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"SOME IMPORTANT POINTS IN INFANT FEEDING."¹

Abridged.

By BERNARD MYERS,
C.M.G., M.D.

THE conclusions arrived at in this lecture represent the opinion formed from careful observation of over a thousand babies who have been under my care during the last five years at the Children's Clinic, the Royal Waterloo Hospital, and the Babies' Hostel, Alexandra Road, N.W.

We endeavour to feed each infant with the requisite quantity of protein, fat, carbohydrate, salts and water during each twenty-four hours, to allow for repair of waste, for growth, and for the production of heat and energy. The different constituents of the food should be in the form which the baby

can digest, and in the correct proportion to each other. All the vitamins must be present in the food and in adequate quantity. The presence of immune bodies and certain ferments in the mother's milk are to the child's advantage.

If properly fed and cared for the baby should gain weight regularly, show normal mental and physical development, possess high immunity to disease and perfect nutrition; all the functions of the body should act normally and regularly and the child be happy, contented and well.

The experience gained from observing numbers of infants in the same institution fed by different methods, shows quite definitely that the breast-fed baby is much more frequently the ideal baby, as judged from the above points, than babies fed by other methods. In my experience this is well borne out in baby shows.

Every mother, therefore, ought as a matter of duty to feed her baby for nine months, but if for any reason she cannot

¹ Lecture given at the Children's Clinic, 48, Cosway Street, London, June, 1931.

will not do so, every endeavour must be made to induce her to feed her child for as long as possible, to give it a good start in life, be that period only a month or even a week or two.

Many a mother will breast-feed her infant if one or more feeds of any ordinary milk-mixture be given daily (supplementary feeding), and this should always be agreed to by the physician under such circumstances.

If the mother can only supply at each feed an insufficient quantity of milk, this should be given to the baby at the usual regular intervals and the balance made up by a milk-mixture, given from a bottle, in the quantity necessary to complete the feed (complementary feeding). The milk-mixture will consist of certified milk, if possible, sugar and water, as described later. The amount to be given by the bottle can be ascertained by doing test-feeds, when the baby is carefully weighed before and immediately after the feed. In many instances the baby can be left to take as much as it wishes of the milk-mixture, after each breast feeding. Some greedy children take too much and vomit the excess. This can be obviated by putting into the bottle the requisite quantity of mixture as ascertained from weighings.

When the mother cannot feed her offspring and a suitable, healthy wet-nurse is available, who is medically fit, and has plenty of good milk, she might be tried to feed the baby if there be no other objection. Her own baby should be a week or two older than the baby she is to feed. Under favourable conditions the result is most satisfactory.

Test feeds are valuable for showing if the baby is obtaining sufficient food, or again if it be getting too much or too little. It is desirable that test feeds should be done at every feed for twenty-four hours, although sometimes this is impossible. If the baby is obtaining too much food it should be put to the breast for a shorter period at each feed, such as five to ten minutes instead of fifteen, which should allow the child to receive just the correct quantity. On the other hand, if

too little food is taken, and there be no fault in the infant's sucking power nor defect of the nipples, complementary feeding is necessary.

Many children are fed from one breast at each feed, the breasts being used alternately, but in numerous instances the child is given about five minutes at each breast at every feed, and the result is equally as good as the other method. We have seen a case where a mother developed an abscess in the right breast soon after the birth of the child, and as no milk was secreted from that side, the baby was fed entirely from the left breast. It obtained ample supply and gained normally, while keeping in perfect health. A couple of months after weaning, at the ninth month, the two breasts were almost equal in size.

It is not an easy matter to increase the milk secretion, but where the mother has been underfed and is healthy, giving her suitable foods in sufficient quantity, will probably produce an ample supply of milk. It is necessary that all worries be removed, that she does not work too hard, and obtains sufficient sleep. In many cases, if mothers drink some milk or water immediately before feeding the child, the supply of breast-milk is increased. Other methods of stimulating the secretion of milk are by applying to the breasts hot and cold douches alternately, and then suitable massage. The highly-strung mother is generally a source of trouble and needs most tactful handling and encouraging; where, as so frequently happens, her child is also highly-strung, the difficulties are further increased. This type of child should be kept very quiet and no one but the mother should be in the room during feeding time. These children frequently take the breast better if they are taken up quietly from sleep.

It is rarely necessary to analyse the mother's milk, as from a series of analyses we ascertained that the percentage composition did not alter materially except in rare instances, and should the percentage of fat

be high it is wonderful how well, in nearly every instance, the baby digests it. Where the milk is deficient in quality and this cannot be remedied, the baby will probably have to be weaned. This is, however, rarely seen.

Hours of Feeding.—From a series of observations which were done at the babies' hostel, it was quite clear that the average baby does better when fed three hourly, or six feeds in twenty-four hours, during the first six to ten weeks of life and then four-hourly up to nine months, or five feeds in the twenty-four hours. The three-hourly feeds commence from the third day of life. The hours for three-hourly feeding are: 6 a.m., 9 a.m., 12 noon, 3 p.m., 6 p.m. and 10 p.m., and the four-hourly feeding at: 6 a.m., 10 a.m., 2 p.m., 6 p.m., and 10 p.m. Where as occasionally happens an extra feed is given the time for it would be 2 a.m.

Too much preparatory treatment is sometimes given to the mother's nipples. Certainly, where fissures have existed previously, it may be desirable to apply surgical spirit on cotton-wool once or twice daily during the last few weeks of pregnancy, but otherwise, we find no applications are necessary. Should the nipple be indrawn, it can be gently drawn out by a breast-pump. After the birth of the child, the mother's nipples should be washed in tepid water and gently dried with a soft warm towel both before and after feeding. Where a fissure of the nipple occurs the best application is tincture benzoin co. and glycerine.

The mother should take the greatest care of her health during lactation, and keep away from infection. Plenty of rest, good digestible food, daily action of the bowels, and a happy contented mind are essential.

A mother who suffers from tuberculosis or other wasting disease should not be allowed to feed her child. Where the child is gaining weight and the mother is losing weight there is something wrong, and she should be immediately examined as the baby will probably have to be weaned and the mother herself may require treatment.

Artificial Feeding.—Where complimentary or supplementary feeding is necessary or the infant has to be weaned from the breast during the early months of life the child can be fed on milk mixtures made with fresh cows' milk, water, and the necessary amount of sugar, or by using dried milk or in some special cases with full-cream condensed milk. There are various patent foods upon the market which are sometimes used for a particular purpose for a time.

Where breast-feeding is not sufficient, not possible, the best mixture to give the infant is one containing fresh cow's milk, and this should be always if possible certified Grade A T.T. The only objection to this high-class milk at the present time, is that it is a little more expensive than ordinary milk, but, it is hoped that children of all classes will before long, be provided with it, as the best only is good enough for our growing infants. In the absence of this high-class milk, good milk which has been filtered and pasteurised by a first class company, and sold out in sealed bottles, should be used.

Caloric Feeding.—I do not advocate that children should be fed by this method, as I am of opinion that a sufficient amount of protein, carbohydrate and fat, with the necessary amounts of salts, water per lb. of body-weight and vitamins is a better method than ordering so many calories per lb. of body-weight. At the same time, all will agree that a knowledge of the caloric value of the food per lb. of body-weight is essential in order to prevent over-feeding or under-feeding.

If artificially fed an infant requires 35 calories per lb. of body-weight during the first fortnight of life, and 40 calories during the third and fourth weeks. From 1 to 6 months' old 45 calories are suitable, and the same 50 calories up to the age of 6 months. From that period to 9 months 45 calories will suffice.

Fat infants require fewer calories per lb. of body-weight than lean ones. Recently,

very fat baby gained 8 to 12 oz. weekly on food containing 40 to 45 calories, while a lean baby at the same time gained only 4 to 6 oz. per week on a food containing 60 calories per lb. of body-weight. A baby suffering from marasmus should only be fed the number of calories per lb. of body-weight which it can digest and tolerate, and that may be 30, more or less, but after recovery, 60 or 70 calories may be needed, per pound of body-weight, to obtain an adequate gain. The food given must always be in the form which the infant can digest.

The following method of feeding babies is, I think, a sound one, and has been used by Hess in U.S.A. For every lb. of body-weight the milk-mixture should contain:—

Fat 1·5 to 2 grm. ($1\frac{1}{4}$ to $1\frac{3}{8}$ oz. of milk).

Protein 1·5 grm. ($1\frac{1}{2}$ oz. of milk or skim milk).

Carbohydrate 5 grm. (2 grm. of lactose contained in $1\frac{1}{2}$ oz. of milk, and $\frac{1}{10}$ oz. sugar are therefore added).

During the first few weeks of life 1 oz. of cow's milk is required for each lb. of body-weight, but when the infant is a month old $1\frac{1}{2}$ oz. of milk are needed if the digestion is normal. Later on, some babies will require $1\frac{3}{4}$ oz. or even 2 oz. per lb. of body-weight.

Infants should be given $2\frac{1}{2}$ oz. of fluid per lb. of body-weight during the twenty-four hours up to the age of nine months.

The quantity of food to be given to the baby at each feed is, generally speaking, an oz. more of the milk-mixture than his age in months, if fed three-hourly; those fed four-hourly require 2 oz. more food than their age in months. Thus, a child aged 3 months would require 4 oz. at each feed by the former method, and 5 oz. by the latter method.

A milk-mixture for an infant weighing 8 lb., would contain, for the average baby, whole cow's milk, 12 oz.; water, 8 oz.; and lactose, 8 level teaspoonfuls, which give a caloric value of 336. This represents the total quantity for the twenty-four hours, and

would be given to the infant by six feeds of $3\frac{1}{4}$ oz. each.

I give an example of an average baby, aged 5 months, whose birth weight was 7 lb. and present weight 14 lb.:—

Details of milk-mixture as follows—Whole milk $14 \times 1\frac{3}{4}$ oz. = $24\frac{3}{4}$ oz.; water, $14 \times \frac{3}{4}$ oz. = $10\frac{1}{4}$ oz.; lactose, 14×3 grm. = 42 grm. = $1\frac{1}{2}$ oz. (equivalent to $4\frac{1}{2}$ level teaspoonfuls of lactose, or to $4\frac{1}{2}$ of dextrin-maltose, or to 3 of cane sugar. The total fluid = $35\frac{1}{4}$ oz. ($2\frac{1}{2}$ oz. fluid per lb. of body-weight). It may be taken that cow's milk contains protein, 3·5 per cent.; fat, 3·75 per cent.; carbohydrate, 4·5 per cent.; salts, 0·72 per cent.; and the milk-mixture therefore contained: protein, 2·45 per cent.; fat, 2·6 per cent.; carbohydrate, 7·2 per cent. (3 + 42); salts, 0·5 per cent.

The total mixture contained 25·97 grm. of protein, or 1·85 grm. per lb. of body-weight; carbohydrate, 75·39 grm., or 5·38 grm. per lb.; fat, 27·82 grm., or 1·99 grm. per lb.; salts, 5·34 grm. or 0·38 grm. per lb. of body-weight. This gave 48·2 calories per lb. of body-weight.

The milk-mixture was boiled in a Soxhlet apparatus in the ordinary way. There were five four-hourly feeds of 7 oz. each in the twenty-four hours, and the child was fed at 6 a.m., 10 a.m., 2 p.m., 6 p.m., and 10 p.m. Four teaspoonfuls of fresh orange juice were given twice daily with an equal quantity of water and a pinch of sugar, and half a teaspoonful of cod-liver oil once daily. Two teaspoonfuls of raw egg-yolk were put into one bottle daily.

Modifying the Curd of Cow's Milk.—This can be done by diluting the milk with water or cereal water; by boiling the milk in a single saucepan for three to five minutes, or in a double saucepan for six to ten minutes; by peptonization; by the use of alkalies such as citrate of soda, lime water, bicarbonate of soda or milk of magnesia; by feeding with dried milk; or by feeding with a condensed milk; or by feeding with lactic acid milk. The object of the above method is to

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denaturize the protein and render the casein curds more digestible.

Carbohydrates.—These are given to the infant in the form of sugar, such as sugar of milk, or as dextri-maltose especially in diarrhoea, or as cane sugar. In some cases it is useful to make a mixture of the three sugars in equal parts. Starches are usually introduced into the dietary about the sixth or seventh month, and a good method is to give one level teaspoonful of groats in one bottle daily; the mixture requires boiling for fifteen to twenty minutes.

Vitamins.—All infants who are artificially fed should be given orange juice and cod-liver oil from the first few weeks of life, in order that there may be a sufficiency of vitamins A, B, C and D, in the diet. This is desirable in the summer, but still more so during the winter months. At 2 months old the baby can be given one teaspoonful of sweet orange or grape juice night and morning, mixed with an equal quantity of water and a pinch of sugar. Half a teaspoonful of cod-liver oil once daily is ample. At six months two tablespoons of orange juice and a teaspoonful of cod-liver oil should be given in the twenty-four hours. The cod-liver oil can be given as the pure oil alone, or as an emulsion, or mixed with maltine. Lately I have been trying White's cod-liver oil concentrate, and its use appears to be quite satisfactory. The tablets are broken up into a powder by the back of a spoon and shaken with the milk-mixture in a bottle. In some cases irradiated certified milk is used instead of cod-liver oil, and sometimes ostelin. All these ways give satisfactory results.

Feeding with Acid Milks.—These milks are absolutely invaluable for babies suffering from diarrhoea and vomiting, or marasmus, and the results obtained from their use are, in my experience, superior to other methods of feeding dyspeptic or marasmic babies.

Bacteria such as *Streptococcus lacticus* may be added to the milk which is incubated at 55° F. for six to twelve hours; the lactose is fermented, and the acidity of the milk

increased. It is usual to add water to the milk to begin with. If thought desirable some of the cream can be taken off the milk before the souring process begins. Another method is by adding 45 mm. drop by drop of B.P. lactic acid to a pint of cold milk previously boiled. This milk should not be heated beyond 100° F., when being warmed for the baby. Various other acids have been tried, such as hydrochloric, but lactic acid appears to be best. Butter-milk can be obtained in a fresh or dried state, and is diluted according to necessity. A dried butter-milk, which is made in Germany, has proved to be excellent; the dilution made, being 1 in 10 with water and a requisite amount of dextri-maltose is added. There are, as a matter of fact, various varieties of dried lactic acid-milk at the present time. Finkelstein's protein milk is still popular on the Continent, though not frequently used in England.

A female, aged 5½ months, suffered from digestive disturbance; bronchitis, vomiting and diarrhoea were present. Marasmus developed. She was first given water diet only for six hours, and then dried butter-milk with dextri-maltose added to the mixture. As the symptoms decreased, and the nutrition improved she was fed with half-cream lactic-acid milk and next by half-cream dried milk. By gradual changes she went back to an ordinary milk mixture. Before she was discharged from hospital, her average gain was 2 oz. daily. Her recovery was complete, and she left in perfect health. Orange juice and cod-liver oil were administered daily from the third day of illness.