

are told 'He went about doing good.' In so high a vocation it is not enough to turn out a much-taught, highly trained woman: the right personal qualities are all-important matters from the patient's point of view. True, the mind as well as the heart and hand must equally be trained in order to evolve the best type of nurse. The general aim must be to stimulate and foster the nurse's powers of development. At the same time we realise that the finest work is done when the 'Spirit of Service' is the energising force, and we therefore try to place first and foremost what for want of a better term I will call 'The Spirit of the Wards.' To those whose lives are spent in hospital, this spirit is common-place. It is this spirit which creates the atmosphere of love and devotion to be found in all our Voluntary Hospitals—the feeling that the best is never too good for the patient—the whole-hearted, willing self-sacrifice which cheerfully, through bad days as well as good days, spends itself in the service of others—it is, in short, 'The Spirit of the Wards.' "

PRINCIPLES OF ARTIFICIAL FEEDING.*

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REQUIREMENTS OF PHYSIOLOGICAL FEEDING.

Very few methods of Infant Feeding except Breast-feeding comply with all the requirements of physiological feeding, which briefly stated are as follows:—

1. The energy or "food-value" of the food supplied as measured in calories must fulfil the requirements of heat-production, display of energy, growth and repair, and of the elaboration of secretions.
2. The balance of the main constituents, *i.e.*, proteins, carbohydrates and fats must be arranged on a physiological basis, which will vary with the special requirements of the child, but which will not, in conditions of health, depart widely from the standard of breast-milk.
3. All those accessory factors, such as the vitamins, organic salts, extractives, lecithin, cholesterol, etc., which are required for growth and maintenance purposes must be supplied in adequate amount.
4. The food must be presented in such a form that it can be not only digested, but can also develop the still latent functions of digestion.
5. The food must be given at such intervals, at such rates, and in such a degree of purity as to comply with the physiological requirements.

Taking these rules one by one, it may be said that as regards No. 1, the particular amount required by any individual baby will vary from time to time in accordance with the character of its environment and its physiological activities. Food is only required for four purposes; these are:—

- (1) For the maintenance of bodily heat.
- (2) For the output of energy or work.
- (3) For growth and repair.
- (4) For the elaboration of secretions.

* A lecture delivered at 117, Piccadilly, London, during National Baby Week, 1922.

Since these requirements are constantly changing within comparatively wide limits there can be no such thing as a fixed or standard requirement for infants of any particular age or any particular weight, although for all practical purposes certain averages of requirements are extremely useful points of departure. These average needs have been ascertained by painstaking researches both of a clinical and laboratory nature, and we can state them now with very considerable precision. They are best expressed in terms of calories which are the only units which can accurately represent the energy value of all kinds of food.

A calorie represents the amount of heat which is required to raise one litre of water through one degree of temperature (centigrade), and which is capable of affording the energy necessary to perform 2,975 foot-pounds or 425 kilogramme-metres of work. If you can estimate the total expenditure of energy of any baby as measured in calories, and you know the caloric value of the food, it is quite easy to calculate the total quantity you must give it in the 24 hours. The caloric value of breast-milk or any artificial substitute made up to this standard is 20 per ounce, while that of sugar, fat, and protein are 116, 263 and 116 respectively.

As far as the caloric value of food is concerned it is quite easy to supply the correct amount as long as you know the energy requirements. But it is by no means immaterial whether you supply all the required energy in the form of carbohydrates, fats or proteins, or in some particular combination of them.

What we mean by balance is the particular combination in which you give these three necessary varieties of food. In each case there is a particular combination which is better than any other, and it should be our object to get as near to this optimum as possible. The balance as it exists in breast-milk is undoubtedly the best balance for the majority of infants, but it by no means follows that it is the best balance under particular circumstances for every individual child. Circumstances alter cases! The balance in breast-milk is altogether different from the balance in cow's milk. The human baby may be able to live and maintain relative health on a food of the same balance as that on which a calf will thrive, but it will never attain its maximum of health under such circumstances.

In breast-milk the proportion of protein is low as compared with the percentage of the non-nitrogenous elements, *i.e.*, 1.5 per cent. as compared with 7 per cent. of sugar and 3.5 per cent. of fat, whereas in cow's milk the percentage of protein is 4 per cent. as compared with 4.5 per cent. of sugar and about 3.5 per cent. of fat. Infants who are brought up on unmodified cows milk with its excessive protein content suffer ultimately in various ways. Their gastric functions become over-developed and clamorous. Further, infants fed on these lines suffer from a combination of symptoms of the nature of recurrent bilious attacks or cyclic vomiting, which become more marked and characteristic during the 2nd, 3rd and 4th years of life. They suffer from dirty complexion, dark lines under the eyes, foul breath, offensive stools and strong smelling and acid urine. A study of mammalian milks of different kinds shows that nature provides a milk of a different balance for the young of animals with different natural habits. It always seems to

me to be running in the face of providence to defy Nature's ruling and give the human infant a larger proportion of protein than is provided in breast milk.

The caloric value and balance having been adjusted, it is next necessary to consider the question of the accessory factors as laid down in rule 3. Vitamines have assumed so much importance in the public eye that they appear almost to have ousted consideration of other accessory factors. Far more immediately important are the organic and inorganic salts. An infant will die in a few days if you attempt to feed it on a salt-free diet, whereas it will live for months on one which is vitamine-free.

In addition to mineral elements such bodies as lecithin, cholesterol and animal extractives are absolutely essential to good nutrition. Some of these may be reduced to the vanishing point if infants are fed on cow's milk seriously diluted with water. I have recently made a practice of adding to milk, dilutions, a small quantity of soup made from bones and vegetables in such way that it contains a good proportion of all the required accessory factors. The recipe for preparing such a soup is as follows:—

Take one pound of veal bones, chop up, and allow to simmer with 1½ pints of water and one tablespoonful of malt vinegar for about 6 hours; then add a handful of mixed vegetables (green, roots, leguminous, etc.), and allow the broth to simmer for one hour longer. Then strain and allow to settle into a firm jelly.

A small quantity of such soup—4 ozs. as a maximum for the 24 hours—mixed with milk dilution will, I believe, afford the required allowances of all the accessory factors, including salts in organic combination and a liberal supply of calcium.

The 4th rule is no less important than those which have preceded it. Cow's milk, even in its dilute modifications, is far more indigestible than breast-milk, and should not be given to the young baby, in whom the functions of digestion are inadequately developed, without previous predigestion by artificial digestives such as extract of pancreas or Fairchild's peptonising powders. It is very easy to teach an infant to digest by gradually reducing the degree of artificial predigestion. It is just as important to make provision for the evolution of the normal functions of digestion as it is to avoid symptoms of indigestion by only giving varieties of food which come within the range of existing digestive capacity.

The final point is the importance of regulating the intervals of feeding, the best interval being three-or four-hourly feeds, according to the needs of the baby.

Even when all these rules have been obeyed, there still remains the danger of the introduction of pathogenic organisms, or dirt, into the food in the course of its preparation. The food should be prepared with great attention to cleanliness, and should be sterile when given to the child. Boiling the milk does not alter its caloric value, but it may have some influence upon the potency of the salt and vitamine content, but this alteration can be provided against by giving a modicum of bone and vegetable soup as above described.

Should the food not be free from pathogenic germs, all the preceding precautions cannot save the child from the many and great dangers of artificial feeding.