radiological data, to Dr. M. D. Milne for permission to include Case 1, and to Dr. C. M. Fletcher and other colleagues at the Postgraduate Medical School for advice.

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# CLINICAL AND CHEMICAL STUDIES IN HUMAN LACTATION

## X. THE MAINTENANCE OF BREAST-FEEDING

BY

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AND

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In all parts of Britain the official policy is to promote breast-feeding whenever possible, yet its success seems to vary greatly from one area to another. For example, at the end of three months the proportion of women fully breast-feeding varied from 24% in Newbiggin-by-the-Sea (Hughes, 1948) to 58% in Luton (Dykes, 1949).

It is not easy to understand why such variations occur. In any case, exact comparison between different centres is often impossible because results are expressed in different ways, and the populations studied are not fully described in terms of social class, age, parity, etc. This paper describes how such factors affect breast-feeding rates in Aberdeen. The incidence of successful breast-feeding is defined as the proportion of babies wholly fed on the breast during the first three months of life. After three months mothers commonly introduce other feeds, and it is difficult to know what contribution breast milk is making to the child's total food intake.

Discussion of the literature is confined mostly to those British publications in which comparable information is available. Since there is some evidence (Ross and Herdan, 1951) of considerable changes in breast-feeding habits, only publications of the past ten years are quoted.

### Factors Affecting Breast-feeding

#### Social Status

Most authors agree that breast-feeding is usually more successful in the upper social classes. Ross and Herdan (1951) found in Bristol that women in Social Classes I and II breast-fed longer than those in Social Classes IV and V, but their figures did not include cases of failure during the first four weeks.

Spence *et al.* (1954), in the "thousand families" survey in Newcastle-upon-Tyne, found 42.5% of mothers in Social Classes I and II, 34% in Social Class III, and 29% in Social Classes IV and V wholly breast-feeding after three months. Westropp (1953), studying 574 mothers in Oxford "who regularly attended the Oxford Child Health Survey for at least a year" found that 66% of those in Social Classes I and II, 54% in Social Class III, and 44% in Social Classes IV and V completely breast-fed for four months. Douglas (1950), using material gathered in the 1946 Maternity Survey of England and Wales, found that wives in the professional and salaried classes breast-fed more often for three months than the wives of manual workers; in his investigation a baby was considered to be breast-fed until it was completely weaned. On the other hand, Dykes (1949), in a survey of all infants born in Luton in 1945, found no social class difference in the duration of breast-feeding, and Dummer (1949) found no clear-cut differences in breast-feeding performance between occupational groups.

Women delivered in nursing-homes appear to breast-feed longer than those delivered in hospitals, who in turn breast-feed longer than women delivered at home (Hughes, 1948; Dummer, 1949; Dykes, 1949; Douglas, 1950; Campbell and Cheeseman, 1954; Spence *et al.*, 1954). The possibility that social class differences may have accounted for these findings, at least in part, was not investigated by those authors.

#### Maternal Age

Westropp (1953) found the duration of breast-feeding to decrease with age in primiparae, but Douglas (1950), using the national sample, found that maternal age had little effect when parity and social class were taken into account, although "young mothers appear to be more likely to stop breast-feeding in the first three months." Miller (1952) found no difference in the incidence of full breast-feeding at three months in primiparae aged above or below 35 or in multiparae aged above or below 40; only patients who left hospital breast-feeding were studied.

#### Parity

Dykes (1949), Douglas (1950), and Spence *et al.* (1954) found parity to have little or no influence on breast-feeding, but Westropp (1953) found that second and third babies were breast-fed longer than first or fourth and later babies, except in Social Classes I and II, where the breast-feeding performance improved progressively with increasing parity. Miller (1952) found that, of those leaving hospital breast-feeding, slightly more primiparae than multiparae were still breast-feeding at three months.

#### Physique and Health

Westropp (1953) found that maternal height, weight, and height/weight ratio did not affect the duration of breast-feeding. Miller (1952), however, found that considerably fewer women under 5 ft. (152 cm.) were breast-feeding at three months than taller women, and that somewhat more women "over the average weight for their height and age" were breast-feeding at three months than those who were underweight. Westropp found that women whose health was "uniformly good after delivery" breast-fed more successfully than those whose health was impaired.

The findings in these various studies are so diverse that there is justification for further inquiry.

## Method

In August, 1953, all the available health visitors' records for single legitimate children of Aberdeen women delivered in 1951 were examined, and the length of time up to six months that surviving children were fully breast-fed was determined.

In 1951, 2,769 such infants were delivered in the city of Aberdeen; 2,097 (76%) at the Aberdeen Maternity Hospital, 206 (7%) in the private nursing-home, and 466 (17%) in their own homes. Of this total, some had left the city before their records were complete and for some there were no data available. The numbers who were thus excluded are shown in the Table. Of Social Class I and II mothers,

TABLE I

| Type of Case* | Total No. | Left City | No Data | Total Excluded |
|---|---|---|---|---|
| Maternity hospital | 2,097 | 174 | 91 | 265 (13%) |
| Nursing-home .. | 206 | 36 | 24 | 60 (29%) |
| Domiciliary .. | 466 | 29 | 11 | 40 (9%) |
| Total .. | 2,769 | 239 | 126 | 365 (13%) |

* Cases booked for each service irrespective of transfer to hospital.

18% had left the city, compared with 9% of Social Class III and 5% of Social Class IV and V. Moreover, a greater proportion of Social Class I and II mothers refused visits from the health visitors. It is not considered that these exclusions introduce serious bias into the trends seen in the analysis of the 2,404 cases left for study.

The breast-feeding information was transferred from the health visitors' records on to punched cards, which are prepared routinely by the University Department of Midwifery for all Aberdeen deliveries. Since details of maternal height, general health, social class, and housing were often missing for cases not delivered in the Aberdeen Maternity Hospital, the investigation of these factors was based on the Maternity Hospital booked cases. First and second deliveries in hospital booked cases are believed to be fairly representative of the city as a whole; in later parities, selection factors make it necessary to exercise caution in generalizing from hospital data (Baird and Thomson, 1954).

## Results

At the age of 3 months, 35.6% of the 2,404 infants studied were wholly breast-fed, and after 6 months 24.5% were still feeding from the breast, although most were then receiving supplementary food. For babies delivered at the Aberdeen Maternity Hospital the figures were 35.6% and 25.7%; for

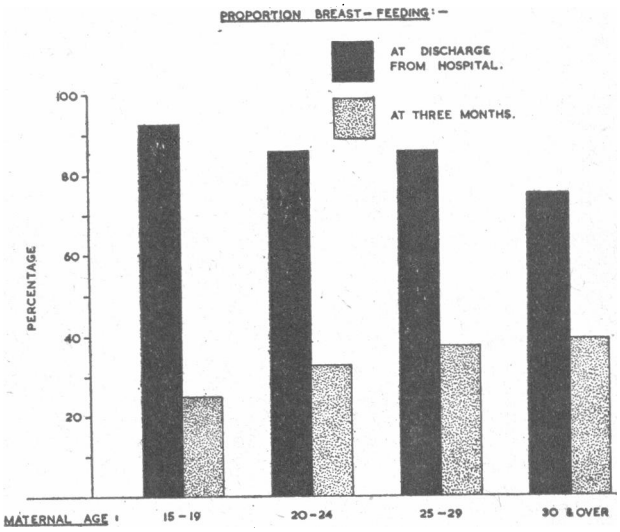


FIG. 2.—Contrast between breast-feeding rates at the time of discharge from hospital and at three months in different age groups. Aberdeen Maternity Hospital, booked married patients, 1951.

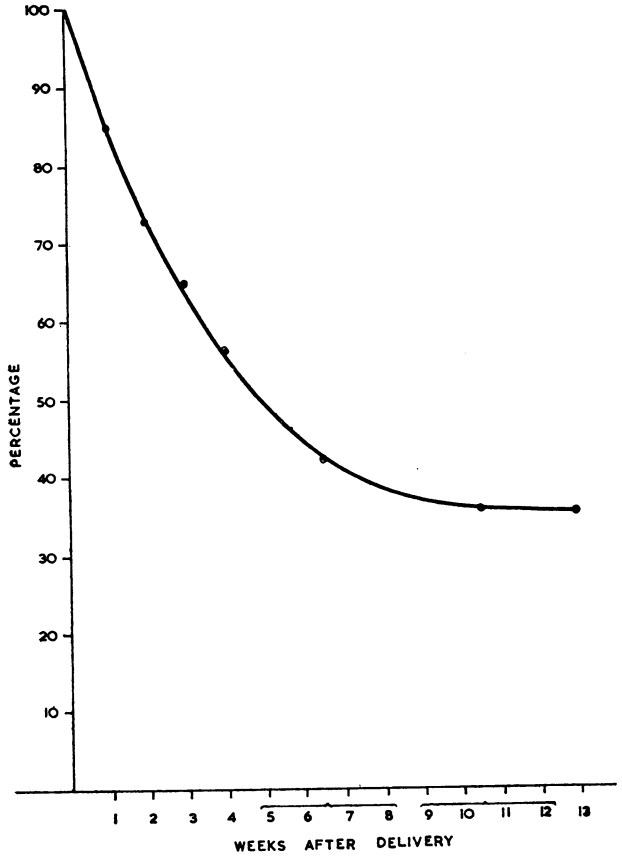


FIG. 1.—Falling incidence of full breast-feeding during the first three months. Aberdeen Maternity Hospital, booked married patients, 1951.

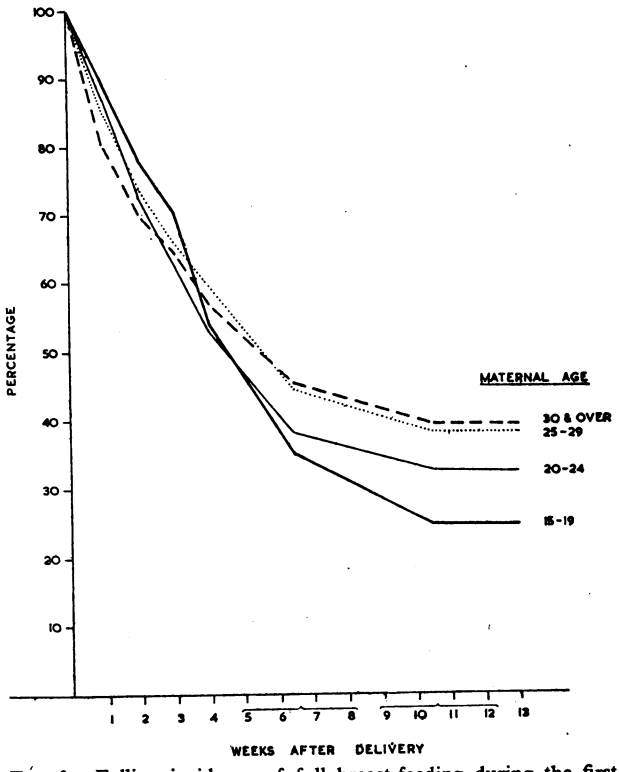


FIG. 3.—Falling incidence of full breast-feeding during the first three months in each age group. Aberdeen Maternity Hospital, booked married patients, 1951.

those delivered in the private nursing-home 44.5% and 28.8%; and for those delivered in their own homes, 32.4% and 20.2%. Therefore, although the incidence of breast-feeding at three months in the nursing-home mothers was considerably above the average and in women delivered at home it was below average, in women delivered at the Aberdeen Maternity Hospital it was almost identical with the average for the whole Aberdeen population.

Fig. 1 shows that the incidence of breast-feeding decreases rapidly during the first few weeks and then more slowly; about two-thirds of those who are not breast-feeding at three months have stopped during the first month, and if breast-feeding is continued into the second month it is likely to be maintained until the end of three months at least.

### Age

Fig. 2 shows that while the proportion of women breast-feeding at the time of discharge from hospital, about 10 days after delivery, declines with maternal age, the position is completely reversed at three months, when older mothers are more likely than younger mothers to be breast-feeding. Fig. 3 shows that the change in trend takes place during the three or four weeks after leaving hospital, when the rate of breast-feeding declines rapidly in younger women and more slowly in older women. At three months, only 25% of women under 20 years of age were still breast-feeding, compared with 39% of women over 30.

### Parity

Fig. 4 shows that the incidence of breast-feeding at three months was higher after second than after first pregnancies, and then declined with increasing parity. This was broadly true of all age groups except that women under 20 with a second baby have a very poor breast-feeding performance. The parity pattern appeared to hold also within social classes; however, an analysis on this basis could only be done on the Aberdeen Maternity Hospital series, and there were not sufficient numbers in the highest and lowest social groups to permit definite conclusions to be drawn.

### Social Class

There were well-marked social-class differences in the incidence of breast-feeding at three months (Fig. 5). Social Class I and II had the lowest breast-feeding rate during the first week, probably because of a higher average maternal age and a high proportion of primiparae; but of those who were still breast-feeding at the end of the first month almost 80% were still breast-feeding at three months. In Social Class III, and to a greater extent in Social Classes IV and V, although the mothers had an initial advantage because they were younger, breast-feeding was not well maintained and the incidence fell more steeply. The lines in Fig. 5 have crossed by the end of the second week, after which time Social Classes I and II had the highest breast-feeding rate. At three months the incidence of breast-feeding in Social Classes I and II was 50%, in Social Class III 36%, and in Social Classes IV and V 31%; a similar social-class gradient is present within age and parity groups, though the

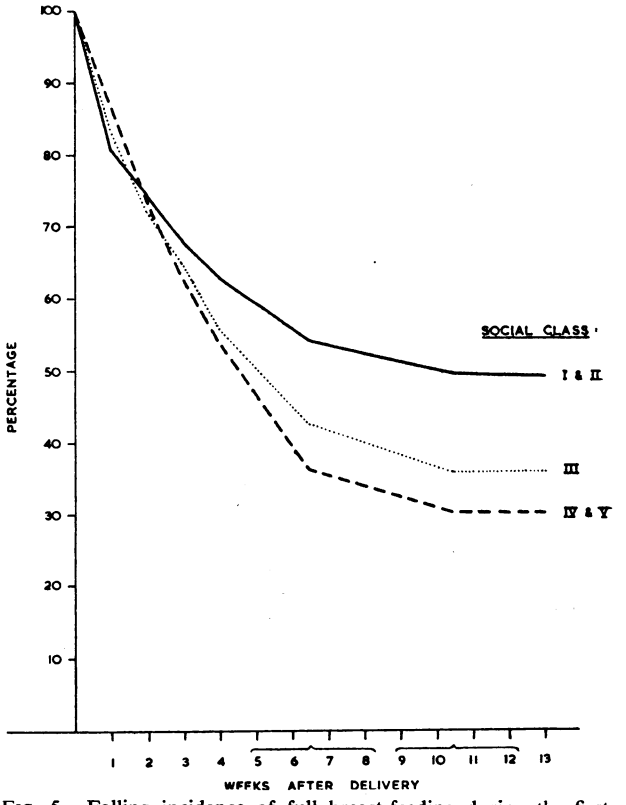


FIG. 5.—Falling incidence of full breast-feeding during the first three months in three social class groups. Aberdeen Maternity Hospital, booked married patients, 1951.

data for third and later babies are erratic, possibly owing to selection of abnormal cases for hospital confinement.

The comparatively high breast-feeding incidence at three months (45%) in women delivered at the private nursing-home and the comparatively low breast-feeding incidence (32%) in women delivered in their own homes may be largely determined by the social-class difference between the groups. The majority of women delivered in the nursing-home were from Social Classes I and II, and only 35% of them were of third or higher parity. Most women delivered at home were from Social Classes IV and V, and 80% of them were of third or higher parity.

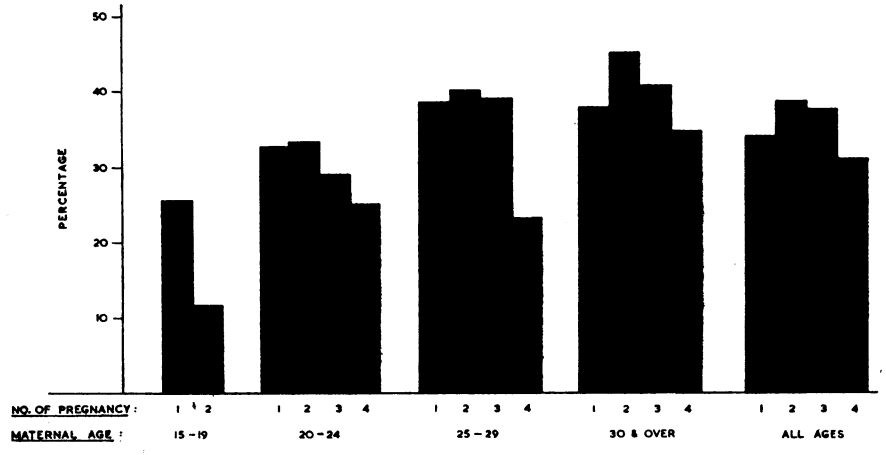


FIG. 4.—Incidence of breast-feeding at 3 months by parity in each age group. All married women delivered in Aberdeen city, 1951.

### Height and Physical Grade

Fig. 6 shows that at the end of three months 42% of women of 5 ft. 4 in. (163 cm.) or more were still breast-feeding compared with 31% of women under 5 ft. 1 in. (155 cm.), and 34% of women of intermediate height. Similar trends with height are apparent within each social-class group. The superiority of tall women is also evident in each age and parity group.

Of those women graded as of "good" or "very good" physique and health at the first visit to the antenatal clinic, 40% breast-fed for three months, compared with 31% for those graded "fair" and 23% in those graded "poor" or "very

poor." Similar trends occurred within each age, parity, height, and social-class group.

### Housing

Breast-feeding was assessed in relation to the degree of overcrowding in the mothers' homes, with the following results :

| | | |
|---|---|---|
| 1 person per room or less | 42% | breast-feeding at 3 months |
| 2 persons per room | 35% | " " " " |
| More than 2 persons per room | 28% | " " " " |

These differences disappeared when social classes were considered separately.

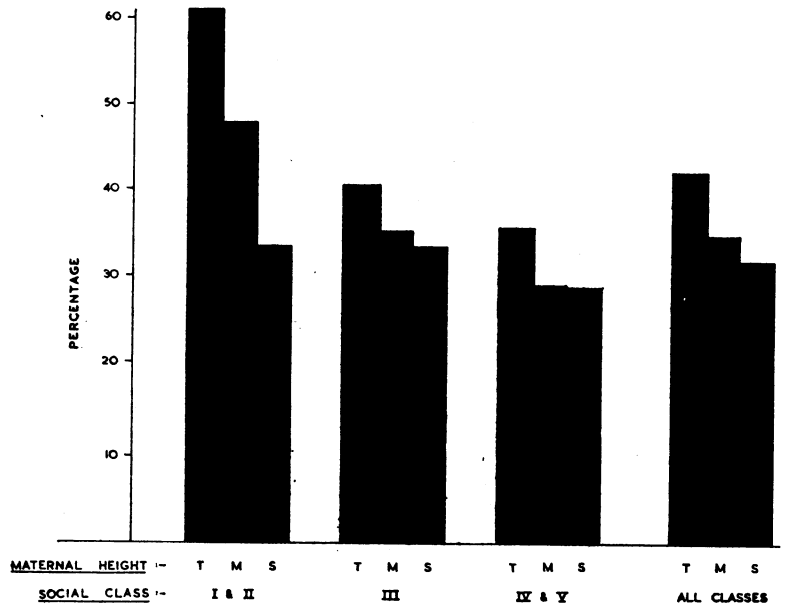


FIG. 6.—Incidence of breast-feeding at 3 months by height in each social class group. Aberdeen Maternity Hospital, booked married patients, 1951. Tall (T) = 5 ft. 4 in. (163 cm.) or more. Medium (M) = over 5 ft. 1 in. (155 cm.) but under 5 ft. 4 in. (163 cm.). Small (S) = under 5 ft. 1 in. (155 cm.).

## Discussion

At the age of 3 months about 36% of Aberdeen infants are still wholly breast-fed. This rate is similar to many reports which have been made recently : 33% from Newcastle-upon-Tyne (Spence *et al.*, 1954), 36% from Bristol (Ross and Herdan, 1951), 41% from Newbiggin (Hughes, 1948), and 44% from England and Wales as a whole (Douglas, 1950). It is, however, much lower than the rates reported in smaller selected groups. For example, Blaikley *et al.* (1953) reported that 70% of 222 primiparae under special supervision were breast-feeding at three months ; Westropp (1953) obtained the same result in women attending the Oxford Child Health Survey ; and Naish (1949) had a rate of 67% in 100 consecutive cases under her own care.

As already stated, the breast-feeding rates at three months in the Aberdeen nursing-home, hospital, and domiciliary groups were respectively 44%, 36%, and 32%. None of the patients was receiving any special treatment to promote breast-feeding. Fig. 6 shows that when the hospital patients are subdivided by social class and height the rates range from 61% in tall women in Social Classes I and II to 29% in small women in Classes IV and V. Within each social class, tall women breast-fed most successfully.

Height may be regarded as a measure of efficiency of growth ; tall women are usually healthier than small women and are found more often in the upper social classes (Baird, 1949, 1952 ; Baird and Illsley, 1953). Our findings are consistent with the belief that both health and environment affect the incidence of breast-feeding at three months, but the relative influence of each is not easy to assess separately. It is extremely difficult to isolate the precise factors in health and environment which are important and which are not ; good physique, diet, education and housing, sufficient domestic assistance, easy access to skilled advice, and helpful attitudes are all likely to promote breast-feeding. Where many such factors are concurrent, as is usual in the upper social classes, the breast-feeding rate is likely to be high. Conversely, the breast-feeding performance of women in the lower social classes is likely to be impaired by a host of adverse circumstances acting together.

The data presented are in marked contrast to those obtained for breast-feeding at the time of discharge from hospital (Hytten, 1954a). Success or failure in hospital depends to a much less extent upon social class and height, and, whereas increasing maternal age is associated with a falling incidence of breast-feeding in hospital, the reverse is true at three months post partum (Fig. 2) ; the cross-over occurred at about the end of the first month, when all age groups had a similar breast-feeding incidence (Fig. 3), and it is interesting to note that in Newcastle (Spence *et al.*, 1954), where maternal age was not found to be related to the incidence of breast-feeding, only the figures at one month were examined. About 16% of women leave the Aberdeen Maternity Hospital feeding the baby wholly or partly on the bottle. It was shown that the main causes of failure were physiological or medical rather than social—inadequate milk production, illness or prematurity of the baby, or abnormalities of the breasts or nipples. The mothers who go home breast-feeding are therefore a selected group, probably less prone to failure from such physiological or medical causes. Subsequent breast failure is, however, much more commonly related to attitudes of mind, way of life, and general health and physique.

It is by no means easy to elucidate the precise reason or reasons for failure in a given case, and the mother's explanation may be misleading. We have attempted, with the help of social field workers, to determine the main causes of failure by correlating information derived from hospital records, health visitors' and clinical reports, and from the women themselves, in a sample of married primiparae ; but the information, though extensive, was frequently very indefinite. Perhaps the commonest cause given was that the supply of breast milk became inadequate, and this view was often supported by the women's medical supervisors. Yet in most cases no satisfactory evidence was available that the nutrition of the baby was inadequate—for example, poor growth or insufficient milk output determined by test-weighing. In many instances the change from breast to bottle was made suddenly and without adequate investigation of the difficulty, although it was usually stated that the family doctor had been consulted and had advised bottle-feeding. As a rule, it seemed that the mother gave up breast-feeding without regrets, and sometimes she had been under pressure from friends and relatives to do so.

We met a few cases where an apparently circumstantial story of inadequacy of lactation did not stand up to investigation : for example, the wife of a colleague contacted one of us in her second month post partum to say she was thinking of giving up breast-feeding. The baby was irritable and restless and did not seem to be satisfied. Supplementary feeds from a bottle during the preceding few days were thought to have been beneficial. She had consulted her doctor, who agreed that her milk might be insufficient and that bottle-feeding was advisable. On detailed inquiry it appeared that the baby's ill-health had begun only about a week previously and was associated with coryza ; until then the baby had been gaining weight steadily and doing well. Test-weighing did not confirm that the breast milk output was unsatisfactory, and it was recommended that she might persist for a little longer. The baby recovered from its

"cold" and was soon progressing normally again on breast-feeding alone. There is no doubt that had breast-feeding been abandoned the mother would have subsequently given a plausible story of lactation failure.

The physical and emotional pleasure which is so often claimed for breast-feeding is by no means universal, and the maintenance of breast-feeding often requires considerable perseverance. Naish (1947) has pointed out that the nursing mother is emotionally less stable than usual, and requires more rest. We have observed that she is liable to tiredness, vague ill-health, and minor infections. Since breast-feeding cannot be delegated, her social activities are often restricted and the domestic routine has to be accommodated to the baby's feeding-times. If for any reason the mother's confidence about her baby's progress on the breast is shaken—as may happen if either suffers from a minor illness or disability—she is not unlikely to think that her milk is "inadequate." It is well known that bottle-feeding can give good results; it may be strongly recommended by friends and relatives and even by doctors, and, after all, the mother herself can "see what he's getting."

There is, nevertheless, some reason to think that in many cases the breast milk is in fact insufficient. It has been estimated, from studies of seventh-day breast milk (Hytten, 1954b), that about one-third of women may be unable, because of deficiency of milk yield or fat content or both, to breast-feed adequately for more than a few weeks. The causes of such deficiencies may be nutritional or inadequacy of breast function, possibly of genetic origin.

### Calorie Requirements

Even if the breasts are capable of adequate milk production, calculation indicates that production may be impaired by an inadequate diet. For milk of average composition the infant's requirements will rise from 500 ml. during the first month (providing 330 calories, or about 50 calories per lb. body weight for a 6½-lb. baby) to about a litre at four months (providing 660 calories, or about 50 calories per lb. for a 13-lb. baby). It has been estimated that the efficiency of conversion of energy intake into milk energy is about 60% (Food and Agriculture Organization of the United Nations, 1950). On this basis, the mother's requirements for milk production would be approximately 550 calories at the beginning of lactation, rising to 1,100 calories after about four months, or higher if the energy value of her milk is greater than average. To this must be added her maintenance requirements. With the modest allowance of 2,100 calories for maintenance, this gives daily totals of roughly 2,700 to 3,200 calories for a *moderately* active lactating woman. Relatively few urban women are accustomed to eating a diet containing 3,000 calories, and it is by no means certain that the stimulus of extra appetite is always present in sufficient degree; again, it is possible that some women may have difficulty in dealing with the extra metabolic load. The cost of these extra calories is by no means negligible, and is, in fact, very much greater than the cost of feeding the same infant on subsidized National dried milk.* No doubt many women can produce the required milk, even in the absence of an adequate diet, by draining their own body stores and tissues, but it is doubtful if this can be done for any length of time without loss of physical energy and well-being, and without loss of body weight.

Thus, breast-feeding, once established, is most likely to be successfully maintained by healthy women who take and have the appetite for a sufficient diet, who can take the responsibilities of caring for a baby in their stride, who believe that breast-feeding is best, and whose confidence is not seriously shaken by intercurrent morbidity. These circumstances are more common in the well-grown and educated women in the "upper" social groups. That these women are taller and healthier has been shown by Baird and Illsley (1953); their diet provides more energy and is more nutritious (Thomson, unpublished); and in the antenatal period they more often express the intention to breast-feed and more often carry out their intention (Baird and Scott, 1953). Such women, however, tend to be older than average, and, while this does not prejudice the long-term maintenance of breast-feeding in those whose lactation is adequate, a greater proportion have inadequate lactation and therefore fail at a relatively early stage.

The somewhat better breast-feeding performance in second than in first lactations is to be expected. The mother has the advantage of previous experience and has a higher milk yield (Hytten, 1954c). It may be more difficult to breast-feed a third or later baby, since the mother has the additional domestic responsibility of attending to previous children while feeding and caring for the latest baby. Selection factors may also come into play, as many mothers, particularly those in the upper social groups, do not have more than two children.

### Need for Further Investigation

In order to determine precisely in any particular case why breast-feeding fails after the mother leaves hospital, much more intensive methods of investigation will be needed. The investigator, preferably a doctor, must be readily accepted into the patient's home and must be able to discuss the baby's feeding dispassionately and at frequent intervals, with full knowledge of all the circumstances, domestic as well as medical, *and without giving the woman the impression that he is taking sides for or against breast-feeding.* This last condition is very difficult to satisfy, yet it is crucial, since patients are well aware of the bias of most obstetricians, paediatricians, and public-health workers in favour of breast-feeding. Unless they feel free of guilt in expressing a preference for bottle-feeding, the truth may be concealed. Investigation should include regular weighing of mother and baby and assessment of their state of health.

Some of the questions such an investigation must attempt to answer are these: Do the deficiencies in milk output and fat content suggested by the analysis of the seventh-day milk (Hytten, 1954b) cause early failure of breast-feeding associated with failure of the baby to thrive? What effect has an inadequate diet on the mother's health and weight and on her milk? What are the circumstances surrounding failure of breast-feeding in women whose milk has been shown to be adequate, and to what extent is this determined by the social background: the mother's attitude to breast-feeding, the opinion of friends and relatives, public-health teaching, and domestic circumstances?

It is hoped to report the result of inquiries on these lines at a later date.

## Conclusions

After breast-feeding has been established, its maintenance is largely determined by good maternal health and favourable social circumstances.

In the city of Aberdeen in 1951 the overall incidence of breast-feeding at the end of three months was about 36%—a similar figure to that of other recently reported studies—but the incidence varied widely within the population. For example, 61% of tall women from Social Classes I and II were fully breast-feeding at three months compared with 29% of small women in Social Classes IV and V.

Good health and good social circumstances are closely interrelated, and imply a wide range of advantages from good physique and diet to good education and sensible attitudes. The relative contributions of all these factors to the promotion of breast-feeding are not easy to determine, and further research along lines described in the text is required.

*It has been estimated, by costing some diets taken by Aberdeen mothers, that the extra calories required to produce average breast milk for the first four months will cost about 7s. weekly, or about £6 per lactation. The cost of National dried milk, together with the required sugar and orange juice for four months, is about 12s., or one-tenth the cost of breast-feeding.

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# WERNER'S SYNDROME

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In 1904 Otto Werner, whilst a medical student working in the Ophthalmological Clinic at Kiel, studied four brothers and sisters suffering from the syndrome which now bears his name, and which he described as "cataract in connexion with scleroderma." It was not until 1934 that Oppenheimer and Kugel first drew attention to the condition in America. In 1941 they reported the first post-mortem examination on a case. Thannhauser (1945) reviewed all the reported cases and literature up to that date. Subsequently, cases have been recognized with increasing frequency, although only one brief report has appeared in the English literature (Williams, 1949).

Werner's syndrome is characterized by a habitus the features of which are short stature, thin tapering limbs, a protuberant abdomen, and stocky trunk. The hair is fine and prematurely grey, whilst it is sparse or absent in the axillae and over the pubes. The disease usually appears about the third or fourth decade with presenile cataracts. Other important features are osteoporosis and diabetes mellitus, together with evidence of hypogonadism (small genitalia, sterility, and menstrual disturbances). The limbs are wasted, thin, and tapering, the legs being affected more than the arms. The skin is tense and shiny, and has a hide-like quality. Ulceration is frequent, and particles of calcium are deposited in the skin, giving rise to a condition known as calcinosis circumscripta.

The following case histories are of two sisters. A brother appears to have had a similar condition, and died in 1937; no clinical or pathological evidence is available. The other seven members of this generation of ten children in the family do not appear to be affected.

## Case 1

A woman aged 51 was admitted to hospital on November 27, 1952. A right-sided cataract had been removed in 1942. Her vision in that eye remained satisfactory for nine years, but in the past year it had again become blurred. During the past seven years she had been developing a cataract of the left eye. As long as she could remember her legs had been thin, and over the past 20 years she had been unable to stand or walk for any time because of an aching pain in her feet, which was relieved by sitting. The skin had always been dry with a sallow brown pigmentation. There was no history of thirst, polyuria, loss of weight, spontaneous fractures, or cramp-like pain in the legs. Menstruation began at 17, was often irregular and scanty, and ceased at 46. She has never been pregnant.

Her father's grandmother died after a lifetime of bad feet and sight. The patient was one of 10 children, 3 of whom had "matchstick legs" and large bellies, and developed cataract early in life. No further data can be found about one (a brother), but the other sibling was investigated four years ago at the same hospital as the patient, and from her records the second case is compiled.

Examination showed a placid thin-faced woman, looking much older than her age, with sparse grey hair, advanced cataract in left eye and a ground-glass appearance of cornea on right; diffuse golden brown pigmentation; spider naevus below left eyebrow and another above right nipple; well-covered trunk, protuberant abdomen (Fig. 1), limbs very thin, with practically no subcutaneous or muscle tissue; skin dry everywhere on limbs and face, but normal on trunk. Feet had trophic claw-like appearance with ulcer over right heel (Fig. 2). Nails normal. Cardiovascular and respiratory systems normal. B.P. 160/80. Alimentary system.—Tongue and teeth healthy. Abdomen very well covered; doughy and resistant on palpation; liver, spleen, and kidneys not felt; no free fluid. Umbilicus normal. Central nervous system.—Right

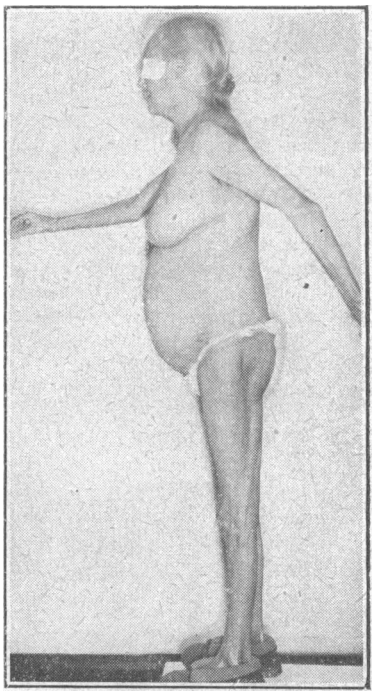

FIG. 1.—Photograph of Case 1.

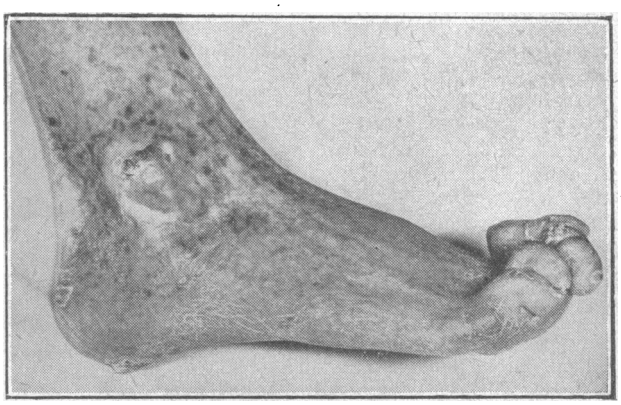

FIG. 2.—Case 1. Showing trophic claw-like appearance of foot.