

DIARRHOEAS IN CHILDREN

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THIS paper does not deal with diarrhoeas which are secondary to other diseases, such as tuberculosis, typhoid or coeliac disease, but only with the diarrhoeas which originate in the alimentary tract. These are most frequently met with and are the most mistreated.

The term diarrhoea is used to include all conditions attended by frequent loose evacuations of the bowels due to increased peristalsis and intestinal secretions.

First, let us bear in mind the normal evacuations before we consider the abnormal. The normal breast-fed infant may have as many as three to four stools a day, while the artificially-fed infant rarely has more than one or two, the character depending on the type of feeding. The stool should be a homogeneous, yellow, pasty mass—deep orange in the breast-fed, and lighter in the artificially-fed. The odour should not be offensive nor should it be highly acid.

There are several underlying factors upon which diarrhoeal diseases depend. Their greatest frequency belongs to the first year of life; after the second year there is a notable diminution both in frequency and severity of the disease. The extreme susceptibility in infancy is due to several causes.

First, the digestive organs are severely taxed to provide for the growing body. The gastro-intestinal tract is very delicate in structure and is constantly exposed to injury, either mechanical, chemical or to infection. Everything which lowers vitality increases the liability to diarrhoeal diseases: chronic indigestion, marasmus, malnutrition and rickets are especially important factors.

Intense heat acts as a powerful depressant of the vital forces, disturbing metabolism, causing indigestion and diarrhoea.

Artificial feeding is an etiological factor of first importance. A small percentage of the severe cases are among the breast-fed, and fatal cases, are extremely rare. It is among the poor, where mothers go out to work, where breast feeding is only partially done and artificial feeding badly done, that we see the highest mortality of diarrhoeal diseases.

Next to this we must place ignorance and stupidity. The simplest rules of hygiene are either unknown or ignored, and the importance of cleanliness, fresh air, regularity are not appreciated.

Impure milk plays an important rôle; that it can cause diarrhoea is established beyond question.

In the years 1901-3 an investigation was undertaken by the Rockefeller Institute and the Department of Health in New York City. The following points were noted :—

1. The results in infant feeding obtained with milk of different degrees of purity, both in winter and summer—shown by gain or loss in weight, gastro-intestinal disturbance and death rate.

2. The relation, if any, existing between the number of bacteria present in milk and the frequency of diarrhoeal diseases.

3. Whether there was a specific organism in milk to which diarrhoeal disease could be ascribed as a cause.

4. Whether the practice of heating milk, pasteurizing and sterilizing affected the results.

5. To what extent older children as well as infants were affected by bacterial contamination of milk.

Observations were made in 592 bottle-fed infants living in tenement houses in New York—202 observed in summer, 390 in winter. The infants were all well when observations were begun and they were watched for a period of three months, being visited regularly by a physician. Samples of milk were frequently examined as to number and character of bacteria. The infants were fed (a) condensed milk, (b) cheapest grade milk, (c) better grade delivered in bottles, (d) best bottle milk. (d) milk modified at a milk station and dispensed in separate feedings.

During the winter the mortality was 2.3 per cent, and in only one case was it due to intestinal disturbance. The health of the infants was not appreciably affected by the kind of milk and by the number of bacteria it contained. The different grades varied much less in bacterial contamination in winter than summer, the cheapest milk averaging less than 750,000 per cc.

During the summer the mortality was 10.5 per cent, four-fifths of the deaths being due to diarrhoeal disturbance. The worst result was found in those whose food was either a cheap grade of store milk or condensed milk, and in those who received the poorest care.

The number of bacteria which milk may contain before it becomes harmful is not at all uniform. Of the usual varieties present no deleterious results were seen until the number reached one million per cubic centimetre. Much above this mark injurious effects were manifest; below this, other factors seemed of greater importance in causing the diarrhoea. Thus in condensed milk, though bacterial contamination was relatively small, yet results were almost as bad as in highly contaminated milk. No relationship could be discovered between any special form of bacteria and the occurrence of diarrhoea.

To test the heating of milk, observations were made during two summers upon 92 infants taking milk prepared at a milk station. The infants were divided in groups. To one was given milk pasteurized (155 F. for 30 min.). To the other group was given raw milk. All infants were well at the beginning. The results are interesting.

	Pasteurized milk	Raw milk
Number	41	51
Remained well	31	17
Severe diarrhoea	10	34
Average number days illness	4	11½
Deaths	1	2

Thirteen of the fifty who were on raw milk were changed before the end of the season because of severe diarrhoea, but for this the result of raw milk feeding would have been even more unfavourable. A similar experiment was done a third time, with the same results. Although the number of cases are small, the results show that in hot weather raw milk, even though from a good source but at time of feeding highly contaminated, causes diarrhoea in a much larger number of cases than when previously heated.

As to age, observations seem to show that milk from healthy cows, produced under cleanly conditions, and kept at a temperature below 70 F., although containing a large number of bacteria, sometimes amounting to many millions per cc., may be taken over a long period of time by children over three without any harmful effect. An orphan asylum containing 650 children, ranging from three to fourteen years of age, used during the entire summer milk in which the bacterial count varied from 2,000,000, to 20,000,000, yet there occurred no case of diarrhoea of sufficient severity to call a physician. The milk was kept cold but unsterilized. Numbers certainly appear to count for less than was once supposed. (The fact should not be overlooked that milk contaminated by careless handling is more liable to contain pathogenic organisms.)

Though it is clear that excessive bacterial contamination is highly detrimental to infants, we must look for other factors also. Another exciting cause is atmospheric heat, especially the stagnant heat of houses. This may act by interfering with normal digestion and metabolism, leading to the formation of injurious substances within the body which excite diarrhoea; or it may favour the excessive growth of bacteria present in the digestive tract.

There are many classifications of diarrhoea. I find that given by Hill, of Boston, the simplest. He divides them according to etiology:

1. Mechanical
2. Fermentative
3. Proteolytic
4. Infectious

The diagnosis is made from the clinical symptoms and from stool inspections. Much can be learned from the latter.

1. *Mechanical Diarrhœas* are rare the first year, but common during the second. They result from indigestion of unsuitable food and from overfeeding of digestible food. Certain physical conditions of milk allow massive coagulations in the stomach. These coagulations passing the pylorus may act as foreign bodies, and set up a mechanical diarrhœa in young infants. Such diarrhœas are unaccompanied by fever, toxemia and prostration. The patient is readily restored to health by a bland diet preceded by a brisk cathartic, such as castor oil or calomel. Castor oil dr. 2 to dr. 3 to a year-old baby is most effective; an insufficient dose only aggravates the trouble.

Brennerman lays stress on boiling the milk when such curds occur. This aids in bringing about changes which prevent the appearance of diarrhœa from this cause. It causes the milk to coagulate in small flocculent curds, thereby making it more digestible.

2. *Fermentative Diarrhœas*. These constitute a large proportion of diarrhœas. In this the saccharolytic flora, i.e., bacteria which develop in a carbohydrate diet, are the offenders. On investigating the history, it is found that this type is rarely sudden in onset. Usually there has been a prodromal period when the child has regurgitated a greater or smaller amount of sour watery fluid about an hour before meals, and has had short seizures of abdominal discomfort. Usually there is an excoriation of the buttocks. The type of food is high in carbohydrates. The stools are characteristic in that they are acid in reaction, copious and watery, and they have a lactic acid odour. They are often green in colour, and contain mucus with some solid fecal matter. There is no toxemia, and rarely more than a little fever, until the child begins to show effects of dehydration.

Treatment. Many deny the value of preliminary purgatives. If the child is seen early a forced evacuation is most helpful. This should be followed by a copious high enema of a 5 per cent. to 10 per cent. soda bicarb. solution. If the lavage does nothing else it neutralizes the acids which irritate the bowels, and prevents proctitis. During the first 12 hours food should be given sparingly, but water fed in quantity. Warm water is less likely to stimulate peristalsis than hot or cold. The food especially fitted for this type of diarrhœa is Finkelstein's protein milk. The preparation of it is difficult, and seldom done right outside of the diet kitchen. There is in the market a dried protein milk which need only be mixed with water, and has been found a valuable food in these cases. If protein milk is not available, buttermilk or sour milk, made out of fat-free milk, may take its place. A good way to make fat-free milk is to buy a

small enema can, insert a cork into the opening at the bottom, pour in the milk, and allow it to stand until all the fat has risen to the top. When needed, take out the cork and drain off the lower part of the milk, which is practically fat free.

It is well to begin with a small amount, which is increased as the child's tolerance is established. During the second 12 hours one-third enough milk is given to meet the child's caloric needs. No sugar should be added. The third day milk should be increased to half of the child's caloric needs and sugar may be added. Corn syrup and malt sugar are the sugars of choice. Mellin's food is nearly 60 per cent. malt sugar. Twenty ounces of a half to one per cent. Mellin's food mixture is the maximum to be used. From day to day milk is to be increased until the child's nutritional needs are met, i.e. 16 to 25 ozs. of milk with 3 per cent. sugar in 24 hours. The sugar must be increased very slowly.

The success of the treatment is evidenced by a decreasing number of stools. If the stools become foul-smelling, carbohydrate must be increased and protein decreased.

With the diminution of the number of stools normal formulæ are to be substituted by replacing the protein or sour milk with a boiled milk mixture, beginning with a bottle a day and gradually increasing.

3. *Proteolytic Diarrhœa*. This is due to the predominance of protein-splitting bacteria. It is characterised by frequent evacuations of a yellowish or brownish stool, semi-solid or liquid, alkaline in reaction, and most often of an exceedingly foul odour. There are some patients whose stool has a peculiar mousy odour, others whose stools are odourless, these characteristics depending on the nature of the proteolytic organisms. It is safe to assume that the predominant bacteria in a stool not definitely acid, nor the result of infectious ileocolitis, are proteolytic. Some of these diarrhœas are very mild, while others are so severe as to threaten life.

In the mild cases there will be anorexia, pallor, sunken deep-ringed eyes, temperature normal, subnormal or slightly elevated. Pulse and respiration tend to be slow and irregular. In the mild cases a prominent feature is the intermittence of the diarrhœa, the child having two or three stools a day, followed by constipation. There is great distaste for food; the child may even refuse to drink water. Most of these children are restless, irritable, though occasionally lethargic. The symptoms are made worse by ingestion of milk, and its withdrawal is followed by a diminution of symptoms. The severe case is simply one of intensity. The stools are more frequent and more liquid, and toxic symptoms more severe. Restlessness and irritability are extreme, but there may be coma. Impending acidosis is seen by deep sighing and irregular breathing. Dehydration in

these cases is less apparent than in the other types, but the need of injection is not the less urgent.

Treatment. The dietetic treatment is obvious; complete withdrawals of proteins for a short period. For 24 hours nothing is to be given but a 10 per cent. sugar solution or a dextrin decoction. Ordinary cane sugar is not effective. Milk sugar is far the most desirable form in which sugar can be given. The best way is to initiate the treatment with a lactose sol. $2\frac{1}{2}$ oz., to 30 oz. of water, in divided doses q 2 h. At the same time, especially if the child shows symptoms of dehydration, a normal salt solution should be given by mouth, one to two ounces at a time. In those cases where toxemia is well developed or when dehydration is advanced, 100 to 300 cc. of normal saline should be given intraperitoneally. This may be repeated in 12 to 24 hours if indicated. After 24 hours of lactose solution feeding, cereal gruel may be added to diet and the lactic acid solution reduced to 5 per cent. sol. Farina, or oatmeal gruel is made by cooking $1\frac{1}{2}$ oz. of cereal and $1\frac{1}{2}$ oz. of lactose in 30 oz. of water, boiling one hour and then straining.

Exclusive carbohydrate diet is maintained for one or two weeks. Milk is then gradually added. Begin by giving 1 oz. of a milk mixture, composed of 5 ounces of milk to 20 oz. of water. After a few days a second ounce may be added, and a few days later a third ounce. Malt soup feedings may be begun. Care must be taken to keep the milk used in the first feedings at a minimum; the milk is gradually increased, adding 1 oz. at a time until the proper proportion of milk is reached. Raw milk should never be used for infants under treatment for diarrhoea. Boiling renders it less readily attacked by bacteria, in addition to changing it physically and chemically so as to make it more digestible.

Older children with proteolytic diarrhoea are more comfortable and return to health more rapidly if milk is excluded. These are best fed with cereals, toast, fruit juice, simple puddings of cornstarch, broth thickened with barley, sago, tapioca, cornstarch or arrowroot. Potato is difficult to digest and should be the last to be added, as it is often responsible for a relapse. Cooked fruit *purées*, passed through a sieve, are especially valuable in this type of diarrhoea; they supply energy, act as diuretics, and discourage the growth of proteolytic flora.

(To be Continued)

Success is the goal of the human race, and in every calling work and merit are inalienable conditions of success.

Illusive schemes and combinations, excessive and sensational claims, fraudulent methods, and gambling speculation all fall in the long run. Temporary success may be obtained, but it is the success of the thief and carries with it the pangs of apprehension and alarm.