CHAPTER 1

Breastfeeding and human milk

In most – yet not all – circumstances, the best possible food for an infant is breast milk. Health workers have a responsibility to encourage a mother to breastfeed her baby, and to support her with information and skilful assistance, given she is not vehemently antagonistic to such a positive proposal. A global and constant effort must be made to protect, promote and support breastfeeding, which can be a matter of life and death for babies.

About 15–20 years ago, breastfeeding rates in New Zealand and Great Britain were similar. Since then, however, although the rate in New Zealand has risen to approximately 84%, the overall level of mothers breastfeeding at birth in the UK has stayed at about 69% (Infant Feeding Survey, 2000). Furthermore, this equates to those infants put to the breast at least once – by four months, only 28% are still being breastfed; by eight months, a mere 16%. In Sweden, an information and education programme resulted in a doubling of the number of mothers lactating within a period of only five years: from 31% in 1972 to 62% in 1976–77. A similar programme in New Zealand of specialist lactation nurse consultants (known as Plunket nurses), akin to health visitors in the UK, now see over 90% of infants under one year of age. Although the reasons for such improvement in New Zealand are multifactorial, the key role of specialist lactation nurse consultants and Plunket family centres must have formed a major component of this successful breastfeeding programme in one part of the Antipodes.

The late Professor DB Jelliffe, an international authority on human milk, pointed out that in some communities, if a mother died in childbirth, her newborn was buried with her because of the hopelessness of a baby deprived of its mother's milk. According to the World Health Organization (WHO), every year over a million babies die for want of breastfeeding. Even where clean water and sanitation are available, artificially fed babies are at greater risk of disease and death. Breast milk will facilitate the opportunity for an infant to realise his or her full potential for health and growth.

Yet babies are remarkably adaptable creatures who can grow adequately on many mixtures of foods, and have always done so. We have all met happy babies who have been artificially fed, just as we have all encountered hungry babies being badly breastfed who benefited from being given additional food. But we cannot deny that all these babies are at greater risk than is the happily thriving breastfed baby. We would be disingenuous with parents if we said that their choice was not risky and had no potential for later adverse effects on their child's life. However, despite advice from the expert, many parents weigh up the risks of artificial feeding and choose to go ahead with it regardless, driven by a number of motives. Other

mothers will begin breastfeeding and experience difficulties that make them consider weaning; for lack of appropriate support and help, many will wean too early.

Why breastfeed?

Many books and papers elaborate on the complex and fascinating role of human milk in infant health and development, and perhaps even adult health and disease, too. There are many compelling factors that influence the informed parent to choose breastfeeding.

Benefits for the baby

For the baby, breastfeeding:

- provides nutritional and growth benefits
- optimises neurological and intellectual development
- enhances the immune system and increases resistance to certain infections
- reduces the incidence of gastroenteritis (e.g. rotavirus, polioviruses, etc.)
- reduces the risk for some chronic diseases (e.g. infectious and allergic disorders of alimentary and respiratory tracts)
- reduces the incidence of necrotising enterocolitis in preterm babies (presence of epidermal growth factor)
- may reduce the risk of 'cot death' (sudden infant death syndrome) and 'near-miss cot death' (acute life-threatening events)
- reduces the risk of obesity
- contributes to proper mouth and jaw development – breastfed infants tend to have a reduced incidence of cavities and need fewer orthodontic corrections later in life
- optimises hand-to-eye coordination
- provides emotional benefits – most breastfed babies cry less because they are held more.

Antimicrobial and antiviral factors in breast milk

There is some evidence in human newborns of a phenomenon known as 'closure', in which the lining of the small bowel becomes mature and does not absorb proteins or toxins. There is even some evidence to suggest that, occasionally, this bowel-wall maturation can develop within the intestine before birth. Until this radical change arises, the infant is at risk of allergen sensitisation (*see* Chapter 8).

There is in breast milk a unique and special antibody known as 'secretory immunoglobulin A' (SIgA). SIgA, which is derived from immunoglobulin A, coats the bowel lining to inhibit microbes from sticking to the gut wall and also prevents the absorption of substances (e.g. antigens) that have a major role in the development of allergy. Professor Allan Walker, a distinguished paediatric gastroenterologist at Harvard Medical School in Boston, has aptly likened this property to that of an antiseptic paint which coats the bowel wall, and this analogy does portray the extraordinary characteristics of SIgA (Fig. 1.1).

Apart from the crucial antibodies to be found in human milk and the passive transfer, *in utero*, of other antibodies from mother to foetus, the immune systems do not develop competently for at least three to four months in the newborn. This

Figure 1.1 Secretory immunoglobulin A.

is why the recommendation to mothers is to breastfeed for at least four months and not to wean before then, so avoiding the exposure of a vulnerable bowel to potentially harmful foods.

If, for any reason, 'foreign' proteins, toxins or other harmful agents imbibed by a baby are 'allowed' to cross the bowel-wall lining, they will enter the circulation and may cause mild or severe symptoms. Alternatively, the portal of entry might be the nose, upper or lower airways, skin or eyes, and cause a local or a generalised reaction. The 'foreign' agent or antigen is not identified as 'self' and so elicits an inflammatory reaction. It does not matter if the foreign body is a transplanted kidney or an invading virus: the principal features of the response will be the same. This initial inflammatory reaction will be succeeded by a variety of immune activities because of the existence of several classes of antibody and cellular properties.

The body endeavours to contain the reaction and engulfs the invading agent prior to elimination. To do this, specific types of blood cells and other highly specialised cells in certain parts of the body (for example, the bowel wall itself) become actively involved in the response triggered by the arrival of a 'foreign' or invading protein or protein-like particle. A combined effort by the antibody and sophisticated body cells destroys or inactivates the antigen and so recovery takes place. If the baby is re-exposed to the same antigen at a later date, a further reaction occurs. However, if the antigen is not successfully dealt with, symptoms appear. These will depend upon the site – for example, in the outer layers of the eyes (conjunctivitis), in the skin (eczema), in the nose (hayfever), in the lungs (asthma), and in the bowel (diarrhoea, windiness, colic or gut bleeding).

There are a number of additional components in human milk that help fight infection. For example, human milk contains living cells such as neutrophils, which will themselves destroy bacteria, whilst others (lymphocytes) have the ability to form antibodies. In addition, human milk contains the enzyme lysozyme and the iron-binding protein lactoferrin. Lysozyme damages the wall of certain bacteria, thereby destroying these microbes (Fig. 1.2). The lysozyme content of human milk is 3000 times that of cow's milk. Lactoferrin competes with particular bowel micro-organisms (bacteria and yeasts) for free iron, which is needed for their growth (Fig. 1.3).

Furthermore, the milk contains enzymes that not only break down fat but can also kill a specific and common parasite – *Giardia lamblia*. This protozoa causes diarrhoea by temporarily damaging the cells that line the absorptive surface of the bowel wall. Consumption (via ingestion of contaminated food or water) of as few as ten cysts can produce illness in both children and adults. If untreated, it results in severe weight loss and other problems. Giardiasis is often found in overcrowded communities with poor sanitation. However, it is not an infrequent cause of diarrhoea in the UK, and, indeed, many other developed countries. Epidemics in day nurseries have been reported.

Diarrhoea is globally uncommon in those who breastfeed. However, even in developed countries, annual and recurrent bouts of diarrhoea are seen frequently. In the UK, from autumn to spring, there are many hospital admissions because of gastroenteritis – frequently due to viruses such as the rotavirus, small round structured virus (SRSV) or adenovirus. We must not underestimate the disruption to family life when one of the members has an acute hospital admission. Furthermore, following discharge, the baby or infant's behaviour will take time to settle down. The consequences to the child of such experiences should encourage us to advocate prolonged breastfeeding. In the UK, and indeed in many other countries, the rotavirus is a major cause of diarrhoea, yet breast milk is rich in antibodies to this viral agent. A thriving child will not be at severe risk from viral enteritis; however, in the developing world, a combination of sudden diarrhoea and malnutrition will often cause death. This topic is inevitably of greater importance in the

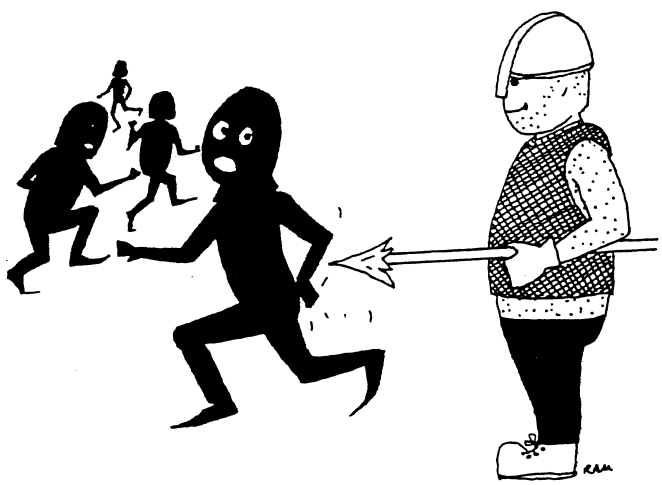


Figure 1.2 Lysozyme: an enzyme which damages the walls of bacteria.

Figure 1.3 Lactoferrin.

poorer nations, where the astronomical death rate and consequences of diarrhoea can be associated with the use of formula.

It is not just bowel disease that is less common with human-milk feeding: many prevalent chest infections due to specific viruses would be seen less frequently had the mother breastfed. The American Sedgwick documented as long ago as 1921 the protective effect of breastfeeding against chest infection as well as diarrhoea.

As can be seen, the protective agents in human milk are very numerous. Furthermore, it has been shown that if a mother is exposed to any infection, in some circumstances her own milk will develop specific antibodies to that infectious agent. While each year scientists struggle to identify the flu virus and make a vaccine before the next winter, every breastfeeding mother exposed to the flu virus has made protective antibodies within days of exposure and is feeding them to her baby.

Protection against diabetes

Recent evidence has shown that, where there is a family history of diabetes, the potential risk to a baby within such a family can be very considerably reduced by breastfeeding. Researchers have demonstrated that prolonged breastfeeding – and, most importantly, the total avoidance of any milk formula until seven months – will reduce the likelihood of future diabetes by as much as 50%. Even offering 100% human milk for just three months, again excluding all baby milk, is beneficial in terms of decreasing the probability of future diabetes. This awareness will put greater pressure upon all healthcare workers in these circumstances to discourage mothers from offering baby formula.

Benefits for the mother

For the mother, breastfeeding:

- increases calorie expenditure, making it easier to lose the pounds gained during pregnancy

- contracts the uterus (due to release of repeated bursts of oxytocin), which reduces the flow of blood after delivery and protects the mother from post-partum haemorrhage
- delays the return of normal ovulation and menstrual cycles
- reduces maternal mortality
- preserves haemoglobin stores
- reduces the risk of premenopausal breast cancer and, possibly, ovarian and uterine cancers
- promotes bonding between mother and child
- helps relaxation
- saves time and money.

Prolactin is a hormone that is formed in the pituitary gland in response to suckling (and emotional factors), then travels, via the bloodstream, to the breast, where it stimulates and sustains milk production. Prolactin also serves to inhibit the response of the ovaries to follicle-stimulating hormone (FSH), which is responsible for ovulation. Consequently, the return of ovulation is delayed in lactating mothers, thereby reducing the likelihood of a further pregnancy. However, despite the folklore tales on this topic, breastfeeding cannot be regarded as a reliable technique of suppressing fertility.

The degree of protection derived from breastfeeding relates to several factors – frequency of feeds and length of time on the breasts, as well as the question of complementing with cow's milk formula. All influence the competence of breastfeeding as a contraceptive. Lower levels of prolactin are noted, for example, when the mother provides only a limited number of breastfeeds as opposed to practising unrestricted breastfeeding. These relative reductions in circulating levels of prolactin permit ovulation to occur because the ovaries are not inhibited in their response to FSH.

Furthermore, during lactation, levels of prolactin decrease despite continued breastfeeding, and, by the tenth week, the mother will ovulate. Mothers need to be reminded that 5% will ovulate before they menstruate and, paradoxically, some will have menstrual cycles during which they fail to ovulate. Early supplements with formula and reduced suckling will result in lower levels of prolactin and a greater likelihood of ovulation, with a risk of conceiving. Theoretically, a mother solely breastfeeding in an unrestricted style might not require any method of contraception in the initial 10 weeks. However, because of the many variables – such as the baby feeling unwell and then not being an active suckler for a period of time – this advice must be tempered with considerable caution.

The close visual and physical contact that is part of the breastfeeding pact can only cement the relationship ('bond') between mother and her baby (Fig. 1.4). Fortunately, however, this 'bonding' is not exclusive to those fed on breast milk, and we have met countless contented babies given only formula but well united with their mothers.

Societal benefits

For society, breastfeeding:

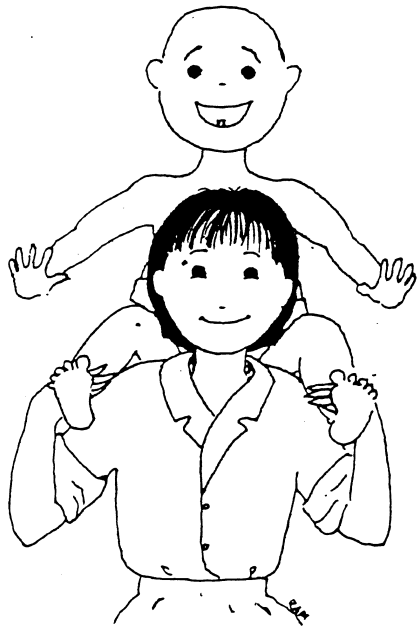


Figure 1.4 Mother–baby relationship.

- reduces total medical care costs for the nation – breastfed infants typically need fewer sick care visits, prescriptions and hospitalisations
- reduces pollution of air, water and land from production of artificial baby milk and its packaging
- conserves energy sources.

Who can breastfeed?

Many mothers are surprised to learn that virtually any woman can breastfeed a baby, given the infant is put to the breast often enough to stimulate the flow. A woman who adopts a baby and wants to breastfeed can do so even though – and this is regrettable – she has not been able to adopt in the early days of life but perhaps has had to wait weeks before she is presented with her baby. Grandmothers, schoolgirls and childless women have all been able to make a success of lactation if they are both well motivated and patient. Small breasts are no less able to store and express milk than are larger ones. Initially, the empty breast will frustrate the baby, so expert support and self-confidence play a role in achieving a good outcome. At times, a woman might decide after the baby is some weeks old that she wants to give up the use of fomula and try her own milk. Allergic reactions might have become evident and some wise health visitor or midwife has astutely related the symptoms to the milk formula; thus, the mother has revised her earlier opposition to breastfeeding. We have even observed mothers who initially having decided their baby was to be adopted, subsequently changed their minds and, with much courage, breastfed. This has arisen even when early physical separation occurred and the mother was conditioning herself to giving up her baby.

When not to breastfeed

Sadly, there are a number of circumstances in which lactation must be avoided. These include mothers in developed countries with HIV infection. Furthermore, if a mother is suffering from an active psychotic disorder and is fearful of harming her newborn, or has 'open' active tuberculosis in her lungs, then clearly formula is a safer option. The presence of anti-cancer agents such as cyclophospamide, cyclosporine, doxorubicin or methotrexate in the breast milk constitutes a contraindication, as does maternal lithium, cocaine, heroin or marijuana use. Refer to the extensive list in the Breastfeeding Appendix of the British National Formulary (BNF) No. 44.

Why do so few mothers breastfeed?

It is sobering and most disappointing to note that, in the UK, the Office of Population Censuses and Surveys (2000) reported a rise in breastfeeding of only 2% since 1980, with 69% of all newborns being breastfed a minimum of once after birth, and only 21% still being breastfed at six months. Moreover, there are dramatic social class differences, which have always given much cause for concern – 85% of mothers with higher occupations breastfeed, compared with only 52% of those with no occupation. The mother's level of education is also closely linked to her likelihood of breastfeeding. For example, 64% of mothers in the highest educational category were breastfeeding at six weeks, compared with 27% of mothers in the lowest educational group. It is tempting to link the higher rate of infection in the disadvantaged classes with suboptimal breastfeeding patterns.

An obvious area where professionals should make more intensive efforts to persuade mothers to review their plans for a formula-feeding practice is in the antenatal period, and not when the baby has appeared and the mother has had many months in which to develop an entrenched and antagonistic attitude to lactation. Reports have shown that in the UK, only half of first-time mothers were questioned antenatally about their feeding intentions. Also, too little is done in schools, and how many countries have educational television advertisements at prime time, demonstrating the benefits of human milk? Mothers opposed to lactation are strongly influenced by their own mothers, who perhaps have had a distaste for breastfeeding, demonstrating a biased attitude which is easily propagated. Fathers in the lowest occupational categories (e.g. manual workers) generally do not favour the idea of their wives or partners breastfeeding, but frequently have not met the experts to discover the plus points of lactation. Perhaps evening antenatal clinics and joint appearances (mother plus father, or, for the single isolated parent, mother plus a friend or grandparent) would help remedy this depressing picture.

Composition of human milk

Breast milk is the most complete form of nutrition for the majority of infants (Fig. 1.5). A mother's milk in normal circumstances has the right type and amount of fat, carbohydrate, water, protein, vitamins and minerals that are needed for a baby's growth and development. Most babies find it easier to digest breast milk than they do formula.

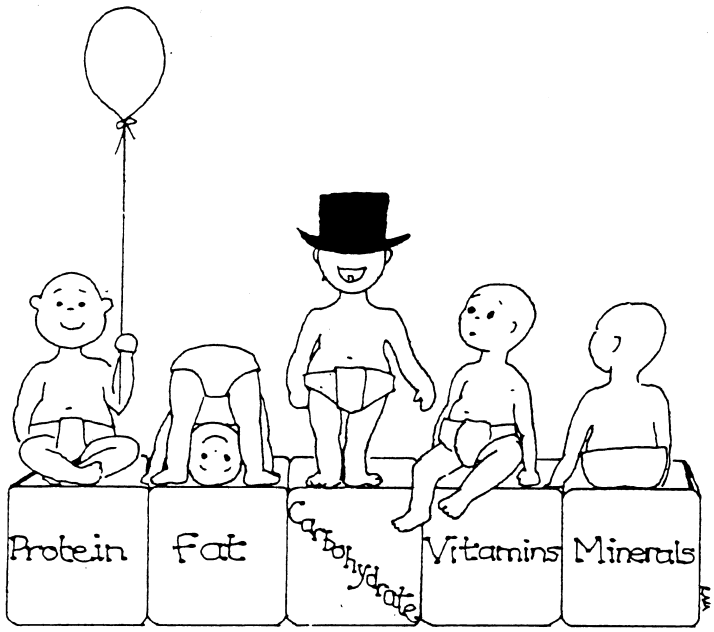


Figure 1.5 The composition of human milk.

The composition of human milk is an interesting – and, indeed, surprising – topic, in that there is variability in content between colostrum, transitional milk, and mature foremilk and hindmilk, differences between each breast, and also alterations on a daily basis.

Colostrum

Colostrum is the initial milk produced in the early days after birth and, because of its protective properties against infections, has a vital role to play in maintaining good health.

Often we hear mothers – and, indeed, inexperienced professionals – underemphasise the enormous importance and benefit of early breast milk. Sadly, it is frequently regarded, quite inappropriately, as water, because it is thin and translucent. However, it is rich in immunoglobulins, including IgA, which has a key role in the prevention of disease, and antibody formation against viruses and bacteria. Before the end of the first week, it will be replaced by transitional milk, which has a different composition. It is salient to record that colostrum, although containing less fat than mature milk, is rich in protein, electrolytes and vitamins. Moreover, this highly specialised milk contains a particular enzyme that prevents the breakdown in the gut, by digestion, of protective antibodies.

It is a matter of interest and perhaps relevance to note that in some hoofed animals and other species, colostrum plays such a major role in disease prevention that its absence is associated with fatal infections. At times, farmers give it to particular calves to protect them.

Mature milk

The transition to mature milk is gradual and stimulated by frequent suckling. The composition of mature breast milk is not homogenous, but varies between individuals, each breast and during a feed.

Protein

The protein in breast milk comprises:

- casein (curd)
- whey (non-casein) proteins – including lactalbumin, lactoglobulin, IgA etc.

Human milk has a lower casein content than cow's milk. When casein meets the acid within the stomach, it will form curds. Infant-milk manufacturers now produce whey-dominant milks, to avoid the formation of such casein curds.

Importantly, minute quantities of ingested proteins from the cow have been identified in human milk. These potential allergens are derived from the maternal diet and may have a role in sensitising the baby and the development of adverse food reactions.

Fat

Fat is made up of triglycerides, which can be broken down into fatty acids. Some fatty acids are 'saturated' and others 'non-saturated'. Although breast milk contains both saturated and unsaturated fats, the latter are present in higher concentrations. The fatty acid content of human milk is related to the maternal diet.

Fat content varies during a feed, being low at the start ('foremilk') and increasing as the feed progresses ('hindmilk'). As a result, the fat concentration in hindmilk is double that in foremilk. Furthermore, there is a change in fat composition of a feed during the course of a day.

Within human milk, but not cow's milk, there is the enzyme lipase, which breaks down the fat so that it can be absorbed from the bowel.

Human milk is rich in the essential fatty acids linoleic acid and alpha-linolenic acid. These can be converted into long-chain polyunsaturated fatty acids (LCPs) – arachidonic acid and docosahexanoic acid, respectively – which are required for brain and retinal development.

Carbohydrate

The sugar in both human and cow's milk (as well as in all other non-specialised formula milks) is lactose. During digestion, it is broken down into glucose and galactose. Galactose has a major role as a constituent of myelin (part of the sheath that surrounds nerve fibres).

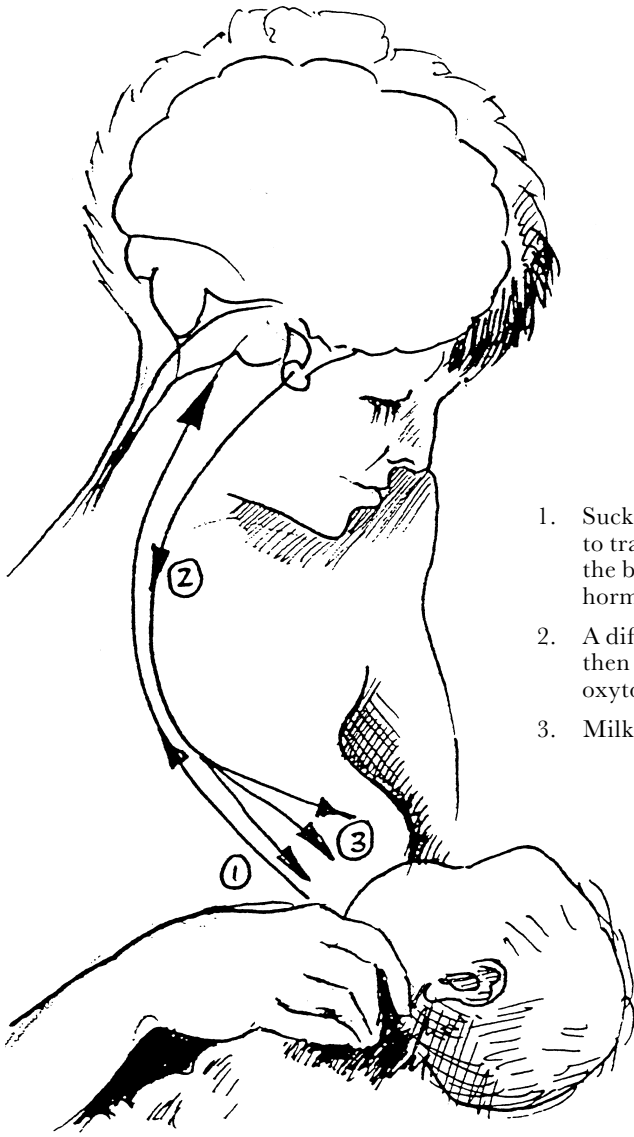
Vitamins and minerals

All of the important vitamins, both fat-soluble and water-soluble, are present in human milk, e.g. vitamins A, D, E, K, C and B. Although levels of vitamins D and K are thought by some experts to be inadequate, well-nourished babies born at term are unlikely to become vitamin-depleted if the mother has an adequate vitamin/mineral status. However, we believe it is prudent to give vitamin supplements to the mother if her diet is marginal, and all breastfed infants should have vitamin drops from six months of age.

The let-down reflex

Milk is secreted continuously into the alveoli of the breasts, but milk does not flow easily from the alveoli into the ductile system and therefore does not continually leak from the breast nipples. Instead, the milk must be 'ejected' or 'let down' from the alveoli to the ducts before the baby can obtain it. This process is caused by a combined neurogenic and hormonal reflex called the let-down reflex (or draught reflex/milk ejection reflex) involving the hormones oxytocin and prolactin (Fig. 1.6).

When the baby suckles the breast, sensory impulses are transmitted to the pituitary gland, resulting in the secretion of oxytocin and prolactin. The oxytocin



1. Sucking causes nerve impulses to travel to the pituitary gland in the brain which then releases the hormone prolactin.
2. A different part of the pituitary then releases another hormone: oxytocin.
3. Milk is squeezed into the nipple.

Figure 1.6 The let-down (milk-ejection) reflex.

then flows in the blood to the breasts, where it causes the tiny muscle cells (myoepithelial cells) that surround the milk glands to contract, thereby expressing the milk from the alveoli into the ducts which are behind the nipple. Thus, within 30 to 60 seconds after a baby begins to suckle the breast, milk begins to flow.

Suckling on one breast causes milk flow not only in that breast but also in the opposite breast, hence the drip milk from the other side.

Successful breastfeeding is not dependent solely upon stimulation of the nipples; sight, sound and also thoughts about the baby will act as stimuli for the let-down reflex.

Timing of the first feed

Because of the let-down reflex mechanisms, early breastfeeding (i.e. immediately or one to two hours after delivery) has been shown to correlate well with successful lactation in the following weeks. Sight and close contact with the baby facilitates hormone release, thus enabling the mother to discharge milk from the nipples when suckled. Stress can impede this ejection reflex (*see* p. 11); therefore, we should endorse a policy of not separating mother and newborn in the delivery suite, nor in the immediate postnatal period. Another disincentive for the establishment of breastfeeding is a caesarean section under general anaesthesia rather than a spinal block. A local anaesthetic would at least ensure that the mother was fully alert and so could put her baby promptly to the breast if she so wished. However, highly motivated mothers or equally determined midwives can diminish the counterproductive influence of an anaesthetic on successful lactation.

Caesarean section is a major operative procedure. The subsequent pain from the mother's abdominal wall is such that the intention to carry out lactation needs to be a resolute one. Should the mother need painkillers in the postoperative period, this might impede her efforts to successfully breastfeed. Because of the scar and discomfort, the position when suckling is critical – unless the baby is being supported and held away from the site of the incision, it will not be easy to relax. If the baby is fed whilst the mother is in bed on her side, she will need physical assistance when she switches to the other breast. After the first week, pain and discomfort from the wound will be lessened and successful feeding is more likely to become established. A kindly midwife can all too readily block a mother's endeavours to lactate by endorsing too generous a use of analgesics and sedatives, but, above all, by the misplaced yet well-meaning practice of not awakening mother at night. In maternity units with a high caesarean section rate, more intensive efforts to achieve a successful policy of lactation will be needed than in other centres where such sections are less frequent.

In some maternity units, a standard dose of pethidine, or a comparable drug, is given for the relief of pain, which is not related to the mother's stature, i.e. if the mother is six foot tall and weighing 90 kg, she will inevitably need more medication than a thin, diminutive 'ballerina' type. Also, often to avoid the vomiting that can accompany the use of opiates (e.g. codeine, morphine, pethidine), older-type anthistamines are given. These can sedate the mother and impede her effort to breastfeed, because of her reduced state of alertness and responsiveness to the baby's presence. After the delivery, the antenatal drugs might still be active and keep mother in a sleepy and unaware condition, perhaps for many hours.

Rooming-in of mother and baby is most important if we are to see any likelihood of breastfeeding becoming established. Happily, nowadays, few maternity units have the end-of-ward nursery seen until recently in too many hospitals. Every evening the cribs were wheeled away from the mother's bedside and not returned until the following morning. No doubt many mothers cried silently and their babies more vociferously.

Mother and baby separation can be the result of the newborn having to enter an intensive care unit (ICU), perhaps for ventilation or other specialised therapy. However, even in this situation – and allowing for the fact that the newborn may be hidden beneath extensive monitoring equipment within an enclosed, or perhaps an open, crib – we believe it is not necessary to separate the baby. One of us (DB) was staggered recently to hear a ward sister on a neonatal ICU with an international reputation, telling her medical colleagues that the mother of a ventilated newborn would not need to be with her baby. We are strongly critical of such advice. However, we realise that few nurses or paediatricians need reminding of the enormous importance of keeping mother and baby together in all situations whenever possible, unless mother poses some hazard to the baby, such as being mentally very ill, perhaps psychotic or physically threatening to her baby – but this is not common.

With goodwill and a positive professional attitude, mother and baby can, and should, be kept close together physically and not just visually. After all, even if apparatus and tubes are blanketing the baby, there is invariably some part of the baby's bare skin, be it just the forehead or foot, that gives the mother the opportunity of touching the skin and hopefully making eye contact. Kangaroo care is where mothers nurse their infants against their chests, being held within the mother's shirt or top, to facilitate skin to skin contact even when the baby may be quite ill. This technique has become increasingly popular in some special care units.

Unfortunately, there are situations where mother and baby cannot always be together. For example, one of us (SA) had twins prematurely: one was in special care while the other was being ventilated in intensive care – therefore it was physically impossible to be with both newborns.

When mothers are unable to breastfeed, they should be encouraged to express very frequently – at least three-hourly and a minimum of once during the night. If the milk supply appears to be diminishing, the mother should be advised to express more often. A photograph of the baby or an article of his or her worn clothing close to hand may help stimulate milk production. It is also important that the mother eats and drinks plenty.

Technique of breastfeeding

Breastfeeding position

Comfort and position are important in the establishment of successful breastfeeding. The baby should be supported snugly in the crook of the mother's elbow. Sitting up, especially in a traditional narrow hospital bed, can often be a most difficult way in which to nurse a baby. A better alternative might be for the mother to lie flat in bed on her side with the baby; and the less clothing between mother and baby, the easier it is to feed.

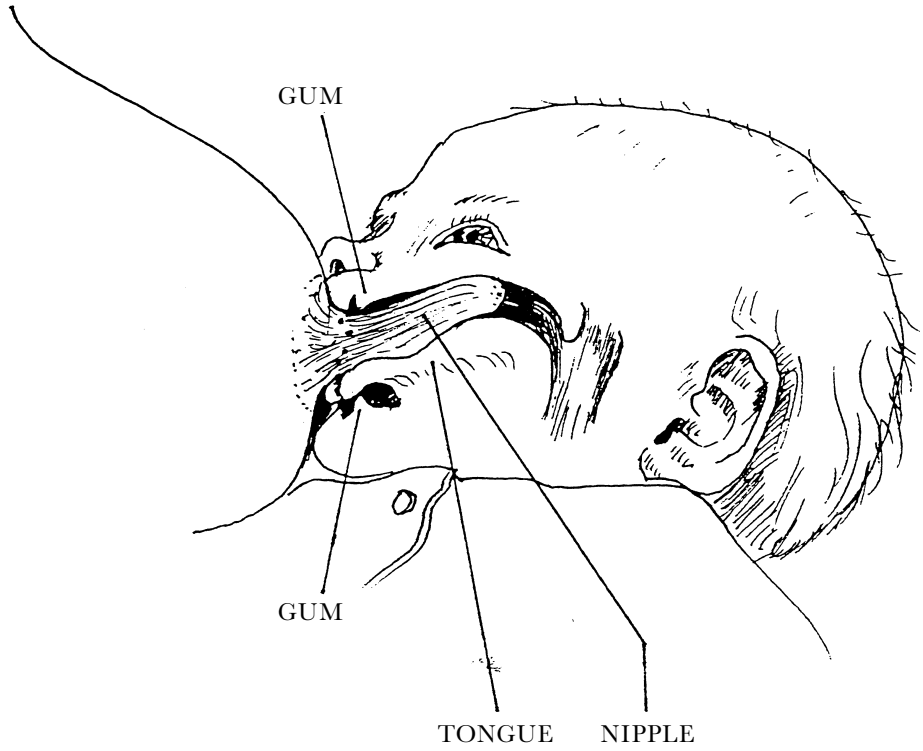


Figure 1.7 How a baby sucks.

For breastfeeding to be successful, the whole nipple (including the areola area at the nipple base) must be placed well within the mouth (Fig. 1.7). Understandably, a mother who is relaxed physically and mentally will have her milk flowing with less impedance than one who is tense and stressed. Also a multigravid woman will be less troubled than a primigravida. If the baby's mouth is pushed onto the nipple, the activation of the important rooting reflex will result in the baby turning towards the cheek that was touched and so stimulated by a primitive mechanism. Frequently a baby will root towards the bedclothes or nightwear that incidentally touched one cheek, thereby disrupting an established feeding session. When the nipple is well within the mouth, it should be directed upwards as if being aimed at the baby's nose. Once the let-down reflex is active, the baby ought not to come off the breast.

It is important to recall that milk reserves are stored beneath the areola and so need to be emptied. In situations where the areola is very large, yet must be emptied, it can be compressed by finger and thumb to ensure it is flattened. Finally, we need to remind mothers both to empty their breasts completely, and to alternate the side they offer.

Breastfeeding during sleep

There is much mythology and superstition about the entire topic of breastfeeding, but certainly particular anxieties exist in respect of a mother feeding in bed and

suffocating the baby by overlying during sleep. Mothers have been observed – and, indeed, filmed – whilst sleeping, and it is quite possible for baby to suck at the breast whilst mother sleeps peacefully throughout the entire exercise. If the mother inadvertently positions herself on top of the baby, her newborn will move his or her head around and so not become asphyxiated from the breasts, whatever their size. Parents can also be reassured that, in normal circumstances, the baby will not fall out of bed. However, as a result of a recent European study into cot deaths, the Foundation for the Study of Infant Deaths has changed its guidelines. Bed or couch sharing could be unsafe for infants in the first eight weeks of life.

Our only other reservations relate to when a mother is ill, is on medication such as tranquillisers, antidepressants or antipsychotic agents, or is under the influence of alcohol. An alert and physically well mother who is uninfluenced by drugs or psychological illness will encounter no problems, and, when awakened, will have satisfied both the baby's nutritional needs and her own sleep requirement. For some basic reflex mechanisms to work, the infant's cheek needs to make contact with the bare breast, and then, in response, the baby's mouth will open and 'home in' on the nipple. Observe a frustrated, if not crying, baby, fully clothed, endeavouring to find the nipple, perhaps through the mother's bra or other obtrusive underwear blocking access. A naked mother and unclothed baby, given neither are cold, readily dovetail, and feeding at the breast is facilitated.

Length of time at the breast

The cornerstone of advice can be condensed into the simple message of 'little and often' and there should be no place for clocks. Between three and four minutes at a breast will release 80% to 95% of the milk, depending upon many factors, such as the absence of anxiety, fatigue or emotional/physical stress during lactation. Within the first two minutes, 50% of the milk can be released. To reassure the mother that timing at the breast is irrelevant, ask for her views about lactation in the developing world. There, for example, a mother may feed her baby whilst working in the fields, and, not surprisingly, is unconcerned about 'x' minutes at each breast. Fortunately, she is unlikely to have a watch or clock. The kidneys of the newborn, especially the immature baby (i.e. less than 37 weeks at birth) have not evolved to cope with large intakes of protein infrequently – thus, small volumes and often is what is needed.

The ideal volume of milk

One of the many major benefits of milk from the breast is that we do not know what volume the mother is giving her newborn – and this is just how the situation should be. A well mother who wants to successfully feed her offspring from her breasts will, if given advice and support, invariably succeed.

Frequency

Newborns may need to be fed one to two-hourly, having as many as 8–10 feeds a day. At one month, feeds will be every two to three hours, and by two to three months of age, every four hours.

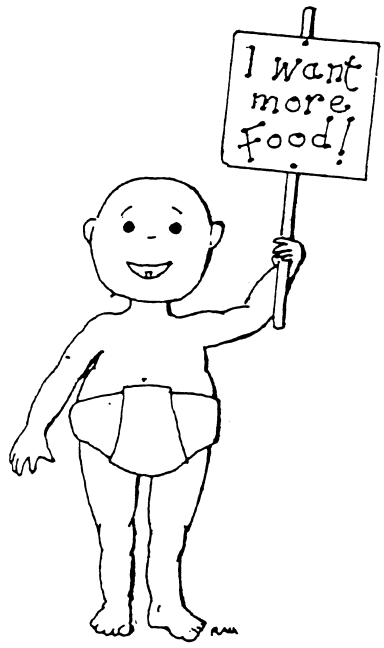


Figure 1.8 'Demand' feeding.

The act of suckling stimulates the nipple and surrounding area; consequently, messages are sent to the pituitary gland to cause the release of the hormones prolactin and oxytocin. Prolactin controls milk production within the breasts, and so we can see quite readily that the more the baby suckles, the greater is the volume of milk formed. Presumably, the more frequent the feeding, the higher is the efficiency of the let-down reflex (*see* p. 11).

The more intensive the activity of 'demand' feeding, the better the actual supply of milk (Fig. 1.8). To achieve an improved weight gain, when the midwives and doctors are concerned about a baby not thriving, the simple remedy is to put the baby to the breast more often. Tight schedules of feeding must be abandoned and the baby fed often, and that could indeed mean every one or two hours. It can be appreciated that for unrestricted but successful feeding, telling the mother to put the baby to the breast four-hourly will thwart baby and mother, and ensure failure of the mother's endeavours. The commonest reason given by mothers for cessation of breastfeeding is that they believed they had insufficient milk. This sadly is a false belief and is demoralising for mothers. The simple remedy is for them to feed more frequently and not to resort to complementary feeding, which is counterproductive.

Often, mothers are given conflicting advice about their lactation practice; this can be very confusing, particularly for a vulnerable mother with her first baby.

Case study

Davina's mother was told that her baby's poor weight gain was due to insufficient breast milk. However, she was feeding four- to six-hourly in a baby only seven days old who had not returned to her birth weight of 3 kg.

The family doctor rightly advised that the baby be breastfed every two to three hours and even at night. Davina's father helped by giving the baby expressed breast milk that had been stored in the fridge during the previous 24 hours. This ensured that Davina's mother had six to eight hours of sleep and so felt revitalised for daytime activities, when she could focus on her baby's needs. Within three days of the new management plan, Davina started to thrive and gained 8–10 g/kg/day.

Energy consumed and stools

During the first few months, most infants need 100–115 kcal/kg/day. This equates to 150–180 ml of breast milk per kilogram per day (based on actual weight). If the infant does not thrive, the volume of milk should be increased. As discussed previously, this can be done by increasing the frequency of feeds or offering both breasts at a feed.

Stool character and frequency

Mothers, especially those in the UK and the US, are often overly concerned with the colour of the baby's stool, and their observations give them much unnecessary anxiety.

The early stool after birth is black and sticky as a result of the presence of meconium (debris, etc. from the bowel wall), but when milk passes along the bowel lumen, stool colour and consistency will change. The nature of a feed (i.e. human milk, cow's milk, soy milk, etc.), and the presence or absence of jaundice and phototherapy, all influence the characteristics of the stool.

In the healthy breastfed newborn, the stools are soft, odourless, and although usually yellow, may be green. Coloration depends upon the type and quantity of bile pigment present in the stool and is unimportant in the absence of biliary tract or hepatic disease.

Babies fed solely on breast milk never pass hard stools and do not get constipated. Initially, some of these babies may pass stools after every feed, resulting in eight or so nappy changes per day; however, others will pass only one stool on alternate days. After a few weeks, the baby's motions appear less often. Because breast milk is absorbed so efficiently, it is not surprising that babies fed solely on human milk produce so few stools. If the baby is well and thriving, this observation is of no significance. Underfeeding may be associated with frequent and small motions.

In contrast to those who are on breast milk, babies fed on formula produce stools that are firmer and brown, with an unpleasant smell. Also, formula-fed babies commonly pass stools less frequently than do those being suckled.

Weight gain

All babies who are born at the appropriate time with a normal weight for their sex lose weight after birth and then regain. This should not be true for those who were

not nourished adequately *in utero*: they should not lose at all but slowly gain weight. A baby who is tube fed may have a more precipitous gain than one on the breast, because the appetite is bypassed and not used to determine uptake. A breastfed baby might not return to his or her birth weight until as long as 10–14 days after birth. The precise gain is not important, but weekly trends do matter. One baby may gain 25 g a day; another, 30 g – providing the baby is well, the practitioner need not be concerned. After four months, the velocity of growth is less, so the daily gain will drop to about 20 g.

Junior doctors, midwives and health visitors can easily get the mother too tuned in to the precise weight as opposed to the rate of gain and overall trend. We often need to remind mothers that using scales at several centres (baby clinic, GP's consulting rooms, hospital clinic and ward) gives dissimilar readings. Clothing might well be different at the time of each attendance. Similarly, measuring a baby's length, and also head circumference, will vary with the skills and patience of different personnel: on occasion, our nurses have reported a length that tells us a baby has shrunk. Nevertheless, plotting all babies' weight, length and head circumference regularly on the Child Growth Foundation growth charts is the best way of monitoring nutritional adequacy. The Child Growth Foundation have also produced new 'breast from birth' charts – weight charts specifically designed for breastfed infants. These charts recognise the different growth pattern of breastfed infants. Breastfed babies initially gain weight more rapidly, but from two or three months of age their weight gain decreases and they begin to move downwards across the centiles unless they are plotted on these new 'breast from birth' growth charts. The Child Growth Foundation argue that the new charts will prevent mothers and health professionals from becoming anxious and changing the infant from breast to formula milk when growth begins to slow down. The Child Growth Foundation also suggest the charts could be used as the reference for all British babies whatever the means of feeding.

Mother's diet and medication use during lactation

Lactation, in contrast to pregnancy, imposes a greater energy and fluid requirement. The additional energy needs for lactation are derived as increments, depending on the volume of milk the mother is producing. This ranges from 450 additional kilocalories per day in month one to 570 kcal per day for exclusive feeding in months three to six. There is no evidence to suggest that a gradual maternal weight loss, in part from uterine involution during lactation, is detrimental to milk production, but it is not advisable to follow a weight-reducing diet until after weaning. In principle, a mother's diet ought to be both well balanced and adequate; where this is not so, milk is produced at the expense of maternal tissue. Women can form milk containing adequate protein, fat, carbohydrate and most micronutrients even when their own sources are limited. Only prolonged lactation in nutritionally depleted women is likely to have an impact on milk composition: in these circumstances, the content of calcium, folate, and vitamins B_6, B_{12}, A and D may be reduced. The maternal diet will, however, affect the fatty acid composition of the milk, particularly that of LCPs, which are important for brain and retinal development (*see* p. 10).

We need to be concerned about the mother's calcium requirements, which rise to a staggering 1350 mg per day whilst breastfeeding: this is not achieved by even two pints of milk alone. In lactating young women and adolescents who will not have achieved maximum bone density, it has been suggested that daily calcium intake should be 1500 mg (three pints of milk). Milk and milk products play a vital role in mothers achieving their calcium requirements; if, for any reason, they are unable to include such in their diets, they require at least 1000 mg of calcium per day as a dietary supplement

There are also increased requirements for protein, vitamin D, thiamine (vitamin B_1), riboflavin (vitamin B_2), nicotinic acid (vitamin B_3), folate, and vitamins B_{12} and A. Vitamin D requirements are doubled to 20 μg/day. There has been a recent resurgence of interest in this due to the apparent increase in the incidence of rickets, particularly in inner-city Asian communities. New recommendations have suggested that pregnant and lactating women be given a supplement of vitamin D (*see* Chapter 6). The other increased requirements can easily be met by a varied diet.

If a lactating mother takes in caffeine-containing drinks or foods, the baby might become irritable or restless. Caffeine is present in tea, coffee, chocolate, cocoa and cola drinks. Alcohol also readily passes into breast milk and high intakes should be avoided during lactation.

Maternal fluid intake does not affect the volume of breast milk produced, but a lactating woman needs to consume more fluid – about two litres per day – to protect herself from dehydration. In practice, breastfeeding mothers are extremely thirsty and often take additional fluids.

Rarely, maternal medications can have a harmful effect on the baby; however, this is uncommon, and only if a mother takes specific treatment for serious diseases, such as cancer, blood clotting disorders, arthritis or thyroid disease, might we then discourage breastfeeding. Box 1.1 gives examples of drugs that can be found in human milk. It is all too easy for an inexperienced midwife or junior doctor to tell a mother to abandon breastfeeding because of his or her own ignorance about the influence upon the baby of the mother's medication. In the final analysis, it is sometimes possible to measure medical drugs that appear in the mother's milk and thus allay everyone's anxiety. However, for technical as well as economic reasons, it is not always easy to measure the medication within human milk.

Box 1.1 Maternal drugs contraindicated in breastfeeding.*

Bromocriptine	Amphetamine
Cyclophosphamide	Cocaine
Cyclosporine	Heroin
Doxorubicin	Marijuana
Dextroamphetamine	Nicotine
Ergotamine	Phencyclidine (PCP)
Lithium	
Methotrexate	
Phenindione	

* This list is not comprehensive.

Environmental pollutants such as DDT and isotopes (e.g. iodine, strontium and caesium) can be detected in the soil, then the grass upon which cows graze, and finally within the cow's milk which is ingested by lactating mothers.

Adverse (? allergic) reactions to food products in mother's milk

It has been known for some years that dairy foods ingested by a mother can be detected in her own milk. In earlier generations, there was a belief that what a mother consumed could influence the baby's health and behaviour. These impressions, if not superstitions, were noted, but not until immunologists were able to demonstrate the presence of cow's-milk proteins in breast milk did clinicians pay heed to such comments.

Many substances, foods, chemicals, pollutants (e.g. pesticides) and, of course, a number of medications find their way into the lactating mother's breast. It was in 1918 that Talbot in America reported the development of eczema in a baby after a mother who was totally breastfeeding ate a lot of chocolate. Even before birth, it is believed that the foetus can be sensitised to an antigen ingested by the pregnant mother.

A family history of eczema, asthma, hayfever, food intolerance or migraine would make the family physician suspect an adverse food reaction in a baby who is in discomfort following a breastfeed. The drug caffeine (present in cocoa, chocolate, coffee, tea, etc.) can be recovered from a lactating mother's milk and, as a stimulant, can distress an infant. The Committee on Toxicology of Chemicals in Food (COT) report on peanut allergy advises against the intake of peanuts for breastfeeding women.

Colic

We, in common with others, have at times observed the development of so-called colic in a baby being breastfed. Colic is characterised by vigorous, periodic crying episodes and bending up of the lower limbs, indicative of abdominal pain; the baby is more restless and distressed upon completion of a feed than at the beginning, when the baby presumably was hungry. We have been impressed that if mothers of such babies remove all milk and dairy products from their own diet, there is a sudden improvement in a high proportion of cases. In this situation, the mother must take a calcium supplement to ensure her requirement of 1350 mg/day is met. It is virtually impossible to achieve this level of intake without milk products in the diet.

If there is fresh blood in the stools of a non-constipated baby, milk-sensitive (or food-sensitive) colitis might be the cause (*see* Chapter 7). Usually, there is increased bowel activity with much flatus and borborygmi. In such cases, a paediatrician's opinion needs to be sought. The family practitioner will be rightly concerned lest the mother attributes the baby's pain and distress to colic, when a more serious condition such as bowel obstruction (e.g. an inguinal hernia incarceration, volvulus, etc.) is present.

Spices, garlic, beef, chicken and eggs, as well as other foods and drinks, in the lactating mother's diet can provoke problems in a small number of suckled babies – these foods, however, should not be avoided unless there is good evidence to do so.

Does avoidance of cow's milk and other allergens reduce the likelihood of eczema or asthma developing in the newborn?

There is much controversy in the medical profession about this, but a number of distinguished paediatric dermatologists and immunologists have shown the benefit of milk-protein avoidance in the early weeks and months of life. However, others have disputed this hypothesis. It would seem prudent, in the presence of a positive family history of intolerance to foods and when the bowel has an inadequate immune system (before four to six months of age), that the well-motivated mother is cautious and strictly avoids at least dairy products (Fig. 1.9). We do not believe that where one child has a history of allergy, the mother (if she has decided against breastfeeding) should resort to a soy milk (*see* p. 37), because that, too, can cause adverse reactions. Nor should she implement a diet that is low in antigens, at the time of weaning, unless eczema is evident and she has sought expert dietetic advice. Paediatricians, together with dietitians, must be involved in such decision-making by the parents.

There is a view that with a family history of significant atopy, probiotic (*Lactobacillus rhamnosus*) capsules should be ingested daily by a mother two to four weeks before delivery of the baby and given to the mother once a day whilst she breastfeeds. There is some evidence to show that probiotics will significantly reduce the presence and severity of eczema in such newborns.

Cow's milk can be found in many foods and it is not always an obvious ingredient; use the checklist in Box 1.2 as a guide to help avoid foods containing milk, where this has been expertly advised. Terms for milk products used in food labelling are listed in Table 1.1. Some medicinal preparations also contain milk products.

All those following a milk-free diet should be referred to a state registered dietician (SRD) to ensure there has been complete elimination of milk proteins and also to evaluate the calcium intake. Older infants who are not taking a substitute formula always require calcium supplementation.

Figure 1.9 In the presence of a family history of allergy, some advocate the mother should avoid dairy products.

Box 1.2 Foods that may contain milk products.*

Protein foods	Sausages, burgers, frozen and canned meat and meat/fish in sauce, meat and fish coated in batter or breadcrumbs
Cereal products	Infant cereals, rusks, biscuits, cookies, bread, buns, cakes, pastries, canned spaghetti with cheese
Dairy products	Margarines; canned, dehydrated and frozen desserts and ice creams; canned and dehydrated baby desserts; powdered coffee whiteners and cream substitutes; malted milks
Fruits and vegetables	Canned and dehydrated vegetables in sauce
Confectionery	Milk chocolate; filled chocolates and chocolate bars; toffees and soft sweets or candies; lemon curd; chocolate-type spreads
Miscellaneous	Canned and dehydrated soups; mustard; pickles in sauces; flavoured crisps and similar snack items; salad dressings

* All ingredients should be checked for hidden sources of milk; many supermarkets now produce lists of milk-free products for their customers.

Table 1.1 Terms for milk products used in food labelling.

Buttermilk	*Casein*	*Lactose*	*Milk solids*	*Whey*
Butterfat, butter solids, milk fat, animal fat, artificial cream, artificial butter flavour	Caseinates, hydrolysed casein		Non-fat milk solids	Hydrolysed whey, vegetarian whey

Maternal problems associated with breastfeeding

Painful breasts (engorgement)

There are many potential problems that can arise during feeding of the newborn. When breastfeeding, especially if the breasts are not emptied frequently, tender and severely painful lumps can appear. To advise a mother then to stop putting her baby to the breast will only intensify the problem and is the wrong approach.

Our experience both within maternity units and in the community has convinced us that treatment of this very common problem can often be mismanaged.

Engorgement arises not only from the presence of excess milk but also may be the result both of an increased blood supply and leakage of lymphatic fluid from its vessels. Such leakage is secondary to the blocked blood vessels caused by the raised pressure within the breasts. The skin of the breasts appears shiny and has the features of orange-peel, with a pit-like surface. The lumps can be very conspicuous and discrete. This phenomenon is often linked with shivering attacks and the mother having a hot sensation; accordingly, doctors can readily interpret this situation as being due to a breast abscess, which is a different problem and requires medical treatment.

The main principles of treatment are to feed more often, and for longer periods of time. As Jelliffe reminds us: 'Successful lactation with an unimpaired let-down reflex leads to adequate emptying of the breasts without milk engorgement and less chance of nipple trauma.' Often it might be too difficult to suckle the baby because of swelling and tenseness, therefore some milk should be expressed (either manually or by a hand or electric pump) to soften the breasts. Applying icepacks will relieve both the tenderness and the pain, as will the use of hot or cold compression packs.

Nipple problems

Nipple soreness is one of the commonest reasons given by mothers who have abandoned lactation. It is disconcerting to recall that Mavis Gunther, a distinguished authority on the subject, said nipple soreness was almost entirely avoidable. She also wrote about 'psychosomatic' soreness. There can be no doubt that when a mother is anxious – or, indeed, ambivalent – about breastfeeding, and feels it is expected of her yet is reluctant to offer her own milk, nipple problems are commoner. We have often predicted on our ward rounds within the maternity unit which mother will have trouble with her nipples, even though they are perfectly normal in size and contour.

In common with so many topics in medicine, there are a number of theories as to why suckling a baby can cause sore nipples. If the nipple is not properly positioned within the baby's mouth, its lining can be damaged. Considerable negative pressure is created as the baby sucks, and if the nipple, because of its shape or length, is ill positioned, it will be injured and cause a painful stimulus for the mother. Examination of the nipple will reveal a line or bar composed of petechiae and small raised projections (papillae). With an adequate let-down reflex, the baby should not need to suck hard. When sore nipples are present, we need to review the mother's position and posture.

Sore nipples are said to be commoner in fair-skinned women with pinker nipples. A cardinal rule is that mothers should continue breastfeeding. Mothers often note that applying milk (especially hindmilk) to the nipple and allowing it to dry prevents soreness. We do not advise application of preparations on the nipple and areola, which is a sensitive site of skin, richly supplied with nerves. Lanolin, present in many skin preparations or creams that might be applied to lessen pain (e.g. analgesics or anaesthetic sprays), can cause skin reactions (e.g. contact dermatitis), and also reduce the 'pheromones'. These chemicals enable each baby to

respond specifically to the unique odours of his or her own mother's nipples and so facilitate breastfeeding. Nipples need not be washed with soap and water. To be convinced of this advice, note the success rate of mothers breastfeeding in non-industrialised countries, who do not have such ready access to soap etc. and are not concerned with nipple preparation or hygiene.

If a crack appears, and this is not nearly as common as is thought, then it is important to try to express milk, because retention will lead to engorgement, and other problems can escalate, with eventual cessation of lactation.

In some women, nipples may be flat or even inverted. This may cause such women to feel disheartened as regards breastfeeding. However, it is uncommon for this apparent problem to pose as much difficulty as might be anticipated. The shape and protraction of nipples undergo a spontaneous and favourable change during pregnancy. Breast shells (shields), too, may help in this regard (Fig. 1.10). These devices consist of a plastic-saucer-like structure with a central hole in the inner surface. They can be worn antenatally inside a bra and exert pressure that may result in nipple protrusion, although there is no conclusive evidence that the shells do in fact achieve eversion of inverted nipples.

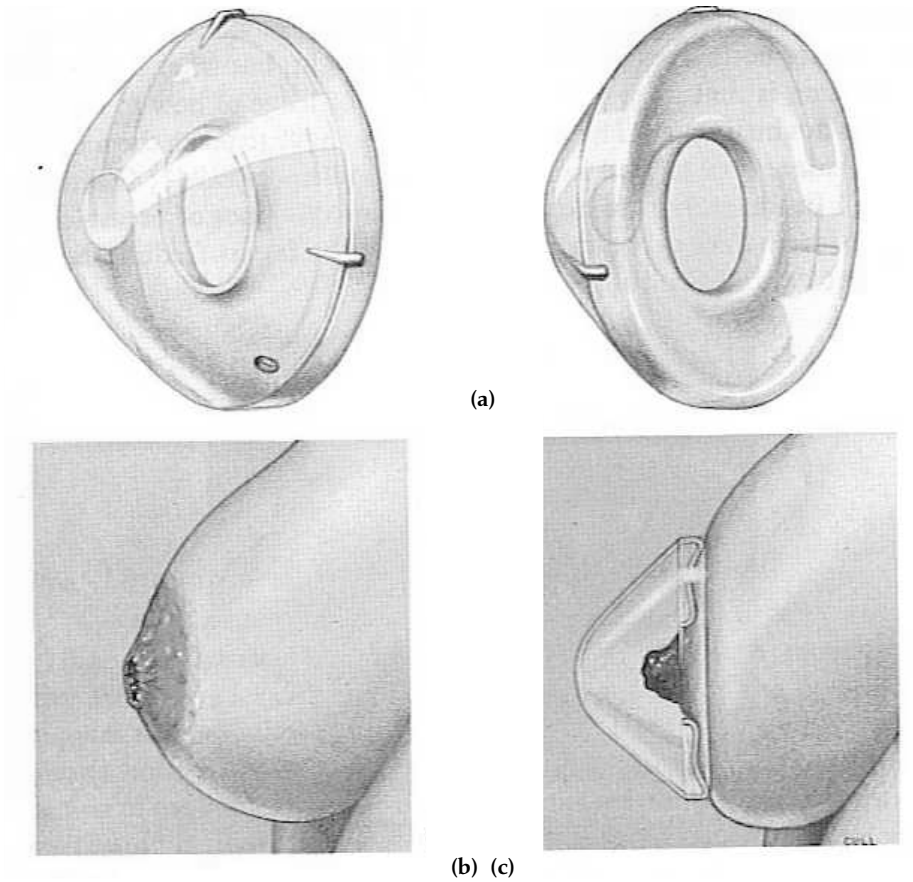


Figure 1.10 Nipple shields. (a) Glass or plastic shields. (b, c) The shield in use.

Even if this apparent problem persists after delivery, it should not deter the woman from breastfeeding. We ought to remind such mothers that just as sexual excitability can transform flattish nipples into erectile structures, so can a suckling infant. Usually, pressure upon the areola will cause the nipple to extrude from its embedded position and so convince a mother that the baby will be able to latch on.

Jaundice and breast milk

Jaundice is a syndrome characterised by hyperbilirubinaemia and deposition of bile pigment in the skin, mucous membranes and sclera, with a resulting yellow appearance of the patient. Jaundice can be caused by a great many mechanisms.

A premature baby has a less efficient liver than one born at full term. The liver has a large number of tasks to perform. One important activity is for it to handle breakdown products of red blood cells. At the end of their lifespan (about 120 days), red blood cells rupture, releasing haemoglobin. The 'haem' element is reduced to form bilirubin, which binds to plasma proteins and is transported to the liver. Here, the bilirubin is removed from the protein and conjugated with glucuronate that makes it highly soluble, thus enabling it to be excreted in the bile. The immature liver in preterm infants is not efficient at conjugation.

Jaundice may appear in some breastfed babies, particularly those who are premature. Breast-milk jaundice is associated with raised amounts of non-esterified fatty acids (NEFA) in the milk. These fatty acids inhibit the transferase that conjugates bilirubin. Fortunately, this situation is not harmful and does not require treatment. Irrespective of the intensity of the skin's yellow colour, lactation ought to continue, even though such babies may be jaundiced for many days or even weeks.

Jaundice due to other conditions, such as ABO incompatibility or other causes of haemolysis, in contrast to breast-milk jaundice, might need light therapy (phototherapy). This may well prove very stressful to both mother and baby: the baby is separated from the mother, and then, naked and blindfolded, is put into an incubator and exposed to a light source. We believe that this technique is used too often and should not be authorised without an experienced paediatrician considering the clinical facts and then determining its validity in a particular case. If, phototherapy is deemed necessary, mothers should be prepared and emotionally supported. As with all situations, some mothers find the whole exercise less disturbing than do others. Because of the increased water loss from the heat created by the light bulbs, extra fluid is usually recommended, and the stool colour will alter and less-well-formed stools will be passed.

To convince a mother that her baby's jaundice is due to her breast milk, as opposed to unrecognised disease, some would suggest that the milk is withheld for 12–24 hours (expressed and saved), then later reintroduced. However, in our experience, this is counterproductive in that successful lactation can so readily be irretrievably disrupted. Measuring the infant's serum bilirubin serially and demonstrating it is mainly of an unconjugated (indirect) type will reassure the mother and her carers and help them to exclude the presence of obstructive biliary disease. The latter will be characterised by conjugated (direct) hyperbilirubinaemia and has serious connotations.

Expression and storage of milk

The baby's sucking reflex is not present until maturation reaches an age of 32–36 weeks (a normal 'term' delivery is 37–40 weeks). If this reflex is absent, sucking will not be activated when the nipple or teat of a bottle is positioned inside the baby's mouth. Therefore, until this age of development is achieved, a mother who wants to breastfeed will need to express her milk. This is then offered to the infant via a feeding tube passed through the nose and into the stomach.

Many contemporary women choose to express milk, via a hand or electric pump, to fit in with their lifestyles and work commitments. If a mother is working, particularly part-time, she could express her milk early in the morning or at any convenient time, and the carers of the baby use the expressed milk. Fathers or other carers often give a feed of expressed breast milk, particularly at night, so as to offer mothers a rest, get infants used to a bottle and for their own enjoyment. Expressing can also be a useful technique to increase milk supply – especially in the morning, when it is plentiful.

Furthermore, this option has a role in the most unlikely situation that the mother is on very powerful drugs (e.g. chemotherapy for cancer) which are present in her milk, the aim being that, when off treatment, she could return to, or indeed commence, breastfeeding. The milk pumped during therapy can be discarded. Other uncommon instances include a mother having 'open' and active tuberculosis, where, even after a short phase of anti-tuberculosis treatment, the infant can return quite safely to the breast, although he or she, too, will receive some of the anti-tuberculosis medication.

Before expressing milk, a mother needs to wash her hands carefully and practice acceptable techniques of hygiene. The milk container and pump must be kept clean and sterilised after use. Expressing milk by hand or pump can be a difficult and stressful exercise. A skilled midwife or counsellor is extremely important – and essential in the early phase.

Types of breast pumps

Hand pumps

The simplest and most compact of all hand pumps are the inexpensive types which can be bought from chemist shops or high-street baby-product sources. Because they are hand operated, they can be tiring, although a benefit is that the force of the vacuum and the speed of expressing is determined manually. However, for long-term use, the electric/battery pumps are often more successful.

Electric and battery-powered pumps

These are useful for long-term pumping where mothers frequently express. They require no manual effort and both the vacuum strength and cycle speed can be altered. Both single and double units are available. Suppliers include:

Egnell/Ameda Ltd
Unit 1
Belvedere Training Estate
Taunton TA1 1BH
Tel: 01823 336362
www.ameda.demon.co.uk

Medela
CMS House
Basford Lane
Leek
Staffordshire ST13 7DT
www.medela.com

It is often possible to hire such machines in the UK from some hospitals with maternity units, or from the La Leche League, or seek advice from the National Childbirth Trust (*see* p. 30).

Storage of milk

Breast milk can be kept at room temperature for six hours; in a domestic refrigerator for 24 hours or for three to five days if a temperature of 2–4°C can be guaranteed; in the freezer compartment of a fridge for one week; and in a deep freezer for three months. When collecting milk from the breast (or the 'drip' milk from the non-feeding side), we advise the use of plastic collecting bottles, if possible, because valuable and viable cells in the milk can be lost by sticking to the walls of glass containers.

Viruses in breast milk

Although, in general terms, bacterial parasites have difficulty surviving in breast milk, the RNA retroviruses, which include human immunodeficiency virus 1 (HIV-1) and human T-lymphotropic viruses 1 and 2 (HTLV-l, HTLV-2), use this route. Cytomegalovirus (CMV), Epstein-Barr virus and human herpesvirus 7 have been detected in human milk. This contrasts with hepatitis viruses B and C, which, although possibly being in relatively high viral numbers in the maternal circulation, are not frequently detected in milk.

Cytomegalovirus

CMV is a member of the herpes family. Breast milk is known to be a possible carrier of this virus. Depending upon the age and the immune status of the host, cytomegaloviruses can cause a variety of clinical syndromes (collectively known as cytomegalic inclusion disease), although the majority of infections are very mild and subclinical. The classic disease is congenital, being acquired *in utero* from the mother; infection can also be transmitted from mother to infant in passage through the birth canal or from ingestion of virus in the mother's milk. Fortunately, the majority of CMV infections in newborns are not apparent, and the baby is well. However, in some infected infants – albeit rare – there may be hepatosplenomegaly, jaundice, chorioretinitis, purpura, microcephaly, cerebral calcifications, and severe central nervous system sequelae with blindness, deafnesss, quadriplegia and mental retardation.

The situation is compounded by our ignorance, in that mothers are rarely screened to determine if they carry CMV. This is unsatisfactory, even though we do not have a vaccine. In the UK, the virus is present in 2%–6% of pregnant mothers and can be found in the urine of 1%–2% of newborns. In the US, it is thought that approximately 30 000 infants with CMV infection are born each year, and about one-tenth will have symptoms such as deafness and mild mental retardation. It has been shown in America that CMV infection is higher in women in the upper- and middle-income groups than in those with lower incomes. Furthermore, this infection is commoner at birth in the highly developed countries as compared with in the developing nations.

Hepatitis and breast milk

Some of the viruses responsible for hepatitis can be transmitted to the newborn from the mother prior to birth, at the time of delivery, or as a result of breastfeeding.

Hepatitis B

The hepatitis B virus (HBV) can be present in various body fluids of mothers. During the postnatal period, close contact between mother and newborn will facilitate transfer of the virus. Newborns of infected mothers from Asia or Africa are at particular risk of developing hepatitis B – more than three-quarters of the babies will develop the infection. The highest incidence is in children born to Chinese mothers.

Fortunately, transmission of HBV can be dealt with by the use of a special vaccine. Sophisticated markers of the disease exist (core antigen values) to measure the degree of risk of infectivity to those in proximity to the mother.

Hepatitis G

The hepatitis G virus (HGV), also known as GB virus C (GBV-C), an RNA agent, is transmitted mainly through the parenteral route. Approximately 2% of pregnant women are HGV antibody positive. There is a higher mother-to-infant transmission rate (30%–50%) of this virus than of HCV. A neonatal source can cause a persistent infection.

Breast milk and the HIV (AIDS) virus

More than 1600 children acquire HIV infection every day globally, and the majority as a result of mother-to-infant transmission. Fortunately, in the UK, policy changes and improvements in antenatal testing, perinatal antiretroviral therapy, planned vaginal or elective caesarean birth, as well as infant formula feeding, have dramatically reduced this transmission rate to less than 2% (Tudor-Williams & Lyall, 1999). In a study conducted in Uganda, a single oral dose of the antiretroviral drug, neviparine, given to HIV-infected women in labour, reduced perinatal HIV infection by about 50%. Additional data from this study demonstrated the continued benefit and safety of neviparine in reducing mother-to-child transmission of HIV up to 18 months, even in a breastfeeding population.

Between one-third to one-half of babies born to HIV-positive mothers are infected before or around the time of birth. A very significant number of cases worldwide have been caused by the virus being in the mother's milk, especially in the presence of mastitis or breast abscesses. It has been estimated that breastfeeding will confer an additional risk of 14% (95% confidence interval, 7%–22%) of mother-to-child HIV infection. Although some experts have disputed the evidence, it would clearly be prudent to note the warning issued by the Chief Medical Officer to the Department of Health and Social Security in the UK (April 1988 and July 1989). It is necessary to advise all mothers in the UK known to be infected with HIV to abstain from breastfeeding. Paediatricians in Africa have questioned the consequential hazards of such guidelines, since human milk is so protective against potential lethal pathogens. In most developing countries afflicted with AIDS, the hazards of bottle-feeding exceed the risk of mother-to-baby transmission of HIV infection. Women donating breast milk to pooled milk banks should be identified as being HIV antibody negative, although we must emphasise this does not give a 100% assurance that all is well. It is also important to note that if the pasteurisation technique is faulty, then HIV, if present, will not be destroyed.

Those at risk of HIV infection include:

- sexual partners of persons known to be infected with HIV
- men who have sex with other men
- anyone who has multiple sex partners
- anyone who has sex with a prostitute
- anyone who shares needles using illegal injected drugs
- anyone who exchanges sex for drugs or money
- anyone who has a sexually transmitted disease
- anyone who has had or currently has a sexual partner with any of the above risk factors.

> 'Behaviour changes can result in a decrease in new HIV infections in both rich and poor countries.'
>
> Arthur J Ammamann, President of Global Strategies for HIV Prevention, 2003

Support groups

There are those babies who seem trouble-free feeders, while others appear disheartened when fed, and readily cry, if not battle with the nipple and mother. At times, the explanation for this apparent conflict can be directed towards those responsible for the immediate postnatal midwifery management. A sudden surge of professional activity in a labour suite, which might well be modestly staffed, can result in insufficient time being offered to a mother keen to start breastfeeding. In such a scenario, we need to recall that the vital sucking reflex is strongest in the initial 20–30 minutes after birth, therefore the baby needs to be put to the breast within that unique first half-hour period.

Fortunately, many support groups exist, and with more openness on the part of midwives and maternity units, members of such groups, hopefully, are welcomed to counsel both mother and staff to ensure teaching is consistent, and the professionals do not contradict one another and confuse a well-motivated mother.

Sadly, but inevitably, many questions are put to our most junior doctors: some find it hard to admit that they know little of the art of lactation, and mothers sense the invalidity of the advice given. We would prefer to see each maternity unit or health centre have a single expert or a small group of 'nutrition' midwives who are committed, particularly in the antenatal period, to the propagation of breastfeeding.

Simple pieces of advice regarding position, type of chair, posture, skin-to-skin contact and creating a relaxed atmosphere, perhaps privacy for a shy mother, are all significant factors for the many who fail to establish successful lactation. Leaflets are available from voluntary organisations such as the National Childbirth Trust (NCT) and the La Leche League. Unfortunately, according to a UK study in 1985, as few as 5% of mothers use the expertise of such organisations.

National Childbirth Trust
Alexandra House
Oldham Terrace
London W3 6NH
Tel: 020 8992 8637
www.nct-online.org

La Leche League
BM 3424
London WC1N 3XX
Tel: 020 7242 1278
www.lalecheleague.org

La Leche League International
Post Office Box 1209
Franklin Park
IL 60131 - 8209
USA

The National Awareness Website
www.breastfeeding.nhs.uk

British Association of Perinatal Medicine
50 Hallam Street
London WIW 6DE
Tel: 020 7307 5640
www.bapm-london.org

Further reading

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- Hale T (2002) *Medication and Mother's Milk* (10e). Pharmasoft Medical Publishing, Amarillo, TX.
- Morgan J and Dickerson J (2003) *Nutrition in Early Life*. Wiley, Chichester.