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Contributors

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Preface

The 1974 Report on infant feeding practice was published at a time which coincided with an upsurge of interest in the subject. The Report drew attention to a number of major nutritional issues such as the need for the composition of artificial feeds, prepared by reconstituting National Dried Milk and the various similar commercial baby milks, to approximate more closely to that of human milk. The Report also called for more research in the field of infant nutrition and for more information about the practice of infant feeding. Accordingly a survey of infant feeding practice in England and Wales was commissioned by the Department in 1975. National Dried Milk and the various similar proprietary baby milks were withdrawn from the market by 1977 and modified low solute preparations were made available for the first year of life. A review of the composition of artificial feeds was made and published in 1980.

In view of recent advances in knowledge on many aspects of infant feeding the Committee on Medical Aspects of Food Policy requested Professor Oppé to reconvene the Working Party, again with nominated representatives from the British Paediatric Association, in order to revise the 1974 Report.

The revised Report reaffirms the value of human milk and encourages professional workers to reassess their efforts not only to continue to promote breast-feeding but also to help mothers to make an informed choice about how to feed their babies. A further survey in 1980 of infant feeding practice in Britain will reveal the measure of their success to date[1]. The age at which mixed feeding is introduced has been reconsidered so that the flexibility of advice intended in the 1974 Report is clarified and stressed. With regard to vitamin supplements, the compromise of a standard dose for all children, within the boundaries of safety and effectiveness, should simplify existing problems concerning their use. Here again, the advice may vary according to professional discretion.

The Chairman and members of the Working Party deserve our renewed thanks for the help they have given so generously both in time and expertise in this most important subject.

H YELLOWLEES
Chairman,
Committee on Medical Aspects of Food Policy

[1]The findings of this survey have been incorporated in the reprinted report.

Committee on Medical Aspects of Food Policy

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Contents

1. Introduction

1.1 Background to this report

1.1.1 In the early 1970s, reports concerning problems in infant[1] feeding appeared in the medical and scientific journals. Paediatricians and manufacturers had been aware for some time that an increasing number of young infants were wholly bottle-fed, that many were also being introduced to solid foods when only a few weeks old and that those responsible for feeding infants often prepared a more concentrated feed than was intended by the manufacturer's instructions.

1.1.2 In the spring of 1973 the Panel on Child Nutrition agreed that a review of infant feeding practice was necessary. This decision was ratified by the parent Committee on Medical Aspects of Food Policy (COMA) at a meeting in June 1973. A Working Party, to which the British Paediatric Association nominated representatives, was set up under the Chairmanship of Professor T E Oppé. A report entitled "Present day practice in infant feeding" was accepted by COMA in December 1973 and published in 1974 (Department of Health and Social Security, 1974).

1.1.3 The report was well received in the United Kingdom and abroad. However, new advances in knowledge and changes in the composition of infant formulae have resulted in much, but not all, of the text now being out-of-date. Accordingly, the Panel of Child Nutrition suggested to COMA that the time was ripe for updating the 1974 report on infant feeding practice. The Committee on Medical Aspects of Food Policy approved the suggestion and invited Professor T E Oppé to recall the original Working Party. The British Paediatric Association again nominated representatives.

1.2 Terms of reference

To revise and update the report entitled "Present day practice in infant feeding" published by the Department of Health and Social Security in October 1974, and to make any necessary recommendations.

1.3 Meetings

The first meeting of the recalled Working Party was held on 11 May 1979 and the new report was accepted by the Committee on Medical Aspects of Food

[1]Throughout this report the term infant means a child who has not attained the first birthday.

Policy at the June meeting 1980. The Working Party has had the benefit of discussions with representatives of industry and of the various professional bodies in medicine and nursing who are concerned with feeding infants (Acknowledgements p vii).

1.4 Scope of the report

1.4.1 The report deals essentially with the practice of infant feeding in the United Kingdom and is chiefly concerned with the continued well-being of healthy infants. Discussion of the feeding of low birth weight babies of or infants who have metabolic or other abnormalities which require special feeding has not been included in any detail.

1.4.2 Minor revisions associated with reprinting of this report in 1983 incorporate the findings of the survey carried out in 1980 by the Office of Population Censuses and Surveys on infant feeding practice in England, Scotland and Wales. At the same time, the text on artificial feeds has been updated as new brands have been introduced or changes made in existing preparations, and tables giving compositional details of individual brands omitted. The section on allergy has also been rewritten.

2. Infant Feeding Practice in the United Kingdom

2.1 The 1970s were characterized by a reawakening of interest in the feeding and nutrition of infants. Research in many countries yielded an increased knowledge of the physiology of young infants and of the composition and physiological properties of both human and cows' milk. In addition there have been advances in food technology and in the development of artificial feeds.

2.2 There have also been administrative changes. By February 1977 National Dried Milk (NDM) was withdrawn and the use of artificial feeds which, like NDM, were based on unmodified dried or evaporated cows' milk to which vitamins A, C and D and iron had been added, was no longer advocated. A list of suitable infant formulae was publicized and arrangements were made for those infants who had qualified for NDM free of charge to have the benefit of these modified low solute foods also free of charge during the first year of life.

2.3 In response to a request from the Food Standards Committee[1] for advice about the nutritional aspects of infant foods, the Committee on Medical Aspects of Food Policy set up a Working Party on the Composition of Foods for Infants and Young Children. An intermediate report (Department of Health and Social Security, 1977) showed that the composition of pooled samples of human milk determined by modern techniques was, in general, no different from that determined by earlier workers of the late 1940s and onwards using far less sophisticated methods. The Panel's major report (Department of Health and Social Security, 1980a) has set *guidelines* for the composition of artificial feeds and recommends that all feeds should be subject to scrutiny by a panel of experts. Nutritional *guidelines* for infant formulae, rather than standards, were set in accordance with the ranges in nutrient composition normally found in human milk so that provision is made for some flexibility in the composition of artificial feeds. The Panel also recommended that no labelling, advertising or promotional literature should imply that, for a healthy full-term infant, an infant formula is to be preferred to human milk or that artificial feeding is to be preferred to breast-feeding.

2.4 Guidelines have been issued by a number of other bodies including the American Academy of Pediatrics, Committee on Nutrition (1976), the Codex

[1]The Food Standards Committee is a Statutory Committee which advises the Secretary of State for Health and Social Services, and the Minister of Agriculture, Fisheries and Food in England and Wales, the Secretary of State for Scotland and the Head of the Department of Health and Social Services for Northern Ireland on all matters concerning control of the composition and description of food.

Alimentarius Commission of the Food and Agriculture Organization and World Health Organization (1976), and by the European Society of Paediatric Gastroenterology and Nutrition (1977).

2.5 At the time of writing the 1974 infant feeding report there was particular concern about neonatal hypocalcaemia and hypernatraemia, obesity and the early introduction of solids, all of which seemed to occur more frequently in bottle-fed babies.

2.6 The low-solute infant formulae at present in use have been shown to reduce the risk of hypocalcaemia (Oppé and Redstone, 1968; Barltrop and Hillier, 1974). A welcome decline in the prevalence of hypernatraemic dehydration has been demonstrated (Arneil and Chin, 1979; Manuel and Walker-Smith, 1980). Some workers have attributed the decline to the increased use of low-solute feeds (Pullan, Dellagrammatikos and Steiner, 1977; Whalley and Walker-Smith, 1977; Sunderland and Emery, 1979; Arneil and Chin, 1979; Davies, Ansari and Mandal, 1979) but a decrease was reported even when the less modified feeds continued to be in common use (Tripp, Wilmers and Wharton, 1977).

2.7 There is now less concern about fatness in babies since there is evidence that the prevalance of obesity in infants has decreased and that the majority of fat babies lose their excess fat by the time of school entry (Section 7.3).

2.8 The earlier report on infant feeding practice (Department of Health and Social Security, 1974) emphasised the fact there there was a lack of information about the incidence of breast- and bottle-feeding in the United Kingdom. Accordingly, the Department commissioned a survey from the Office of Population Censuses and Surveys (OPCS), and a nationally representative sample of babies born in England and Wales in September and October 1975 was studied (Martin, 1978). A further survey of infant feeding practice among babies born in England, Wales and Scotland in August and September 1980 was commissioned from OPCS by the Department of Health and Social Security and the Scottish Home and Health Department (Martin and Monk, 1982). Comparisons were made between the findings in England and Wales in 1975 and 1980 and information was obtained in Scotland as a baseline for comparison with a further national survey to take place in 1985.

2.9 The overall incidence of breast-feeding, defined as the proportion of babies who were put to the breast at all, increased from 51% in 1975 to 67% in 1980. In both surveys there was a higher incidence among mothers of first babies, those educated beyond the age of 18, mothers in the higher social classes, those living in London and the South-East and those who were aged 25 or over. In 1980, four-fifths of the mothers who had started to breast-feed were still doing so at two weeks, almost two-thirds at six weeks, two-fifths at four months and one-third at six months. In mothers who had previous children, a history of breast-feeding the first baby for a short time only was less of a deterrent to trying again than among such mothers in 1975. In both surveys, mothers who breast-fed previous children were more likely to

continue breast-feeding up to four months than mothers of first babies or those who did not breast-feed their previous children. At least 28% of six week old babies and 14% of four month old babies received breast milk alone in 1980 compared with 12% and 1% respectively in 1975.

2.10 The proportions of breast-fed babies receiving artificial milk feeds at six weeks and four months in 1980 showed no significant differences from those found in 1975. In 1980, 55% of mothers introduced solids by the age of three months and 89% by four months compared with 85% and 97% respectively in 1975. Rusks replaced cereals as the most common first foods.

3. Breast-feeding

3.1 Introduction

3.1.1 All mammals provide their young with a complete food which is unique to the species. Man is no exception. First colostrum, then transitional milk and later mature milk can completely satisfy all the infant's needs during the early months of life. The development of sophisticated artificial foods has undoubtedly made bottle-feeding more safe, but no artificial food can completely mimic the nutritional and protective properties of human milk. Since publication of the previous report in 1974, the Health Departments have supported the view of the medical and nursing professions that breast-feeding is preferable to artificial feeding and should be encouraged. The Working Party endorses this view and reaffirms the convictions which are stated in the 1974 report.

3.2 The composition of human colostrum and mature milk

3.2.1 There is considerable variation in the composition of both colostrum and of mature human milk although the percentage of water in mature milk shows very little variation throughout lactation and averages 87.8% (Vaughan, Weber and Kemberling, 1979). Changes in nutrient content during the course of lactation are greater and occur more rapidly during the first week post-partum. Individual samples of milk show a variation from one mother to another in volume, nutrient composition and energy value. There is also a physiological variation during a feed, the 'hind' milk being richer in fat and yielding more energy than the 'fore' milk (Hytten, 1954) and between different feeds during the day, the concentration of fat being least in the early hours of the morning (Gunther and Stanier, 1949). Because of these variations, any figures for composition must be taken as representative rather than absolute values.

3.2.2 *Energy.* It is difficult to give a figure for the energy value of colostrum since much of the protein is not digested and is therefore not absorbed (paras 3.3.2 and 3.3.3). Mature human milk provides on average 70 kcal (290 kJ)/ 100 ml.

3.2.3 *Protein.* Colostrum secreted on the second day after the birth contains about five times as much protein as mature milk. About one-fifth of the protein in colostrum is casein and about four-fifths is a mixture of soluble whey proteins of which over half is secretory immunoglobulin A (Ig A). In the

colostrum which is first secreted, the concentration of secretory Ig A is even higher but it decreases rapidly over the first four days and then more slowly (McClelland, Samson and McGrath, 1978). Human colostrum and milk contain other whey proteins, such as lactoferrin and lysozyme, which are important to the infant (para 3.3.3).

3.2.4 For most constituents the older the infant the greater the intake except for total protein and secretory Ig A. The two-day old infant takes in about five times as much secretory Ig A as the infant who is seven weeks old. The intakes of immunoglobulin G and lactoferrin do not change appreciably, any decrease in concentration in colostrum or in milk being compensated by an increase in the volume ingested. All these changes in concentration, volume and intake take place more rapidly during the first week of lactation, but all are continuous and there appear to be no sudden alterations at any particular time.

3.2.5 *Fat.* Fat provides more than 50% of the energy of mature milk, and it is also the carrier of fat soluble vitamins A, D, E and K and of the essential fatty acids. The fatty acids present in human milk reflect to some extent those present in the maternal diet and may therefore vary. Nevertheless a larger concentration of long chain polyunsaturated fatty acids is present in human milk than in cows' milk. The structural distribution of certain long chain saturated fatty acids, notably palmitic acid, within the triglyceride molecule gives to human milk a fat which is different from and better absorbed than that of the milk of other mammals (Tomarelli, Meyer, Weaber and Bernhart, 1968; Filer, Mattson and Fomon, 1969; Rey and Ricour, 1972). Human milk fat is particularly well absorbed by the very young infant (Southgate, Widdowson, Smits, Cooke, Walker and Mathers, 1969; Fomon, Ziegler, Thomas, Jensen and Filer, 1970).

3.2.6 *Carbohydrate.* The principal carbohydrate of mammalian milks is lactose which, when digested, yields a mixture of galactose and glucose. Galactose is necessary for the synthesis of glycoproteins and glycolipids of the central nervous system, but galactose can be synthesized from glucose in the liver. It is doubtful therefore whether lactose is an essential sugar. However, lactose may have some special function within the lumen of the gut. For example lactose is associated with stool acidity and an intestinal flora which may be important in suppressing the growth of pathogens such as *Escherichia coli* in the gut (Bullen and Willis, 1971).

3.2.7 *Minerals.* The concentrations of major irorganic nutrients in colostrum and mature milk are similar except for sodium, the relatively high concentration of which in colostrum is essential in the development of the secretory function of the mammary gland (Linzell and Peaker, 1971). However, because the volume of colostrum consumed is small, the total intake of sodium by the new-born infant is not large.

3.2.8 *Trace elements* are present in colostrum and in human milk. They include iron, copper, zinc, manganese, chromium, molybdenum, cobalt, selenium, iodine and fluorine. All are essential for the infant and play their particular roles in the metabolism of the body. Most of the metals are bound to protein as part of enzymes.

3.2.9 *Vitamins.* All the known vitamins are present in both colostrum and mature milk. Colostrum contains more vitamin A, both pre-formed vitamin A and carotenoid pigments, than later milk and this is true of the colostrum of other species, for example the cow, sheep, goat and pig (Moore, 1957). Colostrum obtained within 48 hours of delivery contains high concentrations of vitamin B_{12} but within a few days the levels fall to a range similar to those in normal serum (Samson and McClelland, 1980). However, the total amounts of the different vitamins received by the breast-fed infant increase as lactation becomes established.

3.2.10 The vitamin content of human milk is closely associated with the vitamin status of the mother and is sufficient for the infant's requirements provided the mother has a plentiful supply. The need for supplements for the mother during pregnancy and lactation and for the young infant is discussed later (section 6.1).

3.3 Anti-infective factors in human milk

3.3.1 Where there are high standards of personal hygiene and a microbiologically safe water supply, as in most developed countries, the incidence of gastroenteritis in infancy is low. Nevertheless, intestinal infections are less common in breast-fed than in artificially fed infants (Chandra, 1979). The anti-infective properties of colostrum and human milk can be attributed to the presence of maternal antibodies, to living cells—macrophages and lymphocytes—and to the different water soluble whey proteins (Ogra and Ogra, 1978; Pittard, 1979; Adinolfi and Glynn, 1979).

3.3.2 Secretory IgA is active in the lumen of the gut and limits the multiplication of bacterial and viral pathogens within the digestive tract. Immunoglobulin G (IgG) and immunoglobulin M (IgM) are present in smaller concentrations, but all three immunoglobulins have distinct and different antimicrobial activities. Unlike secretory IgA, IgG and IgM may be digested by the proteolytic enzymes of the gut. The presence of secretory IgA and lactoferrin in colostrum at a greater concentration than in later human milk (para 3.2.3) may compensate for some delay in the secretion of IgA by the epithelial cells of the gut. The delay is sometimes called the immunity gap and is occasioned by the change from placental to alimentary feeding.

3.3.3 The iron-binding protein lactoferrin and the enzyme lysozyme inhibit bacterial growth non-specifically. Lactoferrin is also probably concerned with

absorption of iron by the infant (Brock, 1980). Human milk appears to contain a growth factor for *Lactobacillus bifidus* which facilitates the colonization of the intestine with this organism. The acetic and lactic acids that are produced increase the acidity of the intestinal contents and so inhibit the growth of pathogens.

3.4 The establishment and maintenance of lactation

3.4.1 *Antenatal preparation.* A positive introduction to the subject of infant feeding early in the antenatal period is required so that there is time for discussion, consideration and decision-making before the birth. A basic simple understanding of the importance of a nourishing diet for the mother, of the fundamental processes of lactation and of the advantages of breast-feeding for the health of mother and child are all necessary. Both parents should be included in the discussion since the importance of the father's attitude to infant feeding is recognized (Martin, 1978).

3.4.2 *Initiation of breast-feeding.* Factors which are considered to be important in the initiation of breast-feeding are early contact between mother and baby, correct positioning of the baby, avoidance of unnecessary fluids (para 3.4.4) and frequent feeding rather than feeding infrequently at fixed times (Gunther, 1970; MacKeith and Wood, 1971; Stanway and Stanway, 1978).

3.4.3 Putting the baby to the breast immediately after birth for a short period may help to initiate breast-feeding (de Chateau and Winberg, 1978). Skin-to-skin contact between mother and child is said to be of importance by some workers (Sosa, Kennell, Klaus and Urrutia, 1976) and to lead to increased social and psychological interaction of mother and baby.

3.4.4 After birth, first colostrum and then milk satisfies the nutritional needs of the very young infant as well as providing protection against infection (sections 3.2 and 3.3). Glucose water, or any other fluid, is unnecessary during the neonatal period unless ordered for medical reasons. Also to complement the feed with an artificial feed in the early days of breast-feeding undermines the confidence of the mother (Martin, 1978) as well as having other disadvantages (section 7.4).

3.4.5 'On demand' rather than 'regular' feeding allows the frequent stimulation of the breast and nipple which ensures the continued secretion of prolactin for milk production and of oxytocin for the milk ejection or let-down reflex. During the early days of breast-feeding the number of feeds required 'on demand' may be as many as 10–12 or even more in 24 hours although this number will be reduced as breast-feeding becomes established. 'Rooming-in' of the baby with the mother should therefore be encouraged immediately after birth and has been shown to cause less disturbance of the ward at night than occurs when mothers and babies are separated (Cruse, Yudkin and Baum, 1978).

3.4.6 The increased frequency of feeds when given 'on demand' reduces the time taken for the milk to come in (Salariya, Easton and Cater, 1978) and, in addition, the discomfort of breast engorgement and sore nipples occurs less often. Other problems, which were recalled by mothers (Martin, 1978) in the early days, are difficulties in positioning the mother and child, especially if the perineum is painful; sleepy babies who do not feed well; early signs of infection and breast abscess, and the need to express milk either manually or with a breast pump if the baby is transferred to the 'special care unit'.

3.4.7 *Maintenance of breast-feeding.* The importance of breast stimulation by frequent feeding, preferably 'on demand', in the maintenance of breast-feeding has been amply demonstrated. The milk ejection reflex, which is initiated by the secretion of oxytocin, can eventually be induced by conditioned stimuli without tactile stimulation of the nipple. Noel, Shuk and Frantz (1974) found that when a breast-feeding mother saw or played with her baby without any mammary contact there was no increase in prolactin concentration although the let-down reflex occurred within the first 5 minutes. The reflexes concerned with breast-feeding are under the control of the higher centres (Newton and Newton, 1969) and, although adversely affected by anxiety and tiredness, they are reinforced as breast-feeding is established and maintained.

3.4.8 For the first few months, the baby makes many emotional and physical demands on the mother and takes up a great deal of her time so that other activities have to be given up unless she is given help and support. Breast-feeding in our society precludes participation in some customary domestic and social activities as well as employment outside the home. If breast-feeding is to be maintained, the mother needs encouragement about feeding and some help with her anxieties and emotional problems as well as with household tasks and the demands of her other children. In spite of this support, some mothers may encounter sudden difficulties which can be overcome only if help is readily available from a professional adviser (Hart, Bax and Jenkins, 1980) or from an experienced person who may be a relative, friend or voluntary worker in organizations such as the National Childbirth Trust or the La Leche League.

3.4.9 Another problem for mothers is the lack of facilities for infant feeding in, for example, large department stores, offices and colleges. Were better facilities available in more places outside the home, the establishment and maintenance of satisfactory lactation would be encouraged.

3.4.10 Lactation can be established successfully even for babies in special care units. First colostrum and then milk is expressed until such time as the infant can be fed directly by the mother.

3.4.11 The survey of infant feeding practice in 1980 in a nationally representative sample (Martin and Monk, 1982) reveals the extent of the increase in breast-feeding in all areas of England and Wales since 1975 (Martin, 1978) and gives comparable findings for Scotland in 1980. Nevertheless, the Working Party is of the opinion that there is still much to be

done before society in general accepts the benefits of breast-feeding. The Working Party urges health authorities and their professional staff, in hospitals and in the community, to review policy and practice so that breast feeding is encouraged. Mothers can then make an informed choice and be helped to feed successfully by the method which they have chosen.

3.4.12 *Duration of breast-feeding.* The length of time for which an infant should be fully breast-fed depends on whether or not the mother's output of milk is adequate for the nutritional requirements of her baby. As bodyweight increases after birth the body stores of some nutrients, for example iron, become depleted. Eventually, even though lactation is well established, requirements cannot be met by milk alone and other foods must be introduced. The age at which a mixed diet becomes necessary is subject to considerable individual variation due to a number of social, cultural and nutritional factors, but some infants thrive on human milk alone for as long as 6 months (Rattigan, Ghisalberti and Hartmann, 1979). Whitehead, Paul and Rowland (1980), in a comparative study in Cambridge and in the Gambia, found that breast-feeding alone is often insufficient to satisfy theoretical nutritional requirements much beyond 3 months of age. Lönnerdal, Forsum and Hambraeus (1976) and Waterlow and Thomson (1979) came to the same conclusion. However, Whitehead and colleagues (1980) emphasize that their findings 'do not represent the inevitable, but rather what appears to be the limit for existing practice'. Mothers should be encouraged to continue breast-feeding for longer than 3 months, as long as the baby continues to thrive. After the introduction of a mixed diet the mother may continue to breast-feed for as long as she and her baby wish.

3.4.13 *Inadequate breast-feeding* usually results in a discontented crying baby but the infant may remain quiet and, if allowed, may sleep for long intervals between feeds and during the night (Evans and Davies, 1977; Levi, 1979). In either case weight gain is unsatisfactory and, when undressed, the infant looks undernourished (Davies, 1979). The problems of inadequate lactation can often be anticipated and, with appropriate counselling, can be prevented. If adequate lactation cannot be restored, despite more frequent feeding at the breast or complementing breast milk with infant formula for a few feeds, steps must be taken to see that the baby's nutritional requirements are met by supplementary feeding or by full artificial feeding.

3.4.14 *Supplementary feeding* means giving an artificial feed in addition to or in place of one or more feeds at the breast. For example, some working mothers breast-feed at home but, while they are at work, the child is bottle-fed.

4. Artificial Feeding

4.1 Trends

4.1.1 In 1961, only 17% of the babies in a survey in Nottingham were not put to the breast at all (Newson and Newson, 1963), in Glasgow in 1965 the figure was 69% (Arneil, 1967), in Dudley in 1970 72% (Shukla, Forsyth, Anderson and Marwah, 1972), and in the 1975 national sample of babies in England and Wales 49% (Martin 1978). Half the mothers in the 1975 survey made up their minds from the start to bottle-feed and, by 6 weeks, only 4% were fully breast-feeding without giving solids and/or artificial feeds. In 1980, 35% of mothers surveyed in England, Scotland and Wales made no attempt to breastfeed (Martin and Monk, 1982). By 6 weeks 37%, and by four months 60% of mothers who started breast-feeding were no longer doing so. United Kingdom infants are still to a large extent bottle-fed and it is clearly important that mothers should know about artificial feeds and bottle-feeding.

4.2 Infant Formulae

4.2.1 Infant formulae are artificial feeds which are manufactured to take the place of human milk. Such feeds are sold as powders or as concentrated liquids which need to be reconstituted with water or as 'ready-to-feed' liquids. Because human milk is variable in composition (para 3.2.1), the composition of the feed cannot be exactly the same as that of human milk, but it is usual for an artificial feed, which is reconstituted according to the manufacturer's instructions, to be comparable in respect of most nutrients with average mature human milk from healthy well-nourished mothers. Some nutrients are introduced into infant formulae in excess of the amounts in average mature human milk, in order that the feed should have the same biological effect. For example, artificial feeds contain more iron than human milk because the young infant absorbs iron better from human milk than from artificial feeds (para 6.2.3), and more of some vitamins in order to compensate for losses which may occur during processing and storage.

4.2.2 Most infant formulae which are at present available in the United Kingdom are manufactured from products derived from the dairy industry. Some formulae contain proteins other than cows' milk protein, for example soya protein, but in general such more specialized foods are used for infants with special requirements.

4.2.3 The most important products of the dairy industry which are used in the manufacture of infant formulae are:—

a. *Cows' milk*. Compared with human milk, cows' milk contains more protein, more minerals, less lactose and about the same quantity of fat. The protein of cows' milk contains a larger proportion of the caseins, and the fat of cows' milk has a different fatty acid composition from that of human milk. Minerals are mostly dissolved in the water phase of milk although some minerals form complexes with casein. Some vitamins are dissolved in the fat phase of the milk and others in the water phase.

b. *Skimmed milk,* when dried, is technically known as 'milk solids—not-fat' (SNF) and is a by-product of butter manufacture. SNF contains all the nutrients of cows' milk except fat and fat soluble vitamins.

c. *Whey* is a by-product of cheese manufacture and contains soluble whey proteins, lactose, water soluble minerals and vitamins, and nitrogen compounds other than proteins.

d. *Demineralized whey* is whey from which most of the minerals have been removed by a process of ion exchange, electrodialysis or ultrafiltration.

4.2.4 Other substances which are used in the manufacture of some infant formulae are not products of the dairy industry, for example, maltodextrin, vegetable oils, animal fats, mineral salts and vitamins. Trace elements such as copper, zinc and manganese may also be added.

4.2.5 Infant formulae based on cows' milk are of two main types:—

a. skimmed milk with added carbohydrate and fats, examples of which are:—

Cow and Gate Plus (added lactose)
Milumil (added maltodextrin and starch)
Ostermilk Complete Formula (added maltodextrin)
Ostermilk Two (added maltodextrin)
SMA (added lactose)

In these infant formulae the protein is unmodified cows' milk protein, the fat is a mixture of vegetable oils and animal fats and the carbohydrate is lactose from the skimmed milk to which is added either more lactose, or maltodextrin and starch. The concentration of protein and minerals is reduced compared with cows' milk. The fatty acid composition of the mixture of vegetable oils and animal fats resembles that of human milk fat more closely than does the fat in cows' milk.

b. Skimmed milk with demineralized whey and mixed fats, examples of which are:—

Aptamil
Cow and Gate Premium
Osterfeed
SMA Gold Cap

A small amount of skimmed milk is used with demineralised whey, and a mixture of vegetable oils and animal fats is added. The protein of this type of infant formula is cows' milk protein which has been modified so that the

ratio of whey protein to casein resembles that of human milk more closely. The fat is a mixture of vegetable oils and animal fats and also resembles human milk fat more closely than does the fat in cows' milk. The carbohydrate is lactose from skimmed milk and demineralized whey. The use of demineralized whey in these formulae permits the mineral content to be reduced and to approach more nearly the average concentrations found in mature human milk.

4.2.6 Table 4 gives the nutritonal guidelines for the composition of artificial feeds compared with that of human milk. Maximum and minimum values are given where possible to allow for variation by manufacturers according to choice and circumstances. Because the composition of cows' milk depends on the breed of cow, stage of lactation and season of the year, there are small variations in the composition of infant formulae. Furthermore the mixture of vegetable oils and animal fat which is used in some infant formulae depends, to some extent, on which oils and fats are available from world supplies. Thus the amounts of the different fatty acids in the fat of infant formulae may also vary within narrow limits. Because of these differences and because, with advances in technology, new infant formulae continue to be marketed, the tables of composition of some brands of artificial feeds are omitted from this edition of the report.

4.2.7 All the infant formulae named in section 4.2.5 meet the compositional guidelines. Discussion of the differences between the various reconstituted feeds is not relevant to this report. There is no firm evidence upon which to base a choice of one particular infant formula as being more suitable than another. In practice maternity hospitals stock a limited selection of standard formulae for babies who are not breast-fed and mothers usually continue to use the same brand on returning home. Special infant formulae for low birth-weight infants or those with metabolic disorders should be used only under medical supervision and are beyond the scope of this report.

4.2.8 Some soya-based milk substitutes either conform or approximate to the compositional guidelines and are therefore suitable as the sole source of nourishment of young infants. Examples are:—

Formula S Soya Food
Pro Sobee
Velactin
Wysoy

These are free of lactose as well as of milk protein and, for various forms of milk intolerance, may be prescribed as borderline substances, but their indiscriminate use for vague symptoms and signs not proved to be due to cows' milk intolerance is to be avoided (Taitz, 1982, and see para 7.4). Those of entirely plant origin are acceptable to vegetarians and vegans (para 7.5). These infant formulae must be differentiated from some other soya-based 'milk' preparations which may not meet the requirements of either young infants or older infants and preschool children.

Table 4 *Composition of mature human milk and nutritional guidelines for the composition of artificial feeds per 100 ml*

		Mean values for pooled samples of mature human milk (1, 2)	Guidelines for artificial feeds (2) Minimum	Maximum
Energy	kJ	293	270	315
	kcal	70	65	75
Protein (3)	g	1·3	1·5	2·0
(4)	g		1·2	2·0
Lactose	g	7·0	2·5	8·0
Total carbohydrate	g		4·8	10·0
Fat	g	4·2	2·3	5·0
Vitamins				
A	μg	60	40	150
D	μg	0·01	0·7	1·3
E (5)	mg	0·35	0·3	
K	μg	0·21(6)	1·5	
Thiamin	μg	16	13	
Riboflavin	μg	30	30	
Nicotinic acid	μg	230	230	
B_6	μg	6	5	
B_{12}	μg	0·01	0·01	
Total folate	μg	5·2	3	
Pantothenic acid	μg	260	200	
Biotin	μg	0·76	0·5	
C	mg	3·8	3·0	
Minerals				
Sodium	mg	15	15	35
Potassium	mg	60	50	100
Chloride	mg	43	40	80
Calcium (7)	mg	35	30	120
Phosphorus	mg	15	15	60
Magnesium	mg	2·8	2·8	12
Iron (8)	μg	76	70	700
Copper	μg	39		
Zinc	μg	295		
Iodine	μg	7		

(1) Department of Health and Social Security, 1977.
(2) Department of Health and Social Security, 1980a.
(3) Cows' milk protein in which casein to whey ratio is unadjusted (type a milks).
(4) Casein whey ratio is similar to that of human milk (type b milks).
(5) The ratio of tocopherol (mg) to polyunsaturated fatty acids (g) should not be less than 0.4:1.02
(6) Haroon, Shearer, Rahim, Gunn, McEnery and Barkhan, 1982.
(7) The ratio of calcium to phosphorus should not be less than 1.2:1.0 or more than 2.2:1.0
(8) Guidelines for trace elements other than iron are not set.

4.2.9 The following recommendations were set out in Section 6.3 of the earlier report (Department of Health and Social Security, 1974):—

a. that milk feeds should contain a concentration of phosphate, sodium and protein which is lower than that of cows' milk and nearer to that of human milk;

b. that artificial feeds should be so manufactured that they are either liquids which are ready to feed, or liquids or powders that require the addition only of water and no other substance;

c. that artificial feeds should be so manufactured that the dilution required to reconstitute the milk should be independent of the age of the baby and thus instructions about dilution can apply to feeds for a baby from birth onwards.

The artificial feeds currently in use satisfy these criteria and accord with the guidelines for artificial feeds produced by the Working Party on the Composition of Foods for Infants and Young Children (Department of Health and Social Security, 1980a). The important recommendation made in this later report that infant formulae should be marketed only after scrutiny and acceptance by a panel of experts is endorsed by the present Working Party, the Committee on Medical Aspects of Food Policy and the Food Standards Committee (Ministry of Agriculture, Fisheries and Food, 1981).

4.3 Giving feeds

4.3.1 Detailed instructions about the preparation of feeds and the cleaning and care of bottles and teats, although relevant, are not given in this report. Information about these matters is clearly set out by manufacturers on the labels of their packs, in booklets and articles. To avoid the incubation of bacteria in what is effectively an excellent culture medium, vacuum flasks and insulators should not be used to keep feeds warm for more than a few minutes before feeding.

4.3.2 Many factors which are important in breast-feeding, namely contact between mother and baby, feeding on demand and consideration of individual variation are also important in artificial feeding. Some babies are said to be dissatisfied when given reconstituted infant formulae, but there has been no reliable study to find the effect of flexibility in both the frequency of feeding and the amount of feed. Inadequate bottle-feeding has the same effects as inadequate breast-feeding (para 3.4.13) and, if the young bottle-fed baby appears to be hungry, the amount per feed (but not the concentration) and/or the number of feeds per day should be increased by feeding on demand as for the breast-fed infant before any attempts are made to satisfy hunger by introducing solids.

5. Introduction to a Mixed Diet

5.1 General

5.1.1 The 1975 national survey of infant feeding practice in England and Wales revealed that 3% of the babies had been given some food other than milk in the first 2 weeks of life, 18% within the first month, 45% by 2 months, 85% by 3 months and 97% by 4 months (Martin, 1978). Changes noted in the 1980 survey are given in para 2.10.

5.1.2 *Weaning* is the process which begins when breast- or bottle-feeding starts to be replaced by a mixed diet. Weaning should be a gradual process, which extends over a period of weeks or even months. Weaning does not commence at the same age or the same weight for all infants.

5.1.3 *Mixed feeding* refers to the use of any food other than human milk, infant formula and supplementary vitamin drops, and includes the use of household milk (unmodified cows' milk) as well as semi-solid foods.

5.2 The change to cows' milk (household milk)

5.2.1 Because human milk and infant formulae are more suitable than cows' milk for the relatively immature physiological processes of the very young infant, the change from breast- or bottle-feeding to household milk is not advised before about 6 months of age. To continue with reconstituted infant formula beyond the age of six months, instead of changing to cows' milk, may be beneficial. The intake of a sufficient amount of iron and of vitamins A, C and D will then be assured but, when cows' milk is introduced, vitamin supplements will be necessary (section 6.1) and iron deficiency may be a problem.

5.2.2 The change to cows' milk may, rarely, be associated with a risk of infection. Most milk in this country is pasteurized and, although this does not make it sterile, it is microbiologically safe for infant feeding provided that it is kept refrigerated and uncontaminated. In some rural areas of the United Kingdom however, household milk is not pasteurized nor can it always be guaranteed to be from herds which are free from tuberculosis and brucellosis (Public Health Laboratory Service, 1980). If there is any doubt, the milk should be brought to the boil and then cooled in a covered saucepan prior to feeding infants.

5.3 Mixed feeding

5.3.1 Infants need a mixed diet when nutritional requirements are no longer satisfied by milk alone and development of feeding behaviour has progressed from sucking to biting and chewing. In addition to developmental and nutritional considerations, cultural, social and medical factors also appear to influence the age at which solid foods are introduced. In general, there is a tendency for bottle-fed infants to be started on mixed feeding earlier than those who are fully breast-fed. The age at which individual infants should be offered solid foods varies; one baby may thrive on milk alone up to 8 months of age, while another may benefit from mixed feeding from 3 months. A mother who cannot maintain full lactation at 3 months may wish to introduce solid food rather than start bottle-feeding her baby at this age. Provided that the baby receives adequate nourishment and that due regard is paid to the development of feeding abilities (Palmer, Thompson and Linscheid, 1975) a flexible approach is desirable. Nevertheless, it is likely that a few infants need food other than milk before about 3 months of age, and that by 6 – 8 months nearly all babies require mixed feeding (Whitehead, Paul and Cole, 1981).

5.3.2 Many mothers in the United Kingdom introduce cereals as the first food but there is no evidence that these foods are nutritionally better than other foods. There has been some concern about giving foods containing gluten in early infancy because this may cause the onset of gluten enteropathy (coeliac disease) in susceptible infants (Department of Health and Social Security, 1974, section 3.4). However, for the majority of infants there is no evidence that wheat-based cereal foods are a hazard.

5.3.3 Epidemiological studies in adults have shown an association between populations who eat small quantities of salt (sodium chloride) and relative freedom from hypertension (Dahl and Love, 1957; Truswell, Kennelly, Hansen and Lee, 1972). Experiments suggest that in some strains of rat an increased salt intake for a period in infancy may influence adult blood pressure (Meneely and Dahl, 1961; Dahl, 1972). There is at present no direct evidence that salt intake in human infants is related to the subsequent development of hypertension.

5.3.4 Since salt appetite is unrelated to salt requirements and is perhaps a learnt phenomenon, restriction of salt intake from infancy may be considered as a contribution to a reduction in the incidence of hypertension in later life. It may prove easier to restrict salt intake in the infant and young child than to reverse salt appetite at a later age (Lauer, Clarke and Rames, 1978). There is no advantage in a salt intake in excess of requirements, and since natural foods can be expected to supply the requirements of infants, the practice of adding salt to infant foods should be discouraged.

5.3.5 There have been suggestions that the introduction of foods sweetened with sucrose or other sugars at an early age may establish a preference for sweet foods. Whether or not this is so, there is a good case for avoiding the excessive use of sucrose in order to avoid dental caries (para 6.1.12).

5.3.6 The process of weaning infants to a mixed diet in the United Kingdom seems to be generally satisfactory. However there are problems during the weaning period in some Asian children (Jivani, 1978). The parents adhere to cultural and religious dietary customs and prefer imported foods with which they are familiar rather than foods grown in the United Kingdom which can be obtained more easily. The parents may be vegetarians and iron is poorly absorbed from plant foods. Young children may develop iron deficiency anaemia. They also tend to be kept indoors and to wear more clothes, with arms and legs covered, than British children. The importance of sunlight falling on bare skin for the synthesis of vitamin D is not always realized and young Asian children may develop rickets. Doctors and other health professionals should be alerted to these problems, and the parents encouraged to use infant formulae rather than cows' milk during late infancy, to give vitamin supplements when necessary and to introduce the available weaning foods which are appropriately fortified with iron and vitamins until the child is old enough to eat an adequate family diet (Department of Health and Social Security, 1980b).

6. Dietary Supplements

6.1 Vitamins

6.1.1 *Pregnancy and lactation.* A healthy mother who has a nutritionally adequate diet, has been out in sunlight and has had the recommended daily supplement of vitamin tablets, will not only be in excellent vitamin status but she will be able to supply her baby with a milk which contains all the vitamins known to be necessary.

6.1.2 During pregnancy and lactation, disease due to deficiencies of vitamin A, vitamins of the B complex or vitamin C are no longer seen in this country. However, vitamin D deficiency still occurs, chiefly among young Asian women. Even when such women of child-bearing age appear to be healthy they may show evidence of vitamin D deficiency when subjected to the physiological and metabolic stress of pregnancy (Felton and Stone, 1966; Dent and Smith, 1969; Holmes, Enoch, Taylor and Jones, 1973). The importance to these women of a daily vitamin D supplement cannot be overestimated (Department of Health and Social Security, 1980b). If this were recognized the prevalence of fetal rickets might be reduced (Felton and Stone, 1966; Heckmatt, Peacock, Davies, McMurray and Isherwood, 1979). A vitamin D supplement should continue to be taken by lactating Asian mothers.

6.1.3 The vitamin tablets[1], which are available under the Welfare Food Scheme at maternity and child health clinics and at welfare food distribution centres for expectant mothers and for mothers up to 30 weeks after the birth, are sold at a low price to all and are free of charge to those who qualify for special benefits. The Working Party agrees the present composition of the tablets and recommends that all women should receive vitamin supplements during pregnancy and lactation.

6.1.4 *Infancy.* With the exception of conditions due to vitamin D deficiency, diseases due to a deficient intake of vitamins almost never occur in Britain in infants born at term. The extent to which this freedom from vitamin deficiencies is achieved by the provision of vitamin supplements is uncertain. Young infants who are breast-fed with milk from a well-nourished mother

[1]The tablets have the following composition:

vitamin A	1200 μg (400 i.u.)
vitamin C	60 mg
vitamin D	10 μg (400 i.u.)
dibasic calcium phosphate	190 mg
potassium iodide	130 μg

already receive an adequate supply of vitamins, as do those who are given artificial feeds prepared from proprietary infant formulae which meet approved compositional guidelines.

6.1.5 When mixed feeding is introduced and especially if, after the age of six months, the infant is given cows' milk the possibility of vitamin deficiency is greater. However, nearly all foods marketed for infants and toddlers are enriched with vitamins and most household diets contain adequate amounts of all vitamins except D. Nonetheless, there may be some infants who are offered a diet which contains insufficient vitamins, there are other infants and toddlers who are reluctant to consume a variety of vitamin-containing foods and there is the possibility of vitamin D deficiency rickets due to insufficient sunlight reaching bare skin, especially in the winter months. The protection against vitamin deficiency which is afforded by vitamin supplements is necessary for these infants.

6.1.6 It seems a wise public health measure to ensure the availability of cheap vitamin supplements and to recommend their general use.

6.1.7 Accordingly the Working Party endorses present policy and recommends that the Government should continue to make supplementary vitamins for infants and young children available under the Welfare Foods Scheme either free of charge or at low cost. The composition of the supplement containing vitamins A, C and D should remain as it is at present.

6.1.8 The Working Party recommend that the full dose of Children's Vitamin Drops be changed from a range of two to seven drops to a standard dose of five drops daily. The single dose of five drops contains approximately:

vitamin A	200 μg
vitamin C	20 mg
vitamin D	7 μg

6.1.9 Children's Vitamin Drops, or a suitable amount of a proprietary preparation of vitamin D, should be given by the time the infant is one month old, and should be continued at least until two years of age, and preferably until five years of age.

6.1.10 It is unnecessary to advise the use of vitamin supplements when there is no doubt that an individual infant is already receiving an adequate intake. Such a decision, that the use of supplements for an individual child is unnecessary, should be the responsibility of the professional adviser who will be aware of the nutritional status and needs of the child.

6.1.11 Children's Vitamin Drops contain only vitamins A, C and D, because the other vitamins are plentifully supplied by human and cows' milk (paras 3.2.9 and 4.2.3). An excess of vitamin A can be harmful but the excess must be large, probably more than 20,000 iu daily and be given for several weeks, before harm results (Mahoney, Margolis, Knauss and Labbe, 1980). A much

smaller excess of vitamin D, equivalent to about 4–14 doses of children's vitamin drops given daily for several weeks, has been associated with the problem of hypercalcaemia in children who may be particularly sensitive to excess vitamin D (Department of Health and Social Security, 1980a). Therefore, since many proprietary vitamin supplements can be obtained, care should be taken that only one supplement of vitamin D is given at any one time. An excess of vitamin C or of any of the B vitamins is not harmful and is excreted in the urine.

6.1.12 Many proprietary vitamin supplements, especially sweet syrups of vitamin C, are less desirable than Children's Vitamin Drops in that they are cariogenic unless diluted by water and given during the feed.

6.2 Iron

6.2.1 The iron status of the fetus and the baby is little affected by the iron intake of the mother during pregnancy or lactation, but it is sensible to ensure that iron deficiency in the mother is prevented by a diet which is adequate in iron-containing foods and by the judicious use of medicinal iron when necessary.

6.2.2 The amount of iron present in an infant at birth depends chiefly on body weight and how much blood from the placenta is allowed to pass into the body before the umbilical cord is tied. The iron present in blood and that stored in the liver, together with the amount absorbed from human milk, is likely to be adequate for the first six months of life in the baby born at term (Saarinen and Siimes, 1978), but the iron requirements of infants who are born prematurely need special consideration.

6.2.3 Only a small amount of the iron in human milk is bound to lactoferrin—one of the whey proteins (Fransson and Lönnerdal, 1980). Absorption of iron from human milk by the breast-fed baby is very efficient and is substantially greater than absorption of iron from cows' milk or from artificial feeds (McMillan, Landaw and Oski, 1976; Woodruff, Latham and McDavid, 1977; Saarinen, Siimes and Dallman, 1977). Iron is therefore added to infant formulae in amounts which are intended to ensure that the infant's requirements for iron can be met (McMillian, Landaw and Oski, 1976; McMillan, Oski, Lourie, Tomarelli and Landaw, 1977; Saarinen and Siimes, 1977).

6.2.4 When mixed feeding is introduced, since cows' milk contains little iron, the diet should include some foods which are a rich source of iron.

6.3 Fluoride

6.3.1 Epidemiological studies have shown that when the domestic water supply contains 1 ppm fluoride (100 μg fluoride per 100 ml water), the

incidence of dental caries is reduced by 50 – 60 per cent. The Royal College of Physicians (1976) recommended the fluoridation of water supplies in the United Kingdom and this has been achieved in some areas.

6.3.2 The daily fluoride intake approved by the Dental Health Committee of the British Dental Association for infants from two weeks to two years of age is 0·25 mg (Dowell and Joyston-Bechal, 1981). Human milk and infant formulae contain a very low concentration of fluoride. Artificially fed infants in fluoridated areas can satisfy their requirements for fluoride from the water used to reconstitute powdered feeds. In areas where the concentration of fluoride in the drinking water is less than 0·3 ppm, satisfactory reduction in the prevalence of caries can be achieved by fluoride supplementation. In the United Kingdom, supplements for infants are available in two strengths which provide 0·25 mg fluoride in either two drops or five drops. Flexibility of dosage according to local water fluoride concentration and the type of feeding (Howat and Nunn, 1981) thus lessen the possibility of overdosage and of enamel fluorosis.

7. Special Considerations

7.1 Water

7.1.1 Infants drink, on average, about 150 ml of water/kg of body weight each day in the early months of life, and this amount decreases to an average of 100 ml/kg/day in later infancy. There is much variation between individuals and, even in the same individual, the fluid requirement varies with the amount of fluid lost in the stools and urine and from the skin and airpassages. Most of the water is taken by the young infant as part of the diet. Human milk and reconstituted artificial feeds contain about 90% water. However the water content of other foods varies, and some infants may take water as a supplement when mixed feeding has begun.

7.1.2 Water supplies, at their source, may contain dissolved organic and inorganic chemical substances, and possibly numerous organisms both living and dead in particulate matter. It is the responsibility of Local Water Authorities to ensure that the water delivered by the mains supply complies with the rigorous standards of quality which have been established against any risk to health. In nearly all households and institutions in Britain these standards are achieved and domestic tap water is used to reconstitute artificial infant feeds, make up dehydrated baby foods and to dilute vitamin syrups.

7.1.3 The tap water used to reconstitute feeds or to prepare meals is not necessarily identical in composition with water from the mains supply as this enters the home. Changes may take place during storage in tanks or cisterns and while passing through the domestic water pipes. Occasionally a water softener is deliberately used to change the composition of mains water prior to its domestic use, and often water is boiled before it is used for infant feeding. Boiling may cause some changes in composition in addition to killing any potentially pathogenic micro-organisms which may be present.

7.1.4 In practice, except when water is softened within the home, it is rarely necessary to take the composition of domestic water into account when considering infant feeding beyond the precautions recommended to prevent contamination by pathogenic organisms. Circumstances can arise, however, which give such cause for concern as to require action by those responsible for the health of mothers and babies. The problems most likely to occur are associated with unduly high concentrations of nitrates and of sodium, and with excessive contamination of water with lead.

7.1.5 *Nitrates.* The use of water with an excessively high nitrate content is one of the causes of methaemoglobinaemia in infants. Nitrates are converted into nitrites in the gut and, when absorbed, nitrites react with haemoglobin to

form methaemoglobin (Comly, 1945; Knotek and Schmidt, 1964). Unlike haemoglobin, methaemoglobin is unable to carry the oxygen needed for respiration. Because of the risk of methaemoglobinaemia, limits for the permissible amount of nitrate in drinking water have been suggested by the World Health Organization (1970) and are defined in a recent directive of the European Economic Community. In this country, advice about the composition of domestic water is given by a joint committee of the Department of the Environment and the Department of Health and Social Security on Medical Aspects of Water Quality and the nitrate content of water intended for domestic use is monitored. If, due to climatic conditions, the nitrate concentration in water were to increase substantially it might become prudent for Health and Water Authorities to arrange for the distribution of bottled water suitable for the reconstitution of feeds. However, no cases of methaemoglobinaemia were reported as a result of the drought of 1975/76. No other harm from the presence of nitrates in drinking water has been established, although considerable research on their medical significance is being carried out.

7.1.6 *Sodium.* The sodium content of an artificial feed is affected by the sodium content of the water used to make up the feed. An excessive intake of sodium in infancy is undesirable because it will reduce the ability of the infant to withstand conditions associated with an excessive water loss and may lead to hypernatraemia (Finberg and Harrison, 1955; McCance and Widdowson, 1957; Taitz and Byers, 1972). In the view of some experts an excessive intake may contribute to the development of hypertension in later life (para 5.3.4). A feed made up with water which has a high sodium content may exceed the recommended upper limits for sodium of 35 mg sodium/100 ml feed (Department of Health and Social Security, 1980a). For this reason domestic water which has been artificially softened, or water which has been repeatedly boiled, should not be used in the reconstitution of infant feeds.

7.1.7 *Lead.* There has been controversy about the possibility of adverse effects from lead when ingested in small amounts over a long period (Department of Health and Social Security, 1980c). Waters containing unacceptable amounts of lead are not found in the mains supply. However, soft acid waters and some hard waters are plumbosolvent in that they liberate lead from any lead-containing domestic plumbing. Information on lead concentration in British tap water was given in the report "Lead in Drinking Water—A Survey in Great Britain 1975–1976" (Department of the Environment, 1977). In less than 5% of households did the concentration of lead exceed the World Health Organization maximum of 0.1 mg/litre.

7.1.8 The potential hazards of lead toxicity, in areas where plumbosolvent water is supplied, will be greatly reduced by the implementation of programmes which are at present being developed for the chemical treatment of plumbosolvent waters, and by the by-passing or replacement of lead-lined roof tanks and lead pipes. Some time will inevitably elapse before these measures can be introduced where they are needed (Department of Health and Social Security 1980c). Meanwhile there are several measures which can be

taken to reduce the possible risks. The concentration of lead in water drawn from a cold tap for reconstituting infant feeds can be reduced substantially by running a washbasinful of water for non-drinking purposes before drawing water for the preparation of infant feeds. In order to avoid waste of water, especially in areas where this supply is limited, any further advice should be given only after consultation between Health and Water Authorities. The effectiveness of these measures in reducing sufficiently the amount of lead in drinking water is to be assessed and further advice will be given to the public if this proves to be necessary.

7.1.9 *Bottled Water.* In normal circumstances there is no advantage in using bottled water rather than tap water for reconstituting feeds. Only those bottled non-carbonated waters which conform to the limits described above for nitrates, sodium and lead are suitable for infants. Hygienic precautions with regard to microbiological contamination should be taken as for tapwater.

7.2 Assessment of nutritional status

7.2.1 The regular assessment of nutritional status should be an essential part of health surveillance of infants, and those individuals who make the assessment should receive adequate training and be provided with the appropriate equipment. Inspection of the baby should not be neglected. It is desirable that the infant be completely undressed in a warm atmosphere. Removal of the vest and napkin may reveal unexpected wasting (or adiposity) in a baby who appears normally nourished when clothed.

7.2.2 Although much information can be gained from a single examination, serial observations which enable the *rate* of growth to be assessed are of special value in providing early evidence of sub-optimal nutrition. Weight measurements remain the most widely used form of assessment. Again it is essential that the infant is weighed unclothed, or the appropriate allowance is made for the clothes that are worn. The weight obtained should be plotted on a standard chart for the sex and age. Interpretation of these measurements will be aided if length can also be measured and plotted but such measurements require special apparatus and some skill in measuring. The accurate determination of length, although desirable, may not be possible at present in many clinics. If serial weight measurements are available and plotted on charts which show percentiles for different ages, deviations from a normal rate of weight gain will be detected easily. Some skill is needed in the interpretation of growth curves especially during the first six months of life (Valman, 1980). Deviation from a previous centile may indicate physiological adjustment rather than failure to thrive or the onset of obesity. These physiological adjustments are usually temporary and are due to catch-up-growth in small infants, to a reduction of growth rate in large infants or to the genetic influence of parental size (Davies and Morton, 1980).

7.2.3 Other anthropometric measurements (skinfold thickness, arm and head circumference) can also provide information about the overall nutritional

status but are not usually practical in clinics. Certain special investigations may be required if specific nutritional deficiencies are suspected, for example anaemia or rickets. It is beyond the scope of this report to discuss these in any detail.

7.3 Obesity

7.3.1 Obesity means an excess of adipose tissue and not all babies who gain weight rapidly are necessarily becoming obese. At the beginning of the 1970s a number of studies in the United Kingdom indicated that many babies were too fat during the first year of life, with prevalence rates for obesity of around 20–30%. Many contributory factors were postulated and these included the decline in breast-feeding, the practice of artificial feeding with unmodified cows' milk foods, the tendency to over-concentrate dried milk feeds during reconstitution, the addition of cereals and excessive amounts of sugar to bottle feeds, and the too early introduction of non-milk solids into the diet of the infant (Department of Health and Social Security, 1974 paras 4.1 to 4.7). Investigation of these factors has failed to confirm that the age at which solid foods are introduced influences weight gain, growth in length, or change in skinfold thickness (Wilkinson and Davies, 1978).

7.3.2 During the past few years there are indications that the prevalence of excessive weight gain in infancy has been decreasing. Taitz (1977) reported that, whereas in 1971, 79% of infants had weights greater than the 50th centile at 6 weeks of age, in 1976 the corresponding figure was only 43%. In a survey of skinfold thickness in 1976, Whitelaw (1977) found that the distributions of triceps and subscapular skinfold measurements at one year of age were considerably smaller than those reported in a survey in 1967–68 (Hutchinson-Smith, 1973). Thus when the measurements obtained in 1976 were plotted against the centiles derived from the 1967 data, none of the infants in 1976 had values above the 90th centile, only 28% were above the 50th centile, and 32% were below the 3rd centile.

7.3.3 The reasons for the apparent decline in the prevalence of obesity in infancy are likely to be as complex as the cause of obesity itself. An increase in the prevalence of breast-feeding, the abolition of the 'unmodified' baby milks and better understanding of the need to reconstitute dried milks accurately according to the manufacturers' instructions may all have contributed. There is no doubt too that awareness of obesity as undesirable in infancy has increased among both mothers and their health advisers.

7.3.4 Although it is gratifying that the prevalence of obesity appears to be decreasing it is important that the harmful effects of obesity are not over-emphasized. In seeking to prevent over-nutrition, infant feeding practice should not produce a swing to under-nutrition.

7.3.5 Studies of the prognosis of infant obesity show that about 10–20% of fat babies will still be fat at 5–7 years of age (Mellbin and Vuille, 1973; Poskitt

and Cole 1977); that there is a slightly greater tendency for fat adolescent girls to have been fat at the age of one year (Hernesniemi, Zachmann and Prader, 1974), and that about 14% of babies with weights greater than the 90th centile are obese adults 20–30 years later (Charney, Goodman, McBride, Lyon and Pratt, 1976). Thus the great majority (over 80%) of obese babies are likely to lose their excess fat after infancy. However, fat babies still have a significantly greater chance of being fat in childhood, adolescence or adult life than do thin babies and this, coupled with the fact that of obese children nearly 50% will have been fat as babies (Lloyd, 1977), makes it desirable that obesity in the first year of life should be avoided.

7.3.6 The prevention of obesity depends upon the understanding by parents and their advisers of the principles of infant nutrition, regular nutritional surveillance, and correct interpretation of the measurements of height and weight, and of skinfolds if these are made. Particular attention should be paid to infants who are known to be at greater risk of developing obesity, either in infancy or later. These include infants whose parents are obese, and some infants who are physically or mentally handicapped.

7.4 Allergy and hypersensitivity

7.4.1 Clinical manifestations of allergy, such as asthma, eczema, rhinitis (hay fever) and gastro-intestinal reactions to food are common in children (Kuzemko, 1978). They appear to result from an abnormal immunological reaction in susceptible individuals on exposure to specific substances known as allergens (Basten, 1978). The development of allergy depends on many factors including genetic predisposition, various environmental influences and the type of feeding (Smith, 1976). Discussion of the diagnosis and treatment of allergy is beyond the scope of this report but, as the role of infant feeding practices in the development of allergic conditions is the subject of much interest, this aspect is considered.

7.4.2 The first ingested foreign protein to which infants are usually exposed is cows' milk. It has been suggested that at least 1–2 per cent of children become allergic to cows' milk protein (Savilahti, 1981), and it has been demonstrated by several workers that the incidence of allergic disease is reduced, particularly in babies of allergic parents, if the infants are fully breast-fed for 6 months (Matthew, Taylor, Norman, Turner and Soothill, 1977; Saarinan, Bajasaari, Backman and Siimes, 1979). The apparent protection afforded by exclusive breast-feeding is not absolute nor is the benefit of avoiding the early introduction of foreign proteins into the diet fully proven (Kramer and Moroz, 1981).

7.4.3 Avoidance of cows' milk in early infancy seems to be a rational approach to the prevention of allergy in infants who are believed to be at special risk, such as those whose parents have a history of atopic disease. Breast-feeding appears to be a satisfactory and sometimes effective means of avoiding allergy (Chandra, 1979; Glaser and Johnstone, 1953; Kjellman and

Johansson, 1979). However, sensitization to food allergens can occur in fully breast-fed infants (Warner, 1980), presumably because the allergen is secreted in the milk.

7.4.4 Experiments in guinea pigs suggest that the sensitizing capacity of cows' milk proteins is substantially reduced by heat treatment as in the manufacture of infant formulae (McLaughlan, Anderson, Widdowson and Coombs, 1981; Kilshaw, Heppell and Ford, 1982). Breast-feeding should be strongly recommended for the prevention of allergy in a susceptible child but when this is not possible the use of a heat-treated cows' milk based infant formula, a soya-based infant formula or goats' milk may be considered. Present evidence suggests that no great benefit accrues from replacing cows' milk formulae with soya (Taitz, 1982) or goats' milk, both of which may cause allergy.

7.4.5 For the potentially allergic child, it is reasonable to avoid the early and indiscriminate introduction of foods that are commonly associated with the development of allergy such as fresh cows' milk, egg, nuts, and fruits with many pips. Beyond six months of age the range of foods can be cautiously widened and an unrestricted diet eventually be achieved.

7.5 Unconventional diets

7.5.1 Many vegetarians include milk, butter, cheese and sometimes eggs in their diet but strict vegetarians (vegans) eat no food of animal origin. In Britain, vegetarian diets may be eaten for religious, social or cultural reasons or often as an expression of concern about modern methods of livestock farming and food technology. In many countries such diets would be considered conventional. Most vegetarians and vegans are in favour of breast-feeding and the nutritional requirements of an infant can be met provided that a supplement of vitamin B_{12} is given to the mother (Wighton, Manson, Speed, Robertson and Chapman, 1979). Children of vegetarians or of vegans are weaned on to a vegetarian or vegan diet. Although such diets are nutritionally adequate for the adult, they may not be completely suitable for the growing infant and young child who will therefore require a suitable substitute for human milk once breast-feeding has come to an end.

7.5.2 Health risks occur when young infants are not breast-fed and, instead of receiving one of the proprietary infant formulae, are given household cows' milk, goats' milk, some soya based preparations, Zen macrobiotic or other diets which are nutritionally inadequate (American Academy of Pediatrics, 1977; Roberts, West, Ogilvie and Dillon, 1979).

7.5.3 Neither unmodified cows' milk nor goats' milk is a suitable replacement for human milk because each contains an excess of protein and minerals and a deficiency of some vitamins. Goats' milk, like cows' milk, can be suitably diluted and the composition adjusted to contain adequate carbohydrate and vitamins (Francis, 1979), but the milk should be boiled

before use to reduce the risk of tuberculosis, brucellosis and other infections. Boiling will further reduce the concentration of folate and other heat-labile vitamins in goats' milk. Cases of harm to young infants when fed solely on goats' milk have been reported (Tripp, Francis, Knight and Harries, 1979).

7.5.4 Allergic reactions to soya protein have been described (Eastham, Lichauco, Grady and Walker, 1978) and some, but not all, of the milks based on soya protein have been reported as nutritionally inadequate (Tripp, Francis, Knight and Harries, 1979; Linshaw, Harrison, Gruskin, Prebis, Harris, Stein, Jayaram, Preston, Di Liberti, Baluarti, Elzouki and Carroll 1980).

7.5.5 Zen macrobiotic diets consist largely of cereals and, like strict vegetarian (vegan) diets, can depress growth rates and cause other nutritional problems in infants (Berkelhamer, Thorp and Cobbs, 1975; Roberts, West, Ogilvie and Dillon, 1979).

7.6 Rickets

7.6.1 Rickets in children (osteomalacia in adults) is a disease caused by a deficiency of vitamin D so that absorption of calcium from the gut and deposition of calcium in bone is defective. The chief source of vitamin D is synthesis in the skin by the direct action of ultra-violet radiation (UVR) usually from sunlight. UVR cannot pass through ordinary window glass or clothes. Requirements for vitamin D are increased during periods of rapid growth, such as infancy and childhood, adolescence and pregnancy.

7.6.2 If insufficient UVR is available, for example in the winter months, requirements cannot easily be met from food alone and supplements of vitamin D may become necessary.

7.6.3 The introduction of vitamin D supplements under the Welfare Food Scheme in the early 1940s resulted in the virtual eradication of rickets by the 1950s, but in the 1960s there was a recrudescence of the disease in a few places among families in which the mother either did not start breast-feeding or ceased soon after the birth and fed cows' milk (Arneil and Crosbie, 1963). Since then rickets has become more widespread, chiefly in areas where Asian families are numerous (Ford, Colhoun, McIntosh and Dunnigan, 1972; Dawson and Mondhe, 1972; Goel, Sweet, Logan, Warren, Arneil and Shanks, 1976). The disease has been reported in the fetus (Russell and Hill, 1974) and in the neonatal period (Ford, Davidson, McIntosh, Fyfe and Dunnigan, 1973; Moncrieff and Fadahunsi, 1974), but more commonly in older infants and children, adolescents and young Asian women. There is now evidence that the incidence of rickets is declining (Department of Health and Social Security, 1980b). The importance of vitamin supplements to Asian women when pregnant and lactating and to the infants born to them, and of not taking more than the stated dose or more than one preparation of vitamin D at a time has been discussed (section 6.1).

7.7 Non-nutritive non-protective substances in human milk

7.7.1 Human milk may contain a number of substances, derived from maternal blood, which have no nutritive or protective value for the infant. Many are physiologically inactive or are present in negligible amounts but some compounds including some hormones, drugs, pollutants and contaminants are excreted in a pharmacologically or physiologically active form and in amounts which could cause adverse effects. In general the risk of any harm is out-weighed by the benefits of breast-feeding but a decision may be necessary as to whether or not human milk containing such substances is suitable for breast-feeding or for inclusion in a human milk bank.

7.7.2 *Maternal Hormones.* Although several maternal hormones and their metabolic products are excreted in breast milk no adverse effects have been reported. In some cases of so-called 'breast-milk jaundice', certain steroid hormones such as 3α, 20β pregnanediol which are present in the milk of some mothers may cause hyperbilirubinaemia in the infant by inhibition of the conjugation of bilirubin (Hargreaves and Piper 1971). Hyperbilirubinaemia from this cause may be prolonged but is rarely of such severity as to require cessation of breast-feeding. Mothers should be reassured that this jaundice is harmless. Nevertheless the condition is important because it must be distinguished from those serious conditions which can cause jaundice in the first weeks of life.

7.7.3 *Foods, beverages and other substances.* Mothers who are breast-feeding are often advised to avoid excessive consumption of certain foods and beverages, including alcohol, and to smoke only in moderation, if at all. The purpose of this advice is to ensure that the mother remains in good health and nutritional status. Some substances in human milk, which are derived from the maternal diet, are said to cause symptoms in the breast-fed infant either by pharmacological action or by acting as allergens. The symptoms observed are usually trivial, such as frequent stools, colic or wind, and rarely is there any scientific evidence to support a causal relationship with the suspected constituents in milk. Nevertheless, pharmacologically active amines and alkaloids such as senna, caffeine and nicotine have been shown to pass into breast-milk and alcohol is also partially excreted in milk, sometimes in sufficient amounts to cause symptoms (Binkiewicz, Robinson and Senior, 1978). Although to deny a liberal choice of foods and beverages and to discourage the fancies which many lactating women show in the puerperium may seem unreasonable, there may be occasions when it is sensible to recommend a mother temporarily to reduce or eliminate from her diet a constituent which is suspected, on grounds of careful clinical observation, to be responsible for symptoms in her breast-fed child.

7.7.4 *Medicines.* Nearly all medicines or their metabolic products pass into the mother's milk in concentrations which depend on, for example, the solubility of the drug, the degree to which it is bound to protein, and the

concentration in maternal blood. Any pharmacological or toxic action in the infant will depend on the ability of the infant to metabolize and excrete the drug, and on any special physiological sensitivity possessed by the infant. Few detailed pharmacokinetic studies of medicines in human milk have been made and, at present, knowledge is largely confined to the presence or absence of drugs in human milk, and to anecdotal reports of symptoms occurring in exposed infants. The available information is summarized in the Pharmaceutical Handbook (Wade, 1980) and in the British National Formulary Number 4 (1982). Breast-feeding is rarely contraindicated by reason of risk to the health of the infant from ingestion of drugs in milk, but it is always desirable for the professional adviser to be aware of any medicines taken by the mother. When there is any doubt about the safety of the human milk the advice of an expert should be sought.

7.7.5 *Pollutants and Contaminants.* Several environmental pollutants and contaminants have been detected in human milk. Those which are fat soluble may occur in concentrations considerably greater than in the mother's blood. Some, such as dichlorodiphenyl trichloroethane (DDT) and the polychlorinated biphenyls (PCB), accumulate in the body and are potentially hazardous (Rogan, Bagniewska and Damstra, 1980) but the degree of risk is small and is out-weighed not only by the benefits of breast-feeding but also by the difficulty of excluding such pollutants completely from artificial feeds based on cows' milk.

7.7.6 *Lead.* There is little information about the concentration of lead in breast-milk. Recent studies indicate that the concentrations of lead found in breast milk are about 10% of those in maternal blood (Department of Health and Social Security, 1980c). The breast-fed infant is likely to take in a much smaller amount of lead than the baby who is artificially fed.

7.8 Human milk banks

7.8.1 When lactation is well established, some mothers may find that they produce more milk than is required by their own child. The excess milk may be donated to human milk banks for use by other babies, especially those who are small and sick or whose mothers are unable to feed them. A separate expert sub-group has been set up by the Committee on Medical Aspects of Food Policy and has described guidelines for the collection and storage of human milk through milk banks. (Department of Health and Social Security, 1981).

7.9 Contraception during breast feeding

7.9.1 After separation of the placenta, the oestrogen concentration of maternal blood decreases rapidly, blood prolactin concentration increases and the mammary glands become more active. Oral contraceptive pills containing oestrogen impair the release of prolactin and should be avoided during breast-feeding. Only 'low-dose' progesterone derivatives should be considered

suitable during lactation. Other contraceptive methods which have no effect on the hormone balance of the mother are preferable (Loudon, 1979).

7.9.2 In some societies lactational infertility can last for as long as two to four years and is an effective form of family spacing (Short, 1976). In the United Kingdom the period of lactational infertility is short even in women who breast-feed their babies and breast-feeding cannot be considered a reliable means of contraception.

8. Education

8.1 Lifelong impressions of infant feeding can be formed in childhood through watching younger siblings or other children feeding at the breast or from a bottle. The fact that families are now often limited to one or two children and that the extended family is more scattered reduces the opportunities for such observations of infant feeding practice.

8.2 The influence of the father on the mother's choice of feeding (Martin, 1978) and the lack of success of attempts in some hospitals to increase breast-feeding by mothers from social classes IV and V suggest that infant feeding should be included in the curriculum for both boys and girls in school (D'Souza and Black, 1979). The choice made by the mother before or early in pregnancy is likely to be followed, and promotion of breast-feeding should try to reach young people between leaving school and impending parenthood (Hally, Bond, Crawley, Gregson, Philips and Russell, 1981) as well as in the education of parents during the antenatal period (para 3.4.1). The nutritional requirements of infants, the importance of breast-feeding and the value of correct artificial feeding if breast-feeding is not possible are all matters for discussion so that a better understanding of the needs of the young infant is generated.

8.3 Parents should then be able to make an informed choice before the birth about how to feed their baby. However, those who receive conflicting advice can easily become confused. Such confusion can be avoided only if all members of the health professions speak with one voice in the antenatal period. Once the baby is born, advice must be tailored to the particular needs of the individual mother and baby.

8.4 A high standard of education in all aspects of infant feeding practice, including the assessment of normal growth and development, is required. The present standard of basic training and continued education of doctors, health visitors and midwives needs to be improved (Helsing and King, 1982). There is also a need for co-operation between the professions and members of lay organisations who are concerned with infant feeding, such as the National Childbirth Trust, La Leche League and the Association of Breastfeeding Mothers. Good relationships have already been established in some areas and should be encouraged.

8.5 Advertising, by whatever means, should give consistent, accurate and simple advice and should not imply that bottle-feeding is as good as or better than breast-feeding. Implementation of the International Code of Marketing of Breastmilk Substitutes (World Health Organization, 1981) in the United Kingdom by means of a Voluntary Code of Practice for the Marketing of

Infant Formulae, together with the setting up of a Code Monitoring Committee, should establish and maintain standards for manufacturers and distributors of infant formulae. Health professionals should follow guidance in Departmental circulars (1983) on the promotion of correct feeding practices in the health care system.

8.6 The Working Party wishes to record approval of the way in which many producers in radio and television, journalists, authors and personnel in industry have sought information from the Health Departments, consultant paediatricians, senior members of the nursing profession and the Health Education Council. The Working Party hopes that, in future, co-operation will not only continue but be increased in the interests of the health of the next generation.

9. Recommendations

9.1 Breast feeding

9.1.1 The Working Party reaffirms the conviction, stated in the 1974 Report, that satisfactory growth and freedom from disease are more likely when an infant is fed human milk than when an artificial substitute is given. We recommend that the Department of Health and Social Security, the Scottish Home and Health Department, the Welsh Office and the Department of Health and Social Services in Northern Ireland should continue to encourage all mothers to breast-feed their babies for the first months of life (para 3.1.1).

9.1.2 Although there is some evidence of a welcome increase in breast-feeding in some areas, we recommend that health authorities continue to pursue a positive interest in the provision of resources and facilities for the promotion and maintenance of breast-feeding (para 3.4.11).

9.1.3 We recommend that all professional staff who are concerned with infant feeding should review their policies and practice to ensure that the parents receive adequate advice to encourage the mother to breast-feed her baby (para 3.4.12).

9.1.4 We are of the opinion that the helpful contribution which can be made by voluntary organizations and lay bodies to the encouragement and maintenance of breast-feeding should be more widely recognized (para 3.4.8 and 8.4).

9.1.5 We recommend that facilities for a mother to breast-feed when away from home should be increased, both within the National Health Service and in other places, for example, shops, supermarkets and colleges (para 3.4.9).

9.2 Artificial feeding

9.2.1 We accept that, in the present climate of opinion about infant feeding, some mothers will choose to give artificial feeds and some may have to do so for one reason or another. We recommend that approved infant formulae (paras 4.2.1 to 4.2.7) should be available for feeding up to at least the age of six months, and that the use of an approved infant formulae throughout the first year of life may be an advantage (para 5.2.1).

9.2.2 We endorse the recommendation which has already been accepted by the Health Departments that, in the foreseeable future, only those infant formulae which have been scrutinized and approved by a panel of experts

should be marketed as suitable for feeding infants when mothers either do not wish to, or cannot, breast-feed (para 4.2.9).

9.2.3 We suggest that many factors which are important in breast-feeding a young baby, namely contact between mother and baby, feeding on demand and not giving other foods in the early months are also important in artificial feeding. We recommend that, if the bottle-fed infant appears to be hungry, the volume given at each feed and/or the number of feeds should be increased (para 4.3.2). The concentration of the milk should not be increased.

9.3 Introduction to a mixed diet

9.3.1 We recommend that when the change from human milk or reconstituted infant formula to cows' milk occurs vitamin supplements should be given (paras 5.2.1 and 6.1.4).

9.3.2 We are concerned that allowance should be made for individual variation in the length of time during which the nutritional needs of the young infant can be met solely by human milk or by reconstituted infant formula. We agree that the age at which solid foods are introduced into the diet should be individually determined from a consideration of the method of feeding practised, the developmental progress of the baby, and the preference of the mother. It seems likely that the majority of infants should be offered a mixed diet not later than the age of six months, and that very few will require solid foods before the age of three months (para 5.3.1). We recommend accordingly.

9.3.3 Although weaning does not usually present problems in the United Kingdom, there are some individuals to whom special attention should be given. These include many children in Asian families. We recommend that the child health services in areas where Asians live should continue to review the nutritional advice, especially that on infant feeding, which is offered to these families (para 5.3.6 and section 7.5).

9.3.4 We endorse the recommendation which we made in the 1974 Report that mothers be advised not to add sugar (sucrose) or salt (sodium chloride) to the solid foods in an infant's diet, and that caution should be exercised by manufacturers in the addition of sucrose and of sodium chloride to their infant food products (paras 5.3.3, 5.3.4 and 5.3.5).

9.4 Vitamin supplements

9.4.1 We recommend that the Government should continue to make vitamin supplements available, under the Welfare Foods Scheme, either free or at reduced cost to expectant and lactating mothers, and to infants and young children up to the age of 5 years (paras 6.1.3 and 6.1.5–6.1.7).

9.4.2 We recommend no change from the present formulation of Children's Vitamin Drops and the Vitamin Tablets for expectant and lactating women (paras 6.1.7 and 6.1.3).

9.4.3 We recommend that the dose of the Children's Vitamin Drops be altered from a range of two to seven drops to five drops per day and be given from the age of about one month until at least two years and preferably five years of age (paras 6.1.8, 6.1.9 and section 7.6).

9.4.4 We endorse the current recommendation of the Department of Health and Social Security that either the vitamin tablets which are available under the Welfare Foods Scheme or an appropriate proprietary alternative should be advised for all expectant and lactating mothers (paras. 6.1.2 and 6.1.3).

9.4.5 We recommend that all infants and young children should receive adequate amounts of vitamins. A vitamin supplement is particularly important for the following groups of children: low birth weight infants, those who receive household milk, Asian children and those for whom other sources of vitamin D (notably from the action of ultra-violet radiation on the skin) are in doubt. We recommend that these children should receive Children's Vitamin Drops or one suitable proprietary alternative. We recommend that not more than one preparation of supplementary vitamin D should be given (para 6.1.11).

9.4.6 We recommend that only when the mother's professional adviser is sure that an infant is receiving an adequate intake of vitamins from other sources such as human milk, an approved infant formula, fortified baby foods, or a proprietary multi-vitamin preparation is there no need to advise the use of supplementary vitamins (para 6.1.10).

9.5 Assessment of nutritional status

9.5.1 We recommend that, as part of health surveillance, all infants should be weighed regularly and the weights plotted on standard centile charts so that attention can be paid at an early stage to inadequate or excessive weight gain (para 7.2.1 and 7.2.2).

9.6 Water

9.6.1 We endorse the action already taken by Local Water Authorities to ensure that domestic tap water meets the accepted standards of quality, and we recommend that Health Authorities should ensure that artificially fed infants are not exposed to excessive intakes of lead, nitrates or sodium which could be harmful (paras. 7.1.1–7.1.8).

9.7 Education

9.7.1 We reaffirm the recommendation made in the 1974 report that

> 'adequate instruction in the principles of nutrition, including infant feeding, should be given in the training of all professional personnel who are to be concerned with infant feeding—doctor, midwife, health visitor, nurse and dietitian.'

9.7.2 We recommend that breast-feeding should be encouraged by education of boys and girls in school, parents in antenatal clinics and classes and at home, mothers in the maternity units of hospitals and at home, and in the training of doctors, health visitors and midwives (paras 8.2 and 8.4).

9.7.3 We recommend that the principles and practice of infant feeding should be agreed by all concerned in health education and that, at all levels, education in nutrition including infant feeding should be co-ordinated (paras 8.3 and 8.4).

9.7.4 We recommend that lay organizations and the mass media could with benefit continue to be used in educating the public in the principles of infant feeding which are stated in this report (paras 8.4 and 8.6).

9.7.5 We recommend that no labelling or advertisement should imply that artificial feeding is as good as or better than breast-feeding (para 8.5).

9.8 Information

We recommend that a regular review of the pattern of infant feeding practice and the effect of social and economic factors should be made at intervals of approximately five years.

9.9 Research

We agree that further research into the principles and practice of infant feeding should be made.

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