving near universal coverage of interventions that impact immediate causes of undernutrition (Figure 2.1); for more gains interventions addressing the underlying and basic causes such as early age of conception and unplanned pregnancies, household food insecurity, inappropriate water, sanitation and hygiene practices, low social capital, limited access to entitlements are needed.

4 Prendergast AJ and Humphrey JH. The stunting syndrome in developing countries. Pediatrics and International Child Health, 2014; 34 (4): 250-265.

2.1 Nutrient metabolism and nutritional demands of pregnancy

Nutrient requirements are the quantities of nutrients that healthy individuals must obtain from food to meet their physiological needs. The recommended dietary allowances (RDAs) are estimates of nutrients to be consumed daily to ensure the requirements of all individuals in a given population. The recommended level depends upon the bioavailability of nutrients from a given diet. The term bioavailability indicates what is absorbed and utilized by the body. In addition, RDA includes a margin of safety, to cover variation between individuals, dietary traditions and practices[5].

2.1.1 Energy: Requirements and sources

Energy requirements increase in pregnancy because:

- body weight increases,
- basal metabolic rate (BMR) increases an average 10–15%
- growing foetus and maternal physiological changes demand energy

Energy requirements are higher in later pregnancy but may be, at least partially, offset by the mobilisation of fat stored in early pregnancy. Many women sustain a pregnancy with a successful outcome on less than the recommended energy intake due to different adaptive strategies. However, there is a limit to the physiological capacity of the body to adjust nutrient metabolism, and foetal growth and development may be compromised[6]. In under-nourished women, or adolescent mothers who are still growing, nutrients are preferentially partitioned to the mother, effectively protecting nutrient stores from foetal demand, so that foetal growth is compromised than maternal growth[7].

RDA	An additional 350 Kcal energy is recommended daily over the recommended intake for non-pregnant and non-breastfeeding adult women (55 kg) varying with level of physical activity (1900 Kcal, 2230 Kcal and 2850 Kcal for sedentary, moderate and heavy worker) (Table 2.5).
Sources	Energy is derived from multiple food groups including whole grain cereals, millets, fats (vegetable oil, ghee butter), nuts and oilseeds and sugars.

2.1.2 Protein: Requirements and sources

Protein requirements increase in pregnancy because:

- maternal tissue is synthesized
- foetal growth is rapid (principally in the third trimester)

Protein accretion in mother and foetus is 36 g in first 10 weeks, followed by 165 g, 498g and 925 g at 20,30 and 40 weeks of gestation[8]. Metabolic adaptation in pregnancy enhances the efficiency of protein synthesis from the start of pregnancy[9]. However, there is no evidence that pregnant women store protein early in gestation for later foetal demands; the increased requirements of late pregnancy must be met by physiologic adjustments that enhance dietary protein utilization. If the dietary supply is low, a greater change in the physiologic

5 National Institute of Nutrition. Dietary guidelines for Indians, 2011.

6 Kopp-Hoolihan LE, van Loan MD, Wong WW, et al. Longitudinal assessment of energy balance in well-nourished, pregnant women. American Journal of Clinical Nutrition 1999; 69(4): 697–704.

7 Wallace J, Bourke D, et al. Nutrient partitioning during adolescent pregnancy. Reproduction, 2001; 122: 347–57.

8 Hytten F, Chamberlain G.Clinical physiology in obstetrics.Oxford, United Kingdom:Blackwell Scientific Publications, 1980.

9 Duggleby SL, Jackson AA. 2002. Protein, amino acid and nitrogen metabolism during pregnancy: how might the mother meet the needs of her fetus? Current Opinion in Clinical Nutrition and Metabolic Care 5(5): 503–9

adjustments is necessary to meet foetal needs than if dietary intake is liberal[10].[11]

RDA	Recommended increase in protein intake for women (55 kg) during pregnancy is 23 g per day resulting in an RDA of 78 g per day (Table 2.5).
Sources	Animal foods like milk, meat, fish and eggs and plant foods such as pulses and legumes are rich sources of proteins. Animal proteins are of high quality as they provide all the essential amino acids in right proportions, while plant or vegetable proteins are not of the same quality because of their low content of some of the essential amino acids. However, a combination of cereals, millets and pulses provides most of the amino acids, which complement each other to provide better quality proteins[11].

2.1.3 Fats: Requirements and sources

Fat requirements increase in pregnancy because:

- increased energy needs must be met
- in early pregnancy the foetus uses fatty acids
- long-chain polyunsaturated fatty acids (LCPUFAs) such as docosahexaenoic acid (DHA) and arachidonic acid (AA) are necessary for normal brain growth and development in infants, especially in the last trimester, when nerve tissue growth is maximal

The accretion of fat in mother and foetus increases over 10 times from early to late pregnancy, with most rapid increase between 10 to 20 weeks gestation. It is 328 g in first 10 weeks, followed by 2064g, 3594g and 3825g in 20, 30 and 40 weeks gestation[12]. Obese women with insulin resistance, and thin women with little body fat, will be more dependent on dietary intake to maintain an adequate supply. Mother's LCPUFA synthesis is affected by dietary intake of trans-fatty acids; deficiencies of iron, magnesium, zinc, calcium, riboflavin, vitamins B6 and B12; diets low in protein or high in sucrose; alcohol consumption; and inflammation[13].

RDA	Daily intake of 30 g visible fat is recommended for pregnant women (Table 2.5). It should be drawn from a variety of sources, particularly those rich in alpha-linolenic acid (ALA), the building block for the longer chain omega-3 fatty acids and linoleic acid (LA), the building block for longer chain omega-6 fatty acids. FAO/WHO recommend 25-30% of total energy intake in pregnancy should be from fats; 2-3% should be from LA and 0.5 – 2% from ALA and other omega-3 fatty acids.
Sources	Fats are derived from both plant and animal sources and include ghee, butter, vegetable oils such as groundnut, mustard and soybean oil. In addition, we consume fats which are integral part of food - invisible fats as well as - hidden fats in processed foods. Sources of essential fatty acids are presented in table 2.1.

TABLE 2.1: Sources of essential fatty acids

Saturated	Monounsaturated	Polyunsaturated		
		LA (Omega-6)		ALA (Omega-3)
Coconut Palm kernel Ghee/butter Vanaspati	Red palm oil Palmolein Groundnut Rice bran Sesame	Low	Red palm oil Palmolein	Rapeseed Mustard Soybean
		Moderate	Groundnut, Rice bran Sesame	
		High	Safflower, Sunflower, Cottonseed, Corn, Soybean	

10 King JC. Physiology of pregnancy and nutrient metabolism. Am J Nutr, 2000; 71: 1218S-1225S.

11 National Institute of Nutrition. Dietary guidelines for Indians. 2011

12 Ibid (Hytten F, Chamberlain G)

13 Scientific Advisory Committee on Nutrition. 2004. Advice on Fish Consumption: Benefits and risks. London: Committee on Toxicology/The Stationery Office. Original source: King JC. Physiology of pregnancy and nutrient metabolism. Am J Nutr, 2000; 71: 1218S-1225S.

LCPUFA such as DHA (Omega-3) and AA (Omega-6) are mainly available from animal sources – oily fish such as salmon and mackerel, egg yolk and organ meats.

2.1.4 Carbohydrates and dietary fibre: Requirements and sources

The metabolism of carbohydrates (and lipids) alters throughout pregnancy to ensure that the foetus receives a continuous supply of each macronutrient despite fluctuations in maternal intake[14]. In early pregnancy, glucose tolerance is normal and insulin sensitivity is enhanced, favouring maternal fat production and storage. In later pregnancy there is a shift towards reduced insulin sensitivity, mobilisation of maternal fat stores and maternal metabolism of fatty acids. Blood glucose levels are maintained at a significantly higher level to meet the increasing requirements of the placenta and foetus.

An adequate intake of dietary fibre is essential for proper gut function and regular laxation and may also be related to reduced risk for several diseases, including heart disease, certain cancers and diabetes. In pregnancy, high progesterone levels affect smooth muscle tone and result in a decreased rate of gastrointestinal transit. This decreased rate has advantages for nutrient absorption because gut contents are in contact with sites of absorption for longer, but water is also reabsorbed, which often results in constipation. Thus, adequate dietary fibre intake is particularly important during pregnancy to maintain regular bowel habits.[15]

RDA	About 50-60% of total energy should be drawn from carbohydrates, preferably from complex carbohydrates. These are overall recommendations with no specific ones for pregnancy. Specifically, 25g dietary fibre per 1000 Kcal energy should be consumed in pregnancy.
Sources	The glycaemic index (GI) of foods is an important consideration when sourcing carbohydrates. GI is a ranking system of carbohydrate-rich foods based on their effect on blood glucose level. High GI foods break down quickly during digestion and their blood glucose effect is fast. Low GI foods are digested slowly and cause a slow and sustained increase in blood glucose[15]. Cereals and millets are the main sources of carbohydrates in Indian diets (Table 2.2).

TABLE 2.2: Glycaemic index of some carbohydrate rich foods

Sl. No.	Name of the foods	Glycemic Index	Sl. No.	Name of the foods	Glycemic Index
1	White wheat bread	75 ± 2	17	Mango (raw)	51 ± 5
2	Whole wheat bread	74 ± 2	18	Watermelon (raw)	76 ± 4
3	Wheat roti	62 ± 3	19	Potato (boiled)	78 ± 4
4	Chappathi	52 ± 4	20	French fries (potato)	63 ± 5
5	White boiled rice	73 ± 4	21	Carrots (boiled)	39 ± 4
6	Brown boiled rice	68 ± 4	22	Milk (full fat)	39 ± 3
7	Barley	28 ± 2	23	Milk (skim)	37 ± 4
8	Instant oat porridge	79 ± 3	24	Ice cream	51 ± 3
9	Rice porridge /congee	78 ± 9	25	Chick peas	28 ± 9
10	Millet porridge	67 ± 5	26	Soya beans	16 ± 1
11	Sweet corn	52 ± 5	27	Lentils	32 ± 5
12	Cornflakes	81 ± 6	28	Chocolate	40 ± 3
13	Apple (raw)	36 ± 2	29	Popcorn	65 ± 5
14	Orange	43 ± 3	30	Soft drinks/soda	59 ± 3
15	Banana	51 ± 3	31	Honey	61 ± 3
16	Pineapple	59 ± 8	32	Glucose	103 ± 3

Wheat bran, cereals and vegetables are good sources of water-insoluble non-starch polysaccharides which form bulk of the faecal matter. Water soluble non-starch polysaccharides which lower the GI of carbohydrate rich foods are present in fruits, peas, lentils and oats.

14 Butte NF. Carbohydrate and lipid metabolism in pregnancy: normal compared with gestational diabetes mellitus. American Journal of Clinical Nutrition 2000, 71: 1256–61.

15 Brand-Miller JC. Glycemic load and chronic disease. Nutrition Reviews 2003, 61: S49–55.

2.1.5 Calcium and Vitamin D: Requirements and sources

Calcium: is needed for normal development and maintenance of skeleton. Foetal requirements for calcium are significant but are met largely by increased maternal calcium absorption, turnover and retention in early pregnancy. Maternal bone mass decreases in pregnancy, irrespective of mother's calcium status. Most of the calcium is transferred to the foetus during the third trimester; between 30 to 40 weeks gestation 30g calcium is added to the foetus. 1500–2000 mg per day of calcium supplementation in pregnancy has a protective effect in reducing hypertensive disorders[16].

Vitamin D: The main function of vitamin D is to maintain serum calcium and phosphorus concentrations within the range that optimises bone health, by affecting the absorption of these minerals from the small intestine, their mobilisation from bone and calcium resorption by kidney.

RDA	The requirements for calcium double in pregnancy from 600mg in normal adult women (55kg) to 1200mg in pregnancy (Table 2.5).
Sources	Milk is the best source of bio-available calcium (125 mg per 100 ml). Other sources include cheeses, curds, green leafy vegetables, ragi and nuts. Due to the increased demand for calcium in pregnancy, in addition to including calcium rich foods and exposure to sunlight, daily supplementation of 1g calcium with Vitamin D3 is recommended second trimester onwards. Vitamin D is synthesized in the skin, hence dietary requirements depend on exposure to sunlight. Good sources of vitamin D are oily fish (Salmon, hilsa, mackerel, sardines), fish oils and eggs.

2.1.6 Iron: Requirements and sources

Foetal iron requirements tend to be met at the expense of the mother. Although first trimester iron requirements are lower than for the non-pregnant, non-breastfeeding woman, requirements are markedly higher by the third trimester[17]. There are two types of iron in the diet: haem and non-haem iron. Haem iron from meat, poultry and fish is typically 20 to 30 percent absorbed, and absorption is not significantly affected by other components of the diet. Non-haem iron from non-animal sources such as plant foods, iron medication and iron fortificants in food is less bioavailable, with absorption ranging from 2 to 20 %[18]. Dietary factors that promote absorption of non-haem iron are vitamin C and the presence of meat, fish or poultry. Inhibitors of non-haem iron absorption include phytates (in legumes, bran, grains and rice), polyphenols (in tea and coffee, grains), and vegetable proteins such as those in soybeans. Iron requirements in pregnancy need to provide for the growing foetus and increased maternal blood volume.

RDA	Pregnant women are recommended to consume 35 mg iron per day which is an increase of 14 mg from requirements for non-pregnant and non-breastfeeding women. (Table 2.5).
Sources	Meat, fish and poultry are good sources of haem iron. Green leafy vegetables, legumes (Soybean 10.4mg/100g), nuts and jiggery (2.6mg per 100 g) are good sources of non-haem iron. However, to meet the increased demands of iron and folate (under Vitamin B complex) in pregnancy, daily supplementation with 100mg iron and 500mc folic acid is recommended among non-anaemic pregnant women

16 Merialdi M, Carroli G, Villar J, et al. Nutritional interventions during pregnancy for the prevention or treatment of impaired fetal growth: an overview of randomized controlled trials. Journal of Nutrition 2003; 133: S1626–31.

17 Hallberg L. Perspectives on nutritional iron deficiency. Annual Review of Nutrition 2001; 21: 1–21.

18 Sharma KK. Improving bioavailability of iron in Indian diets through food-based approaches for control of iron deficiency anemia. FAO 2003.

2.1.7 Vitamins A, B and C: Requirements and sources

Vitamin A: Vitamin A status in pregnancy is positively correlated with birthweight, head circumference, length and gestational duration[19]. A high retinol (preformed vitamin A) intake is associated with teratogenicity in the first trimester and causes birth defects[20].

Vitamin B: Thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, cobalamin, folic acid (folate). Thiamine (vitamin B1) is a co-enzyme involved in energy supply and the metabolism of carbohydrate, protein and fat. Thiamine deficiency in pregnancy affects foetal growth and is associated with an increased risk of malformations such as cleft lip and palate, preeclampsia and sudden infant death syndrome[21]. Riboflavin is a co-enzyme involved in a range of metabolic processes. Maternal intake of riboflavin may be associated with foetal growth, and deficiency of riboflavin may be a risk factor for pre-eclampsia. Niacin functions as a co-enzyme or co-substrate in energy metabolism while Pantothenic acid is a component of co-enzyme A and phosphopantotheine, which are involved in fatty acid metabolism. Vitamin B6 (Pyridoxine) comprises six compounds of which the principal active form is pyridoxal 5'-phosphate, a co-enzyme involved in the metabolism of amino acids and glycogen. Vitamin B12 (Cobalamin) is essential for normal blood and neurological function.

Folate: Folate is a generic term applied to dietary sources of related compounds that are involved in the metabolism of nucleic and amino acids, and hence the synthesis of DNA, RNA and proteins. Folate requirements increase in pregnancy due to nucleotide synthesis and cell division. Low levels are associated with neural tube defects in the infant, megaloblastic anaemia of pregnancy, cervical dysplasia and atherosclerosis in the mother.

Vitamin C: Vitamin C is a water-soluble antioxidant and a co-factor for enzymes involved in the synthesis of collagen, neurotransmitters and carnitine. It is required for absorption of iron. Vitamin C deficiency is associated with premature rupture of the placental membranes, pre-term delivery, and infection[22,23].

RDA	The daily requirements for vitamin A (retinol) are 800 mg or 6400 mg beta-carotene. Ascorbic acid requirements increase to 60 mg/day from 40 mg/day for non-pregnant, non-breastfeeding women (Table 2.5). Vitamin B group are required in lower doses, but their requirements too increase in pregnancy. Folate requirements increase 2.5 times in pregnancy that is 500 mcg from 200 mcg needed by non-pregnant and non-breastfeeding adult women (55Kg) (Table 2.5 and 2.6).
Sources	Animal foods such as organ meats, milk and eggs are good sources of retinol. Beta-carotene is abundant in orange and yellow fruits and vegetables (Carrot, pumpkin, mango), green leafy vegetables and some vegetable oils. Table 2.3 gives some sources of B complex vitamins. Vitamin B12 is synthesised by bacteria and found in animal products (eg. meat, eggs, milk and milk products). Vitamin C is found in gooseberry (amla), green chilies, guava, and citrus fruits.

TABLE 2.3
Sources of Thiamine, Riboflavin, Niacin, Pantothenic acid and Folic acid

Vitamin	Dietary source
Thiamine	Bread, milk, peas, legumes, oranges
Riboflavin	Milk and milk products, bread, spinach, almonds
Niacin	Bread, poultry, milk, fish/ sea food
Pantothenic acid	Meats, eggs, legumes, mushrooms, cruciferous vegetables (cauliflower)
Folic acid*	Green leafy vegetables, legumes, nuts and liver

**Increased requirements may not be met from dietary sources hence daily 500mcg supplementation is recommended*

19 Ramakrishnan U, Manjrekar R, Rivera J, et al. Micronutrients and pregnancy outcome: a review of the literature. Nutrition Research 1999, 19, 103–59.

20 West CE. 2002. Vitamin A and carotenoids. In: J Mann, S Truswell (eds). Essentials of Human Nutrition. New York: Oxford University Press

21 Ortega RM, Martinez RM, Andres P, et al. Thiamin status during the third trimester of pregnancy and its influence on thiamin concentrations in transition and mature breast milk. British Journal of Nutrition 2004; 92: 129–35.

22 Siega-Riz AM, Promislow JH, Savitz DA, et al. Vitamin C intake and the risk of pre-term delivery. American Journal of Obstetrics and Gynecology 2003; 189: 519–25.

23 Casanueva E, Polo E, Tejero E, et al. Premature rupture of amniotic membranes as functional assessment of vitamin C status during pregnancy. Annals of the New York Academy of Sciences 1993; 678: 369–70.

2.1.8 Iodine: Requirements and sources

Iodine is a component of the thyroid hormones thyroxine (T4) and its active form 3,5,3'-triiodothyronine (T3). The thyroid hormones play an important role in growth and development, and in energy production. Mild to moderate iodine deficiency during pregnancy adversely affects both maternal and infant thyroid function and has implications for brain development and increases susceptibility to neurological disorders[24]. Severe iodine deficiency during pregnancy is associated with abortions, stillbirth, congenital abnormalities, increased perinatal and infant mortality, psychomotor, speech and hearing defects, dwarfism, spastic diplegia, cretinism and mental retardation. Pregnant women are identified by the WHO as one of the vulnerable groups for iodine deficiency disorders.

RDA	ICMR recommends daily intake of 0.247 mg of iodine in pregnancy
Sources	Iodine levels in soil, irrigation and fertilisers affect iodine in food. Sea food, milk are some sources. In iodine rich soils, cereals, legumes and vegetables are also good sources. However, in India, as soils are deficient in iodine, adequately iodized salt (15 ppm iodine) is the best and recommended source for iodine.

2.1.9 Other micronutrients: requirements and sources

Several other micronutrients are necessary for a health pregnancy.

	Sources	Requirements
Vitamin E (tocopherol)	Oils like olive, sunflower, wholegrain products, egg yolk, nuts	15 mg/day. Development of healthy foetal cells and protects pregnant women from toxins
Vitamin K	Broccoli, spinach	Healthy bones, coagulation homoeostasis
Magnesium	Nuts, wholegrain products and dark-green leafy vegetables	Prevents leg cramps and pre-eclampsia
Sodium	Present in most food naturally	Maintains electrolyte balance in body
Zinc	Red meat, seafood, unrefined cereal	Deficit causes congenital malformations and impaired brain development

2.2 Nutrient metabolism and nutritional demands in postnatal period

A poor maternal diet should be improved during pregnancy and breastfeeding to maintain the mother's health. However, a poor diet should not be a barrier to breastfeeding. Women should be confident that they can still breastfeed even if their diet is not optimal, because the nutritional status of a lactating mother has a minimal effect on milk volume unless she is extremely malnourished [25].

2.2.1 Energy: Requirements and sources

There is an increase in energy requirement during breastfeeding because of the energy cost of producing breast milk. The specific energy cost reflects the volume produced and the energy density of the breast milk. In the first six months of breastfeeding, milk production tends to increase, but thereafter production rates vary with weaning practices. However, a woman's diet will not usually limit her ability to produce sufficient breast milk (with perhaps

24 Zimmermann M, Delange F. Iodine supplementation of pregnant women in Europe: a review and recommendations. European Journal of Clinical Nutrition 2004; 58(7): 979–84.

25 Riordan J. 2005. Breastfeeding and Human Lactation. (4th ed). Toronto, Canada: Jones & Bartlett Publishers.

the exception of severe energy restriction), because maternal nutrition has only a modest effect on breast milk production and composition.

RDA	An additional 600 Kcal energy is recommended daily over the recommended intake for non-pregnant and non-breastfeeding adult women (55 kg) varying with level of physical activity (1900 Kcal, 2230 Kcal and 2850 Kcal for sedentary, moderate and heavy worker) in the first six months followed by additional 520 Kcal between six to 12 months of lactation (Table 2.4).
Sources	Refer section 2.1.1

2.2.2 Protein: Requirements and sources

The relationship between breast milk protein content and maternal diet and nutritional status is inconclusive. Some studies have found lower levels of protein in the breast milk and colostrum of malnourished women, while others found similar levels[26]. None the less an increased intake is recommended.

RDA	Recommended increase in protein intake for lactating mothers (55 kg) is 19 g per day at < 6 months and 13 g per day at 6-12 months resulting in an RDA of 74 g per day and 68 g per day respectively (Table 2.4).
Sources	Refer section 2.1.2

2.2.3 Fat: Requirements and sources

Usually, just over half the energy content of breast milk is fat. The fatty acids in breast milk are sourced from maternal diet or maternal fat stores or synthesized by the breast. Maternal diets containing sufficient energy, but which are low in fat, result in breast milk with a higher concentration of medium-chain fatty acids. It is thought that breastfeeding women have increased requirements for LCPUFAs because their dietary intake must meet both maternal requirements and the significant amount of DHA that is transferred into the milk (about 70–80 mg per day). As in pregnancy, DHA intake is important in lactation too.

RDA	Daily intake of 30 g visible fat is recommended for lactating mother (Table 2.4). It should be drawn from a variety of sources, particularly those rich in alpha- linolenic acid (ALA), the building block for the longer chain omega-3 fatty acids and linoleic acid (LA), the building block for longer chain omega-6 fatty acids. FAO/WHO recommend 25-30% of total energy intake in pregnancy should be from fats; 2-3% should be from LA and 0.5 – 2% from ALA and other omega-3 fatty acids.
Sources	Refer section 2.1.3

2.2.4 Carbohydrates and dietary fibre: Requirements and sources

Carbohydrate requirement increases in breastfeeding to provide the energy for the synthesis of milk. Lactose, the principal carbohydrate in breast milk, is synthesized in the breast from glucose. The concentration of lactose in breast milk is about 74 g per litre and varies little. Low-carbohydrate diets are not recommended during breastfeeding. It can be difficult to consume adequate micronutrients if avoiding carbohydrate-containing foods, and sufficient glucose may not be available for breast milk production. As in pregnancy, dietary fibre is needed for maintaining normal bowel movements.

RDA	About 50-60% of total energy should be drawn from carbohydrates, preferably from complex carbohydrates. These are overall recommendations with no specific ones for lactation. Similarly, there are no specific recommendations for dietary fibre intake in lactation.
Sources	Refer section 2.1.4.

26 Emmett PM, Rogers IS. Properties of human milk and their relationship with maternal nutrition. Early Human Development 1997; 49(Suppl): S7–28.

2.2.5 Calcium and Vitamin D: Requirements and sources

A breastfeeding woman transfers approximately 260 mg per day of calcium to breast milk[27]. Decreased maternal excretion and increased maternal resorption of bone calcium are the most important contributors to levels of calcium in breast milk rather than increased dietary intake or increased absorption[28]. The calcium concentration of human milk and increased bone resorption, particularly in the lumbar spine and femoral neck regions, are independent of calcium intake. The low oestrogen levels of breastfeeding amenorrhoea allow increased bone resorption, and the bone loss is regained once oestrogens return to non-breastfeeding levels.

RDA	The requirements for calcium are same as in pregnancy which is 1200 mg. This is double the requirements for non-pregnant, non-breastfeeding adult women (55kg) (Table 2.4).
Sources	Refer 2.1.5

2.2.6 Iron: Requirements and sources

Iron requirements in breastfeeding women are substantially lower than in pregnancy, and even lower than those for non-pregnant, non-breastfeeding women. The average iron content of breast milk is low at 0.35 mg per litre[29], and appears to be relatively unaffected by maternal intakes. Iron requirements for breastfeeding are based on the assumption of menstruation not being resumed until after six months of exclusive breastfeeding.

RDA	The requirements for iron are same as for non-pregnant, non-breastfeeding adult women (55kg) at 21 mg per day (Table 2.4).
Sources	Refer section 2.1.6

2.2.7 Vitamins A, B and C: Requirements and sources

Vitamin A: The vitamin A content of breast milk is affected by maternal vitamin A status and intake in pregnancy and breastfeeding. Infants are born with low vitamin A status and the infant relies on an adequate supply in breast milk to prevent deficiency.

Vitamin B: The requirement for thiamine, riboflavin, niacin, pantothenic acid, pyridoxine and cobalamin are elevated during breastfeeding to cover the energy cost of milk production and the nutrients transferred to breast milk. Breast milk levels reflect maternal intake. The average amount of folate in breast milk is estimated to be 85 µg per litre per day[30]. Breast milk folate concentrations are protected from relatively low maternal intake at the expense of maternal status, so it is important that women have adequate folate intakes to protect their own health.

Vitamin C: The vitamin C concentration in breast milk appears to be affected by maternal intakes of up to 100 mg per day. Intakes higher than 100 mg per day result in increased urinary excretion of the vitamin[31].

27 Goulding A. 2002. Major minerals: calcium and magnesium. In: J Mann, S Truswell (eds). Essentials of Human Nutrition. New York: Oxford University Press.

28 Prentice A. Maternal calcium requirements during pregnancy and lactation. Am J Cl Nutr 1994; 59(Suppl): S477–82.

29 IOM 2000. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine. Washington: National Academy Press.

30 IOM 1998. Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine. Washington: National Academy Press.

31 Byerley LO, Kirksey A. Effects of different levels of vitamin C intake on the vitamin C concentration in human milk and the vitamin C intakes of breast-fed infants. Am J Clin Nutr 1985; 1(4): 665–71.

RDA	Requirements for vitamins A, B complex and C are higher in lactating mothers than pregnant women. Lactating mothers should consume 950 mg retinol or 7600 mg beta-carotene every day. They require 80 mg vitamin C daily, an increase of 20mg per day from pregnancy requirements (Table 2.5). Folate requirements are higher than that for non-pregnant, non-breastfeeding adult women at 300 mcg per day (Table 2.5). Requirements for other B complex vitamins are presented in table 2.6.
Sources	Refer section 2.1.7.

2.2.8 Iodine: Requirements and sources

Ninety micrograms of iodine are transferred into breast milk per day. The iodine content of breast milk correlates to maternal dietary iodine intake.

RDA	Requirements are elevated as in pregnancy and higher than requirements for non-pregnant and non-breastfeeding women.
Sources	Refer section 2.1.8

2.2.9 Other micronutrients: Requirements and sources

Refer section 2.1.9

Summary tables of RDA for women in India

TABLE 2.4
RDA for energy, protein, fat, calcium and iron per day for women (weight 55 kg)

Activity	Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)
Sedentary	1900	55	20	600	21
Moderate	2230		25		
Heavy	2850		30		
Pregnant	+350	78	30	1200	35
Lactation <6mths	+600	74	30	1200	21
Lactation 6-12mths	+520	68	30		

TABLE 2.5
RDA for Vitamins A, C, and folate per day for women (weight 55 kg)

Activity	Vitamin A (mg)		Ascorbic acid (mg)	Folate (mcg)
	Retinol	βcarotene		
Sedentary	600	4800	40	200
Moderate				
Heavy				
Pregnant	800	6400	60	500
Lactation <6mths	950	7600	80	300
Lactation 6-12mths				

TABLE 2.6
RDA for Vitamins B_1, B_2, B_4, B_5, B_6 and B_{12} for women (weight 55 kg)

Activity	B_1(mg)	B_2(mg)	B_4(mg)	B_5(mg)	B_6(mg)	B_{12} (mcg)
Sedentary	1.0	1.1	12	NA	2.0	1
Moderate	1.1	1.3	14			
Heavy	1.4	1.7	16			
Pregnant	+0.2	+0.3	+2	NA	2.5	1.2
Lactation <6mths	+0.3	+0.4	+4	NA	2.5	1.5
Lactation 6-12mths	+0.2	+0.3	+3			

2.3 Balanced diet for pregnant women and lactating mothers

A balanced diet is one which provides all the nutrients in required amounts and proper proportions. The quantities of foods needed to meet the nutrient requirements vary with age, gender, physiological status, weight and physical activity. A balanced diet should provide around 50-60% of total calories from carbohydrates, preferably from complex carbohydrates, about 10-15% from proteins and 20-30% from both visible and invisible fat. Antioxidants such as vitamins C and E, beta-carotene, riboflavin and selenium protect the human body from free radical damage. In addition, a balanced diet should provide other non-nutrients such as dietary fibre, antioxidants and phytochemicals which bestow positive health benefits.

2.3.1 Recommended portions and energy needs met

Keeping the energy and other nutrient needs in consideration, the National Institute of Nutrition (NIN) has determined total quantities of different food groups that should be consumed by pregnant women and lactating mothers on a given day (Tables 2.7, 2.8 and 2.9)[32].

TABLE 2.7
Balanced daily diet for pregnant woman (sedentary)

Food group	Portion size (g)	Number of portions	Total quantity (g)
Cereal and millet	30	9	270
Vegetables	300	3.5	1050
Fruits	100	2	200
Milk (cow) and products	100	5	500
Pulses	30	1 or 2*	30 or 60
Fats /oils	5	6	30
Sugars	5	4	20

**1 for non-vegetarians, 2 for vegetarians*

TABLE 2.8
Balanced daily diet for lactating mother (sedentary)

Food group	Portion size (g)	Number of portions	Total quantity (g)
Cereals and millets	30	10	300
Vegetables	300	3.5	1050
Fruits	100	2	200
Milk (cow) and products	100	5	500
Pulses	30	3 or 5*	90 or 150
Fats /oils	5	6	30
Sugars	5	4	20

**3 for non-vegetarians, 5 for vegetarians*

Table 2.9
Serving size examples for giving advice to pregnant woman or lactating mother

Food group	Serving size examples	Energy (Kcal)
Cereals and millets	1 cup cooked rice (100 g)	170
	2 chapattis (80-90 g)	160
	1 paratha (80-90 g)	150
	2 slices bread (70-80 g)	170
Vegetables	½ cup vegetable curry (100 g)	85
Fruits	1 medium sized seasonal fruit (100 g)	50 - 80
Milk (cow) and products	1 cup milk (200 ml)	170

32 National Institute of Nutrition (NIN). Dietary guidelines for Indians: A manual. 2011.

	2 slices cheese (40 g)	100
	½ cup curd (50 g)	30
Pulses	½ cup cooked dal (20 g)	100
Fats /oils	1 teaspoon (5 ml)	9
Sugars	1 teaspoon (5 g)	4

2.3.2 Minimum Dietary Diversity (for Women of Reproductive age group-MDD –W)

MDD-W is a dichotomous indicator of whether or not women 15–49 years of age have consumed at least five out of ten defined food groups the previous day or night. The proportion of women 15–49 years of age who reach this minimum in a population can be used as a proxy indicator for higher micronutrient adequacy, one important dimension of diet quality[33]. The ten defined groups are listed and explained in table 2.10.

TABLE 2.10
Ten foods groups for measuring MDD

GROUP 1 Grains, white roots and tubers, and plantains	Also called "starchy staples". These foods provide energy, varying amounts of micronutrients (e.g. certain B vitamins provided by grains) and varying amounts of anti-nutrients, such as phytates.
GROUP 2 Pulses (beans, peas and lentils)	Members of the plant family Fabaceae (alternate name Leguminosae). Includes beans, peas and lentils. The seeds are harvested at maturity, dried and used as food or processed into a variety of food products.
GROUP 3 Nuts and seeds	Comprises mostly tree nuts but also includes groundnut (peanut) and may include certain seeds when consumed in substantial quantities.
GROUP 4 Dairy	This group includes almost all liquid and solid dairy products from cows, goats, buffalo, sheep or camels which are important sources of high-quality protein, potassium and calcium, as well as vitamin B12 (available only from animal-source foods) and other micronutrients.
GROUP 5 Meat, poultry and fish	Sometimes referred to as "flesh foods". All meats, organ meats (that is liver, kidney), poultry, other birds, fresh and dried fish and seafood are included.
GROUP 6 Egg	Includes eggs from birds (domesticated poultry and wild birds)
GROUP 7 Dark green leafy vegetable	Medium green leaves, such as cabbage along with darker greens, are all vitamin A-rich and are included in this group. In addition, they are rich in folate and several other micronutrients.
GROUP 8 Other vitamin A – rich fruits and vegetables	Most common vitamin A-rich fruits are ripe mango and ripe papaya; others include apricot and several types of melon. These foods may also be good sources of vitamin C and/or folate and/or other micronutrients.
GROUP 9 Other vegetables	This group includes vegetables not counted above as dark green leafy vegetables or as other vitamin A-rich vegetables.
GROUP 10 Other fruits	This group includes most fruits, excluding vitamin A-rich fruits.

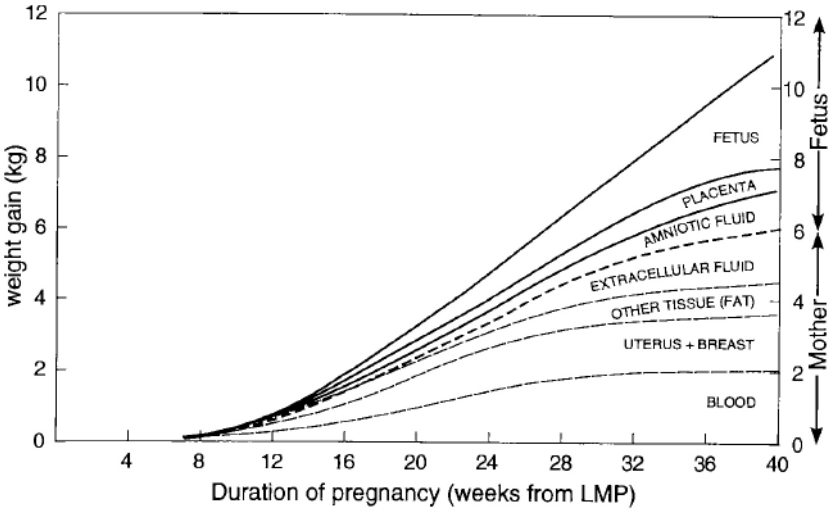
33 FAO and FHI 360. 2016. Minimum Dietary Diversity for Women: A Guide for Measurement. Rome: FAO

2.4 Anthropometric measures of maternal nutrition status

Anthropometric measures of significance in pregnancy include weight and height.

Weight gain is a critical and measurable indicator of pregnancy progress. The patterns and components of weight gain are presented in figure 2.2.

FIGURE 2.2
Patterns and components of weight gain in pregnancy



SOURCE
Pitkin RM. Nutritional support in obstetrics and gynecology. Cilinal obstetrics and gynaecology. 1976; 19: 489-513

2.4.1 BMI based weight gain in pregnancy

Gestational Weight Gain (GWG) should be monitored according to pre-conception BMI (Table 2.11)[34].

TABLE 2.11
BMI (weight gain recommendations are for IOM cut-offs and may not be valid for Asian cut-offs)

Pre-conception BMI (IOM)	Pre-conception BMI (Asian cut-off)	Total weight gain (range in kg)	Incremental weight gain (2nd and 3rd trimester) (Mean and range in kg/week)
< 18.5 kg/m2 (Underweight)	< 18.5 kg/m2 (Underweight)	12.0–18.0	0.51 (0.44 – 0.58)
18.5-24.9 kg/m2 (normal)	18.5–22.9 kg/m2 (Normal)	11.5–16.0	0.42 (0.35 – 0.50)
25.0 – 29.9 kg/m2	23.0–24.9 kg/m2 (Overweight)	7.0–11.5	0.28 (0.23 – 0.33)
≥ 30 kg/m2	BMI ≥ 25 kg/m2 (Obese)	5.0–9.0	0.22 (0.17 – 0.27)

Measurement protocol

Height: Measurement of height requires a vertical board with an attached metric rule and a horizontal headboard that can be brought into contact with the uppermost point on the head. The individual to be measured should be barefoot or in thin socks, wearing little clothing such that positioning of the body can be seen. Person should stand on a flat surface, with weight evenly distributed on both feet, heels together and head positioned so that line of vision is perpendicular to the body. The arms should hang freely on the sides and the head, back and buttocks and heels should be contact with the vertical board. Individual is asked to inhale deeply and maintain fully erect position. The movable headboard is brought onto the topmost point on the head with sufficient pressure to compress hair.

Weight: Weight should be measured using a levelled platform scale with a beam and movable weights. Person should and still in the centre of the platform, with body weight

34 IOM. Weight Gain During Pregnancy. Re-examining the guidelines. Washington, DC: National Academies Press; 2009:370.

evenly distributed between both feet. Light weight indoor clothing can be worn but heavy clothing such as sweater, should be removed. Weight is recorded to nearest 100 g.

Calculating BMI and using GWG charts: BMI is calculated as: Weight (kg) / Height^2 (m^2). It can also be estimated using a nomogram.

The BMI based GWG are being developed by The International Foetal and New-born Growth Consortium for the 21st Century, or INTERGROWTH-21st, which is a global, multidisciplinary network of more than 300 researchers and clinicians from 27 institutions in 18 countries worldwide and coordinated from the University of Oxford. GWG charts for pregnant women with normal pre-pregnancy BMI are currently available.[35]

2.4.2 Screening for severe stunting (height < 145 cm)

In under-resourced settings, variations in adult height are due to environmental influences such as undernutrition and socio-economic deprivation, especially in the early years of life and result in life long effects such as stunting. Among women a cut-off point of 145 cm has been most widely reported and frequently used to indicate obstetric risk[36]. It corresponds to being short statured or severely stunted. Maternal short stature is an independent risk factor for adverse effects on pregnancy outcomes- an increased risk of complications in pregnancy, the need for assisted delivery, and child's LBW; and poor foetal physical development.

2.4.3 Using MUAC in pregnancy

MUAC reflects both past and current nutritional status. It is less responsive than weight to short term changes in health and nutritional status. It is relatively stable in pregnancy, and even in late pregnancy, may be more reflective than weight of pre-pregnancy conditions. It is a relatively simple and inexpensive measure and unrelated to gestational age. Research indicates that MUAC cut-offs of <23cm and < 21 cm in pregnant women correlate strongly with BMI <18.5 kg/m^2 (undernourished) and <16.5 kg/m^2 (severely undernourished)[37]. However, currently it is not recommended to be used for assessing nutritional status in pregnancy. Measures of weight gain are stronger predictors of LBW and small for gestational age birth outcomes especially when weight measured at 20 weeks is included and BMI based weight gain remains the measure of choice[38].

KEY POINTS

Anthropometric measures and cut-offs that enable identification of "at nutrition risk" pregnant women are:

Height: Short stature or height <145 cm

Weight: Pre-pregnancy weight of <43 kg

BMI: Pre-pregnancy (or within 20 weeks gestation) BMI of <18.5 kg/m^2 or >= 25 kg/m^2

2.5 Dietary assessment tools in OPD settings

While there are many dietary assessment tools, the most commonly used tool in a clinic setting is a 24-hour dietary recall. The method assesses food and beverage consumption during the previous day or the preceding 24 hours. It is a retrospective assessment method and done without prior information to the person on whom it is administered. As a 24-hour recall has an open-ended format, hence when using it with pregnant women or lactating

35 https://intergrowth21.tghn.org/

36 United Nations ACC-SCN. 2nd report on the world nutrition situation. Volume I: Global and regional results. 1992

37 Kumar P et al. Screening maternal acute malnutrition using adult mid-upper arm circumference in resource poor settings. Indian J Com Med 2018; 43 (2): 132-134

38 WHO 1995. Physical status: Use and interpretation of anthropometry.

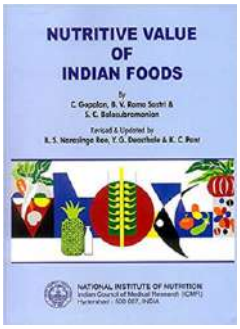
mothers it is important to probe for specific nutrients and/or supplements. Here are some probes:

1. What do you generally eat in the morning? What did you have in the morning yesterday? Probe for quantity and ingredients
2. Were you able to finish everything in the plate?
3. When was the next meal?
4. Did you have anything between these two meals?
5. Please tell me what you had in snack/ meal after breakfast/ morning meal?
6. Were any special foods or drinks taken?
7. Do you remember taking any medicine/ tablet?

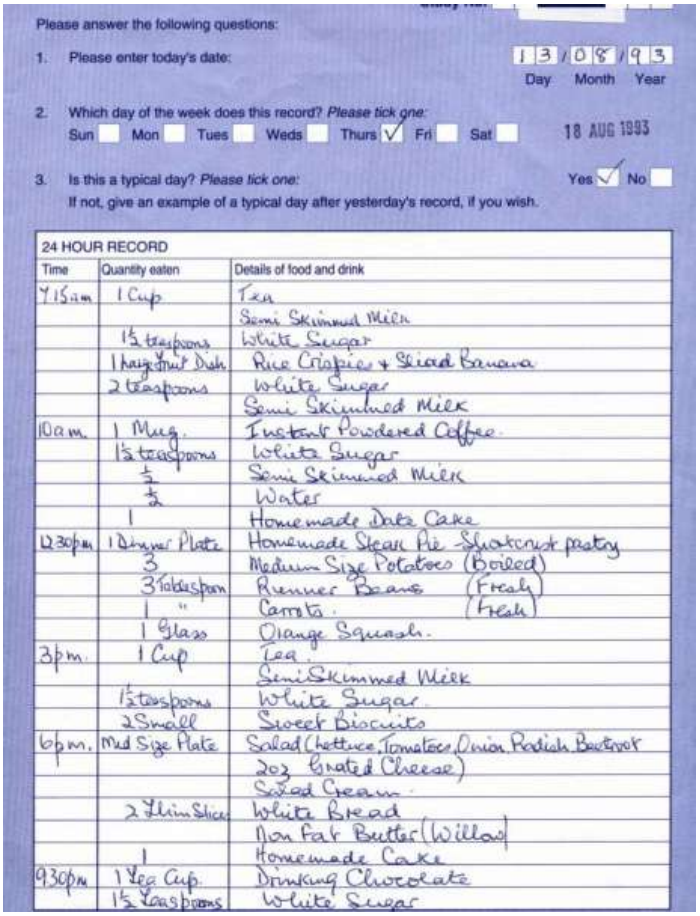
In a clinic setting a quick analysis may be done to assess if:

- Woman had sufficient quantity of food (number of meals)
- She consumed food from at least five food groups as per MDD guidelines
- She consumed iron rich foods (legumes/ nuts/ organ meats/ green leafy vegetables)
- She consumed recommended supplements for iron and calcium

A more detailed data entry should also be done when time permits. Some sample data entry tools are provided. Once the quantity and type of raw ingredients are derived, their nutritive value can be calculated using standardized tables available from National Institute of Nutrition. https://icmr.nic.in/pricepubl/content/1.htm



2.6 Nutritional anaemias



Please answer the following questions:

1. Please enter today's date: 13/08/93 (Day / Month / Year)
2. Which day of the week does this record? *Please tick one:* Sun ☐ Mon ☐ Tues ☐ Weds ☐ Thurs ☑ Fri ☐ Sat ☐ 18 AUG 1993
3. Is this a typical day? *Please tick one:* Yes ☑ No ☐
   If not, give an example of a typical day after yesterday's record, if you wish.

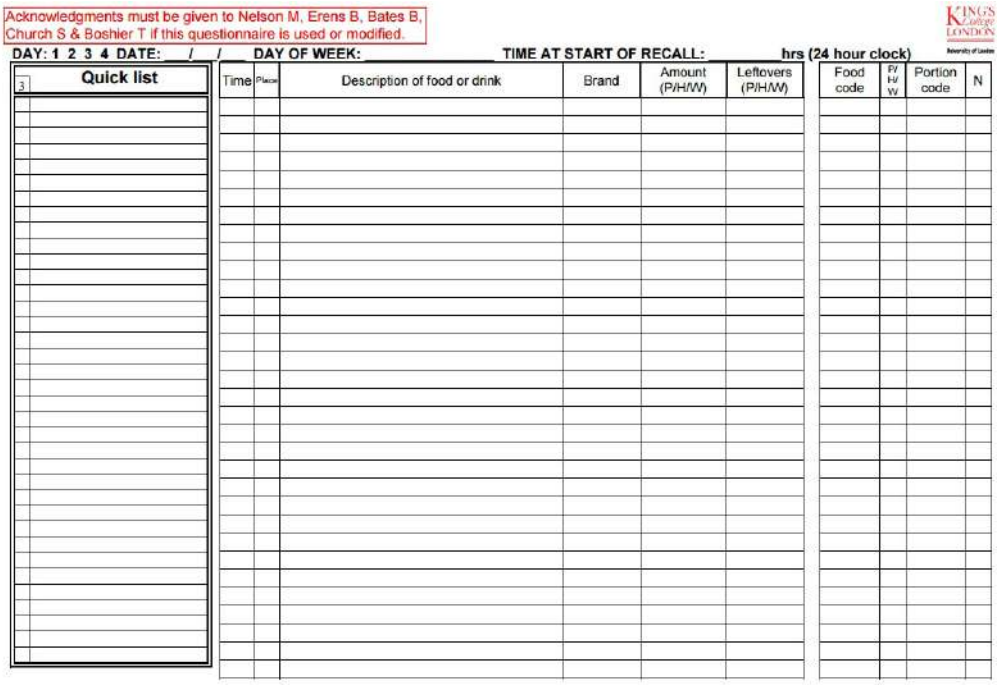
24 HOUR RECORD

Time	Quantity eaten	Details of food and drink
7.15am	1 Cup	Tea
		Semi Skimmed Milk
	1½ teaspoons	White Sugar
	1 half grapefruit Dish	Rice Crispies + Sliced Banana
	2 teaspoons	White Sugar
		Semi Skimmed Milk
10a.m.	1 Mug.	Instant Powdered Coffee
	1½ teaspoons	White Sugar
	½	Semi Skimmed Milk
	½	Water
	1	Homemade Date Cake
12.30pm	1 Dinner Plate	Homemade Steak Pie - Shortcrust pastry
	3	Medium Size Potatoes (Boiled)
	3 Tablespoon	Runner Beans (Fresh)
	1 "	Carrots (Fresh)
	1 Glass	Orange Squash.
3pm.	1 Cup	Tea
		Semi Skimmed Milk
	1½ teaspoons	White Sugar
	2 Small	Sweet Biscuits
6pm.	Med Size Plate	Salad (Lettuce, Tomatoes, Onion, Radish, Beetroot
		20z Grated Cheese)
		Salad Cream
	2 Thin Slices	White Bread
		Non Fat Butter (Willow)
	1	Homemade Cake
9.30pm	1 Tea Cup	Drinking Chocolate
	1½ Teaspoons	White Sugar

FIGURE 2.3: Sample tools for 24-hour dietary recall

Source: University of Cambridge, United Kingdom

Source: Kings College London.



Acknowledgments must be given to Nelson M, Erens B, Bates B, Church S & Boshier T if this questionnaire is used or modified.

DAY: 1 2 3 4 DATE: / / DAY OF WEEK: TIME AT START OF RECALL: hrs (24 hour clock)

Quick list	Time	Place	Description of food or drink	Brand	Amount (P/H/W)	Leftovers (P/H/W)	Food code	FV H-V W	Portion code	N
3										

"Nutritional anaemias" result when the intake of certain nutrients is insufficient to meet the demands for synthesis of haemoglobin and erythrocytes. Iron deficiency is the most common cause (nutritional or otherwise) of anaemia. Anaemia during pregnancy has been associated with poor maternal and birth outcomes, including premature birth, LBW and maternal, perinatal and neonatal mortality[39]. Anaemia in the first or second trimester significantly increases the risk of LBW and preterm birth. Prenatal iron supplementation increases birth weight and significantly reduces the risk of LBW, but not preterm birth[40]. Postpartum anaemia is associated with decreased quality of life, including increased tiredness, breathlessness, palpitations and infections. Women who have anaemia postpartum may also experience greater stress and depression, and be at greater risk of postpartum depression[41,42]. Mothers with anaemia may also be less responsive, more controlling and more "negative" towards their infants, which can have negative implications for infant development[43] .

39 Rasmussen K. Is there a causal relationship between iron deficiency or iron-deficiency anemia and weight at birth, length of gestation and perinatal mortality? J Nutr. 2001;131:590S–603S.

40 Haider BA, Olofin I, Wang M, Spiegelman D, Ezzati M, Fawzi WW. Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: systematic review and meta-analysis. BMJ. 2013;346

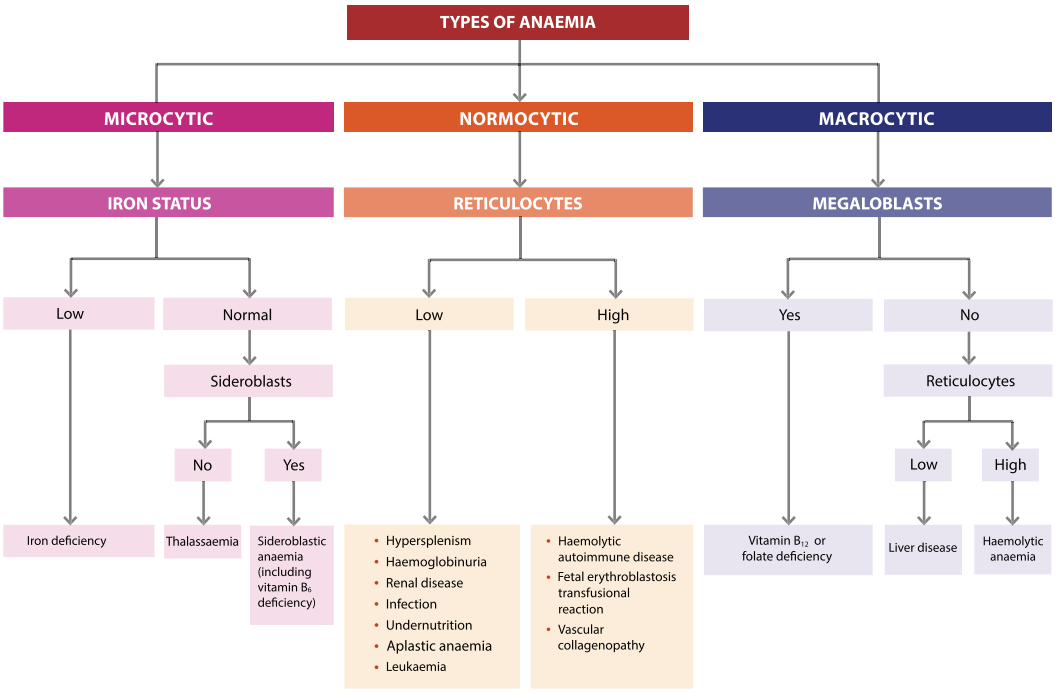
41 Milman N. Postpartum anemia I: definition, prevalence, causes, and consequences. Ann Hematol. 2011;90(11):1247–53.

42 Beard JL, Hendricks MK, Perez EM, Murray-Kolb LE, Berg A, Vernon-Feagans L et al. Maternal iron-deficiency anemia affects postpartum emotions and cognition. J Nutr. 2005;135(2):267–72.

43 Corwin EJ, Murray-Kolb LE, Beard JL. Low hemoglobin level is a risk factor for postpartum depression. J Nutr. 2003;133(12):4139–42.

2.6.1 Types of nutritional and non-nutritional anaemias

FIGURE 2.4: Types of nutritional and non-nutritional anaemias



Source: Nutritional anaemias: tools for effective prevention and control. Geneva: World Health Organization; 2017.

2.6.2 Causes

Iron deficiency is the predominant cause of nutritional anaemias. Other common nutritional deficiencies that can also lead to anaemia include deficiencies of folic acid and Vitamin B_{12}. Deficiency of vitamins A, B_6, C, D and E, riboflavin and copper, may also result in anaemia, though some of these nutrient deficiencies are uncommon and may not play a significant role in the burden of anaemia globally. In many cases, where diets are poor in micronutrients, multiple micronutrient deficiencies are likely to have a synergistic effect on the development of anaemia[44].

2.6.3 Prevention

Prevention requires both direct or nutrition specific and indirect or nutrition sensitive interventions[45].

TABLE 2.12: Nutrition specific and nutrition sensitive interventions

Nutrition specific interventions	Nutrition sensitive interventions
Food-based strategies: improve dietary diversity, fortification, processing/ cooking techniques	Prevention of parasitic infections (malaria, soil transmitted helminth infections, schistosomiasis)
Micronutrient supplementation (folic acid pre-conception, continued till 14 weeks of pregnancy; thereafter IFA tablets for 180 days in pregnancy and 180 days post-partum. 60mg Iron and 500 mcg folic acid)	Access to reproductive health services Access to water, sanitation and hygiene services and products
Social and behaviour change communication to increase uptake of interventions	

44 Balarajan Y, Ramakrishnan U, Ozaltin E, Shankar AH, Subramanian SV. Anaemia in low-income and middle-income countries. Lancet. 2011; 378(9809):2123–35. doi:10.1016/s0140-6736(10)62304-5.

45 Nutritional anaemias: tools for effective prevention and control. Geneva: World Health Organization; 2017.

2.6.4 Screening for anaemia in pregnancy

The cut-offs for haemoglobin concentration used in diagnosing anaemia are presented in table 2.13.[46]

TABLE 2.13: Haemoglobin concentration for diagnosing anaemia and assessing severity[46]

	No anaemia	Mild	Moderate	Severe
Pregnant women	≥11	10–10.9	7–9.9	<7
Non-pregnant women (≥20 years)	≥12	11–11.9	8–10.9	<8

As per recent GoI guidelines use of reflectance photometry based hemoglobinometers, with a minimum sensitivity of 90% has been approved for estimating haemoglobin concentration. Field workers are provided hemoglobinometers and haemoglobin estimations are recommended as soon as pregnancy is confirmed and at least every trimester.

Clinical examination may be used for preliminary screening but must be followed by biochemical testing. Common symptoms of anaemia include - lassitude and fatigue or weakness (earliest manifestations), anorexia and indigestion, palpitation caused by ectopic beats, dyspnoea, giddiness and swelling of the legs, yellowish discoloration of urine or sclera, passage of worms in stools, difficulty in concentrating, dizziness, pale skin, leg cramps and insomnia. Symptoms like hunger for strange substances such as paper, ice, or dirt (a condition called pica), upward curvature of the nails, referred to as koilonychias, soreness of the mouth with cracks at the corners are specific to iron deficiency anaemia. A tingling, "pins and needles" sensation in the hands or feet is commonly reported in Vitamin B_{12} deficiency.

2.7 Nutrition is special conditions- Obesity, GDM and hypertensive disorders

2.7.1 Obesity

During pregnancy, obese women are at increased risk of gestational hypertension, pre-eclampsia, GDM, foetal macrosomia, shoulder dystocia, spontaneous abortion, pre-term birth, stillbirth and neonatal death. Labor is more likely to be prolonged and induction required in obese women than in non-obese women, which appears to cause subsequent complications[47]. Maternal obesity is associated with increased birthweight. High birthweight infants tend to be taller and heavier throughout childhood and have increased risk of obesity in later life. Infants whose mothers were obese also have greater risk of subsequent obesity and coronary heart disease. The weight gain recommendation for obese women is 5 -9 kg over the entire pregnancy (Table 2.11). Obese women should eat a nutritionally adequate diet and receive individual dietary assessment and counselling. The basal energy requirements of obese women are higher. Energy restriction is not recommended during pregnancy; obese women should consider weight reduction before pregnancy.

Practical advice for pregnant women who are obese

- Obese women who are planning to become pregnant should consider losing weight before becoming pregnant.
- Pre-pregnancy height and weight should be measured, and BMI recorded.
- Women who are obese before pregnancy should aim to gain around 5 -9 kg over their pregnancy.
- Obese women planning their pregnancy and who are pregnant should be offered

46 Government of India. Poshan Abihyan. Guidelines for Anemia Mukt Bharat, 2018.

47 Usha Kiran TS, Hemmadi S, Bethel J, et al. Outcome of pregnancy in a woman with an increased body mass index. BJOG 2005; 112: 768–72.

- nutrition counselling and encouraged to be physically active.
- All women should be screened for gestational diabetes.

2.7.2 GDM

Women with diagnosed GDM are recommended Medical Nutrition Therapy (MNT). MNT for GDM primarily involves a carbohydrate controlled balanced meal plan which promotes optimal nutrition for maternal and foetal health, adequate energy for appropriate gestational weight gain, and achievement and maintenance of normoglycemia. Nutrition assessment in GDM should be individualised to allow an accurate appraisal of the woman's nutritional status. This assessment includes assessing her BMI or percentage of desirable pre-pregnancy bodyweight and optimal pattern of weight gain during pregnancy. GDM is managed initially with MNT and if it is not controlled with MNT, insulin therapy is added to the MNT. The nutrients of particular interest in GDM include carbohydrates, fats and fibre[48].

Energy

As per Indian ICMR guidelines for an average weight gain of 10-12 Kg, an addition of 350 K.cal/day above the adult requirement is recommended during second and third trimester.

Equations proposed by ICMR (1989) expert group can be used to calculate adult energy requirement which are as follows:

Energy requirement (K.cal/d)= BMR ×PAL

*BMR= Basal metabolic rate

*PAL= Physical activity level

BMR (K.cal/d)for adult females (18-30yrs)= 14×B.W (Kg) + 471

BMR (K.cal/d)for adult females (30-60yrs)= 8.3×B.W (Kg) + 788

*B.W= body weight

Ideal body weight can be taken in to consideration when calculating the requirement.

TABLE 2.14: PAL values proposed by ICMR expert group (2009) are as follows:

Level of activity	PAL value
Sedentary work	1.53
Moderate work	1.8
Heavy work	2.3

An addition of 350 k. cal can be made after calculating the energy requirement for adults as stated in above table.

Hypocaloric diets in obese women with GDM can result in ketonemia and ketonuria. However, moderate caloric restriction (reduction by 30% of estimated energy needs) in obese women with GDM may improve glycaemic control without ketonemia and reduce maternal weight gain.

Carbohydrates

Carbohydrate foods are essential for a healthy diet of mother and baby. Once digested, carbohydrate foods are broken down to glucose which goes into blood stream. The type, amount and frequency of carbohydrate intake has a major influence on blood glucose readings.

Foods sources of carbohydrate include cereals (wheat, bajra, ragi, corn rice etc.) and its products (suji, refined flour, breads, pasta, noodles etc), pulses (green gram, bengal gram, black gram etc.), starchy vegetables (potato, sweet potato, corn tapioca etc), fruits, sweets, juices etc.

48 Government of India. Ministry of Health and Family Welfare. Guidelines for diagnosis and management of Gestational Diabetes Mellitus, 2014.

Large amounts of carbohydrate foods eaten at one time will lead to high blood glucose level and should be avoided.

Spreading carbohydrate foods over the day will help to prevent this. It is better to spread carbohydrate foods over 3 small meals and 2–3 snacks each day than taking 3 large meals Complex carbohydrates (like whole-grain cereals like oats, bajra, jowar, ragi, whole pulses, vegetables and fruits with skins) should be preferred over simple carbohydrates like food with lots of added sugar or honey, or foods that are made from refined white flour. Some examples of simple carbohydrates include sweets, cakes, puddings, sweet biscuits, pastry, juice, soft drinks, chips, white bread, naan, pizza etc. Counting the number of carbohydrate serves that a mother eats during the day will help her to eat the right amount of carbohydrate. As a guide, aim should be for 2–3 carbohydrate serves at each major meal and 1–2 carbohydrate serves at each snack.

One serve = approximately 15 grams of carbohydrate.

Fats

Saturated fat intake (ghee, butter, coconut oil, red meat, organ meat, full cream milk etc) should be less than 10% of total calories and dietary cholesterol should be less than 300 mg/d for all pregnant women. In obese and overweight women, a lower-fat diet overall can help slow the rate of weight gain. This can be done by using less fat in cooking and avoid frying of foods, substituting fried snacks with heathier options like fruit, poha and consuming low-fat milk and milk products.

Ways to trim the fat from your diet

- Use less fat in cooking and avoid frying of foods
- Using to low-fat dairy products in place of whole milk or full cream products.
- Choosing low fat snacks like substituting fresh fruit for high-fat snacks such as cakes, biscuits, chocolates and pastries.
- Using lean meat in place of red meat

Fibre

High fibre foods especially soluble fibre may help control blood sugar by delaying gastric emptying, retarding the entry of glucose into the bloodstream and lessening the postprandial rise in blood glucose. Soluble fibre in flax seed, psyllium husk, oat bran, legumes (dried beans of all kinds, peas and lentils), and pectin (from fruit, such as apples) and forms in root vegetables (such as carrots) are helpful.

Practical advice for pregnant women with GDM

- Meal timings should be disciplined.
- Eating heavy at one meal or skipping any meal or fasting for long hours should be avoided.
- Include all food groups in daily diet i.e. cereal, pulses, milk and milk products, fruits, vegetable, and fats.
- For non- vegetarian women eggs, low fat meat like well- cooked fish or chicken can be included. Meal plan should be divided in to 3 major meals (breakfast, lunch and dinner) and 2-3 mid-day snack.

Sample meal plan for 1800 Kcal

Meal	Menu	Amount	Number of carbohydrate serves as per exchange list
Breakfast (7-8 am)	Dalia/Porridge/Oats	½ cup	2
	Milk	1 cup	Other varieties can be included in meal plan as per the exchange list
Mid- Morning (10-10.30 am)	Mung bean sprouts (ankurit mung)/Roasted Mung	½ cup	1
Lunch (1-1.30 pm)	Chapati	2	2-3
	Or chapati + Rice	1+1/3 cup	
	Vegetables	1 cup	
	Yogurt/Curd	¾ cup	
	Soya nugget (soya badi) curry/Dal	½ cup	
Evening (4.30-5 pm)	Seasonal fruit (medium size)	1	1-2
	Murmura chat with vegetables/idli with sambhar	1 ½ cup/1	
Dinner (8-8.30 pm)	Chapati	2	2-3
	Or		
	chapati + Rice	1+ 1/3 cup	
	Vegetable	1 cup	
	Dal	½ cup	
	Or		
	Fish (curry/grilled/steamed)	½ cup	
Bed time (10-10.30 pm)	Milk	1 cup	1
	Brown bread	1	
Total fat/d		4 tsp/d	

* Meal plan containing 1800 k.cal approximately provides 70 gm protein, 60 gm fat and 247 gm carbohydrate

Sample meal plan for 2000 Kcal

Meal	Menu	Amount	Number of carbohydrate serves as per exchange list
Breakfast (7-8 am)	Whole grain Bread (Brown Bread)	2	2
	Egg bhurji/egg omelet	1	
Mid- Morning (10-10.30 am)	Vegetable Dalia	½ cup	1
Lunch (1-1.30 pm)	Chapati	3	3-4
	Or		
	chapati + Rice	2+1/3 cup	
	Vegetables	1 cup	
	Yogurt/Curd	¾ cup	
	Soya nugget curry/Dal	½ cup	
	Or		
	Chicken/fish curry	1 cup	
Evening (4.30-5 pm)	Seasonal fruit (medium size)	1	1-2
	Vegetable Poha/vegetable upma	½ cup	
Dinner (8-8.30 pm)	Chapati	2	2-3
	Or	1+ 1/3 cup	
	chapati + Rice		
	Vegetable	1 cup	
	Dal	½ cup	
Bed time (10-10.30 pm)	Milk	1 cup	1
	Chapati	1	
Total fat/d		5 tsp/d	

* Meal plan containing 2000 k.cal approximately provides 80 gm protein, 65 gm fat and 270 gm carbohydrate

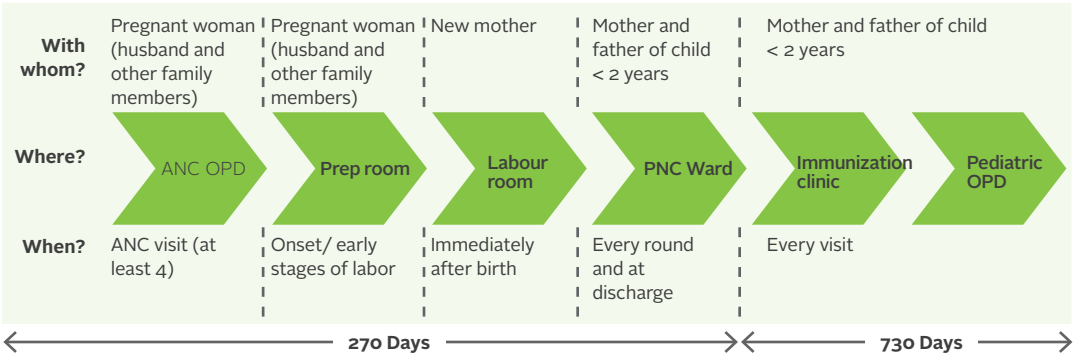
2.7.3 Hypertensive disorders- eclampsia and pre-eclampsia

Calcium supplementation is the only recommended nutrition intervention for prevention of hypertensive disorders. Government of India recommends 1 g calcium supplementation daily after 14 weeks of gestation as two 500 mg tablets taken with meal (breakfast and dinner) and not with IFA so that it does not interfere with iron absorption. Supplementation should continue till six months post-partum.

2.8 Maternal nutrition care: critical contact points, service provider's actions and practical advice

Critical contact points have been identified in five-time periods within the 1000-day window of opportunity. These are: 1) First 90 days or the first trimester, 2) 91 to 270 days or second and third trimester, 3) 271 to 450 days: Lactating mother, new-born and infant (<6months), 4) 451 to 640 days: infants (6 to 11 months) and 5) 641 to 1000 days: young children (12 to 23 months). [49]

FIGURE 2.6: 1000 day "Window of Opportunity" for integrating MIYCN services in health facilities



For each of the five-time periods, the protocol providing evidence for the MIYCN intervention/s, services to deliver interventions, who should deliver these, when? and where? have been developed. These are available in the document titled "PROTOCOL: Delivering recommended Maternal Infant and Young Child Nutrition (MIYCN) interventions in medical colleges and associated hospitals" May 2018 by A&T. A summary of service provider's actions in first trimester and subsequent ANC contacts are presented in tables 2.13a and 2.13 b

TABLE 2.13A: Nutrition interventions and service provider actions for pregnant women in first trimester

Nutrition interventions[49]	Service provider's actions	Key messages for woman
Initiate weight monitoring and counselling	Measure and record weight and height Calculate BMI BMI based weight gain counselling	Know your weight, height and recommended weight gain
Screening for anaemia	Clinical examination and Haemoglobin measurement for anaemia and record findings in MCP card Advice/ Need based counselling on supplementation, dietary diversification, hygiene, malaria prevention	Know your haemoglobin level. Consume iron and vitamin rich foods – cereals, pulses, nuts, green leafy vegetables, citrus fruits. Non-vegetarians should have organ meals, fish. Sleep under a bed-net if malaria is common in your area.

49 Based on relevant GoI guidelines as well as World Health Organisation recommendations as per Essential Nutriton Actions, 2011 and Antenatal care for positive pregnancy experience, 2016.

Nutrition interventions[49]	Service provider's actions	Key messages for woman
Folic acid supplementation (400 mcg)	Prescribe folic acid tablets as per number of remaining days in the first trimester and explain benefits	
Nutrition education or counselling on increasing daily energy-protein intake to prevent LBW	Undertake dietary assessment Advice on improving quantity and diversity of food (at least five food groups)	Have at least two meals/ day in the first trimester. Consume wholegrain breads, cereals, vegetables and legumes, dried fruit, nuts and seeds, and have vitamin C-rich foods and drinks (fruit, fruit juices and vegetables) with meals
Daily consumption of adequately iodized salt (15 ppm)	Advise consumption of iodized salt	Purchase and use only iodized salt

TABLE 2.13B: Nutrition interventions and service provider actions for pregnant women in second and third trimester

Nutrition interventions[50]	Service provider's actions	Key messages for woman
Weight monitoring and counselling	Measure and record weight Counselling based on weight gain since previous visit	Know your weight gain and recommended weight gain
Screening for anaemia	Review of Hb estimation report and record findings in MCP card Need based counselling for treatment of anaemia, therapeutic supplementation, dietary diversification, malaria prevention	Know your haemoglobin level. Consume iron and vitamin rich foods – cereals, pulses, nuts, green leafy vegetables, citrus fruits. Non-vegetarians should have organ meals, fish. Sleep under a bed-net if malaria is common in area.
Prophylactic IFA (60 mg iron and 500mcg folic acid/ day) and calcium (1g/day) supplementation starting 14th week for 180 days of pregnancy	Check timely initiation, compliance and address any issues on side effects related to supplementation. Prescribe tablets to cover the remaining period of pregnancy (if not done earlier).	Have calcium tablet with meal and give gap before having IFA tablet. Avoid having milk with IFA tablet. Avoid having tea/ coffee with meals.
Therapeutic IFA supplementation	Prescribe double the number of tablets	
Single dose of 400 mg albendazole (deworming)	DOT for deworming done once during pregnancy	Wash hands before and after meal and after using the toilet. Practice personal hygiene.
Nutrition education or counselling on increasing daily energy-protein intake to prevent LBW	Undertake dietary assessment Advise on improving quantity and diversity of food (at least five food groups)	Have three main meals/ day in second trimester and three meals with two healthy snacks (fruit, milk/dahi, 'laddu', halwa, matthi, or boiled/fried egg) in third trimester. Non-vegetarians should include oily fish, organ meats and eggs. Be physically active at moderate intensity for a total of 30 minutes on most, all days of the week
Daily consumption of adequately iodized salt (15 ppm)	Advise consumption of iodized salt	Purchase and use only iodized salt

50 Based on relevant GoI guidelines as well as World Health Organisation recommendations as per Essential Nutriton Actions, 2011 and Antenatal care for positive pregnancy experience, 2016.

Annex 1 provides basic tips for effective counselling. A more detailed counselling note is presented in the IYCN section which can be adapted to counselling pregnant women.

2.9 Guidelines on maternal nutrition

Guidelines on overall nutrition and care in pregnancy and post-partum

Title: Dietary guidelines for Indian. National Institute of Nutrition. Indian Council of Medical Research. 2011.

In 2011, NIN released dietary guidelines for Indians which include requirements for adult women, pregnant women and lactating mothers. These are endorsed by the Indian Council of Medical Research and can be accessed from: **ninindia.org/DietaryGuidelinesforNINwebsite.pdf**

Title: WHO recommendations on antenatal care for a positive pregnancy experience. 2016

In 2016 WHO released recommendations on antenatal care including nutrition for a positive pregnancy experience. These can be accessed at: **http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/anc-positive-pregnancy-experience/en/**

Guidelines on GWG

Title: Weight gain during pregnancy. Reexamining the guidelines. Institute of Medicine and National Research Council. 2009

Guidelines on BMI based GWG are available from IOM. In the absence of India specific guidelines, these are used for Indian population and can be accessed from: **https://www.nap.edu/catalog/12584/weight-gain-during-pregnancy-reexamining-the-guidelines**

Guidelines on iron intake/ anaemia prevention

Title: Anemia Mukt Bharat. Intensified National Iron Plus Initiative. Operational guidelines for program managers. Ministry of Health and Family Welfare, Government of India. 2018.

Government of India recommends IFA supplementation for 180 days in pregnancy and post-partum in addition to dietary and anaemia prevention related recommendations. The recommendations have been recently revised in 2018 under the Intensified National Iron Plus Initiative. A major change has been increasing the number of supplementation days from 100 to 180 and reducing iron dosage from 100mg to 60 mg. The earlier guidelines under the National Iron Plus Initiative can be accessed from any of the state governments Health Mission websites and from: **http://nhm.gov.in/nrhm-components/rmnch-a/maternal-health/guidelines.html**

Guidelines on deworming in pregnancy

National Guidelines for deworming in pregnancy. Ministry of Health and Family Welfare, Government of India. 2014

Government of India recommends single dose albendazole 400 mg preferably in second trimester for deworming in addition to complying with recommended hygiene and sanitation practices. The guidelines can be accessed from: **http://nhm.gov.in/nrhm-components/rmnch-a/maternal-health/guidelines.html**

Guidelines on calcium supplementation in pregnancy and post-partum

National guidelines for calcium supplementation in pregnancy and lactation. Ministry of Health and Family Welfare, Government of India. 2014

Government of India recommends daily 1g calcium in form of two 500 mg tablets taken

before meal such that they don't interfere with iron absorption. Supplementation is to begin in the 14th week for 180 days in pregnancy and six months post-partum. The guidelines can be accessed from: **http://nhm.gov.in/nrhm-components/rmnch-a/maternal-health/guidelines.html**

Guidelines on preventing iodine deficiency disorders

Title: Revised policy of national iodine deficiency disorders control program. Ministry of Health and Family Welfare, Government of India. 2006.

These guidelines are applicable to all age groups and include recommendation on consumption of iodized salt with at least 15 ppm iodine daily. It can be accessed from: **http://pbhealth.gov.in/revised%20policy%20guidelines%20govt.%20of%20india.pdf**

Guidelines on diagnosis and management of Gestational Diabetes Mellitus

Title: Guidelines on diagnosis and management of Gestational Diabetes Mellitus. Ministry of Health and Family Welfare, Government of India. 2018

The Ministry released first guidelines on GDM in 2014, which were revised in 2018 as per new global and national evidence. The guidelines provide methods for diagnosing GDM. Nutritonal management of GDM has been detailed along with diet charts and menu plans by different recommended energy intake levels (1800 kcal, 2000 kcal, 2200 kcal and 2400 kcal). **https://nhm.gov.in/New_Updates_2018/NHM_Components/RMNCH_MH_Guidelines/Gestational-Diabetes-Mellitus.pdf**

2.10 Listening and learning

Counselling is a way of working with people in which you understand how they feel, and help them to decide what to do in a different situation like breastfeeding. A pregnant woman or breastfeeding mother may not talk about her feelings easily, especially if she is shy, and with someone whom she does not know well. Here we need the counsellor's skill to listen, and make her feel that we are interested in her. This will encourage her to tell us more and less likely to turn off and say nothing.

1. Use helpful non-verbal communication

Non-verbal communication means communicating through posture, expression, gestures, everything except through speaking. Helpful non-verbal communication makes a mother feel that you are interested in her, so it helps her to talk to you.

Some useful forms of non-verbal communication:

- Sit by the side of the mother
- Maintain appropriate distance
- During discussion keep attention towards the mother (for e.g, eye-to-eye contact)
- Give time to listen to her
- Show affection towards the mother and her baby

2. Ask open questions

Open questions are very helpful, as in answering them a mother can give you some information. Open questions usually start with "How? What? When? Where? Why?" For example: "How are you feeling, Radha?", "What did you eat yesterday?" "How are you feeding your baby?"

Closed questions are most commonly asked questions and usually are less helpful. They tell a mother the answer that you expect, and she can answer them with a "Yes" or "No". They usually start with words like " Are you? Did he? Has he? Does she?" For example: "Are you taking IFA tablet?", "Did you breastfeed your older babies?"

If a pregnant woman or mother says "Yes" to such a question, you still do not know if she has taken IFA as per recommendation or has breastfed exclusively, or if she also gave some artificial feeds, respectively.

To start a conversation, general open questions are helpful.

For example: "How are you feeling today?", "How is breastfeeding going for you?"

To continue a conversation, ask more open questions.

For example: "How many hours after s/he was born did s/he have her/his first feed?"

Sometimes it is helpful to ask a closed question, to make sure about a fact.

For example: "Are you giving him/her water or any other food or drink?"

If she says "Yes", you can follow up with an open question, to learn more.

For example: "What made you decide to do that?" or "What are you giving him?"

3. Use responses and gestures that show interest

Another way to encourage a mother to talk is to use gestures such as nodding and smiling, and simple responses such as "*hoon*" or "*oon*" or "*anha*" or "*hanha hanha*". This shows a pregnant woman or mother that you are also interested in her.

4. Reflect back what the mother says

Reflecting back means repeating what a mother has said to you, to show that you have heard, and to encourage her to say more. Try to say it in a slightly different way. For example, if a pregnant woman says "I had nausea yesterday". You could say "Did you feel better later in the day?" or mother says: "My baby was crying too much last night."You could say: "Your baby kept you awake crying all night?"

5. Empathize: Show that you understand how she feels

Identify with mother's feelings after she has said how she feels.

For example, if a mother says: "My baby wants to feed very often and it makes me feel so tired, "you could say:", You are feeling very tired all the time then." This shows that you understand that she feels tired, so you are empathizing. If you respond with a factual question, for example,: "How often is he feeding? What else do you give him?" you are not empathizing.

6. Try to avoid following words which sound judgemental

Right, wrong, well, badly, good, enough, properly.

If you use these words too much you may make the mother feel that she is wrong or that there is something wrong with her baby.

(Source: Ministry of Health and Family Welfare, Government of India. MAA. Infant and young child feeding. Training module for ANMs. 2016)

2.11 Sample case study for theoretical and clinical tasks

A 24-year-old antenatal mother presents for first time to antenatal OPD with complaints of weakness, fatigue and breathlessness. She says she is 8 months pregnant. She is gravida 3, para 2 living 2. Older one born 3 years and younger 1 year ago. Both babies were LBW. There is no history of IFA intake in this pregnancy. She gives history of passage of worms and blood in stool sometimes. Has not taken any tetanus toxoid prophylaxis.

- LMP: 23rd Dec 2017 of which she is sure.
- Past medical history: blood transfusion in previous pregnancy
- Past menstrual history: normal
- No contraception used
- Personal history: appetite: decreased, sleep, bowel bladder is normal. No addiction or allergy reported
- Socioeconomic history: belongs to lower middle class
- Dietary history: 2 major meals in a day, rice based. Vegetables in meals are usually tubers potato, radish, some seasonal vegetables. Does not consume non-vegetarian diet. Milk intake only in tea three or four times a day.
- Examination findings
- Height: 152cm
- Weight: 44 kg (39 kg pre-pregnancy)
- Pallor: ++
- Oedema: nil
- Cyanosis / clubbing / icterus: neg
- General skin condition: pale
- Heart rate: 92/min, Resp rate 14 /min, no distress, temp: 98deg C, BP: 110/70mm Hg
- Chest: normal respiration, S1S2 audible, No murmurs
- Breast exam: normal
- Neurological examination: normal
- Abdominal examination: No hepato-splenomegaly, fundal height 28 weeks, cephalic presentation, FHS present, regular
- Provisional diagnosis: 3rd gravida with 31 weeks gestation, unbooked pregnancy with anaemia most likely due to Iron deficiency.

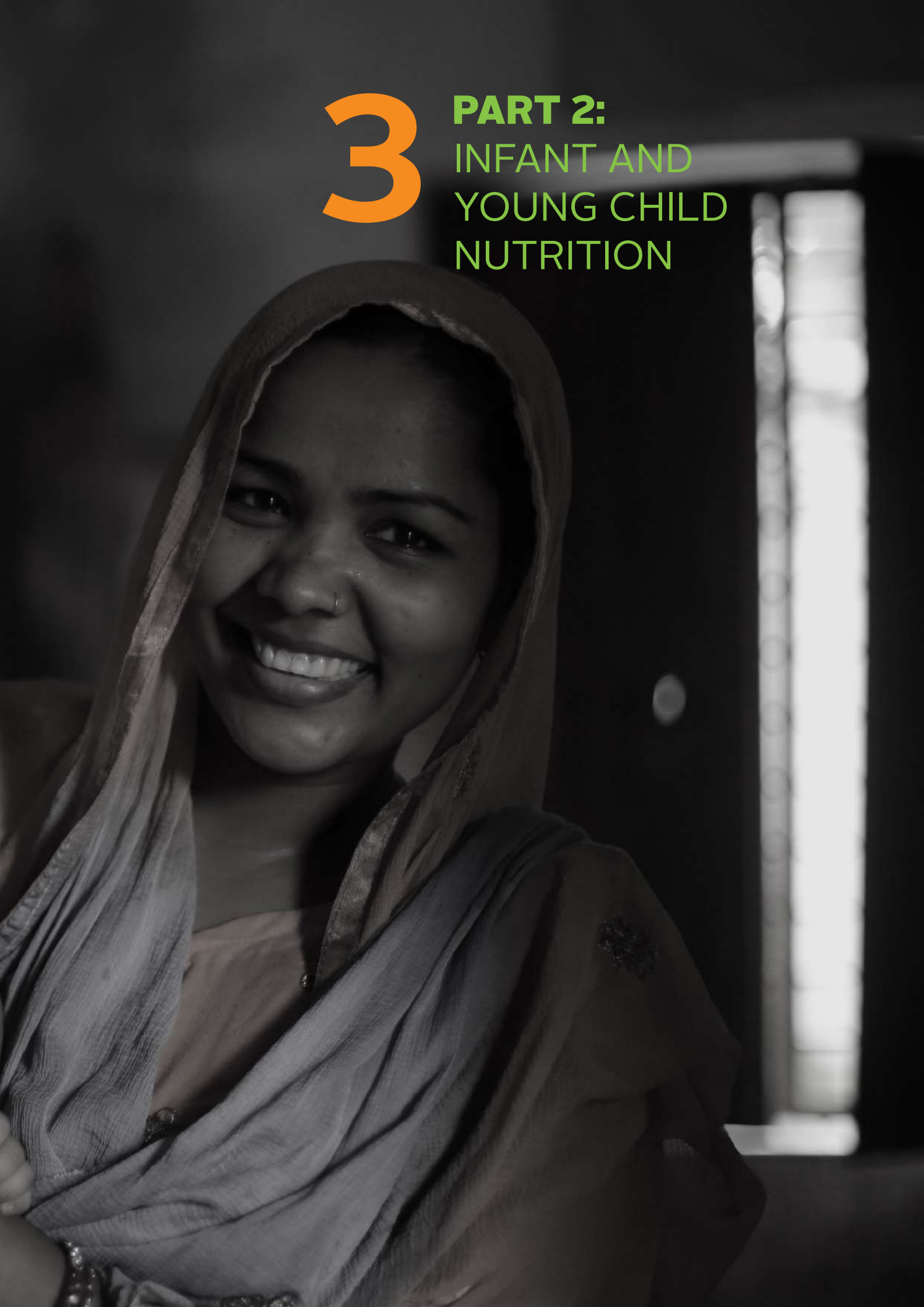
Theoretical tasks for students

1. How to confirm diagnosis of iron deficiency anaemia?
   [- needs understanding of anaemia and its types
   - importance of history, examination, laboratory tests to confirm]
2. What are the findings in history which points to iron deficiency anaemia?
   [- importance of pre-pregnancy menstrual history, socioeconomic, dietary, personal and obstetric history to be emphasized]
3. Prepare a meal plan which contains a balanced diet with iron rich foods
   [knowledge of balanced meal, sources of iron rich food available in India]
4. Prevention of iron deficiency anaemia
   [all measures required at personal, community and country level]
5. Effect of iron deficiency anaemia on mother and foetus.
   [knowledge of adverse effects / complications will strengthen importance if iron deficiency]
6. How to manage this case of iron deficiency anaemia?
   [management of anaemia and pregnancy]

Clinical tasks

(each student to take at least 3 cases in 3rd – 9th semester)

1. Detection of Patients in OPD/ IPD / Community postings of antenatal patients with anaemia
2. Following the course of pregnancy for management of anaemia
3. Following the outcomes of these pregnancies



3 PART 2: INFANT AND YOUNG CHILD NUTRITION

Globally, in 2011 about 101 million children under 5 years of age were underweight and 165 million stunted (short for age)[51]. The Lancet 2013 lists ten key nutrition interventions which with near universal coverage can reduce up to 20% of global child deaths. Infant and young child feeding (IYCF) that is, early and exclusive breastfeeding, and appropriate complementary feeding with continued breastfeeding till two years are among these ten interventions[52]. The deaths of 823 000 children and 20 000 mothers each year could be averted through universal breastfeeding, along with economic savings of US$300 billion[53]. Other interventions include maternal nutrition during pregnancy, vitamin A and preventive zinc supplementation among children at risk and management of acute malnutrition both moderate and severe forms.

3.1 Nutrition requirements in infants and young children

The energy and other nutrient requirements in infancy and young children need to keep pace with the rapid growth in this age group (Table 3.1 to 3.3). These needs can be met from breastmilk alone till the infant is six months after which complementary feeding in addition to breastmilk is needed. [54]

TABLE 3.1: RDA for energy, protein, fat, calcium and iron among infants and young children[54]

Age	Ideal weight (kg)	Energy (Kcal)	Protein (g)	Visible fat (g)	Calcium (mg)	Iron (mg)
0-6 months	5.4	92 /kg	1.16 /kg	-	500	0.046/kg
6-12 months	8.4	80/kg	1.69 /kg	19	500	5
1- 2 years	12.9	1060	16.7	27	600	9

TABLE 3.2: RDA for Vitamins A, C, and folate per day for infants and young children

Age	Vitamin A (mg)		Ascorbic acid (mg)	Folate (mcg)
	Retinol	βcarotene		
0-6 months	-	-	25	25
6-12 months	350	2800	25	25
1-2 years	400	3200	40	80

TABLE 3.3: RDA for Vitamins B1, B2, B4, B5, B6 and B12 for infants and young children

Age	B_1(mg)	B_2(mg)	B_4(mg)	B_5(mg)	B_6(mg)	B_{12}(mcg)
0-6 months	0.2	0.3	710/kg	NA	0.1	0.2
6-12 months	0.3	0.4	650/kg	NA	0.4	0.2
1-2 years	0.5	0.6	8.0	NA	0.9	0.2-1.0

To meet the nutrient requirements from complementary foods after six months, the recommended portion sizes and number of portions of various food groups are presented in table 3.4.

51 UNICEF, WHO, World Bank. UNICEF-WHO-World Bank Joint child malnutrition estimates. New York, Geneva & Washington DC, UNICEF, WHO & World Bank, 2012 (http://www.who.int/nutgrowthdb/estimates/en/index.html, accessed 27 March 2013).

52 Black RE et al. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet, 2008; 371(9608): 5-22.

53 The Lancet. Breastfeeding: achieving the new normal. Lancet, 2016; 387 (10017):404. https://doi.org/10.1016/S0140-6736(16)00210-5

54 National Institute of Nutrition. Dietary guidelines for Indian, 2011.

Table 3.4: Recommended portion sizes and number of portions of food groups, 6 – 23 months

Food group	Portion size (g)	6-12 months		12-23 months		Serving size examples	Energy (Kcal)
		No. of portions	Total quantity (g)	No. of portions	Total quantity (g)		
Cereals & millets	30	0.5	15	2	60	½ cup cooked rice (500g) 1 chapatti (45-50g)	85 80
Pulses	30	0.25	7.5	1	30		
Milk	100	4*	400	5	500	1/2 cup milk (100ml)	85
Roots & tubers	100	0.5	50	0.5	50		
Green leafy veg.	100	0.25	25	0.5	50	1/4 cup vegetable curry (50g)	40
Other veg.	100	0.25	25	0.5	50		
Fruits	100	1	100	1	100	1/2 medium sized seasonal fruit (50 g)	50 - 80
Sugars	5	2	10	3	15		
Fats & Oils	5	4	20	5	25		

**2 portions or 200 ml top milk among breastfed infants*

3.2 Recommended IYCF interventions

3.2.1 Breastfeeding

Till the baby is six months of age, breastmilk is complete food.

Early initiation of breastfeeding: Place babies in skin-to-skin contact with their mothers immediately after birth for at least one hour and encourage mothers to recognize when their babies are ready to breastfeed, offering help if needed. Immediately after birth, babies are in a quiet and alert state which helps in initiating breastfeeding. Mothers benefit from early initiation of breastfeeding as it improves lactation and reduces blood loss. Prelacteal should be completely avoided and families counselled in advance on benefits of early and immediate breastfeeding.

Infants ≤ 6 months should be:

- Breastfed immediately after birth (within an hour)
- Breastfed exclusively

Exclusive breastfeeding: Babies should be fed only breastmilk in the first six months to achieve optimal growth and development. Baby should receive only breast milk from his or her mother or expressed breast milk (or donated human milk under special conditions), and no other liquids or solids, not even water, with the exception of oral rehydration solution, drops or syrups consisting of vitamins, minerals supplements or medicines (if recommended).

Evidence: Reviews of studies from developing countries show that infants who are not breastfed are 6 to 10 times more likely to die in the first months of life than infants who

are breastfed[55,56]. Diarrhoea and pneumonia are more common and more severe in children who are artificially fed, and are responsible for many of these deaths[57,58]. Diarrhoeal illness is also more common in artificially-fed infants even in situations with adequate hygiene[59,60]. Several studies suggest that obesity in later childhood and adolescence is less common among breastfed children, and that there is a dose response effect, with a longer duration of breastfeeding associated with a lower risk[61,62]. A growing body of evidence links artificial feeding with risks to cardiovascular health, including increased blood pressure, altered blood cholesterol levels and atherosclerosis in later adulthood[63,64]. Regarding intelligence, a meta-analysis of 20 studies showed scores of cognitive functions on average 3.2 points higher among children who were breastfed compared with those who were formula fed[65]. For the mother, breastfeeding also has both short- and long-term benefits. The risk of postpartum haemorrhage may be reduced by breastfeeding immediately after delivery, and there is increasing evidence that the risk of breast and ovarian cancer is less among women who breastfed[66,67]. The advantages of exclusive breastfeeding compared to partial breastfeeding were recognised in 1984, when a review of available studies found that the risk of death from diarrhoea of partially breastfed infants 0–6 months of age was 8.6 times the risk for exclusively breastfed children. For those who received no breast milk the risk was 25 times that of those who were exclusively breastfed[68]. Recent studies corroborate these findings.

Benefits of colostrum feeding

Colostrum is the first thicker yellow milk secreted in small amounts. Colostrum offers several benefits to the newborn such as:

- It has more antibodies and other anti-infective factors and more white blood cells than mature milk .This protects newborns from bacterial infections and allergies.
- It has a mild purgative effect; helps clear the baby's gut of meconium. It also clears bilirubin from the gut, and helps to prevent jaundice.
- It contains growth factors, which help a baby's immature intestine to develop after birth. This helps to prevent the baby from developing allergies and intolerance to other foods.
- Colostrum is richer than mature milk in some Vitamins - especially Vitamin A. Vitamin A helps to reduce the severity of any infection the baby might have.

55 WHO Collaborative Study Team on the Role of Breastfeeding on the Prevention of Infant Mortality. Effect of breastfeeding on infant and childhood mortality due to infectious diseases in less developed countries: a pooled analysis. Lancet, 2000; 355: 451–455

56 Bahl R et al. Infant feeding patterns and risks of death and hospitalization in the first half of infancy: multicentre cohort study. Bulletin of the World Health Organization, 2005; 83: 418–426.

57 De Zoysa I, Rea M, Martines J. Why promote breast feeding in diarrhoeal disease control programmes? Health Policy and Planning, 1991; 6: 371–379.

58 Bachrach VR, Schwarz E, Bachrach LR. Breastfeeding and the risk of hospitalization for respiratory diseases in infancy: a meta-analysis. Archives of Pediatrics and Adolescent Medicine, 2003; 157: 237–243.

59 Kramer MS et al. Promotion of Breastfeeding Intervention Trial (PROBIT): a randomized trial in the Republic of Belarus. Journal of the AmericanMedical Association, 2001; 285: 413–420.

60 Howie PW et al. Protective effect of breastfeeding against infection. British Medical Journal, 1990; 300: 11–16.

61 Harder T et al. Duration of breastfeeding and risk of overweight: a meta-analysis. American Journal of Epidemiology, 2005; 162: 397–403.

62 Burke V et al. Breastfeeding and overweight: longitudinal analysis in an Australian birth cohort. Journal of Pediatrics, 2005; 147: 56–61.

63 Martin RM, Gunnell D, Davey Smith G. Breastfeeding in infancy and blood pressure in later life: systemic review and meta-analysis. American Journal of Epidemiology, 2005; 161: 15–26.

64 Owen CG et al. Infant feeding and blood cholesterol: a study in adolescents and a systematic review. Pediatrics, 2002; 110: 597–608.

65 Anderson JW, Johnstone BM, Remley DT. Breastfeeding and cognitive development: a meta-analysis. American Journal of Clinical Nutrition, 1999; 70: 525–535.

66 Chua S et al. Influence of breast feeding and nipple stimulation on post-partum uterine activity. British Journal of Obstetrics & Gynaecology, 1994; 101: 804–805.

67 Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50 302 women with breast cancer and 96 973 women without the disease. Lancet, 2002; 360: 187–195

68 Feachem R, Koblinsky M. Interventions for the control of diarrhoeal disease among young children: promotion of breast-feeding. Bulletin of the World Health Organization, 1984; 62: 271–291.

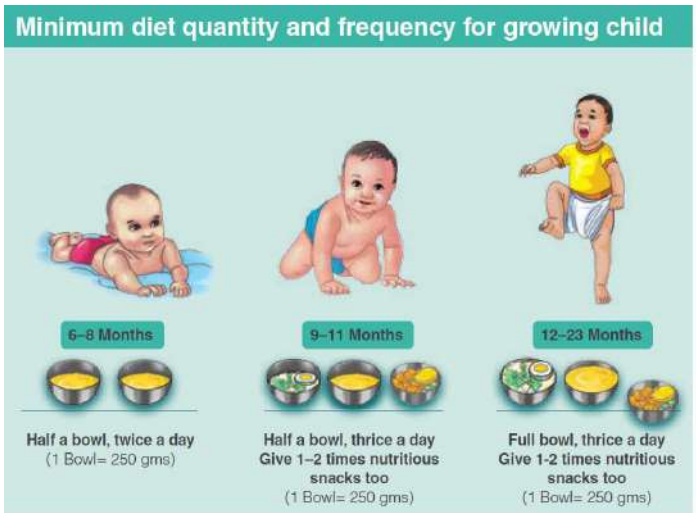
Benefits of breastfeeding for baby and mother

Baby	Mother
Complete nutritional staple up to 6 months, up to 1/2 of nutritional requirements between 6-12 months, up to 1/3, between 12 and 24 months	Reduces post-delivery bleeding and anemia
Provides adequate calories and the right kind of proteins, fats, lactose, vitamins, iron and other minerals, enzymes.	Protective effect against breast and ovarian cancers

3.2.2 Complementary feeding (with continued breastfeeding till child is two years)

After baby is six months, nutritionally adequate and safe complementary foods should be introduced along with continued breastfeeding till child is two years of age.

Figure 3.1: Minimum diet quantity and frequency for growing child



From the age of 6 months, an infant's need for energy and nutrients starts to exceed what is provided by breast milk, and complementary feeding becomes necessary to fill the energy and nutrient gap. In many countries, the period of complementary feeding from 6–23 months is the time of peak incidence of growth faltering, micronutrient deficiencies and infectious illnesses[69]. Even after complementary foods have been introduced, breastfeeding remains a critical source of nutrients for the young infant and child. It provides about one half of an infant's energy needs up to the age of one year, and up to one third during the second year of life. It provides nearly 45% of the RDA for Vitamin A till child is two years of age. Breast milk continues to supply higher quality nutrients than complementary foods, and also protective factors. It is therefore recommended that breastfeeding on demand continues with adequate complementary feeding up to 2 years or beyond.

These recommendations may be adapted according to the needs of infants and young children in exceptionally difficult circumstances, such as pre-term or LBW infants, severely malnourished children, and in emergency situations. Specific recommendations apply to infants born to HIV-infected mothers.

Benefits of complementary feeding

- Prevents growth faltering
- Decreases risk of nutritional deficiencies
- Lessens risk of illnesses
- Helps in proper development

69 Dewey KG, Adu-Afarwuah S. Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. Maternal and Child Nutrition, 2008; 4(s1): 24–85.

3.3 Physiology of breastfeeding

Breast milk contains all the nutrients that an infant need in the first 6 months of life, including fat, carbohydrates, proteins, vitamins, minerals and water. It is easily digested and efficiently used. Breast milk also contains bioactive factors that augment the infant's immature immune system, providing protection against infection, and other factors that help digestion and absorption of nutrients.

3.3.1 Composition of breastmilk

Fats

Breast milk contains about 3.5 g of fat per 100 ml of milk, which provides about one half of the energy content of the milk. The fat is secreted in small droplets, and the amount increases as the feed progresses. As a result, the *hindmilk* secreted towards the end of a feed is rich in fat and looks creamy white, while the *foremilk* at the beginning of a feed contains less fat and looks somewhat bluish-grey in colour. Breastmilk fat contains long chain polyunsaturated fatty acids –DHA and AA, necessary for neurological development, that are not available in other milks.

Carbohydrates

The main carbohydrate is the special milk sugar lactose, a disaccharide. Breast milk contains about 7 g lactose per 100 ml, which is more than in most other milks, and is another important source of energy. Another kind of carbohydrate present in breast milk is oligosaccharides, or sugar chains, which provide important protection against infection.

Protein

Breast milk protein differs in both quantity and quality from animal milks, and it contains a balance of amino acids which makes it much more suitable for a baby. The concentration of protein in breast milk (0.9 g per 100 ml) is lower than in animal milks. Breast milk contains less of the protein casein, and forms much softer, more easily-digested curds than that in other milks. Among the whey, or soluble proteins, human milk contains more alpha-lactalbumin; cow milk contains betalactoglobulin, which is absent from human milk and to which infants can become intolerant.

Vitamins and minerals

Breast milk normally contains sufficient vitamins for an infant, unless the mother herself is deficient. The exception is vitamin D. The infant needs exposure to sunlight to generate endogenous vitamin D – or, if this is not possible, a supplement. The minerals iron and zinc are present in relatively low concentration, but their bioavailability and absorption are high. Provided that maternal iron status is adequate, term infants are born with a store of iron to supply their needs; only infants born with LBW may need supplements before 6 months.

Anti-infective factors

- Breast milk contains many factors that help to protect an infant against infection including: immunoglobulin, principally secretory immunoglobulin A (sIgA), which coats the intestinal mucosa and prevents bacteria from entering the cells;
- white blood cells which can kill micro-organisms; whey proteins (lysozyme and lactoferrin) which can kill bacteria, viruses and fungi;
- oligosaccharides which prevent bacteria from attaching to mucosal surfaces. The protection provided by these factors is uniquely valuable for an infant as they protect

without causing the effects of inflammation, such as fever, which can be dangerous for a young infant.

Colostrum and mature milk

Colostrum is the special milk that is secreted in the first 2–3 days after delivery. Colostrum is rich in white cells and antibodies, especially sIgA, and it contains a larger percentage of protein, minerals and fat-soluble vitamins (A, E and K) than later milk. Colostrum provides important immune protection to an infant. On the third day, an infant is normally taking about 300–400 ml per 24 hours, and on the fifth day 500–800 ml. From day 7 to 14, the milk is called *transitional*, and after 2 weeks it is called *mature milk*.

TABLE 3.4: Comparison of Human Colostrum, Breast Milk, and Cow's Milk (g/L)

Breast milk is ideal for an infant. Its composition is suitable, and its proteins are best for the infant			
	Human colostrum	Human breast milk	Cow's milk
Total protein	23	11	31
Immunoglobulins	19	0.1	1
Fat	30	45	38
Lactose	57	71	47
Calcium	0.5	0.3	1.4
Phosphorus	0.16	0.14	0.90
Sodium	0.50	0.15	0.41

3.3.2 Hormonal control of breastfeeding

Anatomy of the breast

The outer structures include the nipple and the dark skin that surrounds it - areola. Over the areola are small glands called Montgomery's glands which secrete an oily fluid to keep the skin healthy.

Inside the breast are the alveoli, which are very small sacs made of milk secreting cells. There are millions of alveoli the diagram shows only a few. The box shows three of the alveoli enlarged. A hormone called prolactin makes these cells produce milk. Around the alveoli are muscle cells, which to contract and squeeze out the milk. A hormone called oxytocin makes the muscle cells contract to squeeze out milk. Small tubes, or ducts, carry milk from the alveoli to the outside. Beneath the areola, the ducts become wider, and form lactiferous sinuses, where milk collects in preparation for a feed. The ducts become narrow again as they pass through the nipple. The secretory alveoli and ducts are surrounded by supporting tissue, and fat. It is the fat and other tissues which gives the breast its shape, and which makes most of the difference between large and small breasts. Small breasts and large breasts both contain about the same amount of glandular tissue, so they can both make plenty of milk.

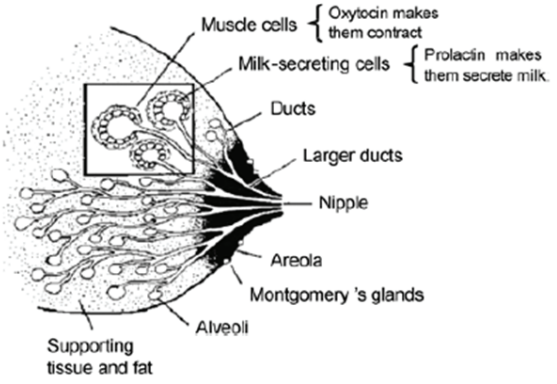


FIGURE 3.2: Anatomy of Breast

There are two hormones that directly affect breastfeeding: *prolactin* and *oxytocin*. When a baby suckles at the breast, sensory impulses pass from the nipple to the brain. In response, the anterior lobe of the pituitary gland secretes prolactin and the posterior lobe secretes oxytocin.

Prolactin

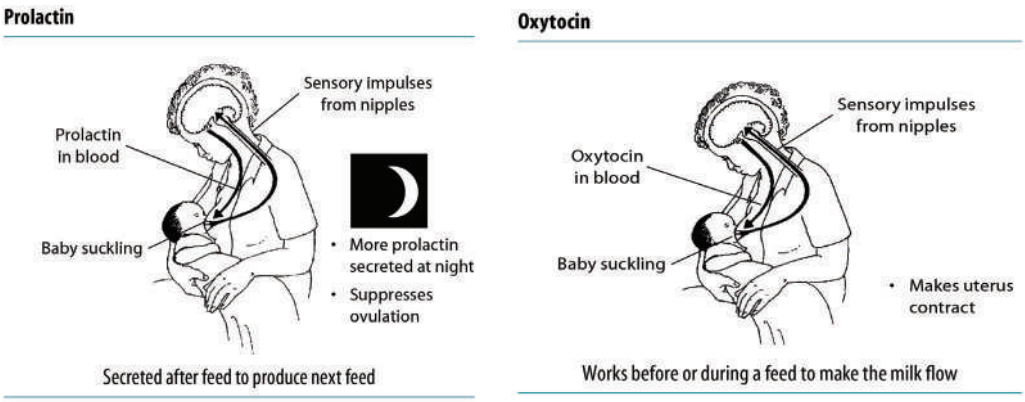
Prolactin is necessary for the secretion of milk by the cells of the alveoli. The level of prolactin in the blood increases markedly during pregnancy and stimulates the growth and development of the mammary tissue, in preparation to produce milk. After delivery, levels of progesterone and oestrogen which block the action of prolactin, fall rapidly and milk secretion begins. When a baby suckles, the level of prolactin in the blood increases, and stimulates production of milk by the alveoli (Figure 3.2). The prolactin level is highest about 30 minutes after the beginning of the feed, so its most important effect is to make milk for the next feed. During the first few weeks, the more a baby suckles and stimulates the nipple, the more prolactin is produced, and the more milk is produced. This effect is particularly important at the time when lactation is becoming established. Although prolactin is still necessary for milk production, after a few weeks there is not a close relationship between the amount of prolactin and the amount of milk produced. However, if the mother stops breastfeeding, milk secretion may stop too – then the milk will dry up.

Oxytocin

Oxytocin makes the myoepithelial cells around the alveoli contract. This makes the milk, which has collected in the alveoli, flow along and fill the ducts (Figure 3.3). The oxytocin reflex is also sometimes called the "let down reflex" or the "milk ejection reflex". Oxytocin starts working when a mother expects a feed as well as when the baby is suckling. The reflex becomes conditioned to the mother's sensations and feelings, such as touching, smelling or seeing her baby, or hearing her baby cry, or thinking lovingly about him or her. If a mother is in severe pain or emotionally upset, the oxytocin reflex may become inhibited, and her milk may suddenly stop flowing well. If she receives support, is helped to feel comfortable and lets the baby continue to breastfeed, the milk will flow again. Oxytocin makes a mother's uterus contract after delivery and helps to reduce bleeding. The contractions can cause severe uterine pain when a baby suckles during the first few days.

FIGURE 3.3: Prolactin

FIGURE 3.4: Oxytocin



3.3.3 Reflexes in the baby

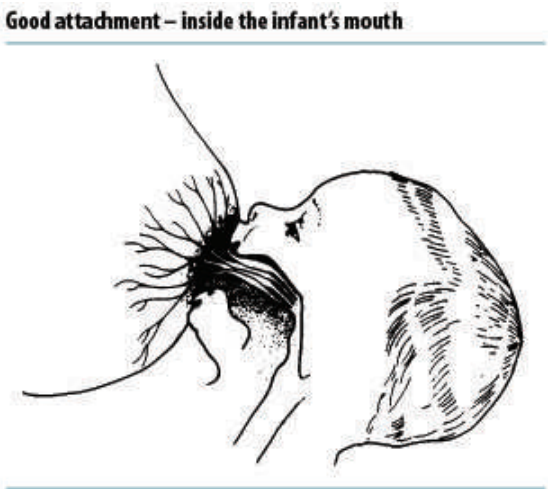
The baby's reflexes are important for appropriate breastfeeding. The main reflexes are *rooting*, *suckling* and *swallowing*. When something touches a baby's lips or cheek, the baby turns to find the stimulus, and opens his or her mouth, putting his or her tongue down and forward. This is the *rooting reflex* and is present from about the 32nd week of pregnancy. When something touches a baby's palate, he or she starts to suck it. This is the *sucking reflex*. When the baby's mouth fills with milk, he or she swallows. This is the *swallowing reflex*. Preterm infants can grasp the nipple from about 28 weeks gestational age, and they can suckle and remove some milk from about 31 weeks. Coordination of suckling, swallowing

and breathing appears between 32 and 35 weeks of pregnancy. Infants can only suckle for a short time at that age, but they can take supplementary feeds by cup. Most infants can breastfeed fully at a gestational age of 36 weeks

3.3.4 Positioning and Attachment

To stimulate the nipple and remove milk from the breast, and to ensure an adequate supply and a good flow of milk, a baby needs to be *well attached* so that he or she can *suckle effectively.* Figure 3.4 shows how a baby takes the breast into his or her mouth to suckle effectively.

FIGURE 3.5:
Four signs of good attachment

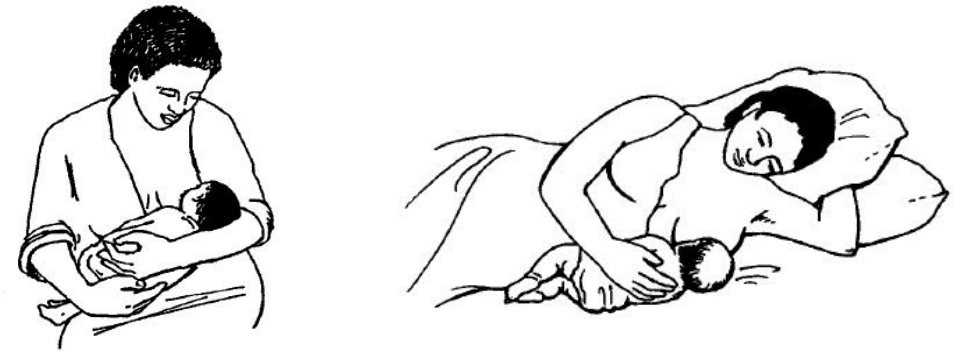


To be well attached at the breast, a baby and his or her mother need to be appropriately positioned.

Positioning the mother and baby for good attachment

To be well attached at the breast, a baby and his or her mother need to be appropriately positioned. There are several different positions for them both, but some key points need to be followed in any position.

Figure 3.6:
Position of the mother and baby for good attachment



Position of the mother

The mother can be sitting or lying down, or standing, if she wishes. However, she needs to be relaxed and comfortable, and without strain, particularly of her back. If she is sitting, her back needs to be supported, and she should be able to hold the baby at her breast without leaning forward.

Position of the baby

The baby can breastfeed in several different positions in relation to the mother: across her chest and abdomen, under her arm, or alongside her body. Whatever the position of the mother, and the baby's general position in relation to her, there are four key points about the position of the baby's body that are important to observe.

- The baby's body should be straight, not bent or twisted. The baby's head can be slightly extended at the neck, which helps his or her chin to be close in to the breast.
- He or she should be facing the breast. The nipples usually point slightly downwards, so the baby should not be flat against the mother's chest or abdomen but turned slightly on his or her back able to see the mother's face.
- The baby's body should be close to the mother which enables the baby to be close to the breast, and to take a large mouthful.
- His or her whole body should be supported. The baby may be supported on the bed or a pillow, or the mother's lap or arm. She should not support only the baby's head and neck. She should not grasp the baby's bottom, as this can pull him or her too far out to the side and make it difficult for the baby to get his or her chin and tongue under the areola.

3.3.5 Breastfeeding pattern

To ensure adequate milk production and flow for 6 months of exclusive breastfeeding, a baby needs to feed as often and for as long as he or she wants, both day and night. This is called *demand feeding*, *unrestricted feeding*, or *baby-led feeding*. Babies feed with different frequencies and take different amounts of milk at each feed. The 24-hour intake of milk varies between mother-infant pairs from 440–1220 ml, averaging about 800 ml per day throughout the first 6 months[70]. Infants who are feeding on demand according to their appetite obtain what they need for satisfactory growth. They do not empty the breast but remove only 63–72% of available milk. The mother learns to respond to her baby's cues of hunger and readiness to feed, such as restlessness, rooting (searching) with his mouth, or sucking hands, before the baby starts to cry. The baby should be allowed to continue suckling on the breast until he or she spontaneously releases the nipple. After a short rest, the baby can be offered the other side, which he or she may or may not want. If a baby stays on the breast for a very long time (more than one half hour for every feed) or if he or she wants to feed very often (more often than every 1–1½ hours each time) then the baby's attachment needs to be checked and improved. Prolonged, frequent feeds can be a sign of ineffective suckling and inefficient transfer of milk to the baby. This is usually due to poor attachment, which may also lead to sore nipples.

3.4 Management and support of breastfeeding in maternity facilities

The Baby-friendly Hospital Initiative (BFHI) was launched in 1992 with the aim of transforming maternity facilities to provide globally recommended standard of care. Hospitals become baby friendly by implementing "Ten steps to successful breastfeeding" as listed below and complying with relevant sections of the International Code of Marketing of Breast-milk Substitutes and subsequent relevant Health Assembly resolutions (collectively referred to as the *Code).*

Ten steps to successful breastfeeding

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within one half hour of birth.

70 Dewey K, Lonnerdal B. Milk and nutrient intake of breastfed infants from 1–6 months: relation to growth and fatness. Journal of Pediatric Gastroenterology and Nutrition, 1983, 2:497–506.

5. Show mothers how to breastfeed and how to maintain lactation even if they should be separated from their infants.
6. Give new-born infants no food or drink other than breast milk, unless medically indicated.
7. Practice rooming-in – allow mothers and infants to remain together – 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants.
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital.

Hospitals should ensure that mothers are counselled about recommended breastfeeding practices during pregnancy and provided support to initiate breastfeeding within an hour of birth. Any difficulty in breastfeeding should be identified at the earliest through close monitoring (Table 3.5). Observation check lists are available to observe and evaluate a breastfeeding session(Table 3.6). This should be used before deciding to discharge mother from the hospital. The BFHI is effective in increasing breastfeeding in hospital, but rates may fall off rapidly after the neonatal period, and continuing support in the community is essential to sustain exclusive breastfeeding. A baby-friendly hospital therefore needs to be concerned about on-going support for mothers after discharge.

TABLE 3.5: Risk factors for difficulty in breastfeeding

Maternal factors	Baby's factors
Previous breastfeeding difficulty.	Ineffective attachment and inability to suck.
Anaesthesia or surgery during delivery.	Use of pacifier or bottle.
Separation from infant.	Persistent sleepiness or irritability.
Damaged nipples.	Long intervals between feeds.
Unrelieved fullness or engorgement.	Baby is LBW.
Perceived insufficient milk.	Twin/multiple births.
Breast and nipple condition, such as flat or inverted nipples.	Cleft palate or other oral anomaly.

TABLE 3.6: Breastfeeding observation job aid (WHO, 2009)

BOX 13

Breastfeed Observation Job Aid

Mother's name..... Date.....

Baby's name..... Baby's age.....

Signs that breastfeeding is going well:	Signs of possible difficulty:
GENERAL	
Mother:	Mother:
❙ Mother looks healthy	❙ Mother looks ill or depressed
❙ Mother relaxed and comfortable	❙ Mother looks tense and uncomfortable
❙ Signs of bonding between mother and baby	❙ No mother/baby eye contact
Baby:	Baby:
❙ Baby looks healthy	❙ Baby looks sleepy or ill
❙ Baby calm and relaxed	❙ Baby is restless or crying
❙ Baby reaches or roots for breast if hungry	❙ Baby does not reach or root
BREASTS	
❙ Breasts look healthy	❙ Breasts look red, swollen, or sore
❙ No pain or discomfort	❙ Breast or nipple painful
❙ Breast well supported with fingers away from nipple	❙ Breasts held with fingers on areola
❙ Nipple stands out, protractile	❙ Nipple flat, not protractile
BABY'S POSITION	
❙ Baby's head and body in line	❙ Baby's neck and head twisted to feed
❙ Baby held close to mother's body	❙ Baby not held close
❙ Baby's whole body supported	❙ Baby supported by head and neck
❙ Baby approaches breast, nose opposite nipple	❙ Baby approaches breast, lower lip to nipple
BABY'S ATTACHMENT	
❙ More areola seen above baby's top lip	❙ More areola seen below bottom lip
❙ Baby's mouth open wide	❙ Baby's mouth not open wide
❙ Lower lip turned outwards	❙ Lips pointing forward or turned in
❙ Baby's chin touches breast	❙ Baby's chin not touching breast
SUCKLING	
❙ Slow, deep sucks with pauses	❙ Rapid shallow sucks
❙ Cheeks round when suckling	❙ Cheeks pulled in when suckling
❙ Baby releases breast when finished	❙ Mother takes baby off the breast
❙ Mother notices signs of oxytocin reflex	❙ No signs of oxytocin reflex noticed

3.4.1 Managing breast conditions that may affect breastfeeding

Some of the breast conditions that may affect normal breastfeeding include: Full breasts, Breast engorgement, Blocked duct, Mastitis, Breast abscess, Sore nipple, Mastitis, Abscess and nipple fissure in an HIV-infected woman, Candida infection in mother or baby, Inverted, flat, large or long nipples

Full breasts

***Symptoms*:** Full breasts occur from 3–5 days after delivery when the breast milk "comes in". The mother feels uncomfortable and her breasts feel heavy, hot and hard. Sometimes they are lumpy. The milk flows well, and sometimes drips from the breast.

Cause: This is normal fullness.

Management: The baby needs to be well attached, and to breastfeed frequently to remove the milk. The fullness decreases after a feed, and after a few days the breasts become more comfortable as milk production adjusts to the baby's needs.

Breast engorgement

Symptoms: The breasts are swollen and oedematous, and the skin looks shiny and diffusely red. The woman may have a fever that usually subsides in 24 hours. The nipples may become stretched tight and flat which makes it difficult for the baby to attach and remove the milk. The milk does not flow well.

Cause: Failure to remove breast milk, especially in the first few days after delivery when the milk comes in and fills the breast, and at the same time blood flow to the breasts increases, causing congestion.

Management: The mother must remove the breast milk. If the baby can attach well and suckle, then she should breastfeed as frequently as the baby is willing. If the baby is not able to attach and suckle effectively, she should express her milk by hand or with a pump a few times until the breasts are softer.

Blocked duct

Symptoms: A tender, Localised lump in one breast, with redness in the skin over the lump.

Cause: Failure to remove milk from part of the breast, which may be due to infrequent breastfeeds, poor attachment, tight clothing or trauma to the breast. Sometimes the duct to one part of the breast is blocked by thickened milk.

Management: Improve removal of milk and correct the underlying cause.

- The mother should feed from the affected breast frequently and gently massage the breast over the lump while her baby is suckling.
- Some mothers find it helpful to apply warm compresses, and to vary the position of the baby (across her body or under her arm).
- Sometimes after gentle massage over the lump, a string of the thickened milk comes out through the nipple, followed by a stream of milk, and rapid relief of the blocked duct.

Mastitis

Symptoms: There is a hard swelling in the breast, with redness of the overlying skin and severe pain. Usually only a part of one breast is affected, which is different from engorgement, when the whole of both breasts are affected. The woman has fever and feels ill. Mastitis is commonest in the first 2–3 weeks after delivery but can occur at any time.

Causes: Mastitis is usually caused in the first place by milk staying in the breast, or milk stasis, which results in non-infective inflammation. Infection may supervene if the stasis persists, or if the woman also has a nipple fissure that becomes infected. The condition may then

become infective mastitis.

Management:

- Improve the removal of milk and try to correct any specific cause that is identified.
- She may take analgesics (if available, ibuprofen, which also reduces the inflammation of the breast; or paracetamol).
- If symptoms are severe, if there is an infected nipple fissure or if no improvement is seen after 24 hours of improved milk removal, the treatment should then include penicillinase-resistant antibiotics (e.g., flucloxacillin). However, antibiotics will not be effective without improved removal of milk.

Breast abscess

Symptoms: A painful swelling in the breast, which feels full of fluid. There may be discoloration of the skin at the point of the swelling.

Cause: Usually secondary to mastitis that has not been effectively managed.

Management: An abscess needs to be drained and treated with penicillinase-resistant antibiotics. When possible, drainage should be either by catheter through a small incision, or by needle aspiration (which may need to be repeated). A large surgical incision may damage the areola and milk ducts and interfere with subsequent breastfeeding and should be avoided. The mother may continue to feed from the affected breast. However, if suckling is too painful or if the mother is unwilling, she can be shown how to express her milk, and advised to let her baby start to feed from the breast again as soon as the pain is less, usually in 2–3 days. Feeding from an infected breast does not affect the infant (unless the mother is HIV-positive).

Sore or fissured nipple

Symptoms: The mother has severe nipple pain when the baby is suckling. There may be a visible fissure across the tip of the nipple or around the base. The nipple may look squashed from side-to-side at the end of a feed, with a white pressure line across the tip.

Cause: The main cause of sore and fissured nipples is poor attachment.

Management: The mother should be helped to improve her baby's position and attachment. Often, as soon as the baby is well attached, the pain is less. There is no need to rest the breast – the nipple will heal quickly when it is no longer being damaged.

Candida infection (thrush) in mother or baby

Symptoms:

In the mother:

- Sore nipples with pain continuing between feeds, pain like sharp needles going deep into the breast, which is not relieved by improved attachment.
- There may be a red or flaky rash on the areola, with itching and depigmentation.

In the baby:

- White spots inside the cheeks or over the tongue, which look like milk curds, but they cannot be removed easily.
- Some babies feed normally, some feed for a short time and then pull away, some refuse to feed altogether, and some are distressed when they try to attach and feed, suggesting that their mouth is sore.
- There may be a red rash over the nappy area ("diaper dermatitis").

Cause: This infection caused by the fungus Candida albicans, often follows the use of antibiotics in the baby or in the mother to treat mastitis or other infections.

Management: Treatment is with gentian violet or nystatin. If the mother has symptoms, both mother and baby should be treated. If only the baby has symptoms, it is not necessary to treat the mother.

Gentian Violet paint:

- Apply 0.25% solution to baby's mouth daily for 5 days, or until 3 days after lesions heal.
- Apply 0.5% solution to mother's nipples daily for 5 days.
- Nystatin:
- Nystatin suspension 100,000 IU/ml; apply 1 ml by dropper to child's mouth 4 times daily after breast-feeds for 7 days, or as long as the mother is being treated.
- Nystatin cream 100,000 IU/ml; apply to nipples 4 times daily after breastfeeds. Continue to apply for 7 days after lesions have healed.

Inverted, flat, large of long nipples

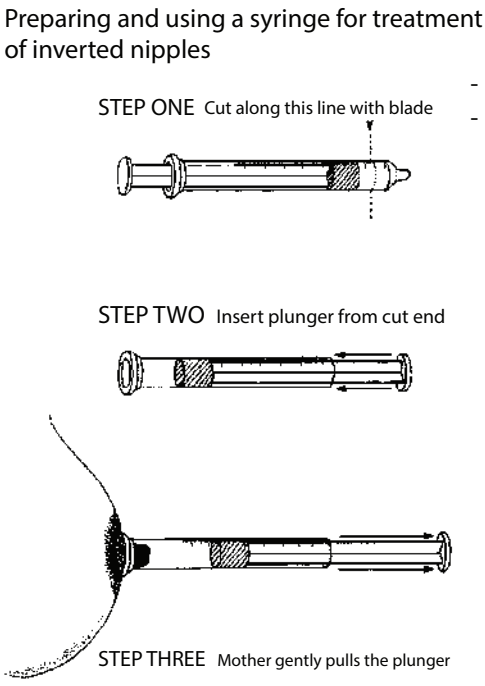
Signs to look for: Nipples naturally occur in a wide variety of shapes that usually do not affect a mother's ability to breastfeed successfully. However, some nipples look flat, large or long, and the baby has difficulty attaching to them. Most flat nipples are *protractile* – if the mother pulls them out with her fingers, they stretch, in the same way that they have to stretch in the baby's mouth. A baby should have no difficulty suckling from a protractile nipple. Sometimes an inverted nipple is *non-protractile* and does not stretch out when pulled; instead, the tip goes in. This makes it more difficult for the baby to attach. Protractility often improves during pregnancy and in the first week or so after a baby is born. A large or long nipple may make it difficult for a baby to take enough breast tissue into his or her mouth.

Cause: Different nipple shapes are a natural physical feature of the breast. An inverted nipple is held by tight connective tissue that may slacken gradually after a baby regularly suckles from it.

Management: The same principles apply for the management of flat, inverted, large or long nipples.

- As soon as possible after delivery, the mother should be helped to position and try to attach her baby. The mother should give the baby plenty of skin-to-skin contact near the breast, and let the baby try to find his or her own way of taking the breast, which many do.

FIGURE 3.7 Preparing and using a syringe for treatment of inverted nipples



- For inverted nipples, which do not evert spontaneously even after delivery causing difficulty for the baby to breastfeed efficiently, a mother can use a 20 ml syringe, with the adaptor end cut off and the plunger put in backwards to stretch out the nipple just before a feed. However, this method is not recommended as a usual practice.

3.4.2 Breastfeeding in special situations

Breastfeeding LBW babies

A baby's own mother's milk is best for LBW infants of all gestational ages. Not all LBW infants are able to feed from the breast in the first days of life. For infants who are not able to breastfeed effectively, feeds have to be given by an alternative, oral feeding method (cup/paladai/spoon/direct expression into mouth) or by intra-gastric tube feeding (Table 3.6).

How to express breastmilk?

In some situations when the baby is not sucking the milk properly from the breast due to his/her illness, low birth weight, inappropriate breast conditions or if the mother is working there is a need to express her breastmilk. You can help her in identifying these situations and the correct technique of expressing breastmilk.

The situations requiring expression of breastmilk are:

- To get relief from engorgement.
- To feed a sick baby who cannot suckle.
- To feed a low birth weight baby or a weak baby by cup as they are unable to suckle.
- To maintain the milk supply, when the mother or baby is ill.
- To feed a baby in breast conditions, where she is unable to breastfeed.
- To leave expressed breastmilk, when she is going out for work.

Manual expression

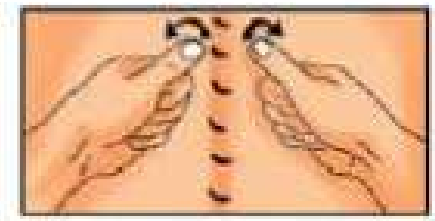
This is one of the easiest and safest methods to express breastmilk.

1. Build a mother's confidence
   - If possible keep the baby in the mother's lap.
   - Try to reduce any source of her pain and anxiety.
   - Help her in thinking lovingly about her baby.
2. Preparation of the vessel/container
   - Choose a cup, glass, bowl/katori with a wide mouth.
   - Wash the cup with soap and water.
3. Prepare mother for expression
   - Sit quietly in a separate room with a supportive friend/helper.
   - Take a warm soothing drink. The drink should not be coffee.
   - Wash breasts with luke warm water

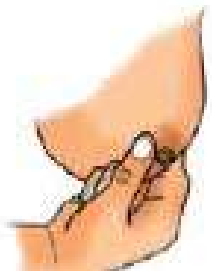
TABLE 3.7: Feeding LBW babies

	FEEDING LOW-BIRTH-WEIGHT BABIES		
	> 36 WEEKS GESTATIONAL AGE	32–36 WEEKS GESTATIONAL AGE	< 32 WEEKS GESTATIONAL AGE
WHAT	breast milk	breast milk, expressed or suckled from the breast	expressed breast milk
HOW	breastfeeding	cup, spoon, paladai (in addition to feeding at the breast)	intra-gastric tube
WHEN	■ start within one hour of birth ■ breastfeed at least every 3 hours	■ start within one hour of birth or as soon as the baby is clinically stable ■ feed every 2–3 hours	■ start 12–24 hours after birth ■ feed every 1–2 hours

- Wash hands thoroughly.
- Massage the breast lightly.
- Stimulate her nipple to activate the oxytocin reflex.
- Ask her helper to rub her back from neck on downwards on both sides of the spine.



4. Expressing by hand
    - Sit or stand comfortably and hold the container near the breast.
    - Put her thumb on her breast ABOVE the nipple and areola, and her first finger on the breast BELOW the nipple and areola, opposite the thumb. She should support the breast with other fingers
    - Press her thumb and first finger slightly inwards towards the chest wall. She should avoid pressing too far, because that can block the milk ducts
    - Press and release. Again press and release.
    - Do this alternatively till the flow of milk starts
    - Press the breast in same way from all sides so that milk flows from all segments.
    - Express milk from one breast for at least 3-5 minutes then express the other side and then repeat the process.
    - Explain to the mother that generally it takes about 20-30 minutes to get enough milk for the baby.
    - Expressed milk can be stored for 8 hours in a clean container without boiling.



DO NOT squeeze the nipple.

DO NOT express milk quickly.

DO NOT rub or slide thumb and finger along the skin.

FIGURE 3.8:
How to express breastmilk directly in baby's mouth

Breastfeeding after caesarean section

In case of spinal or epidural anaesthesia, breastfeeding may be initiated within an hour of birth as in vaginal delivery. Mothers may need support in positioning the baby for correct attachment. If general anaesthesia is administered, breastfeeding can be initiated immediately after birth if a trusted caregiver is available to support the baby in breastfeeding position till mother is comfortable and confident in doing so herself. Else, it is initiated when mother is alert (in about 4 hours); most normal weight healthy babies can wait for first feed till this time. Alternate feeding may be needed for small and sick babies to prevent hypoglycaemia. Most mothers can breastfeed normally after a caesarean delivery if they are given appropriate help.

Breastfeeding babies of HIV positive mothers

The aim of preventing mother-to-child transmission of HIV through breastfeeding needs to be balanced with the need to support optimal nutrition of all infants through exclusive and continued breastfeeding and adequate complementary feeding. The main factors which increase the risk of HIV transmission through breastfeeding include[71]:

- acquiring HIV infection during breastfeeding, because of high initial viral load;
- the severity of the disease (as indicated by a low CD4+ count or high RNA viral load in the mother's blood, or severe clinical symptoms);
- poor breast health (e.g. mastitis, sub-clinical mastitis, fissured nipples);
- possibly, oral infection in the infant (thrush and herpes);
- non-exclusive breastfeeding (mixed feeding);
- longer duration of breastfeeding
- Possibly, nutritional status of the mother.

Recommendations for feeding of infants by mothers who are HIV- infected include:

- The most appropriate infant feeding option for an HIV-infected mother depends on her individual circumstances, including her health status and local situation, but should take consideration of the health services and counselling and support she is likely to receive.
- Exclusive breastfeeding is recommended for HIV infected mothers for the first 6 months of life unless replacement feeding is acceptable, feasible, affordable, sustainable and safe

71 WHO/UNICEF/UNAIDS/UNFPA. HIV transmission through breastfeeding: a review of available evidence, 2007 update. Geneva, World Health Organization, 2008.

for them and their infants before that time

- When replacement feeding is acceptable, feasible, affordable, sustainable and safe, avoidance of all breastfeeding by HIV-infected mothers is recommended.
- All HIV-exposed infants should receive regular follow-up care and periodic re-assessment of infant feeding choices, particularly at the time of infant diagnosis and at 6 months.
- At 6 months, if adequate feeding from other sources cannot be ensured, HIV-infected women should continue to breastfeed their infants and give complementary foods in addition and return for regular follow-up assessments. All breastfeeding should stop once an adequate diet without breast milk can be provided.
- Breastfed infants and young children who are HIV infected should continue to breastfeed according to recommendations for the general population.

Definitions of Acceptable, Feasible, Affordable, Sustainable and Safe

Acceptable:
The mother perceives no significant barrier to choosing a feeding option for cultural or social reasons or for fear of stigma and discrimination.

Feasible:
The mother (or other family member) has adequate time, knowledge, skills and other resources to prepare feeds and to feed the infant, as well as the support to cope with family, community and social pressures.

Affordable:
The mother and family, with available community and/or health system support, can pay for the costs of replacement feeds – including all ingredients, fuel and clean water – without compromising the family's health and nutrition budget.

Sustainable:
The mother has access to a continuous and uninterrupted supply of all ingredients and commodities needed to implement the feeding option safely for as long as the infant needs it.

Safe:
Replacement foods are correctly and hygienically prepared and stored, and fed in nutritionally adequate quantities, with clean hands and using clean utensils, preferably by cup.

Women who need anti-retroviral drugs (ARVs) for their own health should receive them, as they are the women most likely to transmit HIV through breastfeeding.

3.4.3 Medical conditions contraindicating breastfeeding

Some medications taken by a mother may pass into her milk. There are very few medicines for which breastfeeding is absolutely contraindicated. However, there are some medicines that can cause side-effects in the baby – they may warrant use of a safer alternative or avoidance of breastfeeding temporarily (Table 3.8)

TABLE 3.8: Breastfeeding and medication

Breastfeeding contraindicated	Anticancer drugs (antimetabolites); Radioactive substances (stop breastfeeding temporarily)
Continue breastfeeding Side-effects possible Monitor baby for drowsiness	Selected psychiatric drugs and anticonvulsants (see individual drug)
Use alternative drug if possible	Chloramphenicol, tetracyclines, metronidazole, quinolone antibiotics (e.g. ciprofloxacin)
Monitor baby for jaundice	Sulfonamides, dapsone, sulfamethoxazole+trimethoprim (cotrimoxazole), sulfadoxine+pyrimethamine (fansidar)
Use alternative drug (may inhibit lactation)	Estrogens, including estrogen-containing contraceptives, thiazide diuretics, ergometrine
Safe in usual dosage Monitor baby	Most commonly used drugs Analgesics and antipyretics: short courses of paracetamol, acetylsalicylic acid, ibuprofen; occasional doses of morphine and pethidine Antibiotics: ampicillin, amoxicillin, cloxacillin and other penicillins, erythromycin Antituberculosis drugs, anti-leprosy drugs (see dapsone above) Antimalarials (except mefloquine, fansidar) Anthelminthics, antifungals Bronchodilators (e.g. salbutamol), corticosteroids, antihistamines, antacids, drugs for diabetes, most antihypertensives, digoxin Nutritional supplements of iodine, iron, vitamins

3.4.4 Myths about breastfeeding

Myth #1: Gurti should be given at birth

Fact:

- ✓ Giving gurti (honey, jaggery, butter with sugar etc) at birth is an unscientific practice
- ✓ Gurti suppresses hunger, inhibits the sucking reflex resulting in decrease production of breast milk and above all give infection.

Myth #2: Breast milk is not enough during the first few days after birth

Fact:

- ✓ Colostrum produced by mother in the first few days after delivery is rich in white cells and antibodies, especially sIgA, and it contains a larger percentage of protein, minerals and fat-soluble vitamins (A, E and K) than mature milk.

Myth #3: Breastfeeding is not possible after caesarean section birth

Fact:

- ✓ It depends upon the type of anaesthesia given during c- section. It is usually possible for a mother to breastfeed within about 4 hours after a c- section.
- ✓ For the first 24 hours she can breastfeed lying on her back, during the next 24 hours she can breastfeed by turning from side to side and from day three onwards, she can sit up with the pillows support for breastfeeding.
- ✓ It is important to nurse in a way that does not put pressure on the incision sight.

Myth #4: A baby should be on the breast for sufficient time (? 5, 10, 20 mins or longer) on each side.

Fact:

- ✓ It is important **not** to restrict the duration or the frequency of feeds – provided the baby is well attached to the breast. A baby needs to feed as often and for as long as s/he wants, both day and night.
- ✓ Prolonged, frequent feeds (more often than every 1–1½ hours each time) can be a sign of ineffective suckling and inefficient transfer of breast milk to the baby, in which case the baby's attachment needs to be checked and improved.

Myth #5: Many women do not produce enough milk

Fact:

- ✓ In many cases, the baby is in fact getting all the milk that s/he needs, and the problem is the mother's perception that the milk supply is insufficient.
- ✓ The mothers who believe that they do not have enough breast milk should be shown how to attach a baby properly by a skilled person.

Myth #6: There is no way to know how much breast milk the baby is getting

Fact:

There are two signs that show reliably that a baby is getting enough breast milk.

- ✓ Adequate weight gain: A baby who is below his or her birth weight at the end of the second week and who does not gain from about 500 g to 1 kg or more each month after second week, needs to be assessed

- ✓ Passing urine about six times a day: If an exclusively breastfed baby is passing urine less than 6 times a day, especially if the urine is dark yellow and strong smelling, then s/he is not getting enough breast milk.

Myth #7: Milk production is directly related to the size of the breast

Fact:

- ✓ The size of breasts, either large or small, has nothing to do with the amount of milk they produce. The size of a breast is determined by the amount of fatty tissue it contains;
- ✓ However, most breasts have the same number of milk glands, regardless of their size. More the baby nurses, more is the breast milk produced.

Myth #8: Breastfeeding is painful

Fact:

- ✓ Any pain that is more than mild is abnormal and mostly due to the baby attaching poorly.
- ✓ Any excruciating or ongoing nipple pain that is not getting better by day 3 or 4 shouldn't be ignored and medical advice sought.

Myth #9: Baby on exclusive breastfeeding needs extra water in hot weather.

Fact:

- ✓ Healthy infants do not need additional water during the first 6 months if they are exclusively breastfed, even in a hot climate.
- ✓ Breast milk itself is 88% water and is enough to satisfy a baby's thirst. The practice of giving water and other fluids like tea to infants before 6 months has been associated with increased risk of diarrhoea besides affecting breast milk production.

Myth #10: Breastfeeding new-borns need vitamins and minerals/Iron supplements

Fact:

- ✓ At least until the baby is 6 months old, one can be assured that the breast milk will provide for all her/his nutritional needs including vitamins, minerals and Iron, unless the mother herself is deficient.
- ✓ The exception is vitamin D. The infant needs exposure to sunlight to generate endogenous vitamin D – or, if this is not possible, a supplement.
- ✓ Infants born with low birth weight may need supplements with minerals/iron before 6 months.

Myth #11: If the baby has diarrhoea/vomiting the mother should stop breastfeeding

Fact:

- ✓ The best medicine for a baby's gut infection is breast milk. And breast milk is the only fluid which the baby requires during diarrhoea and/or vomiting up to 6 months, except under exceptional circumstances. Breast milk should not be withheld from a sick child.
- ✓ Infants who are not breastfed are 6 to 10 times more likely to die in the first months of life than infants who are breastfed. Diarrhoea has been found to be more common and more severe in children who are artificially fed and is responsible for many of these deaths.

Myth #12: If the mother has an infection/disease should stop breastfeeding

Fact:

- ✓ Breast milk contains many factors that help to protect an infant against infection. The protection provided by these factors is uniquely valuable for an infant.
- ✓ Nevertheless, a small number of health conditions of the mother including HIV, may justify recommending that she does not breastfeed temporarily or permanently.

Myth #13: If the mother is taking medicine, she should not breastfeed.

Fact:

- ✓ There are very few medicines for which breastfeeding is absolutely contra-indicated. Remember to ask the doctor about non-prescription drugs.

Myth #14: A Mother should wash her nipples each time before feeding the baby

Fact:

- ✓ Routine daily bath for the mother and clean clothing including undershirt is all that is required from the breastfeeding mother.
- ✓ Washing nipples before feeding removes the protective oils from the nipple. Moreover, the sterility of the water with which the nipples are washed is always questionable, which might result in spreading infection to the baby.

Myth #15: A Mother will not get pregnant if she is breastfeeding

Fact:

- ✓ Hormones produced when a baby suckles prevent ovulation, and so delay the return of menstruation and fertility after childbirth. This is called the Lactation Amenorrhoea Method (LAM). LAM is effective under the following three conditions
  - The mother must be amenorrhoeic – that is, she must not be menstruating.
  - The baby must breastfeed exclusively,
  - The baby must be less than 6 months old.
- ✓ If these three conditions are met, then a woman's risk of becoming pregnant is less than 2%, which is as reliable as other family planning methods.

Myth #16: A Mother must wean if she gets pregnant

Fact:

- ✓ There is no reason of weaning unless the mother has a history of preterm labour

Myth #17: Mother should have a good diet, or her milk won't nourish the baby properly

Fact:

- ✓ It's best to eat a healthy, balanced diet during pregnancy and lactation
- ✓ Occasional lapses, however, are nothing to worry about. The quality and quantity of breast milk is still maintained.

Myth #18: Breastfed babies will not sleep through the night until weaned.

Fact:

- ✓ Breastfed babies do feed throughout day and night for the first few months in order to get nutrition.
- ✓ Breast milk is so easily digested that babies want to feed sooner than they would on a formula feed.

Myth #19: Breastfeeding limits the freedom of the mother.

Fact:

- ✓ Baby can be nursed by the mother anywhere and anytime, and thus breastfeeding is more liberating for the mother.
- ✓ Mothers do not have the added burden of caring around all that formula paraphernalia.

Myth #20: Breastfeeding ruins the figure/shape of the breasts

Fact:

- ✓ Breasts sag for all sorts of reasons, age, genetics, body type, etc and nothing can be done about them. Some breasts sag more than others.
- ✓ Pregnancy itself, and not breastfeeding, can cause breasts to sag.
- ✓ To maintain the shape of the breasts, the mother should tone up the muscles that support the breasts and avoid large and sudden weight gain or loss (pregnancy related or otherwise).

Myth #21: A working mother can't breastfeed.

Fact:

- ✓ It may be possible to schedule the work with a lunch break during which the mother may return home or go to the child's day-care centre to nurse.
- ✓ Caregiver might bring the child to mom's work place for feeding.
- ✓ Expressing and appropriately storing breast milk which can be given to the baby with cup by the caretaker in the absence of the mother can be done.

Myth #22: It is easier to bottle feed than to breastfeed. Babies need to know how to take a bottle. Therefore, a bottle should always be introduced before the baby refuses to take one.

Fact:

- ✓ Breastfeeding can be a lot more convenient than bottle feeding.

  Breastfeeding, is certainly less time-consuming

  Leaving the baby with the bottle can be extremely dangerous as the baby can easily choke on the liquid or spit up and choke on that.

  Formula feeding mothers need to put in extra time and money for trips to the store to buy supplies, as well as possible extra trips to the doctor's office because of more incidence of infections in formula/bottle fed baby.
- ✓ Breastfeeding offers a new mother an amazing chance to bond with her child
- ✓ It is important to note that a baby who is bottle fed for the first two weeks of life, will usually refuse to take the breast, even if the mother has an abundant supply.

Myth #23: Modern formulas are almost the same as breast milk

Fact:

- ✓ Infant formula is usually made from industrially modified cow milk or soy products.
- ✓ The quantities of nutrients are adjusted during the manufacturing process to make them more comparable to breast milk.
- ✓ The qualitative differences in the fat and protein cannot be altered, and the absence of anti-infective and bio-active factors remain.
- ✓ Powdered infant formula is not a sterile product and may be unsafe in other ways too.
- ✓ Moreover, formulas do not vary from the beginning of the feed to the end of the feed, or from day 1 to day 7 to day 30, or from woman to woman, or from baby to baby. Whereas, breast milk is made as required to suit the baby whereas formulas are made to suit every baby, and thus no baby.

Myth #24: Breastfeeding twins are too difficult to manage.

Fact:

- ✓ Breastfeeding twins are easier than bottle feeding twins, if breastfeeding is started early.
- ✓ Mothers may need help to find the best way to hold two babies to suckle, either at the same time, or one at a time.

Myth #25: Babies who are breastfed are likely to be "colicky". Janam Ghutti relieves the colic pain.

Fact:

- ✓ Colic occurs at certain times of day, typically the evening. The baby cries and may pull up his/her legs as if in pain. S/he wants to feed but is difficult to comfort. The cause is not clear.
- ✓ Babies with colic usually grow well, and the crying decreases after 3–4 months. Carrying the baby more, using a gentle rocking movement, and pressure on the abdomen with the hands or against the shoulder, may help.
- ✓ One of the most common unscientific remedy is to give janam ghutti, as it has been an age-old remedy for colic in most Indian households. Use of Janam Ghuti can do more harm than good by giving infection and/or inducing sleep.

Myth #26: A mother who has mastitis or breast abscess should not breastfeed.

Fact:

- ✓ In case of mastitis, improve the removal of breast milk and try to correct any specific cause that is identified. The mother should breastfeed the baby frequently and should avoid leaving long gaps between feeds. If breastfeeding is very painful, milk must be removed by expression to prevent progression of the condition.
- ✓ An abscess in the breast needs to be drained and treated with antibiotics. Breastfeeding should continue from the unaffected breast; feeding from the affected breast can resume once treatment has started.

Myth #27: A mother who smokes/drinks alcohol should not breastfeed.

Fact:

- ✓ It would be better if the mother does not smoke because smoking can reduce breast milk production temporarily. If the mother cannot stop or cut down smoking, then it is better she smokes (but not in the presence of the infant) and breastfeed than smoke and formula feed. Breastfeeding has been shown to decrease the negative effects of cigarette smoke on the baby's lungs.
- ✓ As is the case with most drugs, very little alcohol comes out in the breast milk. It is advisable that mother doesnot consume alcohol. However, the mother can take some alcohol and continue breastfeeding as she normally does. Alcohol consumption can reduce breast milk production temporarily, so mothers should be encouraged not to use alcohol in excess and given the opportunities and support to abstain.

CASE STUDY

Shruti is a 4-month-old baby who has been exclusively breastfed. She weighs 6.5 kg & 63.5 cm in length. Her mother asks the nurse that she may stop breastfeeding her baby when she returns to work full time in about 2 weeks. Since this is her first baby, she has asked many mothers for advice on feeding. They are encouraging her to start infant formula, fruits etc. right away. But the mother is concerned about choking on giving food.

a. What are the mother's nutrition concerns?

b. What questions should be asked to gather more information?

c. What assessment would be done?

d. Identify key areas of counselling for the mother. (Solution in Annex 1)

3.5 Guiding principles and techniques for complementary feeding

After 6 months of age, it becomes increasingly difficult for breastfed infants to meet their nutrient needs from human milk alone. Furthermore, most infants are developmentally ready for other foods at about 6 months. Breastfeeding should be continued till child is two years of age.

3.5.1 Principles of complementary feeding among breastfed children 6-23 months of age

1. Practise exclusive breastfeeding from birth to 6 months of age and introduce complementary foods after 6 months of age (180 days) while continuing to breastfeed.
2. Continue frequent, on-demand breastfeeding until two years of age or beyond.
3. Practise responsive feeding, applying the principles of psychosocial care.
4. Practise good hygiene and proper food handling.
5. Start after six months of age with small amounts of food and increase the quantity as the child gets older, while maintaining frequent breastfeeding.
6. Gradually increase food consistency and variety as the infant gets older, adapting to the infant's requirements and abilities.

7. Increase the number of times that the child is fed complementary foods as he/she gets older.
8. Feed a variety of foods to ensure that nutrient needs are met.
9. Use fortified complementary foods or vitamin-mineral supplements for the infant, as needed.
10. Increase fluid intake during illness, including more frequent breastfeeding, and encourage the child to eat soft, varied, appetizing, favourite foods. After illness, give food more often than usual and encourage the child to eat more.

3.5.2 Guiding principles for feeding non-breastfed children 6-23 months of age

1. Ensure that energy needs are met.
2. Gradually increase food consistency and variety as the infant gets older, adapting to the infant's requirements and abilities.
3. For the average healthy infant, meals should be provided four to five times per day, with additional nutritious snacks offered one or two times per day, as desired.
4. Feed a variety of foods to ensure that nutrient needs are met.
5. As needed, use fortified foods or vitamin-mineral supplements (preferably mixed with or fed with food) that contain iron.
6. Non-breastfed infants and young children need at least 400–600 mL/day of extra fluids in a temperate climate, and 800–1200 mL/day in a hot climate.
7. Practise good hygiene and proper food handling.
8. Practise responsive feeding, applying the principles of psychosocial care.
9. Increase fluid intake during illness and encourage the child to eat soft, varied, appetizing, favourite foods. After illness, give food more often than usual and encourage child to eat more

3.5.3 Types of complementary foods

Infants should receive thick porridge, dhal as first foods and gradually move to family foods by 12 months of age. Frequency of feeding should also gradually increase from 2-3 meals per day to 3-4 meals per day (Table 3.9)

TABLE 3.9: Practical guidance on quality, frequency and amount of food to offer children 6 – 23 months of age who are breastfed on demand

Age	Energy needed/ day in addition to breastmilk	Texture	Frequency (per/ day)	Amount of food usually consumed/ meal
6-8 months	200 kcal/day	Thick porridge, mashed foods	2-3 (1-2 snacks may be added)	2-3 tablespoons
9-11 months	300 kcal/day	Finely chopped/ mashed foods, finger foods	3-4 (1-2 snacks may be added)	½ of 250 ml cup

FIGURE 3.8:
4 types of diverse and nutrient rich food

12-23 months	550 kcal/day	Family foods. Chopped/ mashed if required	3-4 (1-2 snacks may be added)	¾ to full 250 ml cup

3.5.4 Responsive feeding

Optimal complementary feeding depends not only on what is fed but also on how, when, where and by whom a child is fed. Thus, responsive feeding is recommended. Responsive feeding is based on psychosocial care where in child is fed directly or supported in case older, offered variety of foods and patiently. Feeding time should also be a period of bonding and learning for the baby and caregiver. The key points to ensure responsive feeding include:

- Feeding infants directly and assisting older children when they feed themselves. Feeding should be done patiently and with encouragement. Children should not be force fed.
- Experiment with different food combinations, tastes, textures and methods if child refuses many foods.
- Minimize distractions during feeding sessions
- Keep eye-to-eye contact and talk while feeding to make it a learning experience

Child should be fed from a separate plate or bowl so that caregiver can assess the quantity of food consumed by the child.

3.5.5 Safe preparation and handling of complementary foods

Microbial contamination of complementary foods is a major cause of diarrhoeal disease, which is particularly common in children 6 to 12 months old. Safe preparation and storage of

complementary foods can prevent contamination and reduce the risk of diarrhoea. The use of bottles with teats to feed liquids is more likely to result in transmission of infection than the use of cups and should be avoided. All utensils, such as cups, bowls and spoons, used for an infant or young child's food should be washed thoroughly. Bacteria multiply rapidly in hot weather and more slowly if food is refrigerated. Larger numbers of bacteria produced in hot weather increase the risk of illness. When food cannot be refrigerated it should be eaten soon after it has been prepared (no more than 2 hours), before bacteria have time to multiply.

3.5.6 Difficulties in complementary feeding

Each child needs to be taught how to eat solid and semi-solid foods with patience and encouragement. Problems associated with complementary feeding are rarely due to medical reasons. Causes include: lack of active and responsive feeding of the child (often due to mother's multiple duties and/or due to care being passed to an older sibling), anatomical difficulties (for example, a severe cleft palate or oesophageal atresia) or more general illness, minor infections, such as cold and blocked nasal passages, intestinal infection, gastroesophageal reflux disease (which can also make feeding difficult, affect weight gain, and cause great stress for parents).

CASE STUDY

Ravi is a 2 years old, energetic boy who sleeps well and loves to run and gallop. Since last 3 months, his appetite has decreased, and he is reluctant to try new foods. He is weighing 13.5 kg and 91cm in height. His parents asked the nutritionist how they can get Ravi to eat foods he needs to grow.

a. What are the parents' nutrition concerns?

b. What questions would you ask to gather more information?

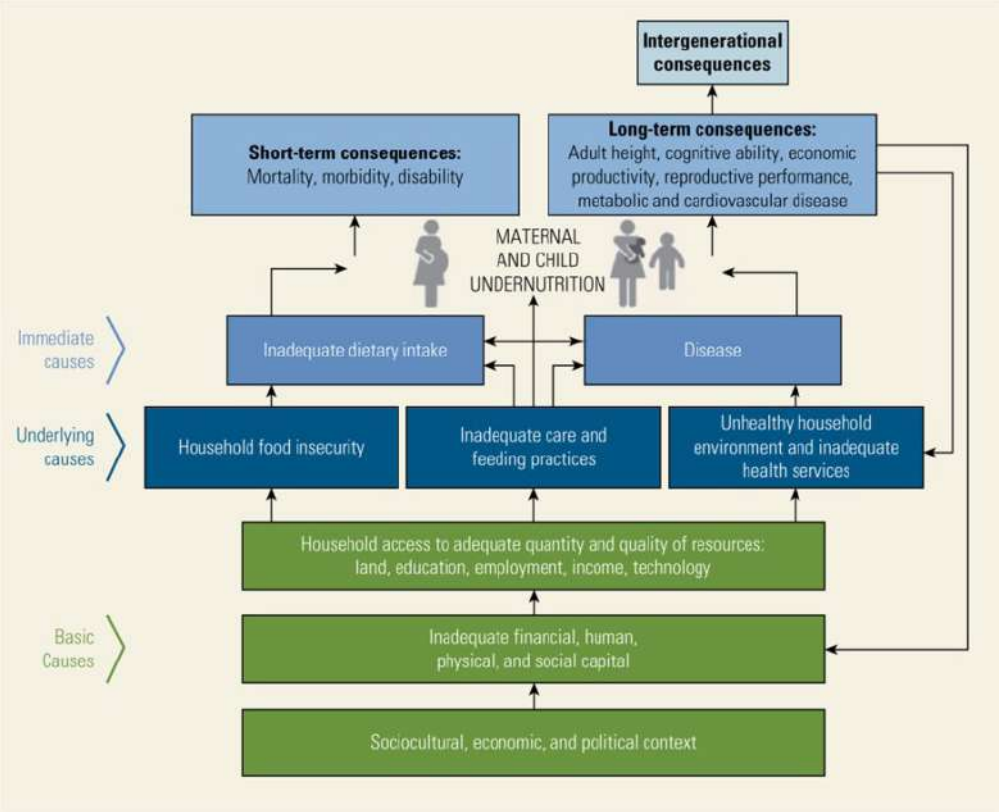
c. What assessment will you do?

d. Identify the areas of counselling. (Solution: Annex 1)

3.6 Undernutrition in children: classifications and risk factors

Undernutrition is the failure to eat enough food and absorb essential nutrients for growth, survival and perform well. Among children it manifests as moderate or severe acute malnutrition and in chronic forms as stunting. If a child's weight is not increasing, or if it is increasing more slowly than the standard curve for more than 1 month in babies less than 4 months of age, or four months in older children, then the child has *growth faltering*. Growth faltering is common in the first 2 years of life and may be the first sign of inadequate feeding in an otherwise healthy child. The child may be less active than others of the same age. Sometimes growth faltering is due to illness or abnormality. When a child is ill, the weight may decrease. Following a period of growth faltering, a recovering child should gain weight more rapidly than the standard curves until he or she returns to his or her original growth

FIGURE 3.9: Causes and consequences of child undernutrition



trend.

3.6.1 Measures of child nutrition status

Weight-for-age (underweight)

Weight-for-age reflects body weight relative to the child's age on a given day. A series of weights can tell whether or not a child's weight is increasing over time, so it is a useful indicator of growth. This indicator is used to assess whether a child is underweight or severely underweight, but it is not used to classify a child as overweight or obese. Because weight is relatively easily measured, this indicator is commonly used, but it cannot be relied upon in situations where the child's age cannot be accurately determined. Also, it cannot distinguish between acute malnutrition and chronic low energy and nutrient intake.

Weight-for-length/height (wasting)

Weight-for-length/height reflects body weight in proportion to attained growth in length or height. This indicator is especially useful in situations where children's ages are unknown (e.g. refugee settlements). Weight-for-length/height charts help identify children with low weight-for-height who may be wasted or severely wasted. These charts also help identify children with high weight-for-length/height who may be at risk of becoming overweight or obese. However, assessing weight-for-height requires two measurements – of weight and height – and this may not be feasible in all settings.

Length/height-for-age (stunting)

Length/height-for-age reflects attained growth in length or height at the child's age at a given visit. This indicator can help identify children who are stunted (or short) due to prolonged undernutrition or repeated illness. Children who are tall for their age can also be identified, but tallness is rarely a problem unless it is excessive and may reflect uncommon endocrine disorders. Acute malnutrition does not affect height.

MUAC

Another useful way to assess a child's present nutritional status is to measure the MUAC. MUAC below 115 mm is an accurate indicator of severe malnutrition in children 6–59 months of age. MUAC should be measured in all children who have a very low weight-for-age. MUAC can also be used for rapidly screening all children in a community for severe malnutrition.

New WHO growth standards based on Multicentre Growth Reference Study

The new growth standards are different from previous one in following ways-

- Study's selection criteria included specific health behaviours that are consistent with current health promotion recommendations (e.g., breastfeeding norms, standard Paediatric care, non-smoking requirements).
- It makes breastfeeding the biological "norm" and establishes the breastfed infant as the normative growth model. The previous reference was based on the growth of artificially fed children.
- Sample from the 6 countries - international standard (in contrast to the previous international reference based on children from one country-United States of America)
- Include new innovative growth indicators beyond height and weight that are particularly useful for monitoring the increasing epidemic of childhood obesity, such as the skinfold thickness.
- The study's longitudinal nature will also allow the development of growth velocity standards. Health care providers will not have to wait until children cross an attained growth threshold to make the diagnosis of under-nutrition and overweight since velocity standards will enable the early identification of children in the process of becoming under- or over-nourished.

Growth charts for girls and boys

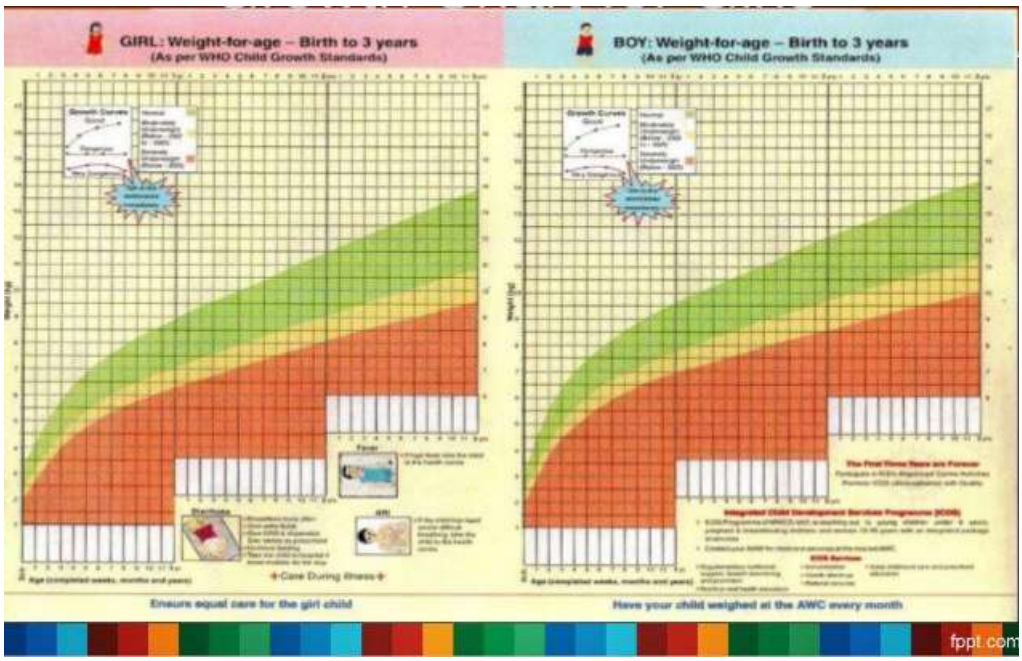


FIGURE 3.10: GoI endorsed growth charts with colour coding to screen for growth faltering

3.7 Measuring IYCF: indicators, tools and techniques

There are six core Indicators for measuring IYCF in a population.

1. **Early initiation of breastfeeding:** Proportion of children born in the last 24 months who were put to the breast within one hour of birth.

$$\frac{\text{Children born in the last 24 months who were put to the breast within one hour of birth}}{\text{Children born in the last 24 months}}$$

2. **Exclusive breastfeeding under 6 months:** Proportion of infants 0–5 months of age who are fed exclusively with breast milk.

$$\frac{\text{Infants 0–5 months of age who received only breast milk during the previous day}}{\text{Infants 0–5 months of age}}$$

3. **Continued breastfeeding at 1 year:** Proportion of children 12–15 months of age who are fed breast milk.

$$\frac{\text{Children 12–15 months of age who received breast milk during the previous day}}{\text{Children 12–15 months of age}}$$

4. **Introduction of solid, semi-solid or soft foods:** Proportion of infants 6–8 months of age who receive solid, semisolid or soft foods.

$$\frac{\text{Infants 6–8 months of age who received solid, semi-solid or soft foods during the previous day}}{\text{Infants 6–8 months of age}}$$

5. **Minimum dietary diversity:** Proportion of children 6–23 months of age who receive foods from 4 or more food groups.

$$\frac{\text{Children 6–23 months of age who received foods from} \geq 4 \text{ food groups during the previous day}}{\text{Children 6–23 months of age}}$$

6. **Minimum meal frequency:** Proportion of breastfed and non-breastfed children 6–23 months of age, who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more. The indicator is calculated from the following two fractions:

$$\frac{\text{Breastfed children 6–23 months of age who received solid, semi-solid or soft foods the minimum number of times or more during the previous day}}{\text{Breastfed children 6–23 months of age}}$$

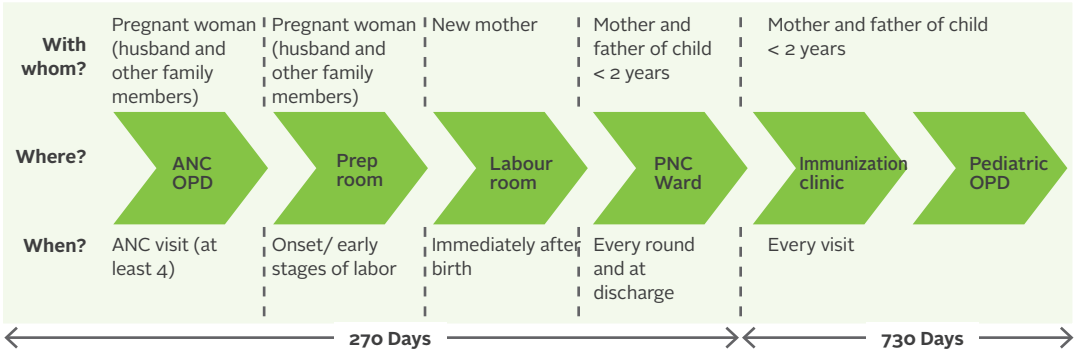
And

$$\frac{\text{Non-breastfed children 6–23 months of age who received solid, semi-solid or soft foods or milk feeds the minimum number of times or more during the previous day}}{\text{Non-breastfed children 6–23 months of age}}$$

3.8 IYCF counselling: critical contact points and protocols

Critical contact points have been identified in five-time periods within the 1000-day window of opportunity. These are: 1) First 90 days or the first trimester, 2) 91 to 270 days or second and third trimester, 3) 271 to 450 days: Lactating mother, new-born and infant (<6months), 4) 451 to 640 days: infants (6 to 11 months) and 5) 641 to 1000 days: young children (12 to

FIGURE 3.11: 1000 day "Window of Opportunity" for integrating MIYCN services in health facilities



For each of the five-time periods, the protocol providing evidence for the MIYCN intervention/s, services to deliver interventions, who should deliver these, when? and where? have been developed. These are available in the document titled "PROTOCOL: Delivering recommended Maternal Infant and Young Child Nutrition (MIYCN) interventions in medical colleges and associated hospitals" May 2018 by A&T. A summary of service provider's actions immediate at birth, within 48 hours of birth and other critical points till child is 24 months of age are presented in tables 3.9 a, b, c and d. [72]

TABLE 3.9A: Recommended nutrition interventions and services in intrapartum period

Nutrition interventions[72]	Services
Early initiation of breastfeeding (colostrum feeding and no prelacteal)	Before delivery: Informing family members especially mothers/mother -in -law and husband on need for early initiation of breastfeeding
	After delivery: Keeping new-born in skin to skin contact immediately after birth. Support and Counsel mother and relatives on breastfeeding initiation and issues-correct position, latching and feeding on demand
Delayed cord cutting	After stoppage of cord pulsations (2 to 3 mins after birth)
Prophylactic injection Vitamin K1 (Phytonadione injectable emulsion)	Administer intramuscular Vitamin K1 injection

TABLE 3.9B: Recommended nutrition interventions and services within 48 hours of delivery

Nutrition interventions	Services
Promote exclusive breastfeeding till 6 months to achieve optimal growth, development and health	Assess breastfeeding in every baby before planning for discharge. For babies unable to suckle, explain expression of breastmilk, storage and feeding with paldai or cup and spoon. Make mother practice before discharge.
	Opt for alternate feeding only when medically indicated
	Advise mother and family member to seek advice/ treatment immediately if there are any challenges in feeding at home

72 Based on relevant GoI guidelines as well as World Health Organisation recommendations as per Essential Nutrition Actions, 2011 and WHO, Infant and young child feeding. Model chapter, textbook for medical students and allied health professionals.

TABLE 3.9B: ***Contd.***

Nutrition interventions	Services
Lactating mothers to continue IFA for 180 days postpartum and calcium supplementation till 6 months	Prescribe 180 IFA and 360 calcium tablets to continue as per pregnancy routine
Initiate Kangaroo Mother Care (KMC) [73]	If new-born weighs below 2000gms, counsel on benefits and process for KMC to mother and attendant
	Support mother in initiating KMC
Advise on self and baby care	Advise on diet and rest, avoiding intake of alcohol and tobacco, prevent infection of mother and baby, exclusive breastfeeding
	Advise on improving quantity and diversity of food (or continue to eat optimal diet)
Complete childhood vaccination	BCG, first dose pentavalent, Hep B and OPV administered

TABLE 3.9C: **Recommended nutrition interventions and services any hospital visit (< 6 months)**

Nutrition interventions	Services
Growth monitoring	Measure weight and length. Chart weight for age.
Screening for SAM*	Growth faltering infants checked for bilateral pitting edema, referred to NRC or provided counselling on dietary intake (follow SAM protocol)
Promote exclusive breastfeeding till 6 months to achieve optimal growth, development and health	Take history of infant feeding using a 24-hour recall tool
	Counsel on exclusive breastfeeding, benefits for baby and mother, breastfeeding in illness
	If mother has to be away from baby, explain expression of breastmilk and how to feed with cup or paldai
Orientation to complementary feeding with continued breastfeeding (infants 4-5 months)	Provide information of types of first foods, feeding techniques
Lactating mothers to continue iron for 180 days postpartum and calcium tablets till 6 months	Assess compliance to micronutrient supplements and give more tablets if needed
Counsel on self and baby care	Counsel on diet and rest, avoiding intake of alcohol and tobacco, hygiene to prevent infection of mother and baby, exclusive breastfeeding till 6 months

**more commonly done for infants closer to 6 months of age*

TABLE 3.9D: **Recommended nutrition interventions and services for infants 6 to 23 months**

Nutrition interventions	Service
Growth monitoring	Measure baby's weight and length, record
	Update growth chart
Screening for SAM	Growth faltering infants should be checked for bilateral pitting edema and referred to NRC or provided counselling on dietary intake
Counselling on age appropriate complementary feeding with continued breastfeeding	Counselling on frequency, consistency and quantity of complementary feeding changes

73 Government of India. Ministry of Health and Family Welfare. Operational guidelines: Kangaroo Mother Care and optimal feeding for low birth weight infants. 2014

TABLE 3.9D: *Contd.*

Nutrition interventions	Service
Vitamin A supplementation (100 000 IU if 6-11 months/ 200 000 IU if 12-23 months)	Administer oral Vitamin A supplement when child visits for measles vaccination
IFA supplementation for infant (20 mg iron and 100 mcg folic acid syrup)	IFA supplementation is biweekly through the Anganwadi or sub-centre. Mother/caregiver is informed of this and given a dose if not initiated already. Do not recommend supplementation if infant has fever, diarrhoea or SAM
Deworming (bi-annual)	DOT, half tablet 400 mg albendazole

3.8.1 Types of counselling

The type of counselling is determined by the target audience. Thus, there is individual, family, couple and group counselling. Some concepts have been covered under section 2.10 on Listening and learning.

Steps and tips

The counselling process is a planned, structured dialogue between a counsellor and a client. It is a co-operative process in which a trained professional helps a person called the client to identify sources of difficulties or concerns that he or she is experiencing. For effective counselling, some basic communication skills are required. Positive counselling skills are important for the successful counselling services.

1. **Good posture**

   The counsellor must adopt open posture and leaning forwards towards the client. Cross legged position is to be avoided.

2. **Listening skills**

   - Look at the mother/caregiver
   - Have a nice quiet mouth
   - Listen attentively what He/she is saying
   - Repeat/paraphrase
   - Check the understanding of the client

3. **Use helpful non-verbal communication**

   - Keep your head level with the mother (or caregiver).
   - Pay attention. Reduce physical barriers. Avoid using mobile phones or any type of distractions while talking to the client.
   - Always make the mother feel that you have time for her, do not appear in a hurry, sit down, greet the mother, smile at her, watch the mother breastfeed her baby and wait for her replies.
   - Touch appropriately.

4. **Use open ended approach**

   - Ask open questions, try not to ask questions which can be answered by Yes or No.

     Example of open questions

     1. Tell me about the breast-feeding pattern of the child?
     2. How do you feel?
     3. How is the sleep pattern of the child?

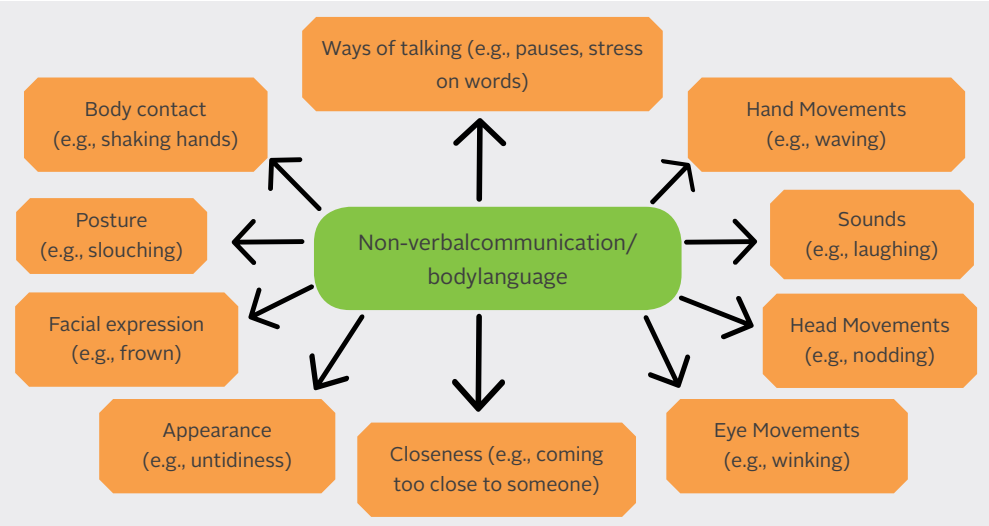
   - Reflect on what the mother (or caregiver) says and use responses and gestures that show interest.

- Avoid using "judging" words.
- Don't react to an unexpected response or be judgemental. Attempt to understand why the mother / caregiver said so and probe for reasons

5. Building confidence and giving support skills

- Accept what a mother (or caregiver) thinks and feels. Let the mother (or caregiver) talk through her or his concerns before correcting any wrong ideas or misinformation. This helps to establish confidence.
- Listen carefully to the mother's (or caregiver's) concerns.
- Recognize and praise what a mother (or caregiver) and child are doing correctly.
- Give practical help.
- Give a little, relevant information at a time.
- Use simple language that the mother or caregiver will understand.
- Use appropriate Counselling Card(s) or Take-Home Brochure(s).
- Make one or two suggestions, not commands.

FIGURE 3.12: Non-verbal communication



Three step counselling helps counsel, problem solve and reach an agreement with mothers (or caregiver) about infant and young child feeding[74].

The 3-Steps are **ASSESS, ANALYZE AND ACT.**

Step 1: ASSESS: ask, listen and observe

- Greet the mother (or caregiver), using friendly language and gestures.
- Ask some initial questions that encourage her (or him) to talk.
- Listen to what is being said and observe what is going on using your listening and learning and building confidence and giving support skills.
- Assess the age appropriate feeding practice(s) and the condition or health of the child and mother (or caregiver).

Step 2: ANALYSE

- Identify difficulty and if there is more than one – prioritize the difficulties
- Decide if the feeding you observe is age appropriate and if the condition or health of the child and mother (or caregiver) is good.
- If there are no apparent difficulties, praise the mother (or caregiver) and focus on providing information needed for the next stage of the child's development.

74 https://www.unicef.org/nutrition/files/IYCF_Flip_Chart-SAATHII_(Pictures).pdf,

- If one or more feeding difficulty is present, or the condition or health of the child or mother (or caregiver) is poor, prioritize the difficulties.
- Answer the mother's (or caregiver's) questions if any.

Step 3: ACT

- Discuss, suggest a small amount of relevant information, agree on doable action with the help of the mother.
- Depending on the factors analysed above, select a small amount of information to share with the mother or caregiver that is most relevant to her or his situation.
- Be sure to praise the mother or caregiver for what she or he is doing well.
- Help the mother or caregiver select one option that she or he agrees to try, to address or overcome the difficulty or condition that has been identified. This is called reaching-an-agreement.
- Suggest where the mother or caregiver can find additional support.
- Refer to the nearest health facility if appropriate and/or encourage participation in educational talks.
- Confirm that the mother or caregiver knows where to find a community volunteer and/or other health worker.
- Thank the mother or caregiver for her or his time.
- Agree on when you will meet again, if appropriate.

3.8.2 Building confidence, giving support and checking understanding

It is necessary that for the breastfeeding mother to have confidence in herself. This confidence ensures success in breastfeeding. This is especially important for first time mothers, who often lose confidence, yield to pressures from family and friends, and start artificial feed for the baby. Your guidance and a helping hand will certainly re-build her confidence to resist these pressures. As a worker, you need to counsel mother and create trust through your behavior and give support, to build mother's self esteem.

These skills will develop slowly and you will learn them with practice.

You can take following steps for building confidence in the mother.

1. **Accept what she thinks and feels**

   For example:

   Mother says: "I give him/her water because days are warmer now".

   Acceptance by worker: "You do feel that sometimes baby needs water".

2. **Recognize and praise the right things she does for her baby.**

   For example:

   Mother says: "My child is 15 months old and still breastfeeding. She also eats dalia, kh-ichdi, fruits, etc".

   Praise by worker: It is good that you are still breastfeeding your child and also giving her complementary foods.

   Praising the mother and her practices in front of others, encourages the mother and also inspires others. After this, the mother will readily accept your suggestions.

3. **Practical help given at the appropriate time increases confidence of a mother.**

   For example:

Mother says: "No, I have not breastfeed him yet, my breasts are empty and it is too painful to sit up". Practical help by worker: "Let me make you comfortable" and you provide a pillow or chair for her. In this situation, mother needs your help rather than your advice. You can also help in cleaning and holding the baby or in giving food.

4. **Give information which is of immediate relevance.**

   For example:

   To the new mother who wants to give prelacteal feed to the baby.

   Relevant information by worker: At this age, the infant needs only colostrum.

   Checking understanding

   Make sure mother remembers / learns what you have said or helped

   For example:

   After giving information to a new mother about colostrum feeding, you may ask:

   "What first feed you will give to your baby ".

   If she says "only colostrum", praise her.

   If she says something different again, reinforce importance of colostrum feeding without being critical, judgemental or aggressive.

5. **Use simple language**

   For example:

   "Exclusive breastfeeding should be done for the first 6 months".

   Instead, Worker can say in simple language: "the baby does not need anything other than breastmilk till s/he is 6 months old".

6. **Give suggestions instead of commands.**

   For example:

   "Feed your baby by the cup"

   Instead worker can suggest: Some mothers feed their babies by the cup.

   Or You may feed your baby by cup.

   With practice and experience, it will be easier for you to decide, when and how to counsel the mother.

   (Source: Ministry of Health and Family Welfare, Government of India. MAA. Infant and young child feeding. Training module for ANMs. 2016)

3.9 Comprehensive Lactation management and Human Milk Banking

High to less complex models of lactation management centres can be set up depending upon the need of health facilities in terms of number of newborns requiring donor human milk, availability of space and human resources.

Government of India has come up with national guidelines for operationalizing these different types of lactation management centres. The lactation management centres would be established at three levels:

I. **Comprehensive Lactation Management Centres (CLMCs)**

   Comprehensive Lactation Management Centres (CLMCs) will be established in phases:

   First Phase: CLMCs will be established at all Medical Colleges that meet the pre-

requisites on assessment carried out by State/District Quality Assurance Committee.

Second Phase: In the second phase, CLMCs will be established in the District Hospitals that meet the pre-requisite for establishing CLMCs on assessment carried out by State/ District Quality Assurance Committee.

The CLMCs will follow technical protocols with respect to adequate space, requisite manpower and equipment. It shall also conform to quality standards and protocols with respect to donor screening, collection, processing, storage and dispensation of human milk.

II. Lactation Management Units (LMUs)

LMUs can be established at all sub-district hospitals and FRUs that meet the prerequisite criteria on assessment carried out by State/District Quality Assurance Committee. These LMUs will facilitate expression and collection of mother's own milk only. LMUs will conform to the quality standards and technical protocol with respect to collection, storage and dispensation of mother's milk for consumption by her own baby admitted at SNCUs.

III. Lactation Support Units (LSUs)

To maintain the continuum of care, Lactation Support Units (LSUs) will be constituted in all

Delivery Points by forming a dedicated team of IYCF trained staff to provide round the clock breastfeeding support, lactation counselling and Kangaroo Mother Care (KMC) support to mothers. The lactation support unit would have a dedicated space/room where lactating mothers visiting the health facility can breastfeed in privacy. Information about breastfeeding space will be prominently displayed for providing greater visibility and support for breastfeeding. The identified space/room for breastfeeding as per Mother's Absolute Affection (MAA) guidelines of MoHFW under MAA program will be utilized for this purpose.

The Lactation Support Unit would ensure that the health facility is well equipped with necessary IEC material and display of IEC on breastfeeding in ANC ward/delivery ward and ANC clinics as per MAA Guidelines of MoHFW.

National and Zonal Level Reference Centres

In addition to establishment of facility based lactation management centres, it is envisioned to re-designate the well performing CLMCs as Reference Centres in each zone- north, east, west, south and central – which would serve as technical resource centres. The technical resource centres would provide training, quality audits and technical support for establishing new CLMCs and LMUs. These resource centres would also facilitate in capacity building of the State/District Program Manager Unit for monitoring of CLMCs and LMUs as well as training of staff of CLMCs and LMUs.

When can the donor milk be used:

Due to inescapable circumstances, if the mother's own milk is not available or available in less quantity as per requirement, only then Donor Human Milk (DHM) is recommended to be used to meet the short-term and long-term needs of the new-born admitted in NICUs/SNCUs with the following conditions- prematurity, LBW, malabsorption and feeding intolerance. National guidelines recommend DHM to be dispensed only on prescription from the physician treating the new-born who is admitted at that health facility.

Following points would be strictly considered for human milk donation process and subsequent use.

- The mother should donate milk after providing for her own baby.
- Breast milk donation will only take place after receiving informed consent, and it will be purely a voluntary activity by the donor mother i.e. donation of breast milk would

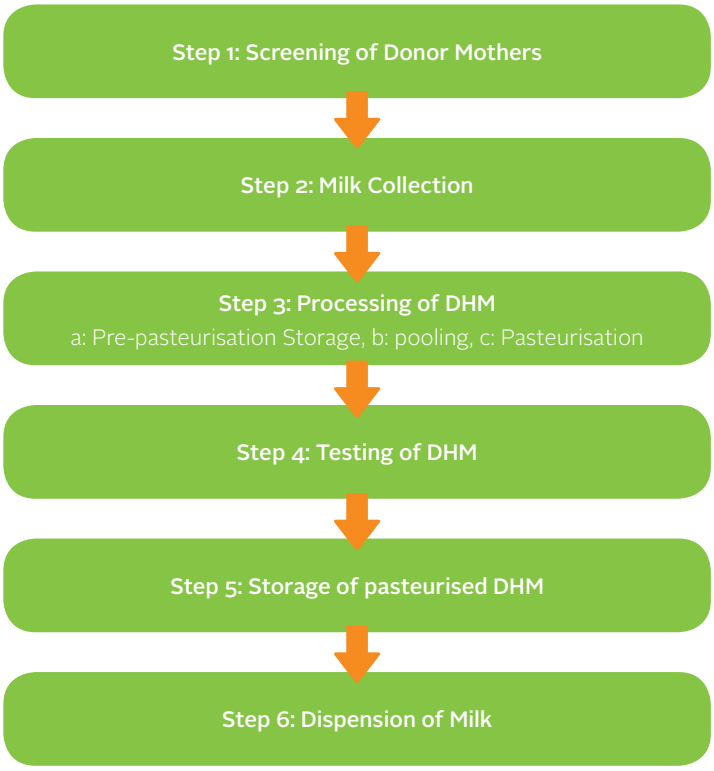
be non-incentivised and no benefits whatsoever in cash or kind would be provided to the donor mother.

- DHM dispensing requires informed consent from parent/guardian of the new-born who would be receiving DHM.
- The DHM in no case is allowed to be used for any other purpose apart from fulfilling the feeding requirement of the admitted sick babies, and never for any commercial purposes.

If supplies of DHM are sufficient, milk may also be dispensed by prescription to the infants less than 6 month, old admitted at that facility where CLMC is situated, in the following conditions:

- Lactation failure/insufficient milk as deemed necessary following lactation counselling and support
- Adoption
- Illness in the mother requiring temporary interruption of breastfeeding
- Health risk to the infant from the milk of the biological mother
- Death of the mother

FIGURE 3.13: Algorithm for CLMC processes: Six basic steps



3.10 Conventions and legislation in support of IYCF

3.10.1 ILO Maternity Protection Convention, 2000 (No. 183)

Maternity protection at work is essential for safeguarding the health and economic security of women and their children. This consensus is reflected in the international labour standards of the ILO, which set out basic requirements of maternity protection at work. ILO Maternity Protection Convention No. 183, adopted by ILO Member States in 2000, covers:

- 14 weeks of maternity leave, including 6 weeks of compulsory postnatal leave;
- cash benefits during leave of at least two thirds of previous or insured earnings;
- access to medical care, including prenatal, childbirth and postnatal care, as well as hospitalization when necessary;
- health protection: the right of pregnant and nursing women not to perform work prejudicial to their health or that of their child;
- breastfeeding: minimum one daily break, with pay;
- employment protection and non-discrimination.

Few countries have ratified this Convention, although many countries have adopted some provisions through ratification of previous ILO maternity protection conventions. Health professionals have an important role to advocate for good legislation on maternity protection, and hospitals and other health facilities should offer maternity leave and breastfeeding support for their own personnel.

3.10.2 International Code of Marketing of Breast-milk Substitutes (IMS Act)

The aim of the Code is to contribute to the provision of safe and adequate nutrition for infants, by the protection and promotion of breastfeeding, and by ensuring the proper use of breastmilk substitutes, when these are necessary, on the basis of adequate information and through appropriate marketing and distribution. The main elements of the Code deal with information and education, advertising and promotions to mothers and health workers, labelling, quality and implementation and monitoring. To maximize the contribution that the Code can make to improve breastfeeding, given the many examples of non-compliance, in-country monitoring of its implementation should be carried out. Companies found to be committing violations should be sanctioned by the government entity charged with Code enforcement. Having all companies that produce infant formula compete for market share in a manner consistent with the Code will benefit these companies by ensuring that no company is given an unfair advantage.

More information on the Code is available here: https://www.who.int/nutrition/publications/code_english.pdf

3.10.3 The Infant Milk Substitutes, Feeding Bottles and Infant Foods (Regulation of Production, Supply and Distribution) Act, 1992 as Amended in 2003 (IMS Act)

The Act covers IMS, infant foods and feeding bottles. The IMS Act prohibits advertisements, distribution of free samples as well as any promotion or educational material on these products. It mandates labels to hold message on promotion of breastfeeding 'MOTHER'S MILK IS BEST FOR YOUR BABY' in English and local language, along with restriction on any pictures of women/infants or use of phrases to promote the product. Direct contact with any pregnant woman or mother of an infant to promote these products is also prohibited. Further, person who produces, supplies, distributes or sells IMS is prohibited from offering or giving any contribution or pecuniary benefit to a health worker or any association of health workers, including funding of seminar, meeting, conferences, educational course, contest, fellowship, research work or sponsorship. In India, health providers and facilities are not only responsible for compliance to the IMS Act but also for reporting any violations of the IMS Act to the Ministry of Health and Family Welfare and Ministry of Women and Child Development. Violation of the Act can lead to imprisonment and financial penalty (Table 3.10).

The IMS Act 1992 is available here: https://wcd.nic.in/sites/default/files/infantmilkpact1.pdf

The IMS Act 2003 Amendment is available here: http://www.bpni.org/docments/IMS-act.pdf

TABLE 3.10: Dos and Don'ts's for health care providers and facilities under IMS Act

Dos	Don't s
Promote breastfeeding at the safest, healthiest and most nourishing methods of feeding to all mothers and families	Do not advertise or promote infant milk substitutes, feeding bottles or infant foods
Encourage and support mothers to place babies skin to skin and start breastfeeding within the first hour after birth	Do not give an impression or create a belief that feeding infant milk substitutes and infant foods are equivalent to or better than mother's breastmilk
Provide skilled support and counselling to support mothers sustain breastfeeding	Do not demonstrate how to use formula for children under two years of age
Inform mothers and their family members the hazards of improper use of infant milk substitutes, feeding bottles and infant foods	Do not allow companies selling or producing food products for children under two years of age to display products or materials in your health facility
In rare cases when a mother faces difficulty in breastfeeding, advise use of expressed breastmilk or seeking support from a lactation management expert.	Do not accept money, gifts or funding for seminars, meetings, conferences, educational courses, contests, fellowships, research work, or sponsorships from manufacturers, suppliers or distributors with the intent of promoting infant milk substitutes, feeding bottles or infant foods.

3.10.4 Global strategy for infant and young child feeding

The Global strategy for infant and young child feeding, adopted by the World Health Assembly (WHA) and the UNICEF Executive Board in 2002, provides the framework for action to protect, promote and support breastfeeding. It builds on key global instruments including- the International Code of Marketing of Breast-milk Substitutes and subsequent relevant WHA Resolutions (referred to as the Code); BFHI and the ILO Maternity Protection Convention No. 183. The Global strategy reaffirms the four operational targets of the 1990 Innocenti Declaration on the protection, promotion and support of breastfeeding and includes additional targets for feeding infants and young children. These include:

1. appointing a national breastfeeding coordinator;
2. ensuring that every facility providing maternity services fully practises all the "Ten steps to successful breastfeeding";
3. giving effect to the Code;
4. enacting legislation to protect the breastfeeding rights of working women;
5. developing, implementing, monitoring and evaluating a comprehensive policy on infant and young child feeding;
6. ensuring that health and other relevant sectors protect, promote and support exclusive
7. breastfeeding for six months and continued breastfeeding up to two years of age or beyond;
8. promoting timely, adequate, safe and appropriate complementary feeding with continued
9. breastfeeding;
10. providing guidance on feeding infants and young children in exceptionally difficult circumstances;
11. considering new legislation or other measures as part of a comprehensive policy on infant
12. and young child feeding to give effect to the Code and subsequent WHA resolutions.

3.11 Guidelines on IYCN

Essential nutrition actions. Improving maternal, newborn, infant and young child nutrition. WHO, 2011.

The WHO's ENAs, 2011, provides recommendations with evidence on improving maternal nutrition as well as IYCN. http://www.who.int/nutrition/publications/infantfeeding/essential_nutrition_actions/en/

National guidelines on infant and young child feeding. Ministry of Woman and Child Development, Government of India. 2004.

Ministry of Woman and Child Development released guidelines on IYCF in 2004 with recommendations on breastfeeding, complementary feeding, feeing in difficult circumstances as well as institutional responsibilities for promotion of optimal IYCF. It also provides operational guidance on promoting IYCF detailing the roles of government, non-government organizations, professional bodies, commercial enterprises and development agencies. http://www.wcd.nic.in/sites/default/files/nationalguidelines.pdf

Guidelines for enhancing optimal infant and young child feeding practices. Ministry of Health and Family Welfare, Government of India, 2013.

These guidelines were developed for use by state and district level reproductive and child health mangers and implementers. The guidelines provide operational guidance on how to implement IYCF interventions, updated technical information on IYCF including feeding low birth weight infants and HIV affected children.

http://www.nrhmorissa.gov.in/writereaddata/Upload/Documents/Operational%20Guide%20IYCF.pdf

Mother's Absolute Affection. Programme for promotion of breastfeeding. Operational guidelines. Ministry of Health and Family Welfare, Government of India. 2016.

MAA is a nation-wide government program to promote breastfeeding in-facility and in the community. The foru components of this program are:

1. Building enabling environment and demand generation through mass media and mid media activities
2. Capacity building of community health workers
3. Capacity building of ANMs/ Doctors on lactation management and reinforcement of breastfeeding at delivery points
4. Monitoring, recognition through awards for individuals and facilities.

The program aims to reach around 3.9 crore pregnant and lactating mothers, 8.8 lakh ASHAs to conduct mobilization and 18,000 birthing facilities to be skilled in lactation management.

Operational guidelines and related resources are available at: http://nhm.gov.in/nrhm-updates/536-maa-programme.html

Protecting promoting and Supporting Breastfeeding in facilities providing maternity and newborn services: the revised Baby Friendly Hospital Initiative. Implementation Guidance. WHO, UNICEF.2018.

The BFHI guidance was revised in 2018 in accordance with WHO, 2017 recommendation so on promoting, protecting and supporting breastfeeding in facilities. The guidance provides the ten steps with revisions as well as a comparison sheet for readers to note the modifications made on the original 1989 BFHI guidelines.

https://www.who.int/nutrition/publications/infantfeeding/bfhi-implementation-2018.pdf

Anemia Mukt Bharat. Intensified National Iron Plus Initiative. Operational guidelines for program managers. Ministry of Health and Family Welfare, Government of India. 2018.

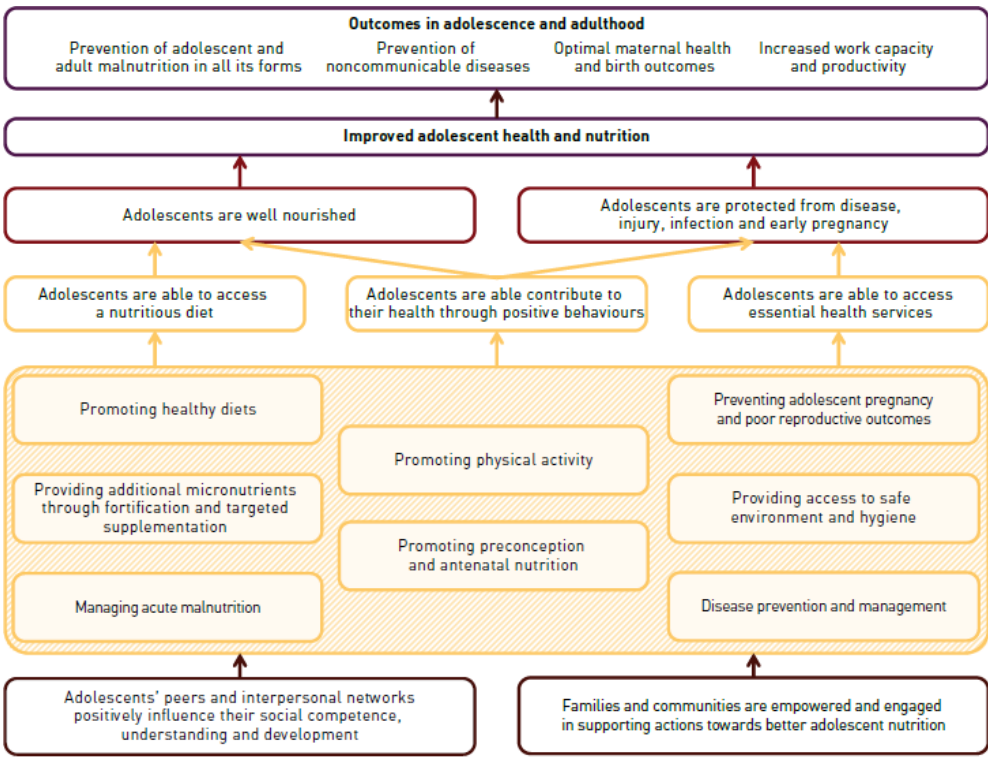
In addition to services mentioned under section 2.9 for pregnant women and lactating mothers, the guidelines also recommend bi-weekly IFA supplementation for children 6 to 59 months using 1ml IFA syrup equivalent to 20 mg Iron and 100 mcg folic acid.

3.12 A peek into adolescent nutrition

Adolescent period is spread almost over a decade. It is characterized by rapid increase in height and weight, hormonal changes, sexual maturation and wide swings in emotion. Investment in adolsecnt nutrition has life long benefits for individuals, improved nutritonal outcomes for future progeny and long term economic benefits (Figure 3.14)

Adolescent growth spurt starts at about 10-12 years in girls and two years later in boys. The annual peak rates for height and weight are 9-10 cm and 8-10 kg. Development of critical bone mass is essential during this period as this forms the ground for maintaining mineral integrity of the bone in later life. Adolescent girls are at greater physiological stress than boys

FIGURE 3.14 Framework for interventions and determinant of adolescent nutriton



because of menstruation. Their nutritional needs are of particular importance as they have to prepare for motherhood. All these rapid anabolic changes require more nutrients per unit body weight.

Requirements for energy, protein, fat, calcium and iron are higher among adolescent girls than those for non-pregnant, non-breastfeeding adult women (Table 3.11). Requirements for other nutrients like Vitamin A, B complex and ascorbic acid are comparable to that of adult women. A balanced diet for an adolescent girl which will meet these requirements is presented in table 3.12.

TABLE 3.11
RDA for energy, protein, fat, calcium and iron, adolescent girls (10-17 years)

Age	Body weight (kg)	Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)
10-12	35.0	2010	40.4	35	800	27
13-15	46.6	2330	51.9	40	800	27
16-17	52.1	2440	55.5	35	800	26

TABLE 3.12:
Balanced diet for adolescent girls

Food group	Portion size (g)	10-12 years		13-15 years		16-17 years	
		Number of portions	Total quantity (g)	Number of portions	Total quantity (g)	Number of portions	Total quantity (g)
Cereals and millets	30	8	240	11	330	11	330
Vegetables	300	4	1200	4	1200	5	1500
Fruits	100	1	100	1	100	1	100
Milk (cow) and products	100	5	500	5	500	5	500
Pulses	30	2	60	2	60	2.5	75
Fats /oils	5	7	35	8	40	7	35
Sugars	5	6	30	5	25	5	25

3.12.1 Adolescent pregnancy

Pregnant adolescents can be considered to be at nutritional risk, particularly girls who conceive within two years of menarche. These young mothers are likely to enter pregnancy with depleted nutrient reserves because their own adolescent growth imposes a heavy demand, and these nutritional deficits, particularly folate, iron and vitamin B_{12}, are compounded during pregnancy. Age has little effect on breast milk volume, so adolescents should be able to breastfeed their infants adequately. It is important for adolescents who are breastfeeding to have adequate energy intakes to maintain their own growth and the growth of their infants. It is especially important that they consume adequate calcium to maintain their bone calcium status.

Guidelines

Among the nutrition relevant guidelines, adolescents are captured under the iron intake/anaemia prevention guidelines. Government of India recommends weekly iron supplementation for non-pregnant, non-breastfeeding adolescent girls (10-19 years) in addition to consumption of iron, folate and vitamin C rich foods and following hygiene practices. WHO has released guidelines on "Implementing effective actions for improving adolescent nutrition" which can be accessed from **http://www.who.int/nutrition/publications/guidelines/effective-actions-improving-adolescent/en/**

Government of India recommends weekly iron and folic acid supplementation (WIFS) for both in and out of school adolescent girls. Recommendations are part of the National Iron Plus Initiative.

ANNEXURES

Annex 1:
Solutions to case studies

Solutions to case study on breastfeeding

a. Whether to feed her baby breast milk or infant formula?

   When to introduce solid foods, what foods to introduce first?

   How to prevent choking on foods?

b. Have you considered expressing your breast milk?

   Would you have a place to store the milk?

   When you return to work, could you breastfeed your baby in the morning and evening and have others to feed your baby expressed milk in the day?

   What type of infant formula do you plan to feed your baby with? Is it iron fortified?

   Do you have any concerns about the infant formula (cost, preparation etc.)?

   Do you have any questions or concerns about feeding your baby?

c. Measure and plot weight for age, height for age and weight for height. Assess developmental readiness for supplemental foods. Infants are ready to eat supplemental foods by about 4-6 months, when their suckling reflex has changed to allow co-ordinated swallowing, they can sit with support and they have good head and neck control.

d. Breastfeeding an infant exclusively for about the first six months provide ideal nutrition and supports the best possible growth and development.

   - The infants must be developmentally ready before being introduced to new foods and textures.
   - Choking can be a problem for infants because they may not have enough muscle control to chew and swallow foods properly. Infants can choke on foods that are small or slippery or dry & difficult to chew.
   - If breastfeeding is not possible (including feeding expressed breastmilk) Iron fortified infant formula may be used.

SOLUTIONS TO CASE STUDY ON COMPLEMENTARY FEEDING

a. How to get Ravi to eat foods he needs to grow? How to make meal times more enjoyable?

b. Do you have any concerns about your child's eating behaviour or growth?

   How would you describe your child's appetite? Good, fair or poor

   Do you have appropriate feeding utensils?

   Do you enjoy sharing meals with your child?

   Do you have any concerns about the food served to him when he is away from home?

   Are you concerned about having enough money to buy food?

c. Measure and plot weight for age, height for age and weight for height.

   - Evaluate the child's progress in developing eating skills (chewing and swallowing)
   - Screen the child for iron deficiency anaemia or if risk factors are present.

d. Emphasize parents that children need healthy meals and snacks at scheduled times throughout the day.

   - Encourage parents to give the child opportunities to develop his eating skills by offering a variety of foods.

- Tell children that children are unpredictable in the amounts and types of foods they eat, from meal to meal and from day to day.
- Reassure parents that food aversions in children are common. Smaller servings of the favoured food can be offered, along with other foods to ensure that child eats a variety of foods.
- Tell parents that they can encourage the child to eat new foods by offering small portions.

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