THE EARLY FAILURE OF BREAST FEEDING

A CLINICAL STUDY OF ITS CAUSES AND THEIR PREVENTION

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'It would be of the greatest service to medicine if the determination became general to submit every minor problem of clinical work in which the conditions allow to methods by which an exact decision would be possible.' (Wilfred Trotter, *Art and Science in Medicine*.)

In the last fifty years, which have seen so much achieved in the protection of infant life, little has been added to our understanding of the unreliability of lactation; yet the key to this riddle would remove what is still the greatest risk surrounding the first weeks of life. In the attempt, which will be described here, to find part of the solution, lactation's common tendency to fail will be treated as a defect of the mammary gland and not, as is more usual, as arising primarily from faults in the conduct of breast feeding. This approach in no sense overlooks the importance of correct management but is adopted with the object of trying to define with greater clearness certain factors governing the maintenance of milk secretion. To separate physiological factors from the details of practical management may seem artificial, and it is not intended that the distinction should be rigidly binding. If the instruction given to women is to be helpful and, above all, if the teaching given to pupil midwives is to be of service to their patients, they should rest upon a sound physiological basis and find their confirmation in practice. It is doubtful if even the hardest supporter of present-day teaching could advance this claim for its results.

As a broad generalization it may be said that women's experience of breast feeding is of two main kinds. In one there is from the outset no break in the continuity of a free and plentiful yield of milk. In the other the yield, though it may be plentiful enough at the start, declines or ceases completely within a few weeks: it may be even within a few days. This difference over-rides all others based on circumstances or social standing, and transcends in importance all the range of variation in human temperament and character which is so apt to occupy discussions on the prevalence of artificial feeding. There can be no doubt many women resume domestic work too early after delivery and need a longer convalescence; are over-burdened with family cares; are unskilled in infant management. Some are incapable of the discipline neces-

sary to succeed in breast feeding and a few are frankly unwilling. Let it be granted also that failures arise from the lack of interest shown by doctors, from mistakes made by maternity nurses and health visitors; and, as is frequently emphasized, from the rigidity and bustle of hospital routine. To all these causes, at one time or another, I have attached a major importance. But after a closer study of the ways in which lactation starts it seems necessary to place above and apart from them all the breast's productive power and the ease with which milk flows into the baby's mouth. If these two conditions are present in full measure women will, as a rule, be found in the group who succeed; and they will succeed without skilled assistance and quite often with a cheerful disregard of the rules framed so carefully for their guidance. In the presence of factors which lower production or interfere with the free passage of milk from breast to baby, women commonly find the task more than they can accomplish. Although I believe this rough classification is substantially correct, I would repeat it is put forward mainly to focus attention on the functional properties of the breast.

The scarcity of statistics

Statistics of the duration of breast feeding are few and the causes of failure are seldom given in detail. A recent Government publication says 'Study of the figures leads us to estimate that about 80 per cent. of babies leave hospital wholly breast fed, and that 95 per cent. of the babies born on the district are wholly breast fed when the midwife leaves. Whether the infants are hospital or home born it appears that by the end of three months only some 50 per cent., and at the end of six months 40 per cent., have continued to be breast fed' (Ministry of Health, 1944). The greater number of initial successes among those confined at home is attributed to the higher number of uncomplicated deliveries and to these I would add the higher proportion of multiparous women. Primiparae succeed no better when delivered at home by midwives than in hospital. Finlay found in Edinburgh that only 55 per cent. of babies were being breast fed at the age of three months and McNeil (1940), contrasting

this number with the 80 per cent. which are wholly breast fed on leaving the Royal Maternity Hospital says: 'If these figures are applicable to all Scotland, it means that breast feeding, the ideal method of nutrition and the main bulwark against infection, is withdrawn in about 25,000 cases in these early months when the baby is specially vulnerable.' (In support of this it may be added that in a series of 48 infants under a year of age admitted to a ward for bronchitis or pneumonia, only five (10.4 per cent.) had been breast fed for more than seven weeks. There were six deaths in the series.) Closer enquiry would show that in the majority the change to artificial feeding is made far earlier than three months. Walker (1942) found that of 650 babies attending an infant welfare centre in Bournemouth 53 per cent. were breast fed for less than three months and 23 per cent. for less than two weeks. Robinson (1943), working in Liverpool, made a careful analysis of 1100 instances of weaning before the age of seven months and found that no less than 583 (53 per cent.) occurred within the first month. The most important item in this enquiry is that in 232 (40 per cent.) of these early failures she could discover no cause. 'About 40 per cent. of the women could give no reason for their failure to continue breast feeding and no reason could be found on examination; the breast milk had just "dried up" and resisted all efforts to increase it.'

In a group of 436 primiparous women seen consecutively at infant welfare centres in East London, it was found that 28 per cent. had ceased to breast feed by the end of one month, 38 per cent. before two months, and 42 per cent. before three months; the first two months thus covering almost the whole. Further, of those who failed soonest, 122 in number, almost all said their milk had 'left them' when they got up or within a few days after. They mostly added that if they made the attempt to persevere 'the baby always seemed hungry,' that they 'could see it was not getting on,' and that its behaviour changed at once and it became 'satisfied' when bottle feeds were given. Many knew their baby was considerably below its birth weight on leaving hospital; some were uneasy because the midwife had told them the birth weight or the weight at fourteen days, but not both, and they suspected a fall. Such statements may not always be strictly accurate, but it is unwise to disregard them or try to explain them away. Most of these women were seen in their homes by health visitors to whom they were well known, and were visited within two or three days of their return from hospital or of the end of the midwife's attendance; many were interviewed not much later at an infant welfare centre. In a large proportion their account was supported by the fact that their breasts had already regressed far towards complete involution. Yet, at the end of the lying-in period, their lactation had been entered as 'satisfactory' on the report from hospital or midwife in 112 of the 122 (92 per cent.), and the babies as breast fed without the aid of supplementary milk. It was not possible to

correlate failure in more than a few with ill-health, the strain of work, poverty, illegitimacy or any of the reasons usually held accountable. Indeed, apart from the change in the breasts, the women who failed differed in no particular from those who were feeding their babies without difficulty, and who had been confined in the same hospitals or were attended by the same midwives. In these women, as Robinson found in Liverpool, 'the breast milk had just dried up.' It becomes clear that at the end of the first fortnight 'wholly breast fed' cannot be construed as 'securely breast fed.'

Here, surely, lies the heart of the problem; the liability of secretion to cease so soon after it has started. Some factor, it seems, has interfered with its maintenance; interfered, because there was nothing to suggest that the majority had not produced milk during at least the first week. On the contrary, it was quite common to hear they had produced too much.

A somewhat more detailed enquiry was made into the events of the first fortnight by questions put to a series of 52 women on their first attendance at an infant welfare centre. Their answers bring out a close association between excessive milk secretion at the outset and a rapid subsequent decline, and with this also a high rate of damage to the nipples.

	Breast 22 (42 per cent.)	Bottle 30 (47 per cent.)
Type of feeding at 4 weeks..		
Early milk plentiful ..	20	26
Overloading of the breasts	10	24
Relief attempted by breast- pump, etc. ..	6	21
Child unable to get milk easily	4	17
Injury to the nipples ..	8	22
Mastitis ..	0	3
Breast abscess ..	0	1

In this group, again, the reports from hospital and midwives were, with two exceptions, uniformly favourable, and no mention was made either of the difficulties which the women themselves described in getting their babies to feed or of the injury and pain they suffered in the process. Indeed, the terms in which many referred to the pain of suckling, when the nipples were damaged, suggested it might well have been a strong deterrent to continue feeding. For example, one young mother who contracted mastitis revealed that throughout two days she substituted a finger for the nipple each time the baby was brought her to feed, trusting the nurse to discover by test weighing that it obtained no milk. On the assumption that pain was a powerful source of discouragement I obtained the co-operation of the nursing staff at the British Hospital to institute an energetic campaign in the lying-in wards with the object of seeing whether this common complication could be prevented. Such conclusions as we reached on the influence of pain on secretion will be mentioned later. Meanwhile, this article will deal mainly with a number of points which arose as the work extended in directions not at first contemplated. They are described in detail not only

because of their bearing on the table set out above, but because they apply to the majority of failures occurring in the first weeks.

The prevention of injury

There are two main reasons why the nipples get damaged in the early days of breast feeding. One depends on its range of protraction and whether or not it is easily drawn away from the breast far into the baby's mouth. The other is the occurrence of engorgement of the breasts, which produces oedema involving not only the covering skin but the areola and the surface of the nipples. If suckling is allowed while the oedema is present a breach of the nipples' surface is inevitable. Here, again, the factor of deficient protraction enters, for the great swelling and tenseness of the breasts restrict the distance to which the nipples can be drawn out.

The first step therefore was to try to improve structural defects of the nipples and reduce engorge-

ment from their use have been seen. No other measure results in a fraction of the same improvement.

The prevention and relief of engorgement of the breasts is a less simple matter and calls for more detailed discussion. I shall describe our attempts before synthetic preparations of oestrogen were available and later give some account of our experience of stilboestrol. We have, however, learned to attach so much importance to the manner in which lactation begins that, despite the familiarity

FIG. 1.—The effect of shields on inverted nipples.

ment whenever it arose. The former proved the easier task. A glass shield was employed with a central opening, a relic of Victorian days, designed originally to collect the overplus of milk and protect the nursing mother's clothing. Worn during pregnancy under a firm support it serves our purpose by pressing the nipple through the opening and gradually stretching and loosening its attachment to the deep structures of the breast. In all but the worst types of deformity the results are good. The length of time it needs to be worn depends on the degree of defect to be overcome, and for this reason the breasts should always be examined early in pregnancy. Usually it is enough if worn for the greater part of the day during the last three months, but some need it for longer. To ensure accuracy of position as well as for purposes of symmetry, two should be worn even if only one nipple is defective. Pressure must be firm to be effective but should not produce discomfort. Most women become accustomed to wearing the shields within a few days, and in many years' experience no ill effects whatever

FIG. 2.—A nipple previously inverted and altered by wearing a shield during pregnancy.

of its general features, a somewhat detailed account is necessary to explain the method of management which has for several years become the routine in the hospital.

The start of active milk secretion

If the changes which occur in the breasts as active secretion begins are watched, it is clear there are great individual differences in the rate and degree of filling and also in the freedom of the milk's outflow. In the first lactation the variety is so wide that its extremes present what amount to two distinct clinical types. There is first the type in whom neither enlargement of the breasts nor the tension within them becomes at all pronounced; filling is gradual and almost as soon as milk is formed it escapes from the nipples. This leakage is at first nearly continuous and by the combination of this and what the baby drinks tension remains low. These women suffer no discomfort. By about the tenth day both fullness and tension have come to

bear a distinct relation to the feeding interval; that is to say the breasts are full by the time the feed is due and comparatively lax when the child has fed. By this date, also, the spontaneous leakage has become intermittent, occurring at intervals of an hour or so. Next it becomes confined to the times when the child is suckled, milk flowing from one breast as the child feeds at the other. These changes represent the earliest signs of reflex outflow that can be distinguished, though as yet seldom forcible enough to evoke the clearly defined sensation to which women refer later as 'the draught' and which they describe as a tingling or 'pins and needles.' It is unusual for this to be realized earlier than the third week in the first lactation and is often delayed until later. By the tenth day a baby of average weight and vigour obtains from 15 to 20 ounces of milk in five or six feeds and has begun to regain the weight lost in the first days of life. The amount of milk rises steadily to 20 and 25 ounces daily and may reach 30 ounces by the end of the first month. This is the normal and favourable start of lactation and breast feeding may be expected to continue without let or hindrance. The figures at Woolwich place, as near as may be, 30 per cent. of primiparous women in this category.

In strongest contrast is a type in whom the onset of secretion is sudden or even violent, and if any leakage occurs at all it ceases within a few hours. Tension rises rapidly, the breasts become hot and heavy and enlarged to perhaps twice their former size, their margins standing out as a sharp ridge from the chest wall. The skin is tightly stretched and glistening, the veins full and prominent. During the next four or five days hard lobules of breast tissue may be felt, or sometimes seen, separately outlined; the state to which the term 'knotted' has been given. But by far the most striking fact is that not only does milk not escape spontaneously but that at the height of the engorgement it cannot be induced to do so by any of the means usually employed, and the baby's efforts to feed are wholly ineffectual. A variety of measures are used to induce the milk to flow; hot fomentations, icebags, the suction-pump and manual expression. But they produce little appreciable alteration, and for this reason many hold it is better not to interfere but rather to wait for the swelling and tension to subside spontaneously, as subside they will sometime during the second week. Meanwhile the woman experiences great discomfort, aching and sleeplessness to which, in a large proportion, is added the torture of suckling her child when her nipples are damaged.

For in addition to the signs just described the breasts are oedematous and pit on pressure. The oedema is often most easily seen in the thickened fleshy condition of the areola, while if the surface of the nipple is closely examined, preferably through a lens, it will be found to have a watery swollen look; and should the baby have been put to the breast there is added a pale yellow glaze, a lymphatic

exudate. In the group to which this account applies we place 20 per cent. of primiparous women.

The two classes just described have no sharply defined limits and merging towards each are the remaining 50 per cent., showing every gradation of tension and ease of outflow. For clinical purposes it has been found helpful to distinguish four grades: the normal with tension scarcely raised; one with a moderate increase; the engorged state; and the last, just described, with oedema and obstructed outflow. A wider survey might show the number placed here at each end of the scale needs some modification, but the estimate is substantially correct. If the account and incidence of those in the last category are accepted it must be recognized that in a fifth of women at the beginning of the first lactation there occurs a period of excessively high tension lasting four or five days and sometimes longer. It is with the later course of lactation in these and their near neighbours in the third grade, perhaps another 15 per cent., that we shall be concerned.

High milk pressure. In veterinary medicine it has long been recognized that high milk tension lowers production and, if excessive and prolonged, suppresses it altogether. This sequence is seen in the human when the fetus is stillborn. Milk is secreted after the usual interval and the breasts pass into the state of massive overload. After a few days production stops, tension becomes less, the milk is absorbed and regression to the resting stage soon follows. In hospital practice to-day it is rare to see the cycle completed, for secretion is artificially inhibited. Formerly the process was left to itself, except that to hasten it further pressure was often added from without by bandaging the breasts firmly to the chest wall. Even without this, involution was practically complete by the end of a fortnight, by which time the breasts were no larger, and were sometimes smaller, than before active secretion began. The same process is seen when the baby finds milk is easily withdrawn from one breast but not from the other. One can often see the change beginning in the unemptied breast during the lying-in period, but it has become much more conspicuous a few weeks later when the gland has shrunk to half, or perhaps less than half the size of the one which is taken. During the stage of extreme engorgement even the most vigorous infant is powerless to extract milk and will only damage the nipples very severely if allowed to try. Both facts, damage and impeded outflow, are due to the oedematous state of the breasts; for oedema which is evident in the covering skin must permeate the whole structure of the gland and involve the duct system. Thus, as regards drainage, the situation in no wise differs from that which follows stillbirth and the same tendency to involution is present. Discussing this relation between excessive tension and reduced production, Hammond (1936) says:

'There is some histological evidence whereby the increased milk pressure inhibits the rate of milk secretion and eventually leads to atrophy of the gland cells.'

In the empty gland the space occupied by the alveolus is small and the cells are columnar, their natural shape in which they can best carry out their physiological process of milk production. But when the alveolus becomes filled with milk under pressure its diameter is doubled so that the individual cells have to expand if they are to remain intact, and they become flattened and drawn out. Neither this, nor the occlusion of the capillaries on the outer side of the alveolus by the milk pressure within is conducive to a high degree of activity in the mammary cell.'

Again, Dawson (1935), in a histological study of the changes seen in post lactation involution, says they occur in this order: '1. The acini become distended with retained secretion which may in places cause rupture of adjacent walls to form larger lumina. 2. This distension flattens the epithelial cells, inhibits the changes associated with secretion and gradually prevents its formation. Distension also causes interference with the capillary circulation surrounding the secreting acini and further favours epithelial inactivity and retrogression.'

Thus both these authorities agree in attributing the first step in the decline of production to alveolar distension. As a rider to the second quotation it can be added that weaning, when it is conducted gradually is not usually, accompanied by anything like the degree of raised milk pressure we are now discussing.

On theoretical grounds then there was much to suggest that whenever this state of overload arises, and for as long as it persists, secretion is endangered and the gland likely to revert to the resting stage. In medicine efficient emptying of the breasts has long been accepted as an essential factor in preserving the continuity of the yield, but in this situation withdrawal of milk by the baby is not possible. Among those of the 52 women in the table who failed so early the commonest statement was that the baby 'didn't seem able to get the milk out.' At the height of engorgement this is understandable, for outflow is actually obstructed. Normally by the second week the reflex expelling force has already come to the baby's assistance, and a week or two later will often reduce its task to little more than the act of swallowing (Waller, 1943). It seems probable that in women as in animals a necessary condition for this reflex is that milk pressure must be kept within a certain range; that it is not evoked below the lower limit and is inhibited if the upper limit is exceeded. The latter is much below the point at which oedema accumulates, so that it may be supposed production is threatened in many instances of severe but not extreme overload. And so, in fact, we found when following up patients after they left the hospital. On all grounds, therefore, and not only as a means to prevent injury, it seemed desirable that overload should be reduced as quickly as possible whenever it arose.

For fear of causing damage the use of any form of suction apparatus was ruled out of court, expression by hand being relied upon as more nearly representing the force by which milk normally leaves the breast. Applied to those with moderate

FIG. 3.—Manual relief of the breast by the mother herself. She learnt the method during pregnancy and was very skilful. The nipples were poorly developed and the lacteal sinuses apparently absent. Milk could only be expressed by pressure applied far back. The baby was weakly and was unable to obtain milk direct for a fortnight.

degrees of overload the benefit was immediately evident, for when tension was lowered the baby's intake rose at once and feeding was found to be secure when reviewed some weeks later. The method was at first thought to be inapplicable to extreme cases with obstructed outflow, but later, with practice and greater skill, several of the nursing staff were able to reduce oedema to the point at which some release of milk was obtained. To effect the necessary lowering of tension two hours of a

FIG. 4.—Relief of high milk tension by a nurse. Thumb and finger are compressing the lacteal sinuses. The funnel is a convenience in collecting the milk.

nurse's time might have to be given several times a day to one patient and when, as often happened, a number needed attention the ward work became disorganized. Again it was found that the yield was preserved in those in whom a free outflow had been quickly obtained, and declined or ceased when the task exceeded what the staff could manage. Some other plan had to be devised. An attempt was made to teach the patients themselves the technique of manual expression, but the time between delivery and the start of secretion was too short for them to acquire the necessary skill. It then appeared that this might be overcome by teaching them to express colostrum during the last weeks of pregnancy when time could be set aside to instruct them in greater detail. These stages are mentioned because the last had an entirely unexpected outcome, and on looking back it is recalled that it was embarked upon without any great hope of success. But the plan had only been in force a few months when the staff of the lying-in wards reported a notable reduction of engorgement among those who had received tuition, and gave it as their opinion that those who had been most successful in acquiring the technique hardly needed to apply it when lactation began. As time passed support for this view increased, the inference being that in some way the pre-natal removal of colostrum improved the subsequent outflow of milk.

It is known that in certain animals the regular removal of colostrum results in its replacement by milk before parturition. Had we, perhaps, produced some change comparable with this, such, for example, as a reduction in viscosity? This was suggested by many women reporting that after they had practised manual removal for a few weeks they found colostrum flowed freely, whereas at the start they could only express a few drops. Moreover, they often described it as becoming 'thinner' and 'more milky,' and so it appeared to be. Some months were therefore spent on an investigation into both the viscosity and protein distribution of the pre-natal and early post-natal secretions. A bomb which destroyed a large part of the hospital wrecked much of the equipment and brought the work to an end; but enough had been done to suggest the pre-natal removal of colostrum led to no systematic alterations in composition (Waller et al., 1941). Nevertheless the feeling persisted that the women benefited, and this in itself was of enough interest to submit to the test of a controlled clinical experiment.

The pre-natal removal of colostrum

We decided to confine the experiment to observations on the first lactation, and as the patients booked for admission to the hospital they were labelled alternately 'Pupils' and 'Controls.' The breasts were examined and a number of anatomical features were recorded, including any defects of the nipples. All who were thought likely to benefit by wearing the glass shields were supplied with them irrespective of which group they were in.

During the last three months of pregnancy the 'pupils' were taught the method of using their

hands which had been found most effective in expressing milk, each one being required to demonstrate her proficiency at intervals of a few weeks so that any faults in her technique could be corrected. This teaching was the only difference made between the two groups, for in the lying-in wards both received identically the same management in respect of the relief of any overloading of the breasts that was called for, the prevention and treatment of injury to the nipples, the number of feeds their individual babies required, the use of supplementary milk, and so on. The need for scrupulous impartiality was impressed on the nursing staff, not only in the interests of the experiment but particularly on behalf of the infants. I am satisfied this object was achieved. The criteria by which it was decided the experiment should be judged were:

1. The freedom of the outflow of milk. To ensure this was not a matter of opinion it was thought best to show it as the amount taken daily by the two groups of babies.
2. The incidence of overfilling and engorgement of the breasts in each group of women.
3. The incidence of injury of the nipples.
4. The number of each group still breast feeding at three and six months.

The supervision of the experiment was given to one sister, who was made responsible for teaching the pupils and recording all details. It was planned to compare 200 pupils with 200 controls and we had in fact taught nearly that number of pupils; but the experiment was greatly interfered with by bombing and late in pregnancy many of the women decided to be confined in the provinces, while others sought safety by dispersal soon after delivery. In the hospital all the patients had often to be moved to shelters in the basement many times in the twenty-four hours, and this made regular and accurate test-weighing exceedingly difficult; much material had to be discarded as incomplete for this reason. The enquiry was therefore closed when data of 100 patients in each group were completed.

Before setting out the results a word is needed on the estimate of the different degrees of breast tension which is met with at the start of active milk secretion. There is no means of measuring it and so it amounts to a matter of clinical judgement based on experience. For some months before starting the experiment its assessment was practised using the appearance of the breasts, their tension to the sense of touch, the presence of oedema and the freedom of the milk's outflow. Four categories were finally settled:—

1. THE NORMAL. In these tension scarcely rose. Outflow was free and there was no necessity for the manual removal of milk.
2. OVERLOAD. Moderate overfilling with rise of tension, easily controlled by manual expression of the excess.
3. ENGORGEMENT. A greater degree, often producing oedema. Feeding was withheld until this had subsided, and when allowed was preceded by removal of the excess. After the child had fed it was usually necessary to empty the breasts further by hand.
4. ENGORGEMENT WITH OBSTRUCTION. The extreme type with no outflow. The breasts were raised and firmly supported, and no

attempt at feeding allowed. Emptying by hand was begun as soon as any outflow could be obtained, and when this became free and all trace of oedema had disappeared the child was allowed to feed. Excess of milk removed before and after feeds.

The results of the experiment will now be given. To the figures of the first test there are added for further comparison the daily amounts of milk taken by the babies of 100 multiparous women, in whom the start of breast feeding is usually far easier.

FIRST TEST

DAILY AMOUNTS OF MILK TAKEN DURING THE FIRST 13 DAYS OF LIFE BY THE BABIES OF 200 PRIMIPARAE (100 PUPILS, 100 CONTROLS), AND OF 100 MULTIPARAE. AMOUNTS IN OUNCES

DAY		1	2	3	4	5	6	7
P	..	0.1	1.0	3.9	8.7	11.7	13.6	15.3
C	..	0.0	0.7	2.7	6.6	10.0	12.4	13.4
M	..	0.3	1.3	4.4	9.0	10.8	12.8	14.3

		8	9	10	11	12	13	
P	..	..	16.4	17.1	17.7	18.3	18.2	19.9
C	..	..	14.5	15.9	16.3	16.4	16.9	17.0
M	..	..	15.0	16.3	16.8	17.1	16.9	17.8

P=pupils. C=controls. M=multiparae.

SECOND TEST

MILK PRESSURE DURING THE FIRST DAYS OF SECRETION: 3RD TO 13TH DAYS

	Pupils	Controls
1. Normal	63	23
2. Overload	12	21
3. Engorgement	20	37
4. Engorgement with obstruction	5	19
	100	100

THIRD TEST

INCIDENCE OF INJURY TO ONE OR BOTH NIPPLES

Pupils ..	12	Controls ..	24
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FOURTH TEST

SUCCESS OF BREAST FEEDING AT THREE AND SIX MONTHS; TO WHICH IS ADDED THE STAGE OF FEEDING ON DISCHARGE FROM HOSPITAL ON THE 14TH DAY

		WHOLLY BREAST FEEDING	PARTLY BREAST FEEDING	ARTIFICIAL FEEDING
On discharge	P ..	97	2	1
	C ..	83	12	5
At 3 months	P ..	87	2	11
	C ..	65	4	31
At 6 months	P ..	83	3	14
	C ..	42	5	53

P=pupils. C=controls.

The figures show very strikingly the correctness of the original observation by the hospital nursing staff. The first test revealed least clearly the true differences between the pupils and controls, for in the case of the controls' babies the amount of milk drunk from about the fourth to the eighth days often represents a combined total of what was taken by direct feeding and a residual quantity expressed and given by hand. This is the general practice in the hospital whenever it is necessary to ensure the breasts are sufficiently emptied, and it was a matter of general agreement that it was far more often required by the controls than by the pupils. Indeed

any resistance to the pre-natal routine as an innovation disappeared as soon as it was realized how little help the pupils needed in getting their babies to feed satisfactorily and how, in consequence, work in the lying-in wards was lightened. The easy start of breast feeding by the pupils was likened by one of the sisters to that seen in the second or third lactation, and this suggested comparison with the amounts taken by the babies of a hundred multiparae. Most notable is the fact that in the quantity obtained the pupils' babies overtook those of the multiparae on the fifth day and never lost their lead.

But by far the most unexpected outcome of the experiment was the fact that 83 per cent. of the pupils were found to be relying wholly on breast feeding at the end of six months compared with 42 per cent. of the controls. This test was chosen to exclude the possibility of any temporary advantage to the pupils from encouragement derived from their training in the ante-natal period. It is not reasonable to suppose any such influence could have persisted for as long as six months after delivery. To what then can the greater security of their lactation be attributed? The explanation to be offered, though influenced by the findings given here, is based upon observations which cover a considerably larger field than that of this experiment and involves the discussion of a number of points not mentioned hitherto.

The conformation of the nipple and the terminal ducts

A first condition for satisfactory breast feeding is the ease with which the nipple can be drawn away from the breast so that it lies far back in the baby's mouth and rests between the base of the tongue and the soft palate. There its surface is protected from the force of suction which falls instead almost entirely upon the skin of the areola. Suction should draw the nipple into this position and maintain it there, bringing the lacteal sinuses within reach of the jaws so that their contents can be squeezed out by the action of the mandible, replenishment being brought about by the downward movement of milk taking place within the breasts. If at all resistant to traction the nipple tends to evade the baby's grasp or at the best will lie in the front of its mouth or between the lips. Here not only are the sinuses beyond reach but the nipple's surface is exposed to suction and is very quickly broken.

Gross types of malformation and inversion of the nipples are not likely to escape notice during pregnancy, but there is a large number which to casual inspection look well enough adapted to their purpose but which must be classed as defective if subjected to a careful test for the ease with which they can be drawn away from the breast. This test is not satisfied merely by pulling on them, for one is apt to apply more force than the baby is able to exert; instead it is necessary to observe what happens when, in imitation of the action of the baby's jaws, the areola is pinched just beyond the nipple's base. If this is done it will be found in a large number it causes the nipple to retract rather than to project. Those which react in this way are

too firmly attached to deep structures, and in some this attachment is felt as a hard cord which can be rolled between the fingers. This defect is a persistence of the original invagination of the mammary dimple which has failed to become detached when later it undergoes eversion. The so-called 'flat' nipple, which in many cases is under-developed rather than malformed and scarcely differs in structure from the areola, is usually quite lax and can be drawn far into the baby's mouth. Some, also, that appear wholly inverted can be turned inside out and present little hindrance to suckling. As already mentioned an attempt was made to detect all those with the least tendency to retract and to correct them before the birth of the child, for if left until then there ensues a contest between the child's strength and the nipple's resistance. A strong vigorous baby may succeed in effecting a grasp, but in process of doing so will almost always inflict damage; a less energetic one will only make perfunctory efforts and for this reason is apt to be labelled 'sleepy' or a 'bad feeder.' The notes made during pregnancy of the nipples' range of protraction when subjected to the test just described are as follows:

RANGE OF PROTRACTION OF THE NIPPLES
(200 PRIMIGRAVIDAE)

		GOOD	MODERATE	POOR
Pupils..	..	25	43	32
Controls	..	24	52	24

So high a proportion of defects is not likely to meet with ready acceptance, but it is scarcely open to question when sought for in the way mentioned. It receives support from the prevalence of another defect with which it is closely associated. The method of manual expression taught to the pupils consists of two separate movements. The first is a compression of the whole breast between the two hands, starting at its margins and continued down as far as the areola. Firm pressure is maintained throughout this movement, which is repeated ten or a dozen times. Its object is to impel colostrum from the finer into the larger ducts and the lacteal sinuses. The second movement is harder to acquire and is designed to empty the sinuses. Their position is found by trial and they are then pinched sharply and repeatedly between the thumb and forefinger of one hand while the breast is held firmly fixed by the other. This action should produce a flow of colostrum from the nipple, but success depends much upon the direction in which the force of the pinch is applied; it needs to be directed somewhat backwards towards the centre of the breast rather than towards the base of the nipple as is always the learner's tendency. But it depends also upon what I think must be the development of the sinuses themselves, both in respect of their size and position and probably of their number as well. In some women a very small amount of force produces a free jet of fluid from the duct openings, in others none or scarcely any. This is by no means related at all constantly to the amount of colostrum

which the breast contains; for a quantity may be expelled by pressure applied to the whole gland when next to none can be obtained by the second manœuvre. Each pupil was taught how to get the best result in her own particular case, and when she had mastered the technique was instructed to carry out the exercise for ten minutes daily. In each an impression of the development and accessibility of the sinuses gained from this test was recorded.

DEVELOPMENT AND ACCESSIBILITY OF THE
LACTEAL SINUSES

		GOOD	MODERATE	POOR
Pupils..	..	30	43	27
Controls	..	31	44	25

The resemblance between these figures and those for the range of the nipple's protraction is very close.

A further point, though it is less certain how much importance should be attached to it, is the number of ducts which can be shown to open on the surface of the nipple by the time term is reached. It seems clear a large number of ducts must conduce to the ease and rapidity of the milk's outflow, and diagrams of the duct system always show such an arrangement. In fact, it is not so. The number may be anything from one to about twenty, and when single the opening is often at the bottom of a craterlike hollow or in the centre of a horizontal furrow.

NUMBER OF DUCTS PATENT DURING PREGNANCY

		NUMEROUS (10 or more)	MEDIUM (5 to 10)	FEW (1 to 5)
Pupils..	..	32	21	47
Controls	..	26	24	50

The large number with a single opening and those with perhaps two or three caused us to follow them with particular interest, and we satisfied ourselves that in about half the entry in our notes had to be altered from 'single' or 'few' to 'several' before term was reached. In others the change was only discernible later and was recorded in the second week after delivery; but there are not a few in whom it is delayed still longer, a fact noticed by the women themselves and commented on as a point of interest. It is possible that this is related to the rise in the milk which the baby obtains as the days pass. It is hoped to take the subject of variation of the ducts and of sinus development further by photography with an opaque medium.

It remains to say a word about yet another anatomical detail which has a bearing on milk pressure. This concerns the capacity of the breast to expand as a whole; its elasticity in response to an increase in its contents. It is perhaps not usual to regard the breast as an encapsuled gland, but in fact the skin serves the function of a capsule and there are wide variations in its texture. The necessity for it to yield to pressure from within is seen in the striation which accompanies the laying down of glandular tissue during pregnancy. Stretching may show as deep red rents in the connective tissue when the skin is thick; as numerous, faint, radiating lines when it is more yielding; and is

not visible at all in the most elastic type. A simple way to gauge the differences is by choosing a place beyond the gland's margin, e.g. just beneath the clavicle will serve, and raising the skin between finger and thumb; here there is always some subcutaneous fat. When the test is transferred to the skin covering the breast the decrease in fat may be very striking; for here the skin can be more freely lifted up. In some it is as thin as tissue paper. But the change is by no means always present, and the transition from thick to thin may be absent altogether. In the experiment an attempt was made to record this point, but there was much less experience in making the test than any of the others. It has since been realized that the figures below should all have been given a decided shift to the right; that is to say, too many were classified as thin and too few as thick.

FIG. 5.—Illustrates thin elastic tissue covering the breast.

TEXTURE OF THE SKIN COVERING THE BREAST

	THIN	MEDIUM	THICK
Pupils..	46	45	9
Controls ..	43	50	7

Even on this classification less than half had skin of the texture best suited to yield either to the enlargement in pregnancy or to the sudden increase in the breast's contents when active milk secretion begins.

The advantage of elasticity throughout the structure of the mammary gland has long been recognized in veterinary science, and has been one of the chief aims in the selective breeding of dairy cattle. Hammond (1936) states:

'The whole structure of the cow's udder appears to be designed for the relief of pressure on the secretory alveolar cells. The elastic fibrous tissue coat, the elastic fibres round the ducts and the thin elastic skin, producing an udder which "shrinks away to nothing" after the milk is withdrawn, or which will expand easily as milk is secreted into it—the ideal udder of the cattle judge—is a mechanism for keeping the internal pressure in the udder as low as possible compatible with the accommodation of a large volume of milk. The provision of a large milk cistern to each quarter, too, acts to relieve pressure on the actual secreting cells in the same way as the bladder acts for urinary secretion.'

So, too, in women the stretching which results from the first lactation serves to aid those which follow and largely accounts for the greater ease with which breast feeding is established in multiparous women. Since in them tension at the beginning less often reaches an excessive height, it gives us the explanation why reflex expulsion appears so much earlier, and why they tell us they can often recognize 'the draught' almost as soon as the milk 'comes in.'

The experiment was designed to test the observation that the regular removal of colostrum by manual expression appears to facilitate the subsequent outflow of milk, and it may claim to have done so. In each of the four tests selected the advantage lay with the 'pupils'; their babies obtained milk more readily in the first fortnight, they were less liable to engorgement and injury, and, as the follow-up reveals, the maintenance of their yield was secured twice as often as in the 'controls.' How can this result be related to the anatomical points we have been considering?

The reference to elasticity just quoted and to the existence in lower animals of 'cisterns' or reservoirs to safeguard the secreting cells, seems to give us a clue. These cisterns are represented in the human by the lacteal sinuses and these, it has been suggested, often appear to be poorly developed, a defect closely associated with a restricted range of the nipple's protraction. It has also been shown that the number of ducts patent at the nipple's surface at term is often small and may be single. In fact, it is not possible to examine a large series of women without reaching the conclusion that at the start of the first lactation the nipple and the terminal part of the duct system are ill adapted to their purpose in a high proportion. Thus, taking the three points just mentioned as being closely related to functional efficiency, in the notes of the 200 women in the experiment only 24 instances (11 pupils and 13 controls) are found of the presence in combination of free protraction, good sinus development and multiple duct openings; only 12 per cent., that is, with the ideal anatomical formation which ensures an easy task for the child and the best drainage of the breast. Even so this leaves out of account the quality of elasticity. The tendency to retraction can be overcome, or at least much improved, in many by the timely use of a simple apparatus, thus greatly aiding the child in its early efforts to feed or, it may be, providing the

only possibility of it feeding at all. But this by itself is not enough. It was supplied impartially to pupils and controls alike and the benefit derived was equal in the two groups; for, as would be expected, the incidence of abnormalities and their degree were almost identical in each. It is when the number subject to high milk pressure is compared that the groups part company, for 56 controls fall into the two highest grades of engorgement as against 25 pupils. This difference represents the difference in freedom of the milk's outflow, and the lower incidence among the pupils must be due to the pre-natal removal of colostrum having forced open and stretched the ducts in the lower part of their course before the inrush of milk which characterizes the action of the lactogenic hormone. In support of this is not only the greater amount of milk obtained by the pupils' babies in the first days of life but also the far greater ease with which their breast feeding began. There was a further fact which deserves a brief mention. The security of breast feeding depends closely on the delicate mechanism of the 'draught' reflex and its conditioning to the stimulus of suckling; and also to a degree of milk pressure which safeguards the secreting cells. The earlier this adaptation occurs the safer the outlook. Women vary much in their awareness of this expelling reflex, especially in the first lactation. In the follow-up, and before three months had elapsed, both groups used in the experiment were asked to state as nearly as they were able when they first clearly distinguished the sensation of 'pins and needles' which accompanied the draught. Not all the 84 pupils and 64 controls who were still wholly breast feeding their babies gave exact answers. For those who did the average was $3\frac{1}{2}$ weeks for pupils and $4\frac{1}{2}$ weeks for controls.

It has been suggested that the oil used on the hands to prevent friction in the pre-natal 'massage' of the breasts increases the elasticity of the covering skin and so enables it to yield more readily when the milk first 'comes in.' Any such effect is probably so slight as to be negligible. To avoid misunderstanding it is perhaps wiser to use some word such as 'preparation' rather than massage since the latter term has, in this connection, become endowed with almost transcendental properties of 'toning up' and 'stimulating' the gland to prodigies of secretion, whereas it is implicit throughout this discussion that it is an initial excess of milk production and its rapid drainage with which we have been concerned. It is more likely that the effect is mechanical and is produced in the way described. The method has also been called new, but any claim to novelty is better waived. I am informed it is met with in China and in some parts of Africa, and an account of what seems to be the same custom among the Maoris runs as follows:

'In the old days the breasts were massaged, and also the nipples, and a Maori mother never had the difficulty of the women who have come in contact with civilization. When a woman became pregnant her breasts were attended to from three months after

(conception) right up to the birth of her child. Her breasts would have the milk flowing easily, and so the child is fed from them soon after birth.'

It will be remembered the work reported here began with the attempt to prevent injury, on the supposition that when the surface of the nipples is broken pain might well lead to a refusal to continue breast feeding. No conclusion has been reached how often artificial feeding provides an escape from pain. A rule of the lying-in wards is that the nurses must ask their patients at every feed whether the act of suckling causes pain, and to report each instance. The nipples are then examined with a lens and, if any breach of their surface is found, feeding is suspended until healing is secure; milk is taken off by hand at each feeding time and given to the baby by bottle. The problem of pain thus scarcely arises. Nearly all the cases of damage recorded in the 200 primiparae were of this slight degree and, judged by some standards, would not be considered injuries at all. The plan is amply rewarded for the deep fissures and denuded areas of former days are never seen, and mastitis or breast abscesses are almost negligible. (Another hospital maxim is that 'Every damaged nipple is a potential breast abscess.') So far as it has been possible to trace, among the 10,000 patients who have passed through the wards during the last nine years, there have been four abscesses. One occurred towards the end of pregnancy and coincided with the intra-uterine death of the foetus; it was probably due to a blood infection from an antral empyema. The other three occurred within three weeks of the patients leaving and are accepted as the hospital's responsibility.

Injury carries a special risk of infection at this stage, when drainage is so often less free than it becomes a few weeks later. But the pain involved has also a special significance; its inhibiting influence on the expelling reflex. A woman may endure pain with the greatest fortitude, but it is doubtful if she can equally control its effect on reflex action. There is evidence that she cannot in the small amount a baby will obtain if allowed to feed when the nipples are damaged. Yet, as has been seen many times, the yield will rise at once if feeding is stopped and milk is regularly removed by hand. So, too, in animals, the milk is not 'let down' if they are hurt in the process of milking, or if they are frightened. It is beyond question that when suckling hurts, many women are extremely apprehensive of developing a breast abscess and will sometimes mention this fear only after all occasion for it has passed. Some are doubtless glad to give up the attempt to feed in the hope that it will lessen this risk; more often they will persevere in the interest of the child. One instance of the severity of the pain has been mentioned and another may be recorded. A young woman told me that while struggling to give her baby the breast when her nipples were torn, she was rebuked for letting her tears fall on its face. 'But I was not crying at all,' she asserted, 'it was sweat

dripping off my forehead.' In such circumstances it is impossible to suppose the breasts are efficiently emptied, and the decline which so often follows is probably due to this cause.

Owing to war conditions much of the work reported here has throughout its course been denied the benefit of discussion and criticism, and it needs some courage to suggest its conclusions are worth verification by others. Nevertheless, I hope it may be thought to be so. If the views propounded here are endorsed by trials elsewhere it follows that, to a far greater degree than hitherto, those in charge of the lying-in period must shoulder responsibility for the fact that nearly 50 per cent. of babies are deprived of human milk before they are three months old; or even, as there is reason to think, before they are six weeks old. The training of midwives and health visitors in the prevention of high milk pressure must be a charge on the teaching staffs of maternity hospitals and must be directed by the obstetricians or the paediatricians whom they appoint to do it for them. Should it take the form advocated here, and now the routine at the British Hospital, it calls for some re-organization of the ante-natal clinic and I have been fortunate in being given every facility in effecting the change. Elsewhere it is possible some prejudice may have to be overcome. The recent Government Report 'On the breast feeding of Infants' opens its discussion on why feeding is not established in so many women by emphasizing an 'over-sophisticated outlook on life,' and in some 'a distaste for the process which may be pathological in origin and sometimes impossible to overcome.' This is, of course, the customary approach to the subject which would scarcely call for comment; but it proceeds:

'It seems to us, however, that in some cases this distaste may have been engendered by an unnecessarily elaborate routine during the ante-natal period. We understand, and fully appreciate, that various forms of treatment may be required for various conditions and types of breast. Nevertheless we feel that if anything more usual than normal hygiene is required it should be prescribed by a nurse or a doctor, after skilled examination. It is, we fear, bordering on the paradoxical to impress upon the ordinary expectant mother that breast feeding is a normal, easy and natural process if at the same time the advice she receives as a routine imposes upon her an elaborate daily ritual of preparation. We think it possible that with an anxious type of woman too much stress on preparation of the breasts may alarm and discourage her to such an extent that she will refuse even to initiate breast feeding.'

It will have been evident that the whole tenor of this paper is throughout frankly opposed to the view that it is fair 'to impress upon the ordinary expectant mother that breast feeding is a normal, easy and natural process,' least of all in her first and most critical lactation. The paradox, surely, lies in the continual bolstering up of this misleading doctrine, so contrary to experience, so fruitful of error and disappointment. For perhaps 30 per

cent of primiparous women it may hold good; for another 50 per cent. breast feeding is beset in varying degree by obstacles, many of which are hard to overcome; while for the remaining 20 per cent. it calls for all the skilled assistance which can be brought to it and even so will by no means always succeed. I am convinced no real improvement will be seen until these figures, or something approaching them, are frankly faced.

At the British Hospital for several years we have been teaching exactly what this Report condemns, and practically without exception it has met with a ready and eager response from the patients. Instruction is of course given by a doctor or nurse and is always preceded by a careful examination. The 'anxious type of woman' who is supposed to be deterred from making the attempt to feed her child has, on the contrary, provided us with many of our most outstanding successes; for as she masters the technique and appreciates its objects she almost invariably gains in confidence and composure. The same applies to those who in a previous lactation have suffered the misery of cracked nipples, of mastitis or a breast abscess. In the experiment described care had to be taken that the controls did not make trial of the pre-natal exercises through hearing of their reputation for giving good results. When giving demonstrations of the method at other hospitals and conferences a number of expectant mothers willingly agreed to go and act as exhibits (even as far from Woolwich as the Midlands) and show the exercises to large audiences of midwives and health visitors and before doctors and medical students of both sexes. The warning issued by the authors of the Report can be dismissed as groundless if it is desired to test the 'ritual' and if instruction is in responsible hands.

It was stated at the outset that one of the puzzling aspects of breast feeding is its tendency to fail in some women, its effortless performance by others. The main grounds of difference put forward have been the hindrances due to anatomical defects and their bearing upon the physiology of milk secretion. There is, however, one more which needs at least brief mention. The contribution to successful drainage of the breasts by the child is a variable factor, and, whenever this is lessened by prematurity, by the stress of labour, the lethargy of jaundice, illness or other like factor a threat to the maintenance of lactation arises. The daily increases in the amount of milk taken by the child which is normally characteristic of its performance in the second week may be delayed considerably beyond this point, and, unless this is realized and due care is taken to control the level of milk pressure by adequate drainage, failure is likely for the reasons already given. Here, again, the phrase 'wholly breast fed' on leaving hospital at the end of the customary lying-in period may denote no more than that the child is still being put to breasts which are rapidly reverting to the resting stage. It needs but a few more days for the mother to realize this, and the artificial feeding to which, quite rationally,

she resorts is attributed to unwillingness to breast feed. This explanation seems to have been accepted by those responsible for the Government Report. 'Many hospitals, we heard, had found mothers so reluctant to continue breast feeding that women who had left hospital completely breast feeding would turn up at the clinic a month later with their babies wholly artificially fed.' This is so entirely at variance with my experience of the cause of failure at the British Hospital and elsewhere over many years that I feel sure it does not do justice to the women and that a clearer understanding of the underlying physiology would provide a truer explanation. In a proportion of first-born infants, and it is probably not less than 20 per cent., the safe establishment of breast feeding is not feasible within the time usually allotted to the lying-in period; yet it is in the maternity hospital that the foundations of security must be laid. The practice of discharging a woman merely with injunctions to keep to some timetable of feeding quite often results in her obtaining admission for her baby to the children's ward of another hospital a few days later, where she is ordered to attend herself to feed it. This can seldom avail. I have seen it done at a teaching hospital when it involved the mother in nine hours' travelling daily and at cost to her of over four shillings a day. Provision for a longer stay where she is confined and a far closer liaison between the nursing staff of the maternity hospital and the health visitors of its neighbourhood, are the most pressing needs.

The use of stilboestrol to control high milk pressure

In the prevention and reduction of engorgement stilboestrol has a useful field, but it needs judgement to adapt the dosage to the individual case. Enough should be given to reduce tension quickly and to confine the use of the drug to a short period. If engorgement is foreseen—and the staff has become very expert in its anticipation—two or three doses of 5 mgm., given by mouth at intervals of four hours may be all that is needed. With an exceptionally rapid and unforeseen rise of pressure it may be necessary to give 20 mgm. three times, followed by 15 and then by 10 mgm. at four-hourly intervals, and the dosage must not be allowed to lapse during the night. This amount produces a halt in secretion followed by a marked reduction of tension and relief to the patient but, as the effects wear off, a return of secretion is always seen; this time it is gradual, so that for several days the baby may obtain very little and must be supplied from other women's abundance. As soon as swelling and oedema show signs of subsiding as the result of the drug the milk the breasts contain should be expressed by hand even though the amount is small. This is found to remove all risk of involution. Feeding is resumed as soon as any revival of secretion is detected. The after course of lactation is unaffected and the normal yield can be expected by the tenth or twelfth day. No ill effects have been seen either

immediate or remote, and in following up women treated in this way breast feeding has been found to have gone on smoothly and securely, and after doses even higher than those described. In acute mastitis equally large amounts are called for, and can alternate with one of the sulphonamides, sulphathiazole in our experience being the one of choice.

Summary

The main principle put forward is that an easy start of breast feeding depends on milk pressure within the breasts not rising to an excessive height. If it does so rise, and if it is not speedily lowered, a rapid decline in production follows by reason of alveolar distension and compression of the secreting cells. This is claimed to be the chief reason for the statement by so many women that their milk fails soon after they get up from childbed. The frequency of high milk pressure at the outset of the first lactation is attributed to certain anatomical defects of the nipples and the terminal ducts, a claim for which there is ample clinical evidence but which needs confirmation by other and more exact means.

A controlled experiment is described in which half the women used were taught the daily removal of colostrum during the last three months of pregnancy, and their breast feeding compared with that of the other half who were not so taught, both groups receiving identical management during the lying-in period. Excessive milk pressure occurred in 25 per cent. of the 'pupils' and in 56 per cent. of the controls, while at the end of six months 83 per cent. of the former were still successfully breast feeding as against 42 per cent. of the latter. For this result it is suggested that the preliminary removal of colostrum facilitated the initial outflow of milk by stretching and enlarging the terminal part of the duct system. A simple means to improve the nipple's range of protraction is also described.

POSTSCRIPT. Since the experiment described here, the preparatory technique has as far as possible been taught to all primigravidae and those who have had experience of lactation difficulties. Replies to a questionnaire sent to 300 primiparae delivered consecutively in the early months of 1945 show that 79.3 per cent. were fully breast feeding at six months. In 5 per cent of this series stilboestrol was used as here described to control milk tension.

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