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2nd Edition

Basic Pediatric Nutrition



Madhu Sharma

Foreword
BNS Walia

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4
CHAPTER

Feeding of Infants (0–6 Months)

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INTRODUCTION

The first consideration that comes to mind when we talk of feeding infants is the newborn child, and feeding a newborn obviously takes us to the most natural God given gift to the mother, that of breast milk. As soon as the child is born, nature prepares both, the mother and the baby to make the best of this natural gift. Soon after birth the mother starts secreting milk and it requires an effort on the part of the baby to suck, so that secretion is further enhanced. In our country from generations this gift of nature is well accepted and justified because the thought of feeding her child comes naturally to the mother and she is mentally geared to do so. The baby also responds spontaneously to the mother's love and the natural instinct of suckling is smoothly initiated. But, unfortunately, in our own country over the years this spontaneous practice of making the best of 'Nature's Gift' is slowly eroding with the result that both mother and child face a lot of problems. Therefore, to bring our attention to this problem and help the mother revert to the dying practice of utilizing nature's gift, WHO has dedicated one week (1–7th August) every year as 'Breastfeeding Week.'

To begin with we shall first discuss why breastfeeding is important and the various factors associated with failure to feed or 'nurse.'

ADVANTAGES OF BREASTFEEDING

The main advantages of breastfeeding are as follows:

- It is **a complete food** by itself for the baby till 6 months of life in all respects. The proportion of all macro- and micronutrients are such that it is tailor made for the newborn. It is rich in fats, especially the essential fatty acids and the protein quality is just right for the baby. It is unique that it is rich in lipase an enzyme which is poor in other sources of milk
- It has water content which is adequate to meet the total requirement of the baby in the driest of summers. There is **no need to feed water as long as the baby is exclusively breast fed**. Offering water to a baby on breast feeds

Table 4.1: Nutritive values of various types of milk

Nutrients	*Human milk*	*Cow's milk*	*Buffalo's milk*	*Goat's milk*
Calories (kcal)	65	67	117	72
Proteins (g)	1.1	3.2	4.3	3.3
Fat (g)	3.4	4.1	6.5	4.5
Carbohydrates (g)	7.4	4.4	5.0	4.6
Calcium (mg)	28	120	210	170
Phosphorous (mg)	11	90	130	120
Sodium (mg)	-	73	19	11
Potassium (mg)	-	140	90	110
Iron (mg)	-	0.2	0.2	0.3
Vitamin A (µg)	41	53	48	55
Thiamine (mg)	0.02	0.05	0.04	0.05
Riboflavin (mg)	0.02	0.19	0.10	0.04
Niacin (mg)	-	0.1	0.1	0.3
Folic acid (µg)	-	8.5	5.6	1.3
Vitamin B12 (µg)	0.02	0.14	0.14	0.05
Vitamin C (mg)	3	2	1	1

Source: 2, Goplan C, Rama Shastri BV, Balasubramanian SC, NIN, ICMR, 2012

can actually cause a reverse effect of reducing the mother's milk output by suppressing her prolactin concentration in the plasma. This fact has been well demonstrated by studies from Brazil by WHO.[1] It was shown that introduction of water or tea even if continuing breast feeds were twice as likely to stop breastfeeding before 3 months compared to those who were fed exclusively for 6 months

- It **is rich in antibodies** in the form of immunoglobulins and leucocytes, which help the baby fight against any infections. A bacterium called *lactobacillus bifidus* present in breast milk prevents the baby from possible infections. The breast milk protein consists of whey protein (80%) in the form of lactalbumin, and easily digestible too, thus making it superior to cow's milk.[1] Table 4.1 gives a comparison between various types of milk[2]
- The **Ca:P ratio is ideal** in breast milk as compared to other milk source.
- Though low in iron, the bioavailability is high due to **presence of lactoferrin** which prevents the baby from being anemic
- Breast milk is **available at just the right temperature for the baby** avoiding the need to cool or heat it as required appropriate for consumption
- The **mother is free to move around anywhere with the baby** without the hassle of organizing to carry formula milk or in premixed form or reheating it or carrying sterilized bottles along with

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- **It is very economical** as it saves the family from spending on expensive formula available in the market
- It **is sterile with minimum chances of contamination**. The enzyme lactoferrin is bacteriostatic thereby inhibiting *E. coli* by rendering iron unavailable to it. An exclusively breast fed infant is about 14 times less likely to die from diarrhea, nearly 4 times less likely to die from respiratory diseases and almost 3 times less likely to die from other infections than a non breast fed infant[3]
- Breast milk ensures stability by **emotional bonding of mother and child**. It also gives a feeling of security to the child
- It ensures certain maternal benefits also by **decreasing postpartum bleeding**
- It burns off extra fat deposited during pregnancy besides possibly **decreasing the risk of ovarian cancers in mothers at a later stage**
- Exclusive breast feeding up to 6 months also **helps spacing between two**
- **pregnancies**. As per WHO/UNICEF estimates, contraceptive prevalence would have to increase by 11% in order to compensate for 25% decline in breastfeeding[4]
- Contrary to the general myth among young mothers of the present generation, breast feeding **helps her to lose the extra weight** she had gained during the course of her pregnancy and **helps regain her figure.**

COLOSTRUM

This is the first viscous yellowish milk which is secreted soon after delivery. Unfortunately, most often this 'early' secretion is discarded by most mothers in certain communities, with the explanation that it is toxic for the baby. On the contrary colostrums is the richest source of proteins and immunoglobulins and the fat-soluble vitamins like A and E. It is rich in secretory IgA, which prevents the baby from any gastrointestinal infections. However, it is lower in fats and carbohydrates as compared to mature milk. This secretion may not be secreted in large volume and lasts for only about 2–3 days, but is very crucial for the baby as it helps in stimulation of mature milk by 2–10 days after birth. It also helps in stimulating peristalsis and acts as a lubricating protective effect on the mother's nipples.

The Indian Academy of Pediatrics (IAP) has spelt out the guidelines for Indian infants, termed as 'Infant and young child feeding practices' (IYCF).[5] The goal of these guidelines is:

1. To ensure normal growth and development from 0 to 2 years of age.
2. To formulate, endorse, adopt and disseminate guidelines related to infant and young child feeding from the Indian perspective.

These guidelines are used for

- Feeding of infants from 0 to 6 months of age
- Feeding of infants from 6 to 12 months of age
- Feeding of young child from 1 to 2 years of age.

As per WHO guidelines and also endorsed by IAP, exclusive breastfeeding should be done for the first six months of life. No other liquid including water

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should be offered except for drops or syrups like vitamins, mineral supplements or medicines. Some important points of the guidelines include:

- Breastfeeding to be initiated within 1 hour after birth for all normal delivery or born by cesarean section
- Colostrum not to be discarded, but be fed for the first 2 days as long as it is secreted. No other prelacteals to be introduced
- Exclusive breastfeeding to be practiced for first six months
- No other food or liquid be given to an infant below six months, unless medically indicated
- Baby to be fed on demand at day and night. This is called demand feeding, unrestricted feeding or baby-led feeding
- An average Indian mother produces about 600 mL of milk in the first six months, which is adequate to meet the baby's requirements
- Mother's working outside maybe supported by either allowing extended maternity leave or alternatively arrange for "Hirakani's rooms" (arrange rooms for facilitate mothers to feed the babies at work place—based on a legend of a woman called Hirakani who jumped from a hill top to feed her baby)
- Mothers to be encouraged to breast feed even during illness unless medically contraindicated
- Artificial feeding, bottle feeding or any advertizing of infant milk substitutes to be discouraged
- In event of discontinuation of breastfeeding due to some reason, 'relactation' should be attempted at the earliest and assisted by a health care worker.

Positioning of Breastfeeding

Breastfeeding can be done in a way most suitable to the mother as well as the baby. Positioning the baby to enable him/her access and suckle at the breast comfortably is very important for successful feeding. A new mother needs the support of the elders or trained professionals to teach them how to do so correctly. Although it can be done in lying or sitting position, the best suitable is for the mother to be seated on the bed or chair, and her forearm should be able to hold the baby's head close to the elbow, at about 45 degrees angle as shown in Fig. 4.1.

The baby should be helped to 'latch on' to the breast in the correct position, with the baby's chin close to the breast rather than only at the nipple (Fig. 4.2A).

Preparing for Breastfeeding

The mother should prepare for the breast feeding process during the antenatal period itself. The nipples should be checked and in case of retracted or involuted nipples, medical help can solve the issue by easy maneuvering as shown in Fig. 4.2B.

All antenatal health workers involved, should also counsel mothers during the pre natal visits, regarding the importance of exclusive breastfeeding for the first six months and desist from any formula feeds.

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Fig. 4.1: Positioning of baby while breastfeeding

It is equally important that the mother take care of her own diet which should be well balanced with all required nutrients. This can be achieved by inclusion of fruits and vegetables, milk and milk products, legumes, nuts and whole grain cereals.

FACTORS CAUSING LACTATIONAL FAILURE

As mentioned earlier, breastfeeding is such a natural phenomenon which should be a spontaneous function, but still we find the incidence of successful breastfeeding practice gradually declining. There can be a number of factors leading to lactation failure. We shall discuss in detail and see what steps can be taken to prevent this problem.

- **Initiation of breastfeeding:** Breastfeeding should be initiated within half to one hour after delivery in the case of normal delivery and at least 4–6 hours after a cesarean section delivery. At birth, the baby is completely ready and alert to begin sucking. In an ideal environment, the onus lies on the part of the family members or the immediate care givers present around to put the baby to the mother's breast so that the sucking reflex is initiated. It should be impressed upon the mother that the initiation of lactation is influenced greatly by the sucking reflex and if she on her part fails to make an effort at that time, lactation failure is bound to set in. Mature milk starts from the third to fourth day and the volume increases gradually from about 100 mL on the second day, rapidly increasing to 500 mL by the second week and going onto about 700–800 mL by 5–6 months. The mechanism involved is that sucking stimulates the production of prolactin (milk production) and

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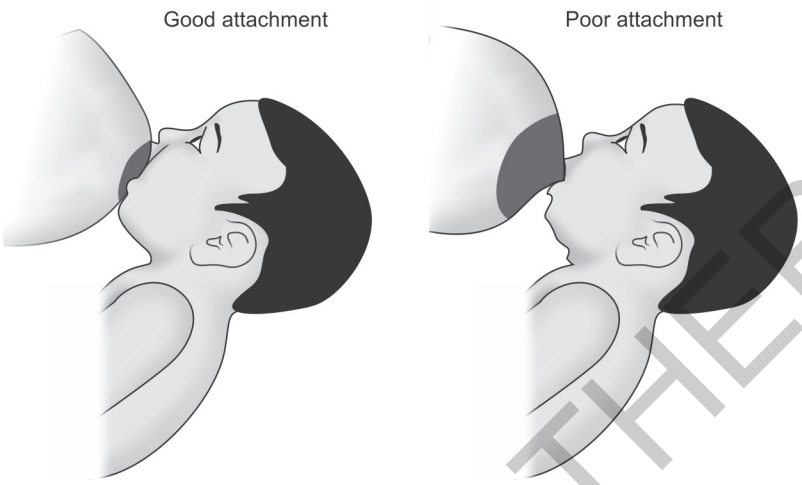

Fig. 4.2A: Correct and incorrect attachment to the breast

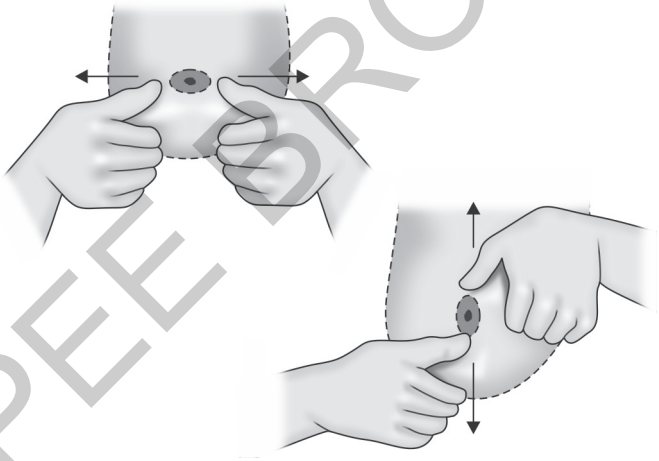

Fig. 4.2B: Way to maneuver inverted nipples

oxytocin (milk ejection) so that lactation is maintained. Oxytocin reflex is also known as the 'let down reflex' due to its role in 'letting down' milk production (Fig. 4.3)

- **Role of prelacteals:** In most communities it is customary for elders in the family to offer pre lacteals to the new born. These can be indifferent forms in different communities like, honey, 'janam ghutti' goat's milk or 'saunf' water etc. This practice is not healthy due to the risk of any infections being passed on to the baby. Honey which is commonly offered as the first food in many communities can actually be responsible for passing any fungal infections. 'Janam ghutti' is usually given as pacifier and considered good

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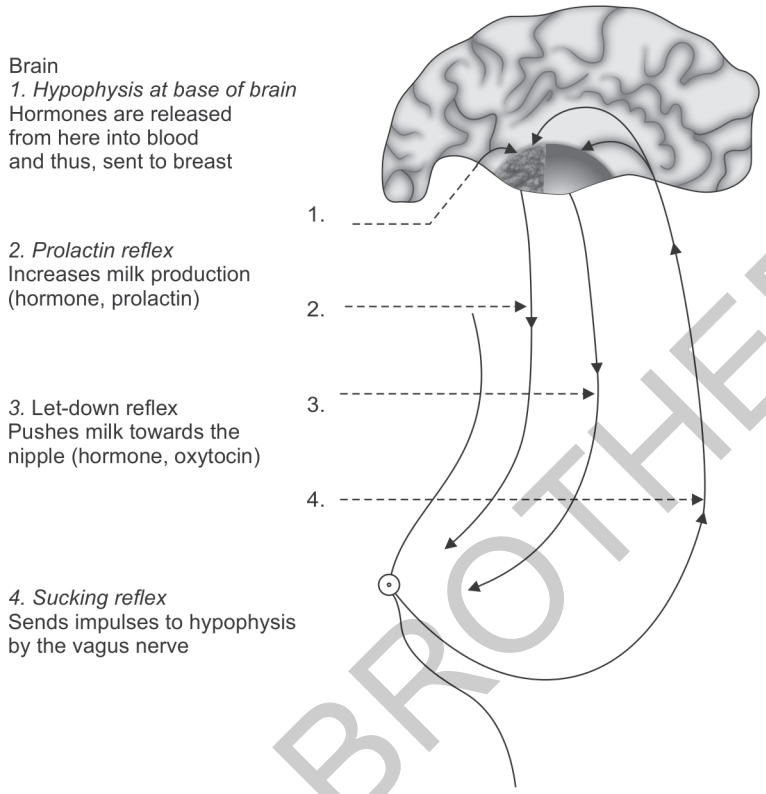

Fig. 4.3: Diagram of physiology of lactation

for digestion. Bloating of abdomen due to aerophagia is very common due to which the baby cries. Mothers then resort to such practices which can indirectly harm the baby's system. Even plain water, either as such or boiled with saunf etc. is not required. Such practices can adversely affect the sucking reflex which in turn suppresses milk output. There can be a risk of aspiration also into the air passages or lungs and secondly highly prone to infections if proper hygiene is not maintained. Therefore, the baby should be put on the mother's breast within half an hour of birth to stimulate the let down reflex by inducing the oxytocin

- **Family support:** The role of the female family elders is very crucial in influencing good or poor lactation. If the mother, mother in law or any one closely associated with caring for the new mother encourages her to feed by re-enforcing its importance, the mother is bound to follow their advice and be 'mentally geared' to feed her baby. On the other hand, if these same people give their own remarks about the baby not 'getting satiated by the mother's milk or that her 'milk is not adequate', or that the mother is 'too weak to feed', the mother is psychologically discouraged and begins to lose confidence in her own ability to satisfy her baby with her own

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feed. The lack of confidence is enough to inhibit the 'let down' reflex and gradually the milk production also dwindles. Added to this, is the fact that because of this reason, the mother herself or the family members begin to offer formula milk or cow's milk in their attempt to be over concerned. It may be noted that the milk production is inversely proportionate to the 'artificial' or 'top milk' fed to the baby, i.e. the more the baby is fed by the bottle; the lesser will become the breast milk output. Therefore, a 'positive attitude' needs to be instilled in the mother and the caregivers to maintain successful breastfeeding. Artificial feeds include water also which should not be offered before 6 months due to the fact that the water content in breast milk is adequate enough for the baby's requirement as mentioned earlier. It is noteworthy to point out here that just supplementing water also along with breast milk is enough to suppress the 'let down' reflex and lead to diminished milk output. Besides these factors, it is important that the mother be totally stress free, with no anxiety of any sort and comfortable since the let down reflex is greatly influenced by these factors

- **Lack of privacy/rooming in:** We live in a society and hence, social interaction is an integral nature of all humans. As per our traditions and social obligations, when a newborn arrives, there is a row of visitors making a bee line to bless the mother and the child. Or, at other times, in families with limited space, the mother does not get a chance to be on her own or have any privacy to be able to nurse the child in peace. This can often lead to distraction of her focus from the baby which itself can be a causative factor in lactation failure. Moreover, the mother is seen feeding her baby amidst other members of the family where there is some discussion going on or her attention is focused on the television or she may be attending any visitors too. This distraction from the baby can reduce the let down reflex further leading to decreased lactation. Therefore, it is very important that some 'rooming in' be allowed to the mother and the child so that she can focus completely on her baby. This allows 'one to one' contact eye contact with the child and may be some verbal communication between the two which helps 'bonding' between the mother and child
- **Early introduction of top feeds:** Ideally breastfeeding should be done 'exclusively' for 6 months as recommended by WHO.[6] But at times mothers in their zeal to feed their babies adequately end up 'overfeeding' them by resorting to artificial feeds. They feel that breast feeds are not adequate or he remains 'hungry', or is not growing adequately. As a result they initiate top feeds in the form of formula, milk substitutes and even semi solids much before 4–6 months. This results in decreased output of breast milk by mothers and again to make up for this deficit, they further add more solids. This vicious cycle ultimately results in further decreased output and lactation failure. On the contrary, if the mother continues to breastfeed at frequent intervals, the milk output is maintained and may normalize eventually. Approximately 700–800 mL milk is secreted per day in a healthy normal lactating women and this is sufficient till 5–6 months

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- **Mother's employment:** In our grandmother's age, lactation failure was unheard of as mothers mostly were housewives and their total energy and commitment was focused on the family and their needs. In the process with the arrival of the newborn, the attention of the mother is totally focused on her baby and its care. Nursing comes naturally to her without which she can continue without ever having the fear of discontinuing it. But in the present scenario, where majority of the mothers are working, there is a latent fear in their minds that sooner or later they will have to leave the baby at the hands of her mother in law, or the care taker or in the crèche. In such a condition she will have to resort to artificial feeding. So, in order to allow the baby to' acclimatize' to the top feeds, the mother tends to introduce these much earlier. As a result, her own feeds gradually decrease and the baby is deprived of the several benefits of her own feeds. This is particularly true of working mothers who have maternity leave and unable to continue nursing their child once they go back to their jobs. Therefore, the fear that the baby may accept the bottle later on, drives her to initiate the child to this technique, so that it is easier for the caregiver or baby sitter to feed the child. This in a way also is enough to overcome her own guilt complex of not being able to feed her child herself. Besides, it is easier for the caregiver to put the bottle to the baby's mouth rather than make an effort to feed him/her with a cup and spoon
- **Problems related to the breast:** A very common problem encountered my some mothers which can contribute to lactation failure is related to engorgement of breasts, mastitis or obstructed ducts or sore nipples. But it may be stressed here that these problems are rather a result of inadequate or improper feeding and the cure lies in more or proper feeding technique rather than discontinuing nursing.

Engorgement

This is a result of inadequate milk removal, poor ejection or failure to 'let down' or insufficient or in frequent nursing. Treatment comprises frequent nursing, warmth, massage or use of breast pumps.

Duct Obstruction

This can be due to tight-fitting clothes exerting local pressure which can be relieved by frequent nursing, moist heat and massage.

Mastitis

This problem is a result of prolonged engorgement or duct blockage if not tackled promptly. There can be development of abscess also, which may require antibiotic treatment. Management again involves counseling of proper nursing technique or removal of milk from blocked ducts. Analgesics can help mitigate the pain to the mother.

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Sore Nipples

This is also due to improper feeding or holding the baby to the breast. When there is improper latching onto the breast, the baby is not able to suck adequately, at the same time hurting the mother's nipples leading to cracks and soreness. Correct positioning of the baby to the mother's breast and the mother's own posture while feeding can help avoid this problem. As seen from Figure 4.2, the baby is 'latched on' in the right position when the baby's chin is close to the breast, rather than only at the nipple. More of the alveola is visible above the baby's mouth, unlike in the wrong position post of the alveolar area is visible and the baby's mouth is not wide open. In the right position, the mouth is wide open. Moreover, if not attached properly, breastfeeding becomes painful for the mother unlike in the right attachment where the baby sucks deeply with slow, regular movements of the tongue. Feeding should not be discontinued due to this problem since correct positioning and 'latching on' to the breast will gradually heal the affected area. In a good attachment, the baby's chin is close to the breast while in the improper latching, the chin is away from the breasts. More of the areola is visible above the baby's mouth than below it and the mouth is wide open with lower lip turned outwards. Nursing is not painful for the mother and the baby sucks slowly. In the wrong attachment, mouth is not wide open and much of the areola is outside the baby's mouth. Breastfeeding is painful for the mother if the latching on is incorrect.

Certain basic precautions if taken heed of can help avoid problems related to soreness of the nipples or blocked ducts, etc.

- Frequent expression of milk both manually or by use of breast pump can stimulate the 'let down' reflex and help in adequate lactation
- Frequent short feeding, e.g. every 2 hourly for 5–10 minutes after the 'let down'. The mother can offer from one side first and after feeding for about 5–8 minutes, the child is satisfied, she can feed from the other side the next time she feeds. This will ensure uniform flow from both breasts. With increase in its requirement with age, it might become necessary to feed from both sides
- Proper 'latching on' of the infant to the breast
- After the baby is satisfied, the mother should try to dislodge the baby from the breast gently by inserting her finger into the corner of the infant's mouth
- The nipple should be washed only with plain water without using soap or any disinfectant solution
- The nipple should be allowed to dry before covering. In case of severe pain or soreness, the mother can express manually rather than allowing the baby to suck, to avoid further pain
- If soreness is very severe and painful, it would be wise to stop nursing at that nipple and express manually from the other side for 24–48 hours
- A mild analgesic can help reduce pain to some extent
- **Expressed breast milk (EBM):** In event of unavoidable circumstances for the mother to go out for work, she can still feed her own milk, by expressing

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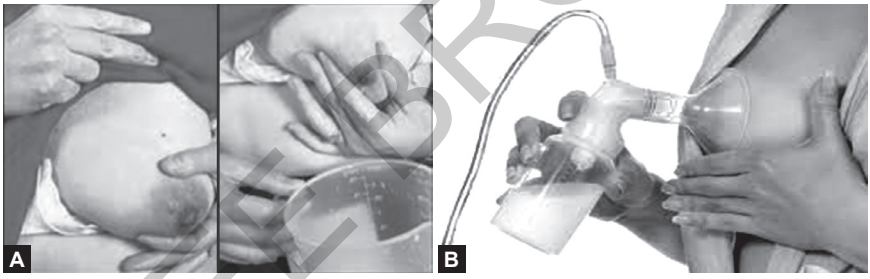
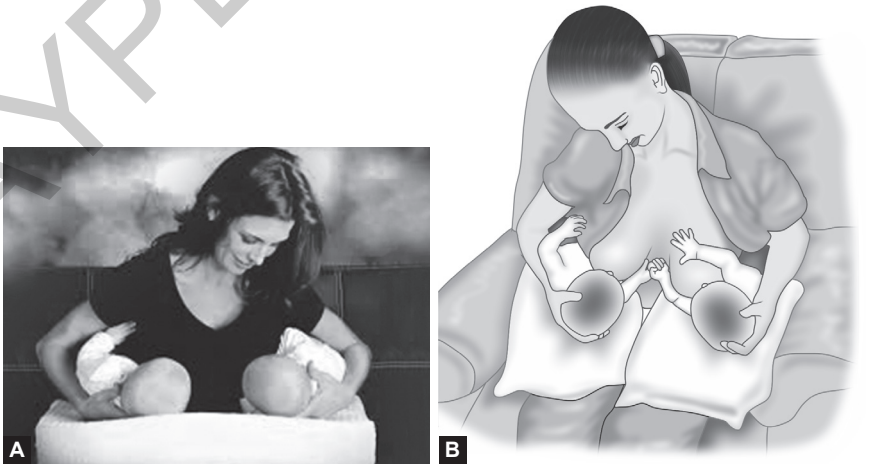
it manually or using a pump which are easily available (Figs 4.4A and B). This can be left at home with the caretakers who can feed the baby with a spoon. This expressed breast milk (EBM) should be collected in a stainless steel container or cup and refrigerate it if required to be kept for more than 7–8 hours. The refrigerated EBM can safely be utilized for up to 12 hours. At the time of feeding this milk can be brought out and kept at room temperature till suitable for feeding, or the milk container can be placed in another container of warm water to bring it to room temperature faster. Use of glass or plastic bottles or cups for EBM should be avoided as the white corpuscles in the milk tend to stick to the glass making them unavailable to the baby. EBM can be expressed every 3 hours in a boiled and cooled utensil and can be stored at room temperature for 8 hours or 12 hours in a refrigerator or also can be frozen for months. Heating EBM directly on gas or microwave should be avoided

- **Feeding twin babies:** In case there are twins, the mother can be helped to feed both the babies together, one on each breast in a double football hold or double clutch position (Fig. 4.5A) and cradle hold position (Fig. 4.5B). The mother has to judge how well which of the babies is able to latch on and accordingly adopt the suitable position. Each baby can also be offered



Figs 4.4A and B: (A) Manual expression of EBM; (B) EBM using pump



Figs 4.5A and B: (A) Football-hold position; (B) Cradle-hold position

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one breast at one feed and then switch them on the other breast alternately. A pump to express the milk also will be helpful to maintain a record of the amount of feed each one of them has had. Each baby may have a different style of feeding, so the mother has to learn by experience which mode of feeding would be most suitable to each one of her babies. The services of a lactation expert may be helpful to mothers in such situations.

Considering the above points, the key to successful exclusive breastfeeding may be summarized as below:

a. Encourage her to relax.
b. Encourage confidence in her to be able to feed optimally.
c. Encourage 'rooming in' by providing reasonable space and privacy.
d. Encourage her to maintain optimum nutrition without food fads.
e. Encourage her to have adequate fluids.
f. Encourage her to 'bond' with the baby by allowing her to handle him/her personally, thereby building a sense of security in the baby also.

FREQUENCY AND DURATION OF EXCLUSIVE BREASTFEEDING

The baby is the best judge in self regulating its timing of feeding. There should not be any fixed schedule of feeding. Demand feeding is the norm advised. Each baby differs from the other in getting satisfied and may have varying stomach capacities. Some may be satisfied earlier but may demand more frequently. Others may continue to be quiet for longer periods, but at a time may feed well from both breasts. Generally 5–8 minutes on each breast is sufficient to satisfy the baby and give a feeling of fullness. A 'crying' baby generally is taken as a signal of a 'hungry baby' by the mother and feeding him generally satisfies him. But crying may not always indicate hunger. At times a wet baby might cry too or he may be ill or experiencing some sort of discomfort in any form. 'Teething' can also be painful or irritable for a child and he may express that by crying. The mother with experience learns to assess the need of her baby and will know whether the child is really hungry or not. Usually babies themselves set their own schedule of about 3–4 hours depending upon how optimally they are able to suck at one given time.

The mother can be assured of her feed being adequate for the baby, by maintaining a record of his weight gain and the frequency of urination. If there is an upward trend in weight gain and if the baby passes urine about 5–6 times per day, she can rest assured that her milk is adequate for the baby and need not resort to formula feeds.

ARTIFICIAL/FORMULA FEEDING

Mothers with the fear of their babies being left underfed, generally resort to formula feeds right from early infancy. In our country, formula feeding is generally discouraged due to the high risk of infections, and bottle

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Basic Pediatric Nutrition

An attempt has been made in this book to give a basic overview of the nutritional aspects pertaining to the pediatric population. Issues related to normal requirements of children of all age groups have been dealt with in detail. Besides, some common nutritional problems encountered among them like malnutrition, obesity and anemia and how to manage them have also been highlighted.

This edition is an updated version of the first one with some additional basic issues related to child health besides incorporating revised guidelines brought out after 2009.

It aims to serve as a basic guide for all those involved in the management of child health, whether in the hospital or the community.

Salient Features

- Gives a detailed account of nutritional assessment of children, both at the community level and at the bedside in the hospital
- Dwells at length regarding feeding of infants and ways to tackle problems related to breastfeeding
- Common nutritional deficiency disorders encountered among preschool and school-age children have been discussed in detail
- Tackling the eating behaviors of adolescents has been presented for the benefit of the caregivers
- Discussion on the causes and management of eating disorders among children
- A brief discussion on the common food allergies has also been touched upon.



Madhu Sharma RD Dip (Dietetics) MSc (Food and Nutrition) is former Senior Dietician from the Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India, since 1980. She has had more than three decades of experience in the field of pediatric nutrition including pediatric gastroenterology.

She is the President of Chandigarh Chapter of Indian Dietetic Association, Life Member of Nutrition Society of India, Indian Society of Parenteral and Enteral Society and International College of Nutrition, and has been actively involved in them from time to time. Her main areas of interest are infant feeding, childhood obesity, lifestyle disorders and cystic fibrosis in children for which she has been trained from Scotland. She is currently a freelance diet consultant besides continuing to be involved in academics and various community nutrition programs and authoring chapters for different books and manuals.

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