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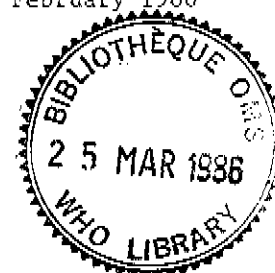
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*Breast feeding*

FACTORS INFLUENCING BREAST-FEEDING  
IN RELATION TO INFANT AND MATERNAL HEALTH

*Infant food*  
by

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Because adequate nutrient intake is more critical in early infancy than at any other time in life, the protection and encouragement of breast-feeding are an important contribution to the healthy growth and development of infants and young children. There are, however, a number of situations - fortunately relatively infrequent - where infants cannot, or should not, be breast-fed. This paper discusses circumstances where breast-feeding is not possible, or is contraindicated, for reasons related to the health of infants and mothers, and where breast-milk substitutes may, therefore, be needed for extended periods. It also considers a number of situations that are frequently thought to be an impediment to breast-feeding but which in fact generally are not. Both have a number of important implications for health and nutrition policy, including the provision of information, education and training concerning infant and young child feeding and nutrition, and the organization and functioning of relevant health and related social welfare services.

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## INTRODUCTION

1. Adequate nutrient intake is more critical in early infancy than at any other time in life. This is so because of the infant's high nutritional requirements in relation to body weight and the influence proper or faulty diet during the first months can have on future health and development. Moreover, the infant is more sensitive, and less adaptable, than in later life to different types, forms, proportions and quantities of food.
2. Breast-feeding is an unequalled way of providing complete food for the healthy growth and development of infants, and forms a unique biological and emotional basis for the health of both mother and child. In addition, the anti-infective properties of breast milk help to protect infants against disease, and there is an important relationship between breast-feeding and child spacing. The protection and encouragement of breast-feeding are, therefore, an important part of the health, nutrition and other social measures required to promote healthy growth and development of infants and young children, and the health and well-being of their mothers.
3. There are, however, a number of situations - fortunately relatively infrequent - where infants cannot, or should not, be breast-fed. This paper discusses circumstances where breast-feeding is not possible, or is contraindicated, for reasons related to the health of infants and mothers, and where breast-milk substitutes may, therefore, be needed for extended periods. Other situations of a psychosocial nature, including the exercise of choice, fall outside the scope of the present review.
4. Before beginning it is useful to distinguish between infants who should not receive breast milk at all and infants who cannot be fed at the breast, but for whom breast milk is still the food of choice. There is also a tiny minority of infants who should not be fed either on breast milk or any milk-based formula; special preparations are required in such cases. Finally, there are a number of situations which are frequently thought to be an impediment to breast-feeding but which in fact generally are not. They, too, will be considered.

## SITUATIONS RELATED TO INFANT HEALTH

### Inborn errors of metabolism

5. Some congenital and hereditary metabolic disorders, characterized by specific enzyme deficiencies, severely limit or render impossible the use of certain milk components. Serious health disturbances may result unless dietary intake of the components in question is restricted or, in some cases, eliminated altogether. There are three metabolic disorders of particular interest in this connection: galactosaemia, phenylketonuria and maple syrup urine disease.
6. Galactosaemia. There are two main forms of this disease; one of these is characterized by a deficiency of galactokinase, an enzyme that is required for the breakdown of galactose, a component of lactose. If infants who have this disease are given breast milk, or any preparation containing lactose, the galactose blood level rises, the sugar appears in the urine, and clinically the infant develops cataracts.
7. The other form of the disease, which is even more serious, is due to a deficiency of another enzyme that is required later in the metabolism of galactose, galactose-1-phosphate uridyl transferrase. The metabolite, which in this case accumulates in the blood, produces even greater damage than the first form of the disease. Symptoms in the infant include diarrhoea, vomiting, hepatomegaly, jaundice and splenomegaly. If lactose is not eliminated from the diet, cataracts, hepatic cirrhosis and mental retardation result.
8. Galactosaemia can be diagnosed through laboratory tests, either during the intrauterine period or immediately following birth, if there is reason to suspect its presence. Since lactose must be eliminated from the diet of infants suffering from both forms of the

disease, they cannot be fed either on human milk or any other milk, including the usual breast-milk substitutes. Specially formulated milk-based, but lactose-free, preparations, or soy bean-based formulas are required. Fortunately, this disease is a rare one; prevalence figures are available only from industrialized countries where they vary between 1 in 20 000 and 1 in 200 000 infants (0.5-5/100 000).<sup>1</sup>

9. Phenylketonuria. This condition is characterized by defective metabolism of the amino acid phenylalanine. It is due to absence in the liver of the enzyme phenylalanine hydroxylase, and its most dangerous clinical manifestation is moderate to severe mental retardation. Diagnosis can be made from birth by laboratory tests, which are performed routinely in many developed countries. The development of the clinical manifestations of this condition can be avoided with a diet low in phenylalanine. Fortunately, breast milk contains a relatively low concentration of this amino acid, much lower in fact than cow's milk. Infants suffering from phenylketonuria may therefore be breast-fed while blood levels of phenylalanine are monitored. Breast milk should be replaced by a special low phenylalanine formula if concentrations in the blood reach dangerous levels.<sup>2</sup> Prevalence figures from industrialized countries vary between 1 in 5 000 and 1 in 100 000 infants (1-20/100 000).<sup>3</sup>

10. Maple syrup urine disease. This disease is due to a defect in the metabolism of the branched-chain amino acids valine, leucine and isoleucine, which are normal components of all natural proteins. The specific enzymatic deficiency is not yet well identified. It is characterized by a typical maple syrup odor of infant urine, refusal of food, vomiting, metabolic acidosis, and progressive neurologic and mental deterioration. If not treated, this disease is fatal within the first months of life. Special synthetic formulas, low in the non-tolerated amino acids, have been developed for the feeding of such infants. The disease is very rare with a prevalence of only about 1 in 200 000 infants (0.5/100 000).<sup>4</sup>

#### Low birth weight

11. A large proportion of low-birth-weight infants (below 2 500 g), particularly in developing countries, are born at term and behave as fully mature infants. They are small as a result of chronic malnutrition and the small size of their mothers. They can and should be breast-fed and do not present any particular problems in this respect.

12. However, some infants with very low birth weight (below 1 500 g), whether or not adequate for gestational age, and who are mostly born pre-term, present special feeding problems. First of all, their nutritional requirements for energy, protein, calcium, sodium and iron are proportionately higher than those of infants born at term with adequate weight. The increase is required for "catch up" growth. At the same time these infants' digestive, metabolic and excretory systems are not yet fully developed. Their gastric emptying time is longer and they have difficulty digesting some proteins, for example casein, and animal fats. Their amino acid requirements are particularly strict. Because their water and electrolyte balance is very sensitive due to renal immaturity, they are at greater risk of dehydration and negative sodium balance. A very delicate nutritional balance is therefore required in feeding them, one that ensures a relatively high concentration of nutrients without creating additional difficulties.

13. Pre-term infants have a very weak or non-existent sucking capability and thus cannot breast-feed. In most instances gastric intubation is required. The question arises as to the most appropriate food for such infants. From a strictly qualitative point of view, that is, based on nutrients present, digestibility, anti-infective properties, and so forth, maternal milk is the ideal food for pre-term infants. Yet it has been estimated that human milk has a lower concentration of nutrients than is actually required by the pre-term infant,<sup>5</sup> while modified cow's milk or standard infant formula have been found to be inappropriate in terms of digestibility and the biological availability of casein, fats and iron. Special formulations have therefore been developed for feeding pre-term low-birth-weight infants.

14. More recently, however, it has been shown that the breast milk of mothers of pre-term infants is indeed different from the milk of mothers of normal infants on which the estimates of nutrient concentrations relative to need had originally been based. In fact,

the milk of mothers of low-birth-weight infants has a higher concentration of energy and nutrients than mature breast milk and is thus well suited to the particular needs of the pre-term infant.<sup>6</sup> The food of choice for small pre-terms remains their own mothers' milk that has been expressed and fed manually.

15. In addition to providing nutritional and immunological advantages, feeding a pre-term infant with expressed breast milk may also help to compensate a distressed mother for not being able to care for her infant who, in most cases, remains in an institutional setting. Expressing breast milk is also essential for lactation maintenance, in preparation for normal breast-feeding as soon as the infant is strong enough.

16. The best alternative in cases where the milk of a pre-term infant's own mother is not available is human milk obtained from a bank. Such milk is generally less satisfactory, however, because its composition varies according to the method of collection, and because such milk is intended for the mature infant. When milk from banks is used to feed pre-term infants, their growth and general health need to be closely monitored. Sodium, calcium, energy or protein supplements are frequently required under such circumstances.

17. When human milk is not available, a specially formulated breast-milk substitute should be used to feed pre-term infants. Great care is required to ensure that these infants' particular nutritional needs are properly satisfied without exposing them to additional health risks.

#### Cleft lip and cleft palate

18. Infants born with a cleft lip or cleft palate may have difficulties in creating the vacuum necessary for proper sucking. The seriousness of the problem depends on the extent of the lesion. Most infants with a cleft lip but intact palate manage to suck, and their mothers soon learn to help them by closing with their breast the opening between mouth and nose. For such infants breast-feeding may in actual fact be easier than bottle-feeding.

19. As with cleft lip, the possibility of breast-feeding in cases of cleft palate depends on how extensive the defect is. If it is unilateral and small, the mother may be able to place her teat in a way that makes sucking possible. Still, sucking may not be strong enough, in which case milk production could diminish. Under such circumstances letting the infant suck at the breast and then expressing milk and giving it to the infant manually will help both to stimulate lactation performance and satisfy infant nutritional needs.

20. In cases of very extensive bilateral malformation, the sucking of either a natural or artificial teat may be altogether impossible, and a spoon, cup, syringe, or similar device will have to be used. The problem posed by this deformation is less one of having to choose between breast milk or a breast-milk substitute than having to overcome an infant's inability to suck. The food of choice for such infants remains breast milk, because of the nutritional and immunological advantages and the importance of lactation maintenance in order that a mother be able to breast-feed her infant normally once the defect has been corrected. The incidence of cleft lip is on the order of 1 per 1 000 infants, while that for cleft palate is 1 in 2 500 infants (1/1000, 0.4/1000).<sup>7</sup>

#### SITUATIONS RELATED TO MATERNAL HEALTH

##### Lactation failure

21. Lactation failure means the inability of a woman to produce significant amounts of milk after giving birth. It should be distinguished from "perceived milk insufficiency", which is discussed below (see paragraphs 76-77). Lactation failure is one of the reasons frequently given by mothers for not breast-feeding their infants; it occurs with high prevalence almost exclusively in industrialized countries and among the higher socioeconomic groups of urban women in the developing world. Yet such women are, in the main, healthy and well nourished, with healthy and strong infants, and without any apparent physiological reason for not being able to secrete milk.

22. In contrast, in traditional societies, even women who live in unsanitary conditions, who are poorly nourished and often ill, who engage in strenuous physical labour, and who bear the greatest number of low-birth-weight infants do not generally fail to secrete milk. For example, in the WHO collaborative study on breast-feeding,<sup>8</sup> it was found that out of a total of 3 898 mothers studied in Nigeria and Zaire, not one was unable to secrete milk. This sample included both women from among the urban elite and those from poor urban and rural populations. In a prospective study undertaken in a small, poor Indian village in the mountains of Guatemala,<sup>9</sup> all the children born during an eight-year period were followed longitudinally. It was observed that all 448 infants born alive during the period, and who survived for forty-eight hours, had been successfully breast-fed.

23. The incidence of lactation failure as a primary physiopathological phenomenon is not easily approached since it depends on being able to assess what proportion of women, for whom there are no external influences that may interfere with lactation, are unable to secrete milk. Lactation performance is very sensitive to psychosocial factors that are frequently difficult to identify. In the case of industrialized countries, inability to lactate is closely associated with women who have little or no information about breast-feeding at their disposal; who have little or no experience with the mechanics of breast-feeding; who are frequently lacking in confidence about their ability to breast-feed; and who have no close family member, friend or other means of social support to aid them in overcoming any problems they may encounter in initiating breast-feeding. At the same time, these women are exposed to a variety of social, economic and cultural influences that may be inimical to breast-feeding.

24. In contrast, in societies where breast-feeding is considered to be as natural a physiological function as breathing and sleeping and the only way to nourish an infant, and where breast-feeding is highly valued and therefore strongly encouraged and supported by families and friends, lactation failure is virtually unknown.

25. Based on experience in industrialized countries, it appears likely that from 1 to 5% of women experience lactation failure on purely physiological grounds.<sup>10</sup> Observations made in traditional societies suggest an even lower figure.

#### Maternal illness

26. Breast-feeding is contraindicated only in cases of very severe maternal illness, for example in the case of heart failure, severe kidney, liver or lung disease, or extreme malnourishment such as that experienced during famine. Breast-feeding would also be inadvisable in rare cases of psychosis or severe postnatal depression where an infant's life may be in danger if cared for by a disturbed mother. However, most common illnesses in mothers are not in themselves reasons not to breast-feed. The possible transmission of infectious diseases to the infant is always a concern and merits a more detailed discussion.

27. Mastitis. The non-epidemic form of puerperal mastitis is a cellulitis of the interlobular connective tissue of the breast, usually produced by Staphylococcus aureus. It is characterized by swelling, pain, redness and fever, and occurs most frequently during the first weeks of lactation. The microorganisms found in breast-milk during this type of infection are the same that are frequently found in the milk of non-infected mothers, that is, the common microorganisms of the skin and mouth of the mother, which she shares with her infant from a few hours after birth, with no deleterious consequences.

28. It has been suggested that early infection of the infant with this type of non-pathogenic microorganisms plays an important role in building up the infant's defense mechanisms.<sup>11</sup> Breast-feeding should therefore not be interrupted during this type of mastitis; on the contrary, drainage by milk excretion is beneficial and it has been observed that the infection is of shorter duration and is less frequently complicated with abscesses when breast-feeding is continued. If breast-feeding at the affected breast is too painful, milk should be expressed manually or with a pump. Symptoms usually disappear within 36-48 hours, although treatment with antibiotics may be required in severe cases.

29. There is also an epidemic form of mastitis, which is a hospital-acquired infection due to more pathogenic microorganisms. By the time symptoms are observed, both the mother and her infant have already been infected. Antibiotic therapy is required for both, but, once again, there is no reason to discontinue breast-feeding.

30. Breast abscess. Breast abscess is a possible complication of mastitis, but is more frequently related to an abrupt interruption of breast-feeding. It requires surgical drainage and appropriate antimicrobial therapy. Breast-feeding should continue at the non-infected breast, and milk from the infected one gently expressed until it can again be taken directly by the infant.

31. Urinary tract infection. This is a commonly observed post-partum bacterial infection. It should be treated with antibiotics but represents no problem for the infant. Breast-feeding should continue.

32. Tuberculosis. Active tuberculosis should be investigated and treated during pregnancy, thus eliminating the danger of infecting the infant after birth. For this same reason, contacts should also be investigated and treated as required. Where an infective bacteriologically positive mother is discovered only after delivery, there is a danger of infecting the infant, not by breast-feeding but as a result of close contact, both of which are otherwise beneficial. Under such circumstances, the mother, who becomes non-infective as soon as treatment is initiated, should be treated with triple-drug therapy. The infant should receive a prophylactic dose of isoniazid for at least six months (10-15 mg per kg of body weight in a single daily dose). It is also recommended that the infant receive BCG vaccine. It is all the more important to breast-feed since situations where a mother is diagnosed only after delivery are found most often among populations at the lowest socioeconomic levels where environmental conditions are very poor. Under these circumstances not breast-feeding an infant may represent only an additional unnecessary risk. Moreover, from a purely practical standpoint of limited living space, it may be quite impossible to separate mother and infant.

#### Viral infections

33. The common viral diseases like rubella, chicken pox, measles and mumps are rare but can be observed in lactating mothers. In these situations, by the time of diagnosis the infant has already had every chance of being infected. There is, therefore, no reason to isolate the infant or to interrupt breast-feeding. On the contrary, the specific anti-infective properties of the mother's milk serve to protect the breast-fed infant who, although infected, will frequently not develop the disease itself. In contrast, acquired immunodeficiency syndrome (AIDS) in mothers has not been sufficiently studied or documented to determine the risk of transmission of the LAV/HTLV-III virus from mother to infant through breast-feeding.

34. There are a number of other viral infections that merit brief discussion.

35. Cytomegalovirus. Intrauterine infection with cytomegalovirus (CMV) is a common cause of congenital anomalies. The infection is, however, of no danger to the infant after birth. A high proportion of healthy mothers (14% in one study in the United States of America) have CMV in their cervical secretions. Their infants become infected during delivery but do not develop any pathology.<sup>12</sup> Similarly, CMV can be excreted by the mother in breast milk or saliva with the inevitable result of infecting the infant, but again without consequence.<sup>13</sup> Discovery of CMV in a lactating mother is, therefore, no reason for discontinuing breast-feeding.

36. Herpes simplex. The infection of the neonate with herpes simplex virus, resulting in a severe disease, occurs during passage through the birth canal of a mother who has active genital herpes lesions. Caesarean section is indicated if the lesions are detected in time, that is at the onset of labour.<sup>14</sup> Breast milk is not infective under such circumstances and there is thus no reason for not breast-feeding. Careful hygienic handling of the infant is in any case required to prevent infection spreading from the mother's hands or clothing.

37. Hepatitis B. The possibility of transmitting hepatitis B virus from an active infected or carrier mother to her neonate via breast-feeding cannot be excluded. In such a situation, however, the infant has already been exposed to a greater risk of infection through maternal blood, amniotic fluid and vaginal secretions during birth.<sup>15</sup> Furthermore, in areas of high endemicity where there is a high prevalence of healthy carriers of the virus, environmental exposure is so frequent that not breast-feeding

provides very little protection.<sup>16</sup> Studies in England, where there is a low prevalence of hepatitis B carriers, demonstrate that breast-feeding does not increase the rate of infection among infants.<sup>16</sup> In the United States of America, where the prevalence of carriers is less than 1% overall, the American Academy of Pediatrics recommends the administration of hepatitis B immune globulin to infants of carrier mothers who wish to breast-feed.<sup>17</sup> In conclusion, breast-feeding should be encouraged by active infected or carrier mothers in most parts of the world in view of all of its advantages and the fact that the risk of increasing infection with hepatitis B virus in this manner is negligible.

#### Relactation

38. It is possible for mothers who have interrupted breast-feeding, and whose milk secretion consequently has stopped, to reestablish lactation. Even women who have not been pregnant recently can secrete breast milk if they are sufficiently motivated and properly stimulated by a sucking infant. For mothers who have been recently feeding their infants, particularly when some milk is still being produced, full milk supply can be reestablished if their infants are again put to the breast frequently and are allowed to suck vigorously. This is all the more important for mothers of young infants in situations where artificial feeding is difficult or risky.

#### CONDITIONS THAT NORMALLY SHOULD NOT BE CONSIDERED CONTRAINDICATIONS TO BREAST-FEEDING

##### Conditions related to the infant

39. Multiple births. The breast-feeding of twins should present no problem for a healthy, well-nourished mother as far as quantity of breast milk is concerned. A lactating mother's capacity for milk production is generally greater than her actual production. Since secretion is determined to a large extent by demand, vigorously sucking twins will stimulate lactation performance and permit a mother to produce enough milk to feed both. This result has been commonly observed in relation to the practice of wet-nursing.

40. If infants' birth weight is too low, or their sucking capacity inadequate, breast milk may initially have to be expressed for manual feeding, in order to maintain lactation performance until the infants are strong enough to take the breast directly (see above discussion regarding pre-term infants). Chronically malnourished mothers may not have the capacity to feed two infants adequately. Under such circumstances it would be advisable to complement the diet of the mother; complementary feeding may also be necessary for the infant, all the while maintaining breast-feeding.

41. There are reports of mothers successfully breast-feeding triplets. Not infrequently, however, the birth weight of such infants is low and they have poor sucking ability. Complementary feeding may, therefore, also be required, while not forgetting to stimulate breast milk production and utilizing it to the best possible nutritional benefit.

42. Breast-feeding jaundice. In addition to the common jaundice of the new born, there is a very rare type of jaundice associated with breast-feeding that usually develops when the infant is about one week old.<sup>18</sup> It lasts about two months and is characterized by high levels of unconjugated bilirubin in the blood. Abnormal bilirubin metabolism is associated with ingestion of the mature breast milk (though not of the colostrum) of some mothers. The specific responsible mechanism has not yet been identified. Apart from jaundice the infant is generally healthy and develops normally. While no ill effects have been observed, it is in any case important to establish a differential diagnosis in order to eliminate other possible causes of jaundice, which may have more serious consequences.

43. A positive diagnosis can be obtained by withholding the breast for 24-36 hours. A rapid and marked drop in bilirubin blood levels in the infant is observed, followed by a rise to lower than previous levels when breast-feeding is resumed. While conducting this test, lactation should be maintained by expressing milk. Since the jaundice is temporary and produces no ill effects, there is generally no reason to discontinue breast-feeding. A brief interruption (24-48 hours) may be necessary, however, if bilirubin blood levels rise above 15 mg per 100 ml.<sup>19</sup> Breast-feeding can safely continue afterwards.

44. Haemorrhagic disease of the newborn. The vitamin K-dependent blood coagulation factors are low in normal full-term, and lower still in pre-term, infants. There is a further decrease in these factors by the second or third day after birth, with a gradual return to the birth values by the seventh to tenth day of life. This condition is associated with prolonged prothrombin and blood coagulation time.

45. Although rarely observed in full-term infants, the transient deficiency of vitamin K-dependent factors is occasionally severe or prolonged in pre-terms and results in gastrointestinal, nasal and intracranial bleeding, or bleeding following circumcision. The syndrome is not observed in artificially-fed infants in whom the normal intestinal flora of the breast-fed infant, predominantly acidophylic, are replaced by alkaline flora having an abundance of Escherichia coli and a large proportion of anaerobic bacteria. Under these circumstances vitamin K is synthesized in the intestinal lumen and its absorption corrects the coagulation defect. Even when severe, however, the condition is easily corrected by the intramuscular injection of a single 1 mg dose of vitamin K and should not be a cause for discontinuing breast-feeding.

46. Diarrhoea. Although diarrhoea is less common among breast-fed than bottle-fed infants, it does occur. There is no reason to stop breast-feeding, even temporarily, an infant who has diarrhoea. On the contrary, infants who continue to be breast-fed use a considerable proportion of ingested nutrients and generally fare better than infants who are denied nourishment. Substituting breast milk would not be desirable under such circumstances.

#### Conditions related to the mother

47. Breast cancer. Some epidemiological evidence suggests that breast cancer is less frequent among women who have lactated than among those who have not. However, there are so many other variables that may influence the occurrence of breast cancer, particularly if studies are based on incidence in different populations, that no definite conclusions can be reached in this regard. On the other hand, pregnancy and lactation do not represent any additional risk to a mother who should develop breast cancer at the same time. Breast cancer which has been operated on may be a reason to avoid pregnancy. When pregnancy occurs under such circumstances, breast-feeding may be in order depending on the general health of the mother and adequacy of breast function. Some years ago, virus particles resembling those associated with breast cancer in mice were found in human milk. It was at one time thought that it could be possible for mothers to transmit the disease potential to their breast-fed daughters, but epidemiological evidence has disproved this hypothesis.<sup>20</sup>

48. Inverted nipples. Inverted nipples are a relatively rare physical malformation and mild cases can be treated at the level of the antenatal clinic. Simple exercises performed by the mother during the last trimester of pregnancy can help to prepare her nipples for successful breast-feeding. Surgery may be required for more serious cases; for the majority, however, breast-feeding is entirely possible.

49. Drug therapy. A lactating mother's need for drug therapy<sup>21</sup> can sometimes raise difficult problems. While nearly all drugs are secreted in breast milk, their concentration and possible effects on the nursing infant vary considerably. There is insufficient information available on many existing drugs to make an appropriate judgement, and the continuous arrival of new drugs on the market poses additional problems. In general, the drug concentration in breast milk is very close to that in maternal plasma. The quantity of drug ingested by the infant is a function of the amount of milk consumed. The total ingested drug dose, however, is not sufficient by itself to judge the possibility of ill effects. Some drugs, although present in breast milk, are not absorbed by the infant. On the other hand, the infant may react idiosyncratically to minute amounts of some drugs. Drugs can also accumulate in neonates owing to their reduced clearance capabilities, or infants may have a specific sensitivity to drugs that are not particularly toxic for older children and adults. Thus, while most common drugs can be safely given to lactating mothers without causing significant risk to breast-fed infants, extreme caution must always be exercised. What follows are a number of general recommendations in this regard.

50. Drug therapy should be avoided in lactating mothers wherever possible. When drugs are indicated, those least likely to have negative repercussions on the infant should be selected first. Lactating women should preferably take drugs during or immediately after breast-feeding to avoid the period of maximum blood (and milk) concentration. Where there is a strong indication for a drug that is known to be harmful to the breast-fed infant, breast-feeding should be temporarily interrupted.

51. The decision is more difficult for new drugs about which little or no information is available on possible ill effects for infants. Interruption of breast-feeding would normally be the safest course. However, if bottle-feeding itself places an infant at greater risk under particular circumstances, it may be preferable to continue breast-feeding while monitoring the infant to detect possible undesirable effects. In any event, should breast-fed infants of mothers taking drugs present symptomatology that cannot be clearly accounted for by other means, the possibility of its being related to the drug taken by the mother should be thoroughly investigated.

52. The Committee on Drugs of the American Academy of Pediatrics has undertaken an extensive review of the literature and published a list<sup>22</sup> that includes:

- (a) drugs that are contraindicated during breast-feeding such as amethopterin, ergotamine, gold salts and thiouracil, which are known to have harmful consequences for the infant;
- (b) drugs that call for a temporary interruption of breast-feeding, for example any preparation resulting in radioactivity in breast milk for a variable time period during which breast-feeding would not be advisable; and
- (c) drugs that are usually compatible with breast-feeding, among which are the large majority of the most commonly used preparations.

53. The use of hormonal contraceptives by lactating women presents a number of special problems.<sup>23</sup> Products containing estrogen frequently cause a significant drop in the amount of breast milk secreted, while products containing progestogen have been found to diminish the fat concentration of breast milk. These steroids will also be present in breast milk, although the amounts actually ingested by the infant in such cases are very low. However, the synthetic steroids normally used in contraceptive pills are not as rapidly metabolized as naturally occurring ones and can cause breast engorgement and other secondary sex changes in the infant.

54. Contraception is generally not required during the first months of lactation owing to lactational amenorrhoea and anovulation. When full protection is desired, or when there is doubt about the timing of the initiation of ovulation, non-hormonal contraceptive methods should be employed. If hormonal methods must be used, preference should be given to products containing only progestogen.

55. Environmental pollutants. Undesirable chemical compounds may be found in breast milk as a result of environmental contamination. Of particular concern are the chlorinated insecticides, especially dichlorodiphenol trichloroethane (DDT) and similar compounds, because of their high level of toxicity. DDT is a fat-soluble chemical that is biologically non-degradable; it accumulates in the fat tissues of animals exposed to it. The only significant way in which the product can be excreted is via breast milk, where it concentrates in the fat component. DDT has been found in human milk in many places in the world. Very high concentrations have been observed in areas where DDT has been widely used, without any control, in the aerial spraying of agricultural crops.<sup>24</sup>

56. In most industrialized countries the concentration of DDT in human milk has significantly decreased since the enforcement of severe restrictions in its use. In most developing countries, where it has been widely used as an agricultural insecticide and in malaria control programmes, DDT is now used much less frequently because of the resistance to it that insects have developed. In highly contaminated areas, DDT is also found in cow's milk. However, it is absent from most industrially-prepared breast-milk substitutes, even when produced with contaminated milk, if vegetable fats are used to replace milk fat.

57. Although DDT has a relatively low level of toxicity for human adults, it can cause such severe and undesirable effects in some animals as hepatic dysfunction, disruption in the reproductive process, and carcinogenesis. No information is available concerning the possible deleterious consequences for infants of the levels of DDT found in breast milk. No ill effects associated with breast-feeding, even in areas of high contamination, have been observed. This does not, however, exclude the possibility of long-term consequences.

58. Maximum daily intakes of this and related compounds have been fixed by WHO and other agencies.<sup>25,26</sup> They are considered "desirable levels", however, and have been set much lower than those of known toxicity. This explains why the health of infants who may be ingesting higher levels of DDT than recommended is not necessarily being jeopardized.

59. A serious dilemma is posed for mothers and health personnel about what to do for infant feeding in areas where there is a high degree of pollution from chemical sources occurring simultaneously in a bacterially contaminated environment. A choice must be made between the known risks of bottle-feeding and the unknown, but potential, risks of breast milk chemical contamination. Clearly, the possible toxicity of DDT and similar compounds requires further investigation. Of much greater importance, however, are effective measures to protect the environment by controlling the use of these toxic products. The possible adverse effects on infant health, and the consequent doubts cast on breast-feeding, are all the more reason to prevent their abuse.

60. A marked reduction in the presence and concentration of DDT in human milk has been observed in industrialized countries where its use has been prohibited or restricted for more than ten years. On the other hand, other industrial chemicals of a similar nature are causing concern as environmental pollutants.

61. Polychlorinated biphenyls (PCBs), which are toxic, non-biologically degradable and fat soluble chemicals, have been widely used in the manufacture of electrical equipment and hydraulic machines. PCBs accumulate in the body and are excreted only in breast milk. Environmental contamination from PCBs is common the world over. Although their industrial use is now restricted, environmental contamination will persist for sometime, since there are no practical, economical means for eliminating these very stable chemicals.

62. Products of even higher toxicity such as polychlorinated dioxins (PCDDs) and furans (PCDFs) can be produced accidentally through fires and explosions in electrical equipment. It has also been determined that most incinerators produce these environmental contaminants.

63. There is no scientific evidence of any undesirable effects in infants resulting from the ingestion of these pollutants via breast milk, which are usually found in low concentrations. However, not enough experience has been gained to exclude the possibility of long-term effects, particularly to exposure through prolonged breast-feeding. Overall, the advantages of breast-feeding are still considered greater than the potential risks, particularly during the first months of life.

64. In a number of industrialized countries, where breast-feeding after four months is less critical than in some societies, consideration is being given to the possibility of counselling mothers against prolonged lactation to avoid an accumulation of PCBs in their infants. It is known, however, that the concentration of PCBs decreases as lactation advances. On the basis of present scientific knowledge such a measure thus does not appear to be justified.

65. Another pregnancy. Although there are many taboos and cultural beliefs against breast-feeding when a mother becomes pregnant again, breast-feeding is still not an uncommon practice during pregnancy in many developing countries. Beliefs in changes in breast milk volume or composition associated with a new pregnancy have not been confirmed by factual observations, nor have any ill effects been detected for either mother or infant. The main concern in such situations is that the mother's additional nutritional requirements are met. They will not be significant during the first trimester of pregnancy, a time when most lactating women would not even be aware of a new pregnancy.

66. It should be noted that it is highly improbable that a lactating woman will become pregnant before her child has begun to be weaned. Usually it is only when the child is receiving significant amounts of complementary foods, and therefore the frequency and intensity of sucking has decreased, that the mother becomes pregnant again. In developing countries this rarely occurs before the infant reaches the age of six months. Another three months will usually elapse before the mother realizes that she is pregnant. Only then does she face the decision of continuing to breast-feed or not. By this time the infant has benefited from the period when breast-feeding is of greatest value and, if necessary, can be more easily introduced to locally available family foods.

67. Problems arise in this context mainly among populations that consume foods that are inadequate or inappropriate for infant feeding, as in the case of such staples as cassava, plantain, or maize, with very few other foods and practically no products of animal origin. Under such conditions, however, the problem is more one of identifying appropriate weaning foods than of replacing breast milk. Continuing breast-feeding for as long as the mother is able and willing to do so, while seeking to supplement her own diet with commonly available foods, is by far preferable to interrupting lactation for a new pregnancy, particularly when an adequate weaning diet cannot be ensured.

68. Malnutrition. In extremely malnourished mothers, for example during famine conditions, breast milk secretion decreases and may stop altogether. From a practical point of view, however, it is more important to understand whether, and at what point, lactation performance is affected, in terms of milk volume and composition, in mothers who are in a chronic state of mild to moderate malnutrition.

69. This is so because it is believed that a large proportion of women in developing countries are, to varying degrees, chronically malnourished, although not presenting clear clinical signs of malnutrition. It is extremely difficult to assess, let alone quantify, the effects of this situation on lactation performance for lack of adequate methods for diagnosing mild to moderate subclinical forms of malnutrition. Moreover, malnutrition does not occur in isolation, but in practice is usually observed together with a series of other variables that may, in themselves, influence lactation performance. Some of these variables will have a positive bearing, for example the fact that breast-feeding is the traditional way of feeding infants and is, therefore, protected and supported by society. Others may exercise a negative influence, such as hard physical labour and environmental stress.

70. Both types of variables tend to invalidate comparisons between populations living under very different socioeconomic and environmental conditions, notwithstanding reports from conditions of poverty of infants whose growth falters earlier than would be expected for the fully breast-fed,<sup>27</sup> and seasonal variations in milk output associated with changes in the dietary intake of mothers.<sup>28</sup> The fact remains that the vast majority of mothers living in socially and economically deprived circumstances in developing countries, who are considered to be suffering from varying degrees of chronic malnutrition, are able to breast-feed their infants successfully and for long periods.

71. The difficulties associated with assessing maternal nutritional status, together with the possible influence of other variables, may account for the inconclusive results of studies of the effect on lactation performance of the supplementary feeding of mothers. There is reason to believe that maternal nutrition during pregnancy plays an important role in determining lactation performance. Thus food supplementation during lactation may not produce the desired results if a mother was malnourished during pregnancy.

72. In the WHO study concerning quantity and quality of breast milk in different countries and at various socioeconomic levels,<sup>29</sup> it was found that only among poor rural women in Zaire were there any indications of reduced milk production possibly associated with poor maternal nutritional status. Nevertheless, these same mothers were able to secrete consistently the same amount of breast milk throughout the first eighteen months of their children's lives. The amount of milk produced by poor rural women in Guatemala and the Philippines was not any less than their well-to-do urban counterparts, and, as in Zaire, these women maintained milk production well beyond the first year of life of their children. The introduction of other foods into the infant diet appears to be the main factor associated with a decrease in breast milk secretion. For example, lactation performance was poor from the first month among the well-to-do urban mothers surveyed in the Philippines, who are also the most frequent users of breast-milk substitutes.

73. As to composition, available evidence suggests that maternal diet and nutritional status have very little influence on the macronutrient content (carbohydrates, proteins and fats), and therefore energy concentration, of breast milk. It appears that, whereas the quantity of milk may decrease if there are not enough "raw materials" available to the breast gland, its composition is not significantly altered.

74. The situation is different where micronutrients (vitamins and minerals) are concerned, their presence in breast milk being directly influenced by a mother's nutritional status in their regard. The development of beri-beri in infants of thiamine-deficient mothers is a typical example of this relationship. In the WHO study mentioned above, no significant differences were found between various groups studied as regards the energy content and the main constituents of breast milk. The single exception to this rule - a higher energy content of the milk of Swedish mothers - was not repeated among well-to-do urban mothers, compared with poor rural mothers, in Guatemala and the Philippines.

75. In conclusion, the widespread malnutrition that is believed to prevail among the majority of the world's women merits continued close attention, both in terms of women's health and that of their infants. Emphasis should be placed on improving the maternal diet in preference to supplementing the infant's. In any case, as a general rule mild to moderate subclinical forms of malnutrition do not justify recommending that mothers not breast-feed their infants.

76. Perceived milk insufficiency. Many mothers decide to complement the diets of their breast-fed infants, or even to interrupt lactation completely, because they believe that they are not producing enough milk, or that their milk is "too thin" or otherwise inadequate. This occurs most frequently among educated, healthy and well nourished mothers for whom there is virtually no physiological evidence of low milk production capability, and still less for inadequate milk composition. The real stumbling block is frequently related to emotional and psychosocial factors, or to an incomplete understanding of breast-feeding, and the infant's normal weight gain should help to reassure the mother. The problem of "insufficient milk", however, may be no less real in its consequences as a result of anxiety which can suppress the let-down reflex, or because of inadequate sucking by the infant due to inappropriate feeding techniques, or by virtue of subsidiary difficulties related to breast-feeding that go unresolved for lack of proper guidance and support. The untimely introduction of other foods may, in fact, be the root cause of decreased milk secretion.

77. The composition of breast milk is quite constant as discussed earlier. Only in exceptional circumstances, for example in the case of the inborn errors of metabolism referred to above, will a mother's milk be inadequate for the healthy growth and development of her infant. What frequently happens when mothers complain that their milk is "too thin" is that, based on inexperience, they compare it to cow's milk, which is quite different in appearance. Such mothers should be reassured and given appropriate support and guidance, while the health and growth of their infants are closely monitored. (See also paragraphs 21-25 regarding lactation failure.)

#### Conclusion

78. The influence of the factors discussed above on the incidence and duration of breast-feeding will vary according to specific circumstances. Distinguishing between situations that are and are not genuine impediments to breast-feeding, or to the giving of breast milk, is an important first step in ensuring safe and, above all, appropriate nutrient intake for infants.

79. Mothers, families and others concerned with infant and young child feeding and nutrition require guidance in this regard, in addition to general information concerning the important role breast-feeding plays in healthy growth and development and the collateral advantages it presents for infants and mothers alike. Their level of awareness, in turn, depends in large measure on the availability of objective and consistent information on the subject.

80. Factors influencing breast-feeding in relation to infant and maternal health thus have a number of important implications, which the competent authorities in countries will wish to take carefully into account when formulating and implementing their health and nutrition policies. Of particular importance in this regard is the provision of information, education and training concerning infant and young child feeding and nutrition, both to the general public and to health workers; and the organization and functioning of antenatal, obstetrical, postnatal and paediatric care and services, and social welfare institutions providing for infants.

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