

*WORLD HEALTH ORGANIZATION*  
*MONOGRAPH SERIES*  
No. 29

INFANT NUTRITION  
IN THE SUBTROPICS AND TROPICS

# INFANT NUTRITION IN THE SUBTROPICS AND TROPICS

DERRICK B. JELLIFFE, M.D., F.R.C.P., F.A.P.H.A.,

*Director, Caribbean Food and Nutrition Institute, Kingston, Jamaica ;  
Visiting Professor of Tropical Medicine, Tulane University School of Medicine,  
New Orleans, USA*

SECOND EDITION



WORLD HEALTH ORGANIZATION

GENEVA

1968

First edition, 1955  
Second edition, 1968

© World Health Organization 1968

Publications of the World Health Organization enjoy copyright protection in accordance with the provisions of Protocol 2 of the Universal Copyright Convention. Nevertheless, governmental agencies or learned and professional societies may reproduce data or excerpts or illustrations from them without requesting an authorization from the World Health Organization.

For rights of reproduction or translation of WHO publications *in toto*, application should be made to the Division of Editorial and Reference Services, World Health Organization, Geneva, Switzerland. The World Health Organization welcomes such applications.

Authors alone are responsible for views expressed in the Monograph Series of the World Health Organization.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature which are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Director-General of the World Health Organization concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

PRINTED IN SWITZERLAND



## CONTENTS

	Page
Preface . . . . .	7
Introduction . . . . .	9
Chapter 1. Evolution of infant feeding . . . . .	13
Chapter 2. Present infant-feeding practices in the subtropics and tropics . . . . .	32
Chapter 3. Present status of nutritional disease among young children in the subtropics and tropics . . . . .	85
Chapter 4. Methods of improving infant feeding in the subtropics and tropics . . . . .	154
Chapter 5. Prevention of nutritional disease . . . . .	179
Chapter 6. Nutrition education : general considerations . . . . .	217
Chapter 7. Nutrition education in practice . . . . .	240
Annex 1. Detection of early protein-calorie malnutrition (PCM) . . . . .	255
Annex 2. Population growth and child nutrition . . . . .	257
Annex 3. Recommendations for closing the world protein gap . . . . .	259
Annex 4. " Ettu " pastes in infant feeding in Buganda . . . . .	261
Annex 5. Multimixes as village-level weaning foods . . . . .	263
Annex 6. A list of protein food mixtures . . . . .	266
Annex 7. Corn-soya-milk (CSM) . . . . .	268
Annex 8. The pre-school protection programme (PPP) . . . . .	269
Annex 9. The educational diagnosis . . . . .	272
Annex 10. Scheme for investigation of social and economic factors involved in a nutritional problem . . . . .	273
Annex 11. Information needed when investigating methods of infant feeding . . . . .	275
Annex 12. Group-discussion demonstrations . . . . .	277
Annex 13. Nutrition education topics . . . . .	279
Annex 14. Guidelines to infant feeding in the subtropics and tropics . . . . .	282
Annex 15. Artificial feeding in tropical regions . . . . .	284
Illustrations . . . . .	289
References . . . . .	307
Index . . . . .	327



## PREFACE

---

*The thirteen years since the publication of the first edition of this monograph have witnessed a mounting tide of literature on the nutritional problems of early childhood found in developing regions of the world, most of which are situated in the subtropics and tropics.*

*While many of the papers published have been concerned with clinical, biochemical and therapeutic aspects of malnutrition, an increasing number have dealt with methods of infant feeding, with field surveys aimed at the assessment of the prevalence of malnutrition in the community, with studies of the ecological factors responsible, and with the development of new infant foods. Furthermore, there has recently been growing concern with the urgent problems of devising, carrying out and evaluating comprehensive nutrition programmes aimed at the prevention of childhood malnutrition.*

*In view of these many new developments, the World Health Organization invited Professor D. B. Jelliffe to undertake the preparation of a second edition of his monograph on infant nutrition in the subtropics and tropics. The text has been thoroughly revised and much new material has been added. No attempt has been made, however, to achieve a complete coverage of the rapidly growing literature. Instead, the aim has been to keep the text practical and geared to the needs and interests of the field nutritionist. This does not mean that the monograph pretends to offer ready-made plans for combating childhood malnutrition; it is concerned more with the principles on which such plans should be based and emphasis is placed on one very important aspect—infant feeding. To be truly effective, any measures to improve infant feeding must form part of a co-ordinated, interdisciplinary food and nutrition programme. For this reason, the monograph also deals briefly with such questions as food technology, agricultural production, and family planning. Some specific aspects of infant feeding and of food and nutrition programmes for the subtropics and tropics are dealt with in a number of annexes.*

*The World Health Organization is greatly indebted to Professor Jelliffe for bringing together so much up-to-date information in the pages of this monograph.*



## INTRODUCTION

---

Millions of children in the subtropical and tropical, technically underdeveloped areas of the world are suffering from malnutrition as a result of poverty, unavailability of suitable food, lack of knowledge, and superstition. The spread of technological civilization has so far done little to help and in many cases may have worsened the position by destroying or making impossible old and well-tried beliefs and practices without supplying the means for newer methods. It is during the rapidly growing period of infancy and early childhood that this malnutrition is most marked, having a high morbidity and mortality, and probably leaving physical and psychological scars in later life in those who survive.

That assistance is needed is self-evident, not to increase still further the spiral of increasing population and diminishing food supplies, but rather as a part of the general attempt to raise the standard of living, with, it is hoped, a resultant tendency to limitation of family size and a drop in the birth-rate, as experience in other parts of the world has suggested.

A knowledge of the present situation clearly shows that it is quite useless to expect the standard textbook instructions on infant feeding to have any significance for most children in the developing countries where by far the majority of the child population of the world is to be found.

The study of child health in the subtropics and tropics is still in its early stages and, although it has many aspects in common with paediatrics as seen in the technically developed countries of the temperate zone, there are many points of difference, some of which may not be readily appreciated by those working in the tropics for the first time. This is particularly so with regard to methods of infant feeding and nutritional disorders in early childhood generally. It is only in the past decade that the complexity of the causation of childhood malnutrition has truly begun to be appreciated so that more logical multidisciplinary preventive programmes can be envisaged.

The nutritional level of a community, especially that of its highly vulnerable young children, is related to numerous interacting ecological forces. It is positively related to the educational and economic level of the community, to the availability of sufficient food of the right quality, and to the adequacy and accessibility of the health services. On the other hand, there is a negative correlation between nutritional level and population size, not merely because a growing population means more mouths to feed but also because it increases the demands for social services, such

as schools and health centres. The most serious and direct effect of the rapidly expanding world population remains, however, the reduction in the amount of protein foods available for feeding young children — the steadily widening “ world protein gap ”.

Fortunately, there is a growing awareness that the real obstacle to dealing with food and nutrition problems is the failure to apply existing knowledge in practice and that community malnutrition has to be attacked by a vigorous and effective alliance between the services responsible for education, health, agriculture, economic development, and population control. The urgent need for practical, long-term approaches to nutritional problems has been reflected in many recent developments. To mention only a few examples : there has been intense activity in the field of food technology, particularly in relation to the preparation of commercially viable protein foods derived from non-traditional sources ; in scientific agriculture, advances of far-reaching and practical importance have been made, such as the discovery by plant geneticists of high-protein cereals ; schemes such as the World Food Programme have brought more logical and constructive use of food aid ; and there has been groping progress towards a better understanding of more effective interdisciplinary methods of nutrition education.

At the same time, these moves towards practicality and adaptation have been reinforced by a realization of the pressing need for workable, functional and effective co-ordinated approaches to problems of food and nutrition by the different ministries and disciplines concerned, and for appropriate interdisciplinary training programmes for the various types of staff required. Pioneer projects of great importance include the applied nutrition programmes and pre-school protection programmes that have evolved in different countries, while the practical experiments in social group dynamics exemplified by national food and nutrition councils in various parts of the world are of key significance. *An understanding of methods likely to lead to an active, influential, non-partisan, and representative co-ordinating committee is often the prime nutritional need, for such a committee may well prove the cornerstone of a comprehensive national food and nutrition policy.*

The present monograph makes no attempt to cover all aspects of community nutrition. A search of the medical, nutritional and anthropological literature revealed that almost a thousand new publications touching on various aspects of this wide-ranging subject have appeared in the last thirteen years. It was felt neither desirable nor possible to refer to all of these.<sup>1</sup> Instead, an attempt has been made to deal with the problems of infant nutrition mainly from the viewpoint of the health worker in the field.

---

<sup>1</sup> For a comprehensive list of references, see Jelliffe, E.F.P. (1968).

Thus, the large volume of important new knowledge concerning the biochemistry, pathology and immunology of protein-calorie malnutrition of early childhood is touched upon only when it has practical significance, although references to authoritative reviews are given. Similarly, no detailed coverage has been attempted of such significant aspects of infant nutrition as protein requirements, community assessment of inter-relations with infections, and the technological development of high-protein processed foods. Numerous monographs, reports and other publications on these subjects have appeared in recent years and reference is made to these where appropriate.

Despite the advances of the last decade, many more carefully planned studies and accurately recorded observations are needed. It is hoped that this monograph will not only present a picture of present knowledge but will also stimulate further work to fill the gaps that still remain.

---



## EVOLUTION OF INFANT FEEDING

---

The methods of infant feeding at present in use in the subtropics and tropics can best be understood and assessed if viewed against the backcloth of present knowledge of the evolution and cyclical variations that have occurred throughout the centuries, from the time when pre-man was living as a purely instinctive wild animal to the present complex phase seen in most technically developed countries, where the pattern is largely influenced by competitive advertising of commercial brands of tinned milks and infant foods.

### MAMMALIAN INFANT FEEDING

The main distinguishing feature of the mammalian group is the possession by the female of milk-secreting breasts, by which the maternal responsibility for foetal nutrition, previously undertaken via the umbilical cord, can be continued after birth. This interdependence is particularly remarkable when it is recalled that no analogous process occurs in non-mammalian creatures, all other species feeding their newborn or newly hatched offspring on exogenous foods or abandoning them to forage for themselves at birth.

As far as one can judge, breast-feeding in animals is usually an easy and automatic process, unless severe general illness or udder disease absolutely prevents it. Suckling generally commences soon after birth and is "on demand", although a rough spacing of feeds may be achieved in some species by the natural sleep/feed rhythm of the baby, the apparent disinclination of the mother to allow feeding until the breasts are distended, and possibly a cyclical variation in the "draught" or "let-down" reflex (Waller, 1938; Isbister, 1954; Newton & Newton, 1948, 1950 a; Newton, 1952).

The mammalian lactatory apparatus is both efficient and, to some extent, species specific. Thus, the average number of breasts found in the female animal corresponds closely to the usual size of the litter, while milk composition may be related to the needs of the particular species. For example, seal milk has been found to have a very high fat content (43%), presumably in view of the necessity for the cub to develop rapidly a layer of insulating blubber; while Brody (1945) has re-stressed the interesting relationship, originally noted by Bunge in 1874, between the

protein content of milks of various mammals and the rate of growth of their offspring, as measured by the time taken to double their birth-weight (see Table 1).

TABLE 1.  
PERCENTAGE OF PROTEIN IN DIFFERENT MAMMAL MILKS AND TIME,  
IN DAYS, TAKEN FOR DOUBLING BIRTH-WEIGHT OF OFFSPRING <sup>a</sup>

Species	Protein (%)	Days
Man	1.6	180
Cow	3.8	70 (47)
Horse	2.7	60
Sheep	5.4	35 (15)
Goat	3.7	22
Pig	6	14
Dog	7.5	9
Guinea-pig	5	7
Rabbit	14	6
Rat	12	6

<sup>a</sup> After Platt & Moncrieff (1947).

Until recently it was considered that human milk contained no substance more or less peculiar to the species. The discovery by György (1953) of the "*Lactobacillus bifidus* factor", which is found in large amounts in human milk as opposed to cow's milk, has suggested that this substance may possibly be a specific requirement for the optimal growth and health of the human infant (György, 1961 a).

Various aspects of weaning have been commented on by Le Gros Clark (1953), who points out that it is a curious process and that the young animal's survival depends upon bridging this biologically momentous transitional period, when it changes from a milk-drinking to a starch- and flesh-eating creature. It is dependent upon the infant animal having reached a certain level of physiological maturity and on the mother being able to apply a well co-ordinated pattern of instinctive behaviour. In animals living in their normal wild state, the time of weaning appears to vary with two interdependent factors: (a) the ability of the infant to live independently, avoiding danger and foraging for itself; (b) the ability of the young animal to take in and digest the food of the grown adult. Variations in these factors have been responsible for the development of the weaning habits best suited to the biological needs of the different species.

During the millenia that form by far the longest period of human evolution, prehistoric man had not developed the art of taming and milking animals—a comparatively recent accomplishment chronologically. Under these circumstances it seems probable that breast-feeding was continued for

a period of years, until the child was to some extent mobile and independent, and—even more important—could digest the possibly pre-chewed raw or charred flesh, roots and berries that would form the food of the adult. (In this context it is of interest to note that, as Andelman, Gerald, Rambar & Kagan (1952) have shown, even premature babies are capable of digesting strained meat preparations.)

The use of animal milk as a human food dates from comparatively recent times, while the widespread use of cow's milk in infant feeding in the technically advanced countries is a modern phase, made possible only by large-scale scientific dairying and the development of the canning industry. As Levin (1962) has emphasized, an epochal change in feeding habits followed man's transition from hunter to husbandman, as it introduced two new edible products—the milk of domesticated animals and cultivated grains. That these are recent developments is not sufficiently realized, while the converse fact that infant feeding can be and is accomplished without the use of animal milk is difficult for anyone to appreciate who has been brought up in a country where "milk emotionalism" exists.

The main change that has occurred in present-day weaning practices is the tendency to remove the baby from the breast during the first nine months of life. This has been made possible by the modification of the two limiting factors previously mentioned. First, although the modern infant does not have to develop into a self-sufficient, mobile, hunting animal—at least not in the prehistoric sense—and remains nutritionally dependent upon his parents for a longer time, the comparative stability of modern living conditions has lessened the necessity for having a suitable food, in the form of breast milk, constantly available for flights or emergencies, as in the uncertain days of the cave-dweller or nomad. Secondly, and much more important, the advances in dairying and milk technology have made possible the introduction of a digestible breast-milk substitute at a much earlier age than in the "pre-milk" days. It is only very recently that widespread production of clean, relatively cheap cow's milk has changed the whole pattern of infant feeding in the temperate zone from the basic sequence of human milk → semi-solid food, to human milk → cow's milk → semi-solid food. As will be discussed at length later, it is of great importance to realize that, for economic, climatic, and, sometimes, cultural reasons, the basic two-stage pattern of weaning is still customary in many tropical countries.

#### ANCIENT CIVILIZATIONS

The history of infant feeding has been reviewed by Wickes (1953 a-e) and by Davidson (1953), and their excellent papers have been very extensively drawn upon in the present brief account.

Early methods were handed down by word of mouth and few written accounts are available. Present knowledge is therefore to a great extent

a matter of speculation, combined with such archaeological clues as are occasionally found in the form of terra-cotta reliefs, rock carvings, figurines, and, especially, the presence or absence of feeding-bottles.

### Egypt and Babylon

The scanty information available indicates that in pre-Ptolemaic Egypt prolonged breast-feeding up to the age of three years was universally practised. This is emphasized by the absence of feeding-bottles from excavated ruins dating from this period. With the spread of Hellenic culture to Egypt, the custom of feeding infants with specially prepared bottles, often shaped rather like a modern eye undine, or of farming them out to wet-nurses appears to have become common. It would seem that, as with later civilizations, the life of the cultured and sophisticated mother offered alternative pursuits and amusements, as opposed to the complete preoccupation of the uneducated mother with her baby.

It has been suggested that, in ancient Babylon, the vital significance of breast-feeding was appreciated, as indicated by the fact that the mother goddess, Ishar, was depicted as suckling a baby. This corresponds closely to the present-day Nigerian figurine of Odudua, the Yoruba goddess of maternity and fertility, who is represented as a woman breast-feeding twins.

### India

The value of human milk in infant feeding has been appreciated for thousands of years in India, as is emphasized by the *Caraka Samhitā*, an encyclopaedic collection of Ayurvedic beliefs antedating Buddha. The annotator of a recent English translation (1949) summarizes the main customs in practice at that time :

Mother's milk was considered to be the best for a child, but human nature was not very different then from now and it seems that the custom of having a wet-nurse was prevalent, at least in the aristocratic class. Great care was taken in selecting a wet-nurse. A minute and thorough examination was carried out not only as regards the age, caste, colour, family, race, character, etc. of the woman, but even the size and shape of the breasts and nipples.

Similarly, Zimmer (1948), in his book on Hindu medicine, remarks that when the newborn is given the breast for the first time, the physician supervising the initial feeding works an auspicious charm on the nursing mother to promote lactation by uttering the following stanzas (Suśruta, III, 10) :

May four oceans, full of milk, constantly abide in both your breasts, you blessed one, for the increase of the strength of the child !

Drinking of the milk, whose sap is the sap of immortal life divine, may your boy gain long life, as do the gods by feeding on the beverage of immortality !

In addition, it is clear that animal milk was widely used and valued in ancient India. The *Caraka Samhitā* (English translation, 1949) devotes twenty stanzas to the properties of milk and its products, and mentions the following species: cow, buffalo, camel, goat, sheep, and "milk of animals of uncloven hoof".

### Greece and Rome

During the earlier stage of Greek civilization, breast-feeding appears to have been carried out largely by the infants' mothers, while later, at the height of Hellenic culture, the babies of the well-to-do were wet-nursed for about six months and then artificially fed with cow's milk for some eighteen months. The commonness of artificial feeding is indicated by the widespread presence of feeding-bottles in excavations dating from this period.

As a result of Greek influence, during Roman times the popularity of wet-nursing and artificial feeding continued, particularly among the wealthy. As stressed by both Wickes (1953 a) and Davidson (1953), the unique treatise of Soranus of Ephesus in the second century A.D. contains considerable detail on methods of infant feeding. He considered that colostrum was harmful to the infant, being "thick, cheesy and difficult to digest"—a belief still held in some countries today, including parts of India. He also advised that the neonate needed no food for the first two days of life, as it was "still amply provided with nourishment derived from its mother", and he suggested that honey should be given on a finger to allay constipation and, particularly, to help to evacuate meconium—a custom still widely prevalent to this day in some countries, including, for example, Saudi Arabia. The introduction of semi-solids, such as bread crumbs mixed with wine, soup, or eggs, was advised at the age of six months; while the classical description of the characteristics of a good wet-nurse was given. The finger-nail test of Soranus to determine the quality of a sample of breast milk was described and was used for almost two thousand years afterwards. In this, a drop of milk was placed on a finger-nail, and its consistency and presumed digestibility judged by whether it remained in its original drop form or flowed rapidly all over the nail. A similar test has been used in China (see page 57), while in parts of Pakistan milk has been tested separately from each breast by dropping it on to a certain type of beetle, which is alleged to die if the milk is unsuitable (see page 41).

Galen, a contemporary of Soranus, does not appear to have contributed to this subject, although his conception of the fundamental elements—cold, hot, dry, and moist—would certainly have affected infant feeding in that some foods would be considered unsuitable for certain children under particular circumstances. A similar belief has considerable influence on infant feeding in parts of Pakistan and India, where "garam" or

“hot” foods—including eggs—are thought to be unsuitable for children, especially during the warm weather.

### Israel and the Arab World

The Talmud and the Bible contain scattered references to infant feeding. According to Davidson (1953), the baby was put to the breast at once and breast-feeding was continued for two years; honey was given to assist evacuation of meconium. The nursing mother was fed well and did not have to perform heavy work. Wet-nurses were common, and Moses was fed in this way at the orders of Pharaoh's daughter: “Take this child away, and nurse it for me, and I will give thee thy wages” (Exodus ii. 9). Wickes (1953 a) remarks that breast-feeding was universal among the Hebrews, no reference to artificial methods being found in the Talmud.

An important contribution of the Koran to infant feeding is the advice that breast-feeding should be prolonged for two years. The influence of this teaching appears to be strong today in some Moslem countries. Female infants are recommended to be breast-fed for longer than male ones.

### MIDDLE AGES AND RENAISSANCE IN EUROPE

It seems certain that during the Middle Ages in Europe breast-feeding was universal and nursing-bottles are uncommon archaeological finds. With the Renaissance, the first books on the subject were printed in Europe. Wickes (1953 a), in his very full account, quotes from the first textbook in the English language, entitled *The Byrthe of Mankynde* (1540), which was a translation of Roesslin's *Rosegarten*. The quotation describing the correct method of weaning is so apt and sound in principle that it is in part repeated: “Avicen avyseth to geve the chylde sucke two yeres / ... And when ye wyll wene them / then not to do it sodenly / but a lytell and lytell / ... tyll it be able to eate all manner of meate.”

About this time various types of artificial feeding had become popular, and children were often given animal milk through feeding-horns or sucking-cans with cloth nipples. It was advised that supplementary feeding in the form of gruel should be given as well as breast milk, the quantity varying with the amount of breast milk available. The introduction of solid food after the cutting of the front teeth was suggested, and breast-feeding for two years was advised. Forced weaning was sometimes employed, the breasts being painted with a bitter substance, such as wormseed juice. (A similar practice is employed occasionally at the present day in many countries, and Jamaican peasant mothers sometimes use an extract of aloes for this purpose—see page 64.) It was commonly believed that the suckling might be affected and influenced by the moral attributes of the

wet-nurse, a long-standing idea probably dating back to pre-history. On the whole, prolonged breast-feeding appears to have been customary and widespread, while artificial methods were used more as supportive measures, unless breast milk failed or no wet-nurse was available.

#### SEVENTEENTH AND EIGHTEENTH CENTURIES IN EUROPE

During this period there seems to have been a tendency to abandon breast-feeding, especially among the well-to-do. Two alternative methods appear to have been mainly employed: "wet-nursing", using hired lactating women; and "dry-nursing", using various starchy concoctions and gruels.

Wet-nursing became quite well organized during this period in both Europe and North America (Caulfield, 1952), and had the very considerable disadvantage that the poorer women tended to abandon their own babies or leave them at foundling hospitals, so that they could hire themselves out as wet-nurses to the more wealthy. The mortality of infants left at foundling hospitals was exceedingly high, owing to neglect, overcrowding, cross-infection, and a diet of starchy gruels.

Dry-nursing, alternatively known as "hand-feeding", made use of a variety of "paps" and "panadas"; the former were prepared by cooking flour or bread in water, rarely with the addition of milk, while the latter consisted of various mixtures of flour, cereal, or bread, cooked in broth, generally with butter and occasionally with milk added. As might be expected, this predominantly carbohydrate diet was associated with widespread malnutrition, including rickets, and a high infant mortality. Although no definite description has been noted in contemporary literature, it would seem very likely that examples of what is now known as "kwashiorkor" must have occurred not infrequently.

It is of interest to note that mastication of food prior to feeding was common. Cow's milk does not appear to have been very widely used, especially in cities, as the general filth and insanitary conditions prevalent, whereby animals were often kept in cellars in towns, often resulted in infection with frequently fatal "watery gripes".

Despite the tendency to abandon breast-feeding, it is apparent from numerous tracts and publications appearing at this time that its value and importance were fully realized by many thinking people—and this is exemplified by the detailed and specific instructions given with regard to the feeding of infants of plantation slaves in the southern states of the USA, in which it was advised that they be allowed to suckle for at least twelve months (Marshall, 1938). As Wickes (1953 b) remarks, Francis Glisson (1597-1677), in his book *De Rachitide* (1650), strongly extols the virtues of breast milk, which is "the most solubrious and agreeable nourishment [at]

that tender age, especially when it is sucked from the breasts ; for it is a simple and uniform meat, full of nourishment, easie to concoct, and friendly and familiar to the constitution of Infants ”.

#### NINETEENTH CENTURY IN COUNTRIES UNDERGOING INDUSTRIALIZATION

Despite increasing difficulties as a result of poorer mothers having to go out to work in a progressively industrialized society, this century appears on the whole to have been associated with a return to widespread breast-feeding. At the same time scientific methods first began to develop. Initial analyses of milk were undertaken and, while it was found that the milk of asses and mares was the most similar to human milk in composition, cow's milk was the most commonly recommended, owing to its cheapness and availability. “ Direct feeding ”, with the baby actually suckling from the animal's udder, was in vogue in some countries, especially France. At this time also, a scientific interest in the value and danger of wet-nurses developed, especially with regard to the possibility of infection with syphilis.

Test-feeding and condensed milk were both introduced in the middle of the century, while, in France, Budin (1846-1907) started the first prototype infant-welfare centre (“ consultation de nourrissons ”) where regular attendance and weighings enabled infant nutrition to be accurately studied. He emphasized the importance of breast-feeding and, under the influence of the teaching of Pasteur, recommended the use of sterilized, undiluted cow's milk as the best substitute.

#### TWENTIETH CENTURY IN TECHNICALLY ADVANCED COUNTRIES

##### **Breast-Feeding**

There appears to have been a definite and possibly progressive decline in breast-feeding in most technically advanced countries during the present century, although this has been uneven in geographical distribution.<sup>1</sup> Interestingly, breast-feeding appears to be the usual practice in the USSR, and among immigrants from all parts of the world in Israel (Thaustein, Halevi & Mundel, 1960). The findings of Ross & Herdan (1951) are significant in that they demonstrate a decrease in breast-feeding in the city of Bristol over a twenty-year period, complete breast-feeding at the age of three months being found as follows : 1929-30, 77.2% ; 1942, 55% ; 1949,

<sup>1</sup> A recent survey by Arneil (1967) in Scotland showed that only 30.9% of mothers attempted breast-feeding, while only 4.7% continued beyond four months. The pattern also revealed early, expensive and nutritionally unnecessary mixed feeding, often introduced in the first month of life.

36.2%. Also, Spence and his co-workers (1954) in Newcastle-upon-Tyne have found that only a little more than half the infants are wholly breast-fed at the end of one month, and only one-third at the end of three months.

The reasons for this are complex and not completely understood, but include the facts that : (1) many mothers are working ; (2) breast-feeding is by modern convention carried out only in privacy and is, therefore, a social inconvenience ; (3) there are very many efficient, relatively cheap, and highly advertised milk preparations on the market produced exclusively for infants ; (4) there are many alternative pursuits and amusements for emancipated women who wish to take a more active place in the social structure of modern society ; (5) lactation failure apparently tends to be common.<sup>1</sup>

The cause of this failure is often somewhat obscure, and Robinson (1943), in an analysis of 1100 lactation failures in Liverpool, found that 40% had no obvious explanation. Nevertheless, it seems probable that there are three main causes : (a) psychological, due to lack of interest, worry over possible failure, or other emotional tensions, which interfere with the all-important neurohormonal "let-down", "draught" or "milk-ejection" reflex (Newton & Newton, 1951), (b) inadequate emptying of the breast, and (c) lack of nipple stimulation by the baby, with decreased reflex production of the milk-secreting pituitary hormone, prolactin.

More recent studies carried out in Nottingham, England (Newson & Newson, 1962) and in up-state New York, USA (Yankauer et al., 1958) showed that failure to breast-feed is more marked in lower social groups. Conversely, increased awareness of the importance of breast-feeding for mother-child relationships has become evident in highly educated segments of the population in the USA (Pryor, 1963) as shown, for example, by the development of LLL (La Leche League),<sup>2</sup> a nation-wide association to promote breast-feeding (Jelliffe, 1966 d).

An indifferent attitude to breast-feeding has to a certain extent been fostered by some physicians and midwives, who have tended to change infants from the breast to cow's milk unnecessarily. There seems little doubt that the present authoritative view of paediatric nutritionists is that breast milk is the most suitable food for human infants under all circumstances (György, 1961 a), although whether many practitioners pay more than superficial attention to this is somewhat doubtful. As Neale (1952) says :

Most regrettably, that pernicious story is still all too often heard about human milk not being suitable to the baby, a remark which might be regarded as the highest evidence

---

<sup>1</sup> In addition, the direct relation between the ability to breast-feed and the maternal attitude has been re-stressed by the work of Newton & Newton (1950 b), who have clearly demonstrated that women who have a strong prenatal desire to breast-feed are usually successful. The literature on the let-down reflex has recently been reviewed (Newton, 1961).

<sup>2</sup> A brochure *The womanly art of breast feeding* is available in English, French or Spanish from La Leche League, 9616 Minneapolis Avenue, Franklin Park, Ill., USA.

of the lowest clinical ability in paediatrics. Doctors or midwives must remember their special responsibility in guiding the mother through the crucial first month of efficient, normal, natural lactation, which will give her effective confidence to continue and enable the baby to have a flying start in nutrition, and even, probably, provide certain psychological advantages.

A number of advantages of breast milk are well known, such as its cheapness, lack of bacterial contamination, steady composition and temperature, and easy availability. Also, as noted by Platt & Moncrieff (1947), it is agreed that, provided the mother's diet is adequate, the breast-fed baby is less likely to suffer from scurvy, rickets, or iron-deficiency anaemia than the infant fed on cow's milk alone, while the presence of lactose in increased amounts in human milk may, by its effect on intestinal microflora, affect the synthesis of various nutrients. It also promotes the absorption of calcium and phosphorus, presumably because of its influence on the hydrogen-ion concentration of the gut-contents. In addition, from the evolutionary point of view, it is reasonable to suppose that breast milk has, over a period of millions of years, become specifically modified to suit the growth requirements of the human infant. Waller (1952) makes the ingenious suggestion that its composition may in some way be connected with the extremely rapid growth of the baby's central nervous system :

It is generally accepted that the differences in the composition of the milks of mammalian species have been evolved in accordance with the particular pattern of growth best suited to the young ... Now surely the most impressive feature of the human baby's growth is the rapid development of the central nervous system. The brain reaches nearly two-thirds of adult size by the age of 2 years and almost its full size by 7 years. I know of no nutritional studies on the bearing of infant feeding on this phenomenon. But I sometimes wonder whether we may not dismiss too lightly the possibility that the composition of human milk may be specially related to the rapid growth of nervous tissue.

In contrast, it may be noted that, as has been demonstrated by Gordon, Levine & McNamara (1947), premature babies fed on cow's milk in suitable dilution gain in body-weight more rapidly than those fed on breast milk. However, as Graham (1952) observes, while this can be accepted as an undeniable fact, "it is salutary to remind ourselves that good nutrition cannot be determined merely by a gain in weight".

As Bakwin (1953) comments, research into the biochemistry of human and cow's milk has shown that the composition of the two is dissimilar both qualitatively and quantitatively to an extent unsuspected until recent years :

By electrophoretic analysis casein can be separated into two or possibly three fractions of different chemical composition. The amounts of these fractions are different in human and cow's milk ... [Human milk contains] 7 per cent linoleic acid, cow's milk little or none.

The salt content of cow's milk is much higher than that of human milk and the relation of the salts, notably calcium and phosphorus, is different ... Perhaps more important than the dissimilarities in composition are the differences in the metabolic

responses of infants receiving the two milks. Though the percentages of ingested nitrogen, calcium, and phosphorus which are retained are smaller in infants receiving cow's milk . . . , the absolute amounts retained are greater. Consequently the body compositions of the two groups of babies are different, those who receive cow's milk having more nitrogen, calcium, and phosphorus in their make-up than the breast-fed.

The evidence of increased morbidity and mortality from infantile gastro-enteritis in the artificially fed, under conditions that appertain to most of the world, appears to be convincing. In a series of 216 cases, Gairdner (1945) found a death-rate of 61% when infants had been breast-fed for less than a month and only 28% when this had been prolonged beyond that time. Similarly Schlesinger (personal communication quoted by Burgess, Burton & Milton, 1952), found that of 165 infants who were admitted to hospital suffering from gastro-enteritis, in 1949, only 2 (1.2%) were fully breast-fed. It seems possible that the explanation for this may not lie entirely in the obviously increased risk of infection inherent in the more complicated procedure of bottle-feeding, but may also be due to the presence of specific protective substances in breast milk, as has been suggested by the much higher yield of *Lactobacillus bifidus* factor found by György (1953, 1961 a) in human colostrum and milk as opposed to cow's milk. In this context, it may be noted that the colostrum of cow's milk has been shown to contain a substance which protects calves from gastro-enteritis due to *Escherichia coli* type I. It has been suggested that the protective power of bovine colostrum is due to a lactoglobulin, the presence of which was correlated with agglutinins against the prevalent strain of *E. coli* (Lovell, 1954). However, in human colostrum no protective antibodies have so far been identified, except against enteroviruses, including poliomyelitis viruses (Warren, Lepow, Bartsch & Robbins, 1964). The species difference with regard to the prenatal and postnatal transfer of passive immunity is considerable in various mammals (Table 2).

TABLE 2  
TIME OF TRANSMISSION OF PASSIVE IMMUNITY IN MAMMALS <sup>a</sup>

Species	Transmission of passive immunity	
	Prenatal	Postnatal
Ox, goat, sheep	0	+++ (36 hours)
Pig	0	+++ (36 hours)
Horse	0	+++ (36 hours)
Dog	+	++ (10 days)
Mouse	+	++ (16 days)
Rat	+	++ (20 days)
Rabbit	+++	0
Guinea-pig	+++	0
Man	+++	0

<sup>a</sup> From Hemmings & Brambell (1961).

Furthermore, Ross & Dawes (1954) have shown that at least some of the resistance of breast-fed infants to *E. coli* gastro-enteritis is due to the low stool pH and, in particular, to the much higher concentration of formic acid present in the faeces.

However, as recently as the late nineteenth century, "the women in Kansas at that time were convinced that if a baby were fed cow's milk it should surely die. Their belief was fully justified. If you could go back with me and see our cows, or barn, the milk pails and cans, and our lack of facilities for keeping milk cold, you would doubtless have been convinced that no baby could survive such unsanitary milk. It is my belief that I could have survived being fed on milk contaminated with stable filth. It was the cloth strainer which a baby could not compete with by his defence mechanisms. We rinsed the strainer after pouring the morning's milk through it, and hung it up to dry. In summer fifty or more flies would alight on it within a minute and feed upon the milk residues, speckling it with fly-specks. In the evening, the fresh milk was poured through this fly-excrement-laden cloth. A baby could scarcely ever fail, when fed such contaminated milk, to suffer from diarrheal infection and die." (McCollum, 1958)

It must be noted, however, that in a few surveys undertaken with selected groups of especially co-operative mothers—as with Stevenson's (1947) series in Harvard—no difference in the incidence of infantile gastro-enteritis could be found. This may be due, in part, to the lesser likelihood of gastro-enteritis occurring in the babies of the more conscientious mothers selected. As Aldrich (1947) noted, the preventive role of breast milk is much more noticeable when it operates among children in the less favoured classes, who live in relatively unhygienic circumstances. The great risks of bottle-feeding for children in tropical regions are detailed later (p. 174, 284).

A surprising and important discovery is that an exclusively milk diet protects rats from experimental malaria, possibly because it supplies insufficient *p*-aminobenzoate for the parasites' metabolic processes (Maegaith, Deegan & Jones, 1952). This work has been confirmed in monkeys and it has been suggested that the relative immunity to malaria shown by infants under 6 months in many parts of the tropics may be due, to some extent, to a deficiency of *p*-aminobenzoate in their diet of mother's milk (Hawking, 1954).

The probable psychological importance of breast-feeding as one of the major influences in the emotional development of a satisfactory mother-child relationship has become increasingly realized, and the present attitude was well summed up by Czerny (1922) over forty years ago, when he wrote :

Between the person who nurses [the baby] and the child, those relationships develop which are most highly valued when they exist between parent and child. For the child fed by a wet-nurse or a nurse, the mother remains a stranger despite the blood relationship . . . The mother who does not feed the child herself creates, already in the first

year of life, a barrier between herself and the child which is never completely removed. [Trans.]

Stone & Bakwin (1948) summarize the modern attitude<sup>1</sup> when they say :

It is not our viewpoint that all babies who are breast fed will grow up to be happy adults or vice versa. We do feel, however, that it is one step, and an important one, in establishing proper interrelationships between mother and child, and in providing suitable outlets for the young baby's budding emotional needs. In addition, under proper circumstances, it supplies a satisfying experience for the mother.

Cloete (1957) makes the same point, when he says :

For the truth is, that for babe or man, there is no warmth or security to be found in a bottle. There is only one thing to do with it, and that is to empty it. It cannot be toyed with, caressed, or stroked. It is not warm or soft. A bottle is a stone, is sand fused and processed into a vaguely breastlike shape for the holding of liquids, but to the infant it is a mockery.

An interesting development of the present century which must be mentioned is the virtual extinction of wet-nurses in the technically advanced countries and their replacement, in some hospitals, by breast-milk "banks", which are especially of use in the feeding of premature infants.

### **Animal-milk Preparations**

The rapid development of hygienic dairying and milk technology, dating originally from the end of the nineteenth century, has ensured a widespread use of clean, relatively safe, often pasteurized, cow's milk. However, infant feeding with cow's milk undoubtedly received its major impetus from the use of dried and canned preparations. As early as the middle of the last century, a crude sweetened condensed milk was being produced commercially, while just over fifty years ago, roller and spray dried milks were prepared. Since then an increasing variety and complexity of brands and types of dried and canned milks have come on to the market. Competitive advertising has necessitated a constant search after minor, alleged improvements, and, at the same time, has enormously increased the complexity of the subject for both the paediatrician and the parent. As Wickes (1953 d) notes, one firm, in the early nineteen-fifties, produced over twenty different varieties of powdered milk. While it must be agreed that occasionally a special variety of milk can be clinically indicated—as, for example, in the treatment of infantile eczema—the unnecessary confusion of the present situation has been emphasized by the excellent results obtained in Great Britain during the Second World War,

---

<sup>1</sup> Bostock (1962) also stresses that, for the first 9 months of life, the baby is actually an exterogestate "free foetus", needing the food and intimate contact of the continuing symbiotic union with the mother exemplified by breast feeding.

when initially only two types of milk were available : half- and full-cream national dried milk.

### Infant Foods

Powers (1939) sums up the situation with regard to the modern development of infant foods, when he says : " A quarter of a century ago the market was glutted, as it is today, with various baby foods ; the difference is that most of these foods today are not just carbohydrate concoctions but preparations which, while unnecessary, can be used to prepare a balanced diet for the child." Similarly, Wickes (1953 c) has described the rapid increase in the number of farinaceous infant foods at the end of the last century, quoting the following examples : Boaden's (made from barley and wheat flour), Prince of Wales' Food (potato flour), and Plumbe's (pea, bean and potato flour). Later, malted cereals were introduced, and in Great Britain in 1883 apparently 27 brands of patent infant food were available.

When they can be afforded, there is no doubt that modern infant foods are convenient, easily prepared, packaged in suitably small quantities, and usually nutritious, with considerable attention paid to digestibility, attractive presentation, and enrichment with vitamins and iron. They are, however, relatively expensive and far from essential, and it is quite possible that fresh, home-cooked foods may be more valuable nutritionally, although more time-consuming in preparation.

A comparatively recent phase is that dictated by the search for milk substitutes for allergic infants, who appear to be quite common in some countries, especially in the USA. These include amino-acid mixtures, nut and soya-bean preparations, and various meat suspensions, including one made of whale's heart (Glaser, 1953).

### Weaning

Modern practice would appear to consist essentially of introducing semi-solid foods relatively early. Some authorities advise commencing in the first weeks of life, but it is probably a fair compromise to say that many paediatricians are agreed that the infant should be given small quantities of semi-solid foods by the age of about four months, and can be weaned from the breast completely by nine months. There are two reasons for this. First, it has been suggested that the infant's taste appreciation is more easily widened at this early age, thereby making weaning a less difficult process. Secondly, it is realized that after about six months milk cannot supply all food factors adequately, being especially deficient in iron.

Against the very early feeding of semi-solids in the first weeks of life, the opinion of Bakwin (1953) may be quoted :

The optimal time to introduce solid foods is when the oral musculature of the infant is ready to receive it, generally between three and four months. This is not to say that solid food cannot be fed earlier. It can and often is. But, because the infant is not ready, feeding is difficult, the baby often ejecting the food owing to awkwardness of the tongue and lips. . .

Young infants push vigorously with the tongue against a spoon or solid food placed between the lips. At about three to four months, a change takes place. When food is brought to the child's mouth, the lips part, the tongue carries the food to the back of the mouth and swallowing follows. This is the optimal time to introduce solid food, and nothing is to be gained by earlier administration.

### Vitamins and Minerals

It has long been appreciated that the predominant deficiency diseases in infants in the temperate zone are iron-deficiency anaemia, rickets, and infantile scurvy. As the food factors responsible cannot be supplied in sufficient amounts by milk, the relatively early introduction of other foods is usually advised, as mentioned previously. In addition, the use of fish-liver oils rich in vitamin D and of fruit juices containing ascorbic acid has been very extensive, although more recently there has been a tendency to use the numerous multivitamin and iron concentrates, which are made up in a small volume, and are almost tasteless and dispersible, so that they can be mixed with the infant's feeds from the first weeks of life. A new and unexpected difficulty has arisen in this context, as, on rare occasions, hypervitaminoses D and A have been produced in infants grossly overdosed with these potent preparations; it is also likely that some of the cases of so-called "idiopathic hypercalcaemia", described as occurring in infants, are produced in sensitive babies by the high calcium intake resulting from a diet of cow's milk fortified by a moderate excess of vitamin D (Lancet, 1954 b).

### Trends Towards Simplicity<sup>1</sup>

Infant feeding at the beginning of the century tended to be both too rigid and too complicated, and this is still the case to a lesser extent at the present day. As Smellie (1952) observes :

To-day, a perusal of current paediatric text-books and handbooks on the artificial feeding of healthy infants and a cursory glance at the spate of pamphlets, booklets and advertisements of the manufacturers of infant feeds leaves one disconcerted, overawed and aghast. . . Indeed, the position might almost appear to be that, before any intelligent advice can be given on substitute or bottle-feeding, technical knowledge of the chemical composition of the innumerable constituents of breast and cow's milk must be profound, precise and exact. Surely this pseudo-scientific approach has been overdone, and has not the time come when we should return to a more simple, commonsense and realistic attitude ?

---

<sup>1</sup> Trends towards a more simplified approach to both infant feeding and infant development generally have been fully surveyed by Illingworth (1953) in his book on the normal child.

Happily, there is encouraging evidence that many other authorities also feel that over-precise and rigid methods of infant feeding are outmoded and, indeed, harmful, and that babies should be treated as individuals rather than as automata. As Vining (1952) rightly stresses :

Babies are not like penny-in-the-slot machines, and I feel sure that we have done harm in insisting on exact quantities, exact times, and feeding by the clock. Once upon a time there were no clocks, and the untutored mother of the past—like that of the present—would never dream of waking her baby out of sleep to administer another feed.

Neale (1952) is of the same opinion when he observes :

In their varied responses babies are definitely individuals, a fact which emphasizes again the difficulties that overelaborate, mechanical routine in infant feeding may create. A self-demand programme, especially in breast feeding, has often remedied difficulty arising from a mother's too conscientiously clock-regulated routine.

The most striking way in which the present healthy trend towards more natural methods has become manifest is in the move towards the use of self-demand feeding, the baby being fed when he shows signs of hunger. By this means, a more natural feeding-rhythm, adapted to the baby's individual needs, becomes established. The success of this method has been demonstrated by Aldrich & Hewitt (1947), and later by Olmsted & Jackson (1950) in the USA, and by Illingworth et al. (1952) in Great Britain, but it is possible that in practice a compromise between the old-style rigid feeding and the revived "modern" permissiveness is a practical solution, the mother at first working to a rough routine, but with the knowledge that it may have to be modified when the baby's individual requirements become apparent as a result of practical experience. Poncher, Richmond & Abt (1951) emphasize a similar point of view, when they say :

Some [physicians] made of these permissive programs almost as rigid a ritual as was inherent in previous practices ; in more instances well meaning parents mistook permissiveness for a laissez-faire attitude in which the infant, without any positive attitudes on the part of parents, developed in a very insecure environment... Because of the distortion of a wholesomely permissive program into one 'compulsorily permissive' by some parents, we now run the danger of rejecting the good with the bad.

Also in keeping with the present trend is the realization that all infants do not require the same proportional amount of milk. Smellie (1952) summarizes this view when he writes :

Until quite recently the amounts in a feed ... have been rather rigidly defined, but it is becoming more and more appreciated that an infant's desire for food as well as its need are subject to considerable variation from time to time and from day to day. Why should an infant, who through no fault of his own has to be bottle fed, be still further jeopardized by being deprived of satisfying his individual needs and desires like his breast-fed brother ? I cannot subscribe to the opinion that 2½ oz. fluid/lb. body-weight/day [156 ml fluid/kg body-weight/day] is the optimum in all instances and will pro-

vide all that an infant needs, or that the quantity of each of the individual feeds should be obtained by dividing the total by the number of feeds. This is a ritual much too rigid and uncompromising and ignores the baby's appetite, preferences and desires. Such a procedure is against all the rules of nature. Amounts in a feed and intervals between feeds should be elastic and flexible, permitting the individual baby to exercise at least a little personal choice and selection . . . Wallgren (1945) has shown from a detailed study of nearly 400 normal breast-fed infants that there is no significant correlation between body-weight and milk consumption, and that the amount a particular baby may take is unpredictable.

In addition, there has been a tendency among many experienced paediatricians, when breast milk is not available, to employ artificial feeds of cow's milk, based on much simpler formulae than previously. In reviewing the progress of paediatrics from 1914 to 1939, Powers (1939) made this point :

We do not split hairs over slight changes in amounts of protein, carbohydrate, and fat, nor argue much about the relative values of casein and whey proteins. To many of us, discussions over the relative merits of lactose, cane sugar, corn syrup, dextrimaltose, and barley or oat gruel are boring.

Graham (1952) was of a similar opinion : " The percentages of fat, carbohydrate and protein are relatively unimportant and ' percentage feeding ' fostered for so long by the German school, has now been discarded." Vining (1952), in an excellent practical review of his experience with infant feeding over fifty years, repeatedly advises a simple approach, and, in particular, with regard to the preparation of cow's milk feeds :

When the bottle is used as complementary to the breast, or when breast-milk is not available, the bran tub method of trying to find a suitable food is wrong. The ideas alternative continues to be boiled fresh milk with added sugar. My practice has been to order a 4 : 1 mixture [with water], with the addition of a large flat teaspoonful of sugar . . . to every 4 oz. [115 ml]. Such a mixture can be given without alteration up to the age of weaning.

Similar uncomplicated advice was given by Bakwin (1953) of New York :

The large majority of infants will thrive on a formula consisting of two-thirds whole milk, one-third water, and sugar in the proportion of one ounce [28 g] in 20 ounces [560 ml] of total volume. This formula may be started on the third day of life . . . and continued until three or four months of age, when the infant is transferred to whole milk . . . The cheapest sugar (sucrose) is as good as the most expensive.

Likewise, a recent Committee of the American Public Health Association (1966), appointed to advise on economy in the nutrition and feeding of infants, recommended a simple, cheap regimen for the USA based on evaporated milk,<sup>1</sup> sugar and ascorbic acid tablets.

---

<sup>1</sup> The type of milk used for artificial feeding reflects mainly local availability, price, personal preference, experience and the existence (or otherwise) of refrigeration (Bogdan, 1964).

It does, therefore, seem justifiable to suppose that there is at present a definite trend towards a less rigid mode of feeding ; indeed, this is also to be noticed in other attitudes towards infant development, such as a more permissive approach towards toilet-training and a realization of the value of mothers " rooming in " with their infants in hospital. Aldrich (1942) sums up the situation when he says : " Many of the difficulties encountered in caring for young children are, as a matter of fact, due to the disarrangement caused by the impact of new technics on the child's ancient mechanism . . . Streamlined modern methods may not necessarily work out successfully when applied to a baby of stone age vintage."

Also, there is an increasing realization that infant feeding may possibly have late effects in adult life, influencing not only growth and longevity but also disease pattern (György, 1960), including subsequent obesity, atheroma and allergic diseases (Bostock, 1962 ; Barness, 1966 ; MacDonald, 1967).

#### REVIEW AND CONCLUSIONS

This brief historical outline demonstrates the background against which the methods of infant feeding at present in vogue in the technically advanced countries have developed. Whether the present trend will continue it is impossible to say, although it would be encouraging if the future of infant feeding were to represent a blending of scientific knowledge with the millions of years of experience embodied in natural methods.

Examples of recent radical revisions of ideas have been the trend towards immediate feeding of prematures (Smallpeice & Davies, 1964) and the use of unwarmed milk for babies (Holt et al., 1962).

A few general conclusions can be drawn from this bird's-eye view of the subject. Primarily, as Wickes (1953 e) sanely comments at the conclusion of his full account of the history of infant feeding, it can be better regarded as a chronicle of man-made errors : " For many of the writings quoted were intended to be an improvement on Nature though few have succeeded. Those who have heeded Nature anyway, namely the nursing mothers, have seldom found it necessary to put pen to paper."

Certain themes do appear to recur constantly. The value of prolonged breast-feeding receives repeated practical, historical, and religious support ; while the decline of breast-feeding with leisure and emancipation, especially in the well-to-do, occurs over and over again. The unsatisfactoriness of predominantly carbohydrate gruels as the sole infant food is clearly demonstrated historically, as are the inherent dangers of weaning, especially the relation of diarrhoea to bottle-feeding. It is of particular interest to note that animal milk has been used in infant feeding in Europe, with varying degrees of popularity, since Roman and Greek times.

From the converse point of view, the recurrence over the centuries of certain apparent superstitions and of customs not obviously explicable by scientific reasoning, is noteworthy. The avoidance of colostrum and the use of fat and honey to help evacuate meconium may be quoted. \*

However, the main purpose of this short account is to emphasize that the methods of infant feeding as used today in the technically advanced countries are neither immutable nor wholly logical, nor are they of sudden development but rather the result of numerous, continuous and changing cultural, technical and economic influences. In discussing present methods and suggestions for improvements in infant feeding in the subtropics and tropics, it will be found that often very different influences have been at work, so that the resultant problems may themselves be dissimilar.

---