

INFANT FEEDING.¹

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THE feeding of infants under one year of age presents one of the most important, and frequently one of the most perplexing, problems which confronts the physician.

To cover the subject in detail is not the purpose of this paper; but rather to bring out a few points which may be of interest.

It is during the early months of infancy that the future welfare of the child is provided for, as well as its present growth and wellbeing. At this time much can be done to favor or retard; frequently the question is decided during the first three months.

The child must be fed so as to avoid the immediate dangers of acute gastroenteric disturbances, but also to guard against some of the more chronic diseases, as rickets, scurvy, or marasmus. To feed thus, we should not be deceived by the temporary or apparent success which frequently follows the use of improper foods. Reference is made especially to the numerous proprietary foods which are in the market, advertised freely, used by the laity with no knowledge of the requirements for proper nutrition, and frequently not too wisely by the profession. It must be remembered that a growing infant requires the same elements for its nutrition as the adult, but in different and more digestible forms.

The ideal food for an infant is a good breast milk, or rather one which agrees with the individual, and on which it shows a steady gain in weight from week to week. In selecting a substitute for human milk, we should seek one which corresponds most nearly to it in its constituents. The best substitute for human milk is that of the cow, properly modified, as will be shown by comparison with woman's milk, and also by comparison with some of the more common proprietary substitutes.

Freshly drawn human milk is bluish white in color, sweet to the taste, usually alkaline in reaction, but sometimes neutral, with an average specific gravity of 1.031. Cow's milk has a specific gravity of 1.028 to 1.033, and is acid in reaction. It is more opaque, due partly to the fats but also to the calcium phosphate which is combined with the casein. The total solids are slightly more abundant.

The average human milk contains 4% fat, 7% sugar in the form of lactose, 1.5% proteids, and .20% salts.

The average cow's milk contains 3.5% fat, 4.5% sugar, also in the form of lactose, and 4% proteids. It is thus seen that the chief difference lies in the quantity of the proteids and sugar: cow's milk containing nearly three times as much proteid and about two thirds the amount of sugar found in woman's milk.

The difference in the amount of fat is much less. In some breeds the fat may exceed that in woman's milk.

The proteids of cow's milk are more coagulable than those of woman's milk, as is shown by chemical tests and, also, by the infant's stomach. This is

due to the abundance of casein, whereas lactalbumin is more abundant in woman's milk. There is no particular difference in the fats, except the globules in cow's milk are slightly larger.

By a comparison of woman's milk with the following foods it will be seen that the constituents are all out of proportion to the requirements of a growing infant and that some contain substances foreign to any known milk.

Nestlé's Food, which is well known, contains 5.48% fat, 11% proteids, 45.57% soluble carbohydrates, consisting of dextrins, cane sugar and lactose. It contains in addition to this excess 29.95% starch, a substance which a child under nine months of age does not digest, as the starch ferment is not secreted.

Mellin's Food contains .31% fat, 10.7% proteids, no milk sugar, but 82.57% carbohydrates, consisting of dextrins, dextrose and cane sugar. It does not, however, contain starch.

Malted milk contains 2.66% fat, 15.18% proteids, 67.91% carbohydrates, including cane sugar.

Ridge's Food contains 1.11% fat, 11.93% proteids, 2.91% soluble carbohydrates and 77.96% starch.

One other preparation to which attention was recently called, Lacto-Preparata, contains 12.35% fat, 14.51% proteids, 63.68% milk sugar. In the advertisement it is stated that the different ingredients are in the same proportion as in mother's milk, and that the addition of boiled water renders it in every respect exactly like woman's milk in appearance, food value and digestibility. The analysis shows that it contains about three times the proportion of proteids and carbohydrates found in woman's milk.

The difference between these preparations, modified with water to correspond with milk, may be seen another way by reference to the table:—

	Breast Milk.	Mellin's Food.	Malted Milk.	Nestlé's Food.	Ridge's Food.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Fat	4.00	0.04	0.39	0.76	0.16
Proteids	1.50	1.50	2.28	1.54	1.07
Soluble Carbohydrates	7.00	11.56	10.18	6.38	0.41
Insoluble Carbohydrates	4.19	10.91
Inorganic Salts	0.20	0.45	0.50	0.24	0.07
Water	87.30	86.45	86.65	86.89	86.78

— Holt.

It is thus seen that these foods are deficient in fats and that they contain an excess of carbohydrates, consisting for the most part of forms not found in milk, and some of them for which an infant has no digestive ferment. The fats and proteids, moreover, are of vegetable origin and not animal.

The statement is frequently made that many children apparently thrive on some one of these preparations. They may increase in weight, but there is not a corresponding increase in strength or in the power to resist disease. It is their easy digestibility which gives a false sense of security. That they may at times serve a useful purpose is admitted, but their continued use is dangerous and frequently leads to disaster. They are useful

¹ Read before the Middlesex North District Medical Society.

in later childhood, and in some cases where we wish to withdraw the fats and proteids for a short time only. We should not be influenced too far by the statements of those interested in the manufacture and sale of these preparations. We would not accept their opinion on a question of diagnosis or treatment. Why, then, should we accept their ideas of what constitutes a proper diet for a growing infant?

Under the etiology of scurvy, Holt states that in most cases the diet has been either some form of proprietary food or condensed milk, and that it may occur when fresh milk has been added. The essential cause of rickets is dietetic, although surroundings are to a lesser degree a factor.

That the best results may be obtained, the fats, proteids and carbohydrates must be supplied in the proper proportions. The food should be of animal origin and not vegetable, as an infant is a carnivorous animal. These proportions can be obtained within a small fraction of 1%, by the proper modification of cow's milk.

That milk may be modified intelligently, it may be well to consider briefly the requirements for proper nutrition.

The proteid elements are used to replace the continuous nitrogenous waste. They alone may sustain life, but by so doing a great excess is required, and the digestive powers are sorely overtaxed. In feeding cow's milk, especially during the early months of infancy, they should be reduced somewhat below the percentage in woman's milk, owing to their less digestible character; but in so doing there is great danger in keeping an infant for too long a time on a low proteid. They should be gradually increased provided there are not contra indications. Insufficient proteids are indicated by anemia, feeble circulation and a general failure of nutrition; later an inability to digest the other elements.

The fats are closely associated with the proteids in the building up of the body. They are not only heat producers, but they tend to diminish nitrogenous waste, so that the whole energy of the proteids may be expended in the growth of the body. They add to the body weight by being stored up. They aid in the absorption of the inorganic salts. A nursing infant requires a greater proportion than the adult.

A large part is discharged in the stools, to which fact is due their soft consistency. The carbohydrates are important as heat producers, but they are also converted into fat and so go to increase the body weight. The proportion required in infancy is smaller than in adult life.

The form which is supplied by nature is milk sugar. While this form is preferable, it is not so essential as that the fats and proteids be of animal origin and obtained from milk.

The reasons for modifying cow's milk are to reduce the proteids to the proportions found in woman's milk and to make up the deficiency of the other elements.

If plain cow's milk is reduced so that the proteids are in the same proportion as in woman's milk, the other elements are reduced to about one third the desired quantity.

No attempt will be made to present any method

of milk modification which can equal the laboratory for accuracy, but one which will enable us to prepare a mixture approaching closely the proportions found in woman's milk, and one by which, if intelligently carried out, the mother or nurse can attain good results. This can be done if we have a cream of known strength. Cream varies in strength whether obtained by the separator or by skimming.

If obtained by the gravity process, it varies with the method of skimming and also by the length of time which it has set.

The idea frequently prevails that cream is a substance entirely different from milk. Analyses show that it is essentially milk with an excess of fat, the other elements not being materially changed.

The proportion of proteids and carbohydrates vary slightly in different analyses, but the differences are so small that for practical purposes they may be disregarded.

These variations may be seen in the following table:—

	Whole Milk.	Cream.			
Fat	4.00	8.00	12.00	16.00	20.00
Sugar	4.30	4.30	4.20	4.00	3.80
Proteids	4.00	3.90	3.80	3.60	3.20
Salts	0.70	0.70	0.64	0.60	0.55

—Holt.

It will be noticed that the diminution of the proteids, even in 20% cream, is less than 1%.

The mixed milk of a herd is preferable to that of a single cow, for the reason that its quality is less likely to be disturbed by the feed or disease.

It is the custom of the writer to set the mixed milk from a herd of sixty cows in a cylindrical can holding ten quarts, placed in ice water. At the end of eleven hours, approximately the lower three-quarters are withdrawn. This leaves in the can a layer of cream and a layer of milk, which is then drawn, mixed and sent to the ward, where the various mixtures are prepared by the nurse.

By testing the fat of this mixture, it is found that the upper five pints or upper quarter of the morning's milk averages 10% to 10.5%, a very slight variation. The night's milk set and drawn the same way gives a fat of 12% to 13%; so that instead of using the upper five pints the upper three quarts are used, and a cream averaging 10% to 10.5% fat is obtained. To account for this variation in the strength of the cream, it was found that the night's milk averaged 3.6% to 3.8% fat, and the morning's milk about .4% less. Allowing, then, that this cream contains 10% fat and about 4% proteids and 4% sugar, it is evident that one ounce diluted twenty times will give .5% fat, .2% proteids and .2% sugar. One tablespoonful of milk sugar added to this will raise the percentage 2%.

For convenience the twenty-ounce mixture is used as a basis for figuring the percentages. Thus if eight ounces of cream, two and one-half tablespoonfuls of milk sugar, one ounce of lime water, and boiled water to twenty ounces are ordered, a mixture is obtained containing 4% fat, about 6.6% sugar and about 1.6% proteids, which closely resembles mother's milk.

It is rarely necessary to feed a higher proportion of fat than can be obtained by this method.

If a high proteid and a low fat is desired, it can be obtained by adding the fat-free milk from the bottom of the can, or by the addition of the white of an egg.

This method can be carried out in the family by using any glass jar with cylindrical sides for raising the cream.

When a fat analysis cannot be made, the essential thing is a cream of uniform strength. The upper quarter, set as described above, may be used if it is remembered that the percentage of fat may vary from 10% to 13%.

The mixture having been made, the required amount for each nursing should be measured into bottles, plugged with cotton, and Pasteurized for twenty minutes, then placed on ice till used. Pasteurization can be done by placing the bottles in a pail or kettle with a cover, and raising the temperature to 167° F. This does not change the character of the milk, but does destroy the ordinary forms of bacteria. Boiling causes a greater coalescence of the fat globules and also changes the character of the other elements.

Minute directions should be given the nurse or mother for the care of all bottles, glasses and utensils which come in contact with the milk.

The nursing bottle should be washed in cold water and scalded after each nursing; it should then be filled with cold water till used again, when it should be scalded immediately before filling with milk.

The nipple should be boiled, turned inside out and kept in cold water, to which has been added a pinch of soda bicarbonate.

Rubber tubing connected with a nursing bottle should never be used.

A bottle should not be warmed over for a second feeding.

It may be well to call attention briefly to a few of the signs and symptoms which are valuable guides in preparing a mixture for an individual case.

Insufficient sugar is usually indicated by a failure to gain properly in weight, provided the other elements are in the proper proportions. An excess of sugar is indicated by colic or thin green watery stools. It may also be indicated by the eructation of gas, or the regurgitation of food.

One of the most important indications of a low fat is constipation, and the stools are harder and dryer than normal. These stools are, however, occasionally seen with a 3% or 4% fat.

Vomiting or regurgitation of food an hour or two after nursing is indicative of an excess of fat. The bowels may be loose and small masses of fat may be passed. Occasionally there is colic.

The most valuable sign of an excess in the proteids is the passage of curds in the stools. There may be diarrhea or constipation, frequently a green movement. These symptoms may, however, all result from over feeding, even when the different constituents are in the proper proportion.

The occasional occurrence of some of these symptoms, if of temporary duration, is not necessarily an indication to change the food; but their persistence demands investigation, for it is the neglect of some of these danger signals which may lead to failure.

In feeding milk, any one fixed formula should be avoided. The mixture should be prepared to meet the requirements of each individual case.

In sick and debilitated cases do not increase the strength too rapidly. The age of the child is to be considered, but that is of less importance than the weight, size, growth and digestive powers which must be closely observed, that the best results may be obtained.

[Analyses from Holt, and by the author.]

Reports of Societies.

THE NEW YORK STATE MEDICAL ASSOCIATION. NINETEENTH ANNUAL MEETING.

HELD IN NEW YORK CITY OCT. 20-23, 1902. ALVIN A. HUBBELL, M.D., OF BUFFALO, PRESIDENT.

FIRST DAY.

The annual meeting of the Council and Fellows was held on this day, and, in this way, most of the executive business was transacted before beginning the regular scientific sessions. The Committee on Conference with the State Medical Society reported that it had been agreed that the association should take the name of the old state society, and that the society should accept the association's new plan of organization, and that the two organizations should apply for a new charter, the new state society to be the sole representative of the state in the American Medical Association. The joint committee had not yet come to an agreement with regard to the code of ethics.

The Council and Fellows then adopted for the State Association the plan of associated medical defense of its members, which has been in practical operation during the past year in the New York County Medical Association.

The following officers were elected: *President*, Dr. FREDERICK HOLME WIGGIN of New York; *Vice-President*, Dr. WILLIAM H. THORNTON of Buffalo; *Secretary*, Dr. GUY D. LOMBARD of New York; *Treasurer*, Dr. E. H. SQUIBB of Brooklyn.

SECOND DAY.

THE PATHOGENESIS OF ECLAMPSIA.

Dr. FREDERICK P. HAMMOND of New York read this paper. After discussing some of the theories concerning the etiology of this affection, he stated that the degree of toxicity of the blood formed a fair basis for prognosis in the individual case. Where the urine was of low specific gravity and was excreted in diminished quantity, even if no albumen were present in it, the condition was one which called for active prophylactic treatment. Ten minims of the tincture of the chloride of iron, given in lemon juice three times a day, would increase the quantity of urinary solids, and a proper dietary would reduce to a minimum the accumulation of toxins in the system. The morning meal should consist of fresh fruit, tea or coffee, and water, but no meat. Only at the mid-day meal should red meat be allowed. When headache, disturbed vision and vertigo were present, the patient should at once be