

NUTRITIONAL DISTURBANCES IN INFANCY  
DUE TO OVERFEEDING.\*

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That overfeeding in infancy is apt to be followed by indigestion is a universally recognized fact. The term, however, usually suggests the giving to an infant of a food that is too rich in one or more food elements, or that is unsuitable to age and conditions, or that is given in too great variety and at too short and irregular intervals. We have not been sufficiently impressed with the fact that even an appropriate artificial food and one properly adapted to the individual case, can give rise to the profoundest nutritional disturbances when given in quantities that exceed the actual economic needs of the infant. In this discussion the term overfeeding will be used in this restricted sense, the giving to an infant of too great a total quantity of good, clean, fresh, unexceptionable, properly modified cow's milk, usually, but not necessarily, at too short intervals.

Continental writers have emphasized the danger of overfeeding in this sense for many years. Biedert was among the first to teach a doctrine of minimum feeding (*Minimalnahrung*), which called for the smallest amount of food necessary to insure perfect development with normal increase in weight. This most desirable minimum daily amount of food he placed at from 150 to 200 grams of fluid per kilogram of body weight, this amount to contain about 80 calories.

Heubner determined along metabolic lines the number of calories, per day, per kilogram of body weight, necessary to insure proper development in normal breast-fed babies. This so-called energy quotient he found to be about 100 from the third week to the end of the sixth month; a gradually diminishing amount after that time to about 80 or 85 at the end of the first year. He established 70 as the approximate energy quotient necessary to maintain a weight equilibrium.

Clinical observations, each extending over many months, have been made on breast-fed infants by Feer, Beutner, Budin, Schlossman, Nordheim, Czerny and Keller, Reyer and others, that have all confirmed rather closely the figures set down by Heubner, so that these can be used as a standard.

Budin of Paris uses a simpler measure. He feeds all of his babies "especially after the fifth or sixth month, or better, weighing 6 or 7 kg., one-tenth of their body weight daily of pure, sterilized, undiluted milk," and claims to have no symptoms of the overfeeding against which he warns so emphatically.

In this country, through the teachings of Rotch, Holt and their followers, we have come to think of nutritional needs and overfeeding rather in terms of percentage than of amount. Certain standards are set up as guides to the strength of food a child should receive, and these naturally find expression in more or less elastic tables of percentages of different food elements adapted to average healthy infants at various ages. Weight is given comparatively little significance, and for conditions other than normal we have most indefinite data.

To Czerny and Keller we are indebted for a symptomatology of overfeeding that, in its totality, is new and original, and is so clean cut and palpable that it alone can serve as a real guide to determine when proper amounts are beginning to be exceeded. Their exhaustive

and truly scientific work<sup>1</sup> that has appeared only in part has placed the whole subject of infant feeding on as firm a foundation in reason and scientific investigation as that on which any other department of medicine stands. Finkelstein has put it none too strongly when he says: "When in the future we shall speak of the attainments of scientific pediatrics, Czerny and Keller's work will be placed first, and everyone who wishes to occupy himself in a scientific manner with the problems of infant feeding must find his foundations there." I wish to acknowledge that this paper and our own recent work in infant feeding has been, in a large measure, inspired by this work, and especially by the chapter on *Milchnährschaden*, a term perhaps most briefly and fully translated by the title of the present paper; a chapter in which they picture a definite and convincing symptom-complex resulting from overfeeding.

For some time we have recognized and studied this clinical picture; we have also, during that time, calculated energy quotients in all of our feedings and have been much impressed by the results. It seemed to me additionally instructive to study our old cases in this light. I have, therefore, recently gone over the histories of our old cases at the Northwestern University Medical School, as well as over my own private cases, to see what our past habits have been with reference to overfeeding, both from a calorimetric and a clinical or symptomatic standpoint, and from this, if possible, to make a deduction as to the prevalence of overfeeding under present conditions in this country.

Our conditions have been rather favorable for such a study. In practically all of these cases we have a complete history of the exact amount of certified milk or cream, of definite strength, that was used, together with the exact weighed amounts of other ingredients used in the mixture. Our weight record, on our own scales, is quite complete, and the rest of the history as to bowel movements, disposition, etc., sufficiently so for this purpose. In nearly all cases the foods were prepared at the diet kitchen—always individually for each case. We have, then, all the necessary data for calculating approximate energy quotients. We have considered the caloric value of 1 ounce of 4 per cent. milk at 21; 1 ounce of 16 per cent. cream at 54; 1 ounce of skimmed milk at 10; 1 ounce of sugar at 120; 1 ounce of cereal water at about 3. It is a simple matter, then, to multiply the number of ounces of each ingredient in the twenty-four-hour food by its caloric value, to add the products, divide by the number of pounds the baby weighs, and multiply the result by  $2\frac{1}{5}$  to reduce from pounds to kilos. The end product is the energy quotient. By caloric value is meant the number of large calories, the latter being the universally recognized unit of measure of food value as expressed in terms of heat production and representing the amount of heat required to raise 1 kilogram of water from 0 C. to 1 C.

The dispensary babies were fed by a number of different instructors connected with the department of pediatrics. Until recently we all used the percentage method. We have, however, gradually come to look on fats with that feeling of caution that pervades our own literature (Holt, Southworth, Jacobi, etc.), and I believe that all of us fed considerably under the usual amounts rather than above them, especially of fat. In the last year most of us have stopped using cream altogether and have used only milk dilutions with the addition of carbohydrates. I believe, then, that I can assume that our

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1. Des Kindes Ernährung, Ernährungsstörungen und Ernährungstherapie.

conditions were representative, or at least not an exaggeration, of what is being done in this country by those who use these methods only.

I was convinced before looking over our records that overfeeding was a factor in our results, but after studying them, *I am positive that, in our past, overfeeding has been a factor in the production and maintaining of nutritional disturbances in infants that towers above all others.*

It seemed impossible to tabulate these cases and have the results of any more value than are general statements, so I have not attempted it. As far as calorimetric overfeeding is concerned, according to Heubner's standard, it can safely be stated that all of our cases were overfed ultimately, except those that were, at the time, suffering from some acute disorder. By overfeeding is not meant simply the exceeding of Heubner's energy quotient of 100, but rather using energy quotients of 120, to 150, to 200—in one case, fed by a physician not connected with the dispensary, who had had peculiarly valuable experience in infant feeding by the percentage method, an energy quotient of 330 was given for two weeks.

#### SYMPTOMS OF OVERFEEDING.

As to symptoms due to overfeeding, it can be said with equal certainty that they were present in the great majority of our babies, at some time, during the period that they were under our care. So typical and uniform are these symptoms that we associate with overfeeding that they form a clean-cut, easily recognized clinical entity. Individual cases differ from the well-marked type only in the number and the degree, rather than in the character of the symptoms, that make up this symptom-complex. Many of our cases gave only a few slight manifestations of trouble that had little or no bearing on the general condition of the child; in others there was every evidence of the profoundest nutritional disturbance.

An infant that is overfed becomes restless, often most strikingly shown by broken and restless sleep at night. At the same time it becomes constipated in a very characteristic manner; the bowel movements that were yellow in color and were soft and moist, become pale gray, hard and dry, will not mix with water, and are of the color and consistency of putty—so that they will roll from the diaper without leaving it soiled. The odor is strong and suggests decomposition. The urine has commonly a strong ammoniacal odor and easily produces irritation of the skin.

At the same time it is noticed that the child gives evidence of a fundamental disturbance of nutrition. It becomes pale, its tissues lose their tone, the abdomen becomes soft and moderately distended with gas. The child becomes less active; it plays less. A striking symptom, often the only one that gives any concern to one not familiar with this picture, is a failure to gain in weight on the same food, or a greater quantity of food, that up to this time has produced normal or even abnormal gain in weight. Still more striking is the fact that a continuation of the same amount of food, or of an increased amount, will regularly produce, not only a stationary weight, but after a time, a steady loss in weight. A further increase in food may again produce a temporary gain, often a large one, but it only makes surer and quicker the ultimate loss in weight.

#### OTHER RESULTS OF OVERFEEDING.

If this course is persisted in one of two results will follow: The child finally presents the picture of atrophy

or marasmus. This we see, not rarely, in the pale, constipated, marantic baby that gives the history of having had a stationary weight, or steady loss in weight, for months, in spite of the fact that it has taken enormous quantities of cow's milk and has had no diarrhea or evident digestive disturbance.

The other result is the acute gastrointestinal catastrophe that may occur at any time in this course, and that is characterized by vomiting, diarrhea, prostration, loss in weight, often by fever, and, usually, by the inability to take more than the smallest amounts of cow's milk, sometimes for many weeks. This condition we have seen more commonly in weaker children, with poorer digestion, especially in those who were rapidly or excessively overfed; while in more robust children, with better digestion, in whom the overfeeding was a more gradual process, though excessive, there has been more of a tendency to the typical chronic course outlined above. In weaker children one often sees one catastrophe follow another, especially in hospital cases, the only progress being made during the period of low feeding generally recognized as necessary after such an upheaval; while in the stronger children the severest symptoms of overfeeding may be present for months before such a catastrophe occurs, if it occurs at all.

In many of these more chronic cases there is evidence of rickets, with the train of nervous symptoms that accompanies that disease. Two other symptoms very frequently appear at some time during the period of overfeeding. One of these, eczema, has been very frequent in those of our cases that have shown other well-marked symptoms of overfeeding, especially the characteristic constipation. It varies from the small, rough, reddish spots in the cheeks that are so well known, to the most extensive and intractable involvement of the cheeks, forehead, scalp, chest and back, and other parts of the body.

The other symptom alluded to is anorexia. Loss of the normal keen appetite of infancy, so that the child needs to be coaxed to finish its bottle, is very common in these cases that are well marked, but a refusal to take more than an ounce, or even less, at a time, is characteristic only of the graver cases, and then often forebodes a catastrophe. We have come to look on this symptom as due to overfeeding in practically all cases in infancy in which there is not some other evident acute, or chronic disorder. There is at present at Wesley Hospital a child of 17 months weighing 16 pounds in whom an increase of food from 26 ounces of milk, 10 ounces of barley water, 1 oz. of cane sugar, to 30 oz. of milk, and 6 oz. of barley water produced in one day a florid eczema of chest and back, spreading later to the cheeks and scalp, and within five days, loss of appetite, restlessness at night, fever and constipation, with hard, dry, gray bowel movements.

While most of our babies gave some evidence of overfeeding, and many of them had well-marked manifestations, such as constipation, pallor, restlessness, eczema, stationary weight, etc., there were very few in whom the final outcome was wholly bad. The ultimate picture of marasmus, of course, came to us in its finished state and was never produced by us. Some of our cases showed undoubted rickets, although under satisfactory control throughout. In general, we considered our results excellent. In some cases this was due not so much to our methods as to the fact that these cases can often stand a surprising amount of overfeeding. While many of our cases did well for weeks and months on energy quotients

of 150, many gave evidence of serious trouble on those of from 110 to 120 or even less. Since calculating energy quotients in all of our cases we have seen few, if any, cases that required over 100, and we have usually regretted it if we have exceeded that "unsurpassable amount" (Heubner). In general, we have found the energy quotients of from 100, at the beginning, to 80, or less, at the end of the first year, as a wholly satisfactory working basis as to the approximate amount of food a child should get.

#### FAT THE DISTURBING ELEMENT.

There seems little doubt that the disturbing element in this condition is the fat of cow's milk, and that its non-digestion, non-assimilation and the resulting disturbed intermediary metabolism are the cause of this train of symptoms. Outside of the negative evidence that proteids and carbohydrate and salts can not produce this picture, there is very positive evidence that fat does. The characteristic dry, hard, pale bowel movement has been found to consist largely of the insoluble salts of the fatty acids (*Seifenstuhl*). If the amount of fat is increased all symptoms are increased. If the fat is sufficiently diminished, and the other food elements are left undisturbed, or increased, there will be rapid improvement. No other result in infant feeding is more striking than the mathematical certainty with which the dry, gray bowel movements of these infants, no matter what their ages, are replaced by characteristic smooth, nearly odorless, curdless, brown, salve-like bowel movements, when they are fed straight, undiluted skimmed milk—a food that is nearly fat free, but contains the maximum amount of proteids and carbohydrates. Nor is the general improvement less certain than that of this one symptom.

The immediate cause of this condition is probably an acidosis (Czerny and Keller), as shown by increased excretion of ammonia in the urine. This is due to the fact that alkalies are withdrawn from the body by the fatty acids produced in the intestines and to satisfy the normal acid products of metabolism ammonia is called on.

The following three cases may be cited as typical cases of overfeeding, in which the percentage method was used:

CASE 1.—Baby F., well developed, strong, healthy baby. Birth weight, 9 pounds 12 ounces. Maternal nursing alone for three weeks, with severe indigestion and considerable loss in weight. After the first month fed artificially on cream and whey mixtures; later on cream and milk. At four months weighed 13 pounds 8 ounces. At five months weighed 13 pounds, a loss of 8 ounces in one month. During this month the child had received a food mixture containing fats 3.6, proteid 2.0, sugar 7.0. Seven feedings of 5 ounces each were given at three-hour intervals. The energy quotient here was about 116. It did not take the food well and would often leave one or two ounces of a 5 ounce bottle. Child was rather pale and thin, but muscular and active. Cranio-tabes well marked. Bowel movements were pale yellow and somewhat dry and offensive. During the fifth month a sudden severe diarrhea occurred, with from twelve to fifteen green bowel movements a day. It was put on barley water for a short time and milk, later cream, was slowly added. Baby now took food eagerly and after the initial loss due to diarrhea and hunger diet, gained one pound in two weeks. Soon began again to refuse to take all of the 5 ounces of food, so the food was made more concentrated: Fat 4, proteid 2, sugar 7.5; the number of feedings was kept the same, as also was the frequency and the amount. The energy quotient now was about 137. Child became rather constipated, the bowel movements were pale, greenish yellow, and offensive, but it gained 20 ounces in eighteen days on this stronger food.

Two weeks later there was no gain in weight, the bowel movements were dry, pale and offensive, the baby was pale, and refused food more and more. Finally it would take only an ounce or two at a time, and was losing in weight. In three months it had gained only 1½ pounds. The mother then, on her own initiative, fed the child potato, bread and gravy, porridge, cracker, soup, etc., and stopped coaxing her to drink milk, the child soon taking less than a pint a day. There was immediate improvement. The child was happier and slept better, bowel movements became normal, and the child gained a little over a pound a month for four months. At eleven months the child weighed 19 pounds. Still rather thin and pale, but marked improvement over former condition. Only very slight evidence of rickets.

In this case the most serious results of overfeeding were avoided by the mother unconsciously meeting the two therapeutic indications, decreasing the milk and increasing the carbohydrates.

CASE 2.—Baby B., weight 11 pounds at birth; maternal nursing insufficient. Was rather underfed for two months, with stationary weight; for the next four months it gained steadily about 6 ounces a week on cream and milk mixtures. During the last two months of this time the child was badly constipated, one or two hard, dry, smooth, pale yellow bowel movements a day, offensive in odor. Eczema was first noticed about this time on cheeks, and later about the ears, then on the forehead and scalp, with one or two small spots on the body; it was variable in intensity. Child always rather pale, but very active and a good baby. During this time the food had a percentage never stronger than, fat 3.6, proteid 2.0, and sugar 6.5, but the energy quotient was from 160 to 165. The cream was diminished and the milk increased so that at nine or ten months the child was practically on about 40 ounces of whole milk, with the energy quotient under 100. Weighed 19 pounds at nine months, and the general condition was excellent. The eczema, which in this case was the chief symptom, had slowly disappeared, and was practically gone at nine months.

CASE 3.—Baby O., a typical case with all the classical symptoms, weighed 7 pounds at birth, was wet-nursed five months, when it weighed 16 pounds 4 ounces. Had been on milk and cream mixtures since then. At seven months the food mixture consisted of fat 3.0, proteid 1.5, and sugar 6.0, with an energy quotient of 86.

At eight months the child weighed 18 pounds and the food mixture was: Fat 4.0, proteid 2.0, and sugar 7.0; the energy quotient being 128.

At nine months: Fat 4.0, proteid 2.8, sugar 6.0, with energy quotient 130.

At ten months: Fat 4.0, proteid 3.0, and sugar 6.0; energy quotient 130.

At eleven months the child weighed 18 pounds 14 ounces—a gain of 14 ounces in three months; the energy quotient was 128.

When one year old the child weighed 19 pounds 8 ounces. The food was milk 40 ounces, sugar 1 ounce, with an energy quotient of 108. During the last few months this child has had no acute illness. Has been out of doors almost constantly. Bowel movements have generally been rather dry, grayish, often nearly white and offensive, typical *Seifenstuhl*. Has had slight eczema for some months, especially recently; is rather pale, does not drink well, and often leaves an ounce or two of food. When thirteen months old, had for several days refused bottle more and more, and finally would not take it at all. The eczema was well marked, and vomiting and diarrhea now set in. Baby was put on barley water for eight days, then milk was added slowly to 40 ounces. At sixteen months of age the child weighed 20 pounds 10 ounces, a gain of 10 ounces in two months. In the last few months the child had taken a daily mixture of milk 40 ounces, sugar 1 ounce, in addition to some carbohydrate food, granos, flaked wheat, etc. During the greater part of this time the stools had been hard, light-colored, and dry.

The child at sixteen and one-half months was rather pale, the anterior fontanelle measured 1 inch across, the head was rather large and square, and the tissues soft. The ribs were

slightly beaded and the costal borders somewhat flared; the abdomen was soft and moderately distended.

This child lived under very favorable hygienic conditions, was out of doors nearly all of the time, was only moderately, but persistently, overfed, and yet developed mild rickets and gained only 24 ounces from the eighth to the eleventh month, or 2 pounds 10 ounces from the eighth to the sixteenth month.

#### TOO LARGE AMOUNTS VERSUS TOO LARGE PERCENTAGE.

So far cases have been cited in all of which high percentages of fat have been used—only once a little above 4 per cent., in the rest 4 per cent. or under. In a paper read before the American Pediatric Society in May, 1904,<sup>2</sup> Holt cites five cases resulting from too high percentages of fat (5 to 7+ per cent.). These he details under the following headings:

HOLT'S SERIES.—CASE 1.—Overfeeding with high fat, rapid increase in weight and progress in development till 8 months old; then general convulsions followed later by tetany, laryngismus, fatty liver (?). Recovery after three months' illness.

CASE 2.—Prolonged feeding with high fat, notwithstanding which constipation and the development of moderate rickets followed by acute disturbances of digestion with repeated convulsions.

CASE 3.—Overfeeding with high fat; convulsions.

CASE 4.—Habitual vomiting aggravated by high fat; serious gastric catarrh produced; finally cured by stomach washing.

CASE 5.—Feeding with high fat; eczema, habitual constipation and finally habitual vomiting.

So striking is the similarity of this symptomatology to that of the cases I have just cited that there can be no reasonable doubt as to an identical cause, i. e., too much fat. This excess Holt repeatedly states in terms of percentages as if the essential point were too high a percentage of fat—not too great an amount. It may seem a trivial matter to point out this difference of viewpoint—and yet right here is the very kernel of the matter—the essential difference between feeding by a percentage method and a method that determines the amount of food that should be given. That these digestive disturbances are not due to too high percentages of fat *per se*, can be demonstrated with the ease and certainty of a laboratory experiment by any one who will feed a number of babies on low milk dilutions in excessive amounts; they will get the identical symptoms that Holt has described and that are undoubtedly due to too much fat.

A year ago I started about a dozen babies on simple milk and water, or milk and cereal water dilutions (1 to 3, to 1 to 0), with about 5 to 7 per cent. sugar. Most of these babies were sick and required a preliminary one or two days' hunger diet. Such immediate results in the form of smooth, rich yellow, well-digested bowel movements I had never seen before. Gradually all those assistants in proteid digestion from alkalies to peptonization were dropped without any appreciable difference, except, in some cases, a beneficial one. These babies were not constipated, they gained rapidly in weight from the start—there was not that long anxious wait in the sicker cases that we were accustomed to in those we fed on whey and cream and cereal water mixtures. One after the other, however, these babies did become constipated, often very much so, with pale, hard, dry bowel movements. Some failed to gain after the first rapid gain. They became restless and did not sleep well at night. Many had eczema and some would not take all of their

food. Some of them gained steadily and well and seemed in good condition. Practically, all were ultimately constipated except those in whom sudden severe attacks of diarrhea broke out, often without any apparent reason. We had been taught, and had ourselves taught, that simple milk dilutions would "invariably cause constipation," so this result was not unexpected, and the other symptoms were considered secondary to it. In certain cases I added cream and found, to my astonishment, that the condition was not only not relieved, but often made much worse.

I then began to estimate energy quotients in all cases, and found that all of these cases had been overfed, being given usually energy quotients from 120 to 170 during the period of eczema and maximum constipation, or just before the catastrophe. Since we have calculated energy quotients in every case constipation has given us comparatively little trouble and the other symptoms of overfeeding no longer occur. We have heard much of "fat diarrhea" in the last few years. Fat constipation deserves at least an equal place in our nomenclature. We have come to look on fat as the constipator—and the one condition in which we have never seen constipation is the use of straight, skimmed milk, the maximum proteid and minimum fat food. A single case from this series will illustrate what has been said:

CASE 4.—Baby E., born March 14. Weight 10 pounds (?) and was wet nursed one month, but lost in weight; so was then fed on modified milk. Was first seen May 12, when it weighed 8 pounds 12 ounces. Had had a good deal of colic, with three to four bowel movements daily, but was now constipated. Started the child on barley water for twenty-four hours, then 5 ounces of milk was added daily until it received the following: Milk, 15 ounces; barley water, 25 ounces; sugar, 2 ounces. The energy quotient was 154. The composition of the food was: Fat, 1.5; proteid, 1.5; and sugar 6.0. Eight 5-ounce feedings were given daily at three-hour intervals.

May 5: Weighed 9 pounds 12 ounces, a gain of 1 pound in one week! The baby was well in every way, so the food was continued. *This enormous gain in weight is characteristic of early rapid overfeeding, and we now consider such a gain an imperative indication for reduction in the amount of milk unless the energy quotient is very low.*

May 30: Weighed 10 pounds 3 ounces; had two or three bowel movements a day; yellow, not offensive, but a little too hard and pale, so that baby grunts a great deal in passing them. Slight eczema. The same food was continued.

June 9: Weighed 10 pounds 13 ounces. Food the same; energy quotient, 123. Two bowel movements daily, which were whitish, dry, formed and offensive. Eczema increased, spreading to chest and back as well as face. On account of the small gain of 2 ounces in one week, 2 ounces of milk was added, and three days later 2 ounces more. The food mixture was: Milk, 19 ounces; barley water, 21 ounces; milk sugar, 1½ ounces, giving an energy quotient of 126. The food strength was: Fat, 1.9; proteid, 1.9, and sugar, 6.0. The number of feedings, quantity and intervals remained as before.

June 30: Weighed 11 pounds 11 ounces, a gain of 14 ounces in fourteen days.

The increase in food, as often happens, even when there was no previous gain, increased the weight, but brought on the catastrophe: a diarrhea for ten days. For a time there were bowel movements every ten to fifteen minutes of a pale, yellow, curdled, cheesy, sour and offensive character. Child was restless, slept little and cried much.

July 3: Baby was put on barley water for two days and the crying stopped, and it slept well. Five ounces of milk were added, with six to eight bowel movements daily resulting, so child was put on barley water for four days longer.

July 7: Weighed 11 pounds 6 ounces. The addition of milk produced the same bowel condition as before. After several attempts to relieve conditions, including trying buttermilk (?) (not fat free), the mother decided to take the baby to the

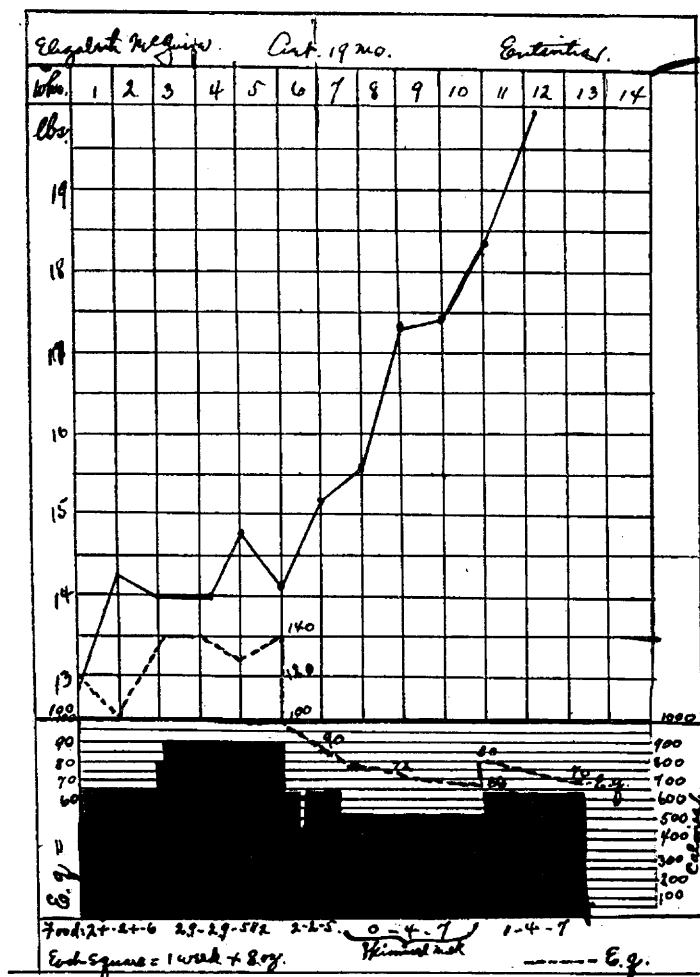
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country and the further history is unknown. The child never had 2 per cent. of fat, although  $3\frac{1}{2}$  months old when the food disagreed, and was typically overfed on  $1\frac{1}{2}$  per cent. of fat.

The following case had less than 3 per cent. of fat at 19 months, but had severe symptoms of overfeeding on an energy quotient of 140 from which she recovered at an incredible rate on less milk—later skimmed milk with very low energy quotient; gaining 5 pounds 14 ounces in 51 days, nearly 13 ounces a week for over seven weeks.

CASE 5.—Baby McGuire (see chart).

August 20: Entered Wesley Hospital, 18 months old; had an enteritis of three weeks' standing; was thin, pale, haggard and



Case 5.—Baby McGuire. Rapid gain on e. q. of 120 followed by loss. No gain for 3 weeks on e. q. of 140. Enormous gain on e. q. of 66 to 80. In general as e. q. is lowered gain is increased, and vice versa. Maximum gain of 1 lb. 11 oz. in one week on e. q. of about 70. Food at this time: Skimmed milk 40 oz., cane sugar 1 oz.

listless, with eyes sunken and a temperature of 101 F. Frequent green, curdy, slimy bowel movements. She was given stimulation and placed on cereal water for four days, then milk was added, three ounces a day.

August 29: Weighed 12 pounds 13 ounces; bowel movements had been normal for several days, but had been losing to this time. Energy quotient was slowly raised to about 120. Food mixture consisted of: Milk, 25 ounces; cereal flour, malt, water, 23 ounces; cane sugar,  $1\frac{1}{2}$  ounces. Six 8-ounce feedings were given daily at three-hour intervals.

September 5: Weighed 14 pounds 4 ounces, a gain of 23 ounces in seven days. Food was the same, with an energy quotient of about 100.

September 14: Weighed 14 pounds, with food as before;

bowel movements were normal. On account of loss, the food was increased to milk, 35 ounces, barley water, 13 ounces, cane sugar, 1 ounce, fed as before, with the energy quotient 140.

September 21: Weighed 14 pounds on same food. One bowel movement daily; several days none; dry, pale, gray and hard. Child had not slept as well as before and showed eczema about the chest.

September 26: Weighed 14 pounds 12 ounces. Had gone home. The bowel movements were hard and dry, so that the child played with one, as with blocks; the eczema was worse. The same food mixture was given in five 10-ounce feedings at four-hour intervals.

October 3: Weighed 14 pounds 1 ounce. Child had not taken food well since she went home and will only take a few ounces at a time. Had five or six bowel movements daily, always gray or whitish; these were at times hard and formed, again soft and cheesy. Never green. Child was cross and peevish and restless at night, but had no fever. The milk was cut down to 20 ounces; barley water, 20 ounces; cane sugar,  $1\frac{1}{4}$  ounces, giving an energy quotient of 98.

October 10: Weighed 15 pounds 3 ounces, a gain of 1 pound 2 ounces in eight days. Had not been cross since the food was changed and took it well almost at once. Slept well and the diarrhea had stopped, but bowel movements are still a mass of whitish curds; the rest pale and yellow.

October 13: On account of the curds was put on straight skimmed (centrifuged) milk, 40 ounces; sugar, 1 ounce. Energy quotient of 75.

October 24: Weighed 15 pounds 10 ounces. Two good, yellow, normal bowel movements daily; no curds two days after being put on skimmed milk; the same food continued.

October 31: Weighed 17 pounds 5 ounces, a gain of 1 pound 11 ounces in one week. Energy quotient 66. Bowel movements normal.

November 7: Weighed 17 pounds 7 ounces. Still on the same food. On account of the small gain child was put on whole milk, 10 ounces; skimmed milk, 30 ounces; cane sugar, 1 ounce. Energy quotient, 80.

November 14: Weighed 18 pounds 5 ounces, a gain of 14 ounces in one week. Child had perfect digestion, good color, good disposition and slept well. Is getting solid; laughs and plays.

November 23: Weighed 19 pounds 15 ounces, a gain of 1 pound 10 ounces in nine days, on the same food. Energy quotient, 70. General condition excellent. Since this child went home it has received a small amount of additional food. I asked the mother many times as to just what this consisted of. She always stated positively that the child had one thin slice of bread about 2 inches square and a half cup of beef soup daily, and, every other day, she chewed a piece of meat the size of one-half a finger. This child had been so sick that the mother had given her up; the latter had been cautioned so often and so hard against giving too much food, and her faith in the last milk was so implicit that I believe her statement is accurate. To make doubly sure I asked the nurse in charge of the diet kitchen to go to the home and investigate the matter. She was equally convinced that the child was getting no more than the mother stated. For a study in actual, rather than relative energy quotients, the caloric value of these could be added to the milk.

Such enormous gains are not so alarming nor do they carry the same therapeutic indication, as when whole milk is given, especially in excessive amounts. The offending fat is not present in sufficient amount to cause trouble.

From all that has been said I believe the inference is justifiable that overfeeding to the point of producing well-marked symptoms is not only widely prevalent in this country, but the rule. Our present methods, especially the percentage method, must then be inadequate to prevent this. If by one method—that of using simple milk dilutions with the addition of carbohydrates, and with no definite check on the total amount to be given, a 7 months' old child among our cases, whose food is in-

creased from 10 to 15 ounces of milk can develop extensive eczema, restlessness, typical constipation, later diarrhea, fever and loss in weight, then this method alone is not so accurate as it would be if combined with a procedure that would tell us in advance that that child's energy quotient was being sent up from a dangerous height of 130 to a disastrous one of 152. And if a "schedule for an average healthy infant (Holt) of 6 months calls for a fat 4, proteid 2, sugar 7 mixture of 30 to 48 oz. then that schedule is not even approximately safe in itself when it permits us to go from a proper energy quotient of 90 to a decidedly dangerous one of 145 if our healthy child weighs 16 pounds, as it ought to. These tables uniformly recommend excessive amounts and too short intervals that must lead to overfeeding unless we are familiar with the above picture of overfeeding and have had an unusual experience. The percentage alone is an unreliable and irrational check even in the healthy child. If we could have our cases under ideal control at all times we might be satisfied with recognizing symptoms of overfeeding as they arise. But with our conditions, especially in those of limited experience, something safer and more tangible is necessary—something that will forestall symptoms rather than permit us to recognize them. We have become convinced that in our feeding cases determination of energy quotient is simply indispensable. Those of us who have adopted it have become enthusiastic over it as we have over no other procedure in infant feeding. It is this point that I wish to emphasize especially, that this determination of energy quotient is not merely an interesting study in physiology, but an intensely practical procedure of the greatest value not alone to the scientific pediatrician, but to any man who feeds babies and wants to be sure of results. It alone enables him to tell approximately how much food his baby really needs, and by keeping this in mind, and departing from it only when clearly indicated, he will avoid on the one hand a prolonged underfeeding that is by no means uncommon and, on the other hand, a still more disastrous overfeeding.

It is true that caloric value represents only one function of food, that of heat production. It is equally true that in our overfeeding we have to do with a real milk overfeeding and that the amount of milk, and not the caloric value, would perhaps be the surest guide to the prevention of this symptom-complex. In a child at Wesley of 17 months and weighing 16 pounds that has been mentioned before, a change of milk from 26 oz. to 30 oz., but with an actual lowering of energy quotient from 96 to 90, due to lessening of sugar and barley water, produced nearly all of the symptoms of overfeeding within a few days. And yet these symptoms would doubtless have arisen with less increase of milk if the higher energy quotient had been maintained. These are theoretical considerations. For practical purposes the method advocated is amply sufficient, and the most desirable one so long as we are all using well balanced but widely different food mixtures and need a common measure.

It need hardly be mentioned that this method is not to be used to the exclusion of other things. To feed a baby one needs all the help obtainable from every source. The baby itself must be seen, it must be weighed regularly and accurately, its disposition must be inquired into, its bowel movements must be seen, not alone described by the mother, the actual preparation of the food must be supervised. Nor is this method applicable only

to the simpler milk dilutions, plus carbohydrates, that we use. Its use is indicated nowhere so much as in the use of high fats in the conventional percentage method, for obvious reasons. Such indications for increase of food as apparent hunger, restlessness, failure to gain or loss in weight, or mere lapse of time, need hardly be discussed after what has been said.

The treatment of this condition, after it is present, is more or less evident from its pathogenesis. In general the fat must be reduced and the carbohydrates increased to take its place. In milder cases it is enough to do only the former, together with lengthening the interval to at least four hours. In severer cases the milk must be greatly reduced and a gruel or flour water added. If this is not sufficient to produce normal bowel movements and gain in weight, more sugar must be added, either as cane sugar, or preferably, according to Czerny and Keller, as maltose. Milk sugar has not shown itself serviceable clinically. To meet this one indication of overfeeding with milk Keller's *Malzsuppe*<sup>3</sup> is intended. This or another combination of milk, flour and cane sugar or maltose, modified to meet the individual conditions, is best kept up for a number of weeks because these children are not readily lead back again to normal amounts of milk. The milk is then gradually increased and the carbohydrate diminished until the usual milk modification is again reached. Rapid improvement and ultimate cure are the rule.

We are handicapped in not having a desirable maltose, or a serviceable malt preparation, in this country. The ordinary malt extracts can not be used in large amounts on account of their laxative action, and the use of maltose itself is not feasible. In some cases we have used for this purpose a well-known "baby food" that is composed largely of maltose, with excellent results.

In all of these cases, but especially in the severer ones, the most rapid and certain *immediate* improvement is produced by the use of a fat-free milk as we would expect. I believe it is a matter of indifference whether this fat-free milk is sweet, i. e., skimmed milk, or whether it is buttermilk. So uniformly certain is the action of buttermilk in these cases, as in nearly all other digestive disturbances of infancy, that its well-deserved popularity is easily understood, and we can see why Baginski considers its use in dyspepsia, for example, as "almost a specific, like antitoxin in diphtheria." After a considerable experience in the use of skimmed milk I am convinced that its action is the same as that of buttermilk, and that in both cases the striking results are due to the fact that we have a nearly fat-free food. If this is true then the use of skimmed milk has obvious advantages over that of buttermilk. It can be used in practically any strength, and is, of course, best prepared with the addition of sugar, and often also of flour, or a gruel, so that the absence of fat is compensated by the greater amount of carbohydrate in its place. The only objections to the use of skimmed milk in these cases of overfeeding are that it is rarely necessary to eliminate the fat so completely, and, secondly, it is often difficult to return from a fat-free to a fat-rich food in a reasonable length of time. Constipation and curds in the bowel movements quite regularly follow the addition of even a small amount of whole milk, i. e., of fat, and the change must usually be made very gradually.

3. Wheat flour, 50 g., are stirred up in .33 l. of cow's milk and run through a sieve. In a separate vessel 100 g. of Loeflund's Malzsuppen extract is dissolved in .66 l. of lukewarm water. The two mixtures are then poured together and under constant stirring are brought to a boil.



Just what part food intervals play in the production of overfeeding is difficult to estimate. Of the therapeutic value of longer intervals than the customary two or three hours there can be doubt only in the minds of those who have not tried it. If cow's milk does not leave the healthy baby's stomach before the end of  $2\frac{1}{2}$  to 3 hours, and much later in the case of the sick one, then it would certainly seem indicated theoretically that the minimum interval should be 3 hours in health and 4 hours in pathologic conditions. A considerable and remarkably uniform experience has convinced us that the 4-hour interval is indicated in all pathologic cases and is preferable in all normal cases. Besides giving the stomach more rest and making the baby more comfortable, this long interval is a potent factor in preventing overfeeding, for it is manifestly more difficult to put enough food into a baby's stomach to overfeed it if that organ is filled only five or six times a day than if that process is repeated eight or ten times a day.

A word as to the ultimate results from feeding less fat. This consideration naturally limits itself to rickets and to the prevalent teaching as to its etiology, i. e., that these children get too little fat. There certainly is at the present time no real evidence that too small an amount of fat is an important factor in the causation of rickets, and there is an ever-increasing conviction that rickets can, and does, develop under our very eyes in spite of the fact that our cases are fed much fat—yes, often because of that fact (Holt and see babies O and F). Moreover, it is far from any one to recommend a small amount of fat. The child needs proportionately more of it early in the first year than at any other time in life, but that amount need never exceed an equal amount of proteid that the child can take with ease.

#### CONCLUSIONS.

1. Overfeeding is so prevalent in this country that it is the rule.
  2. Overfeeding is second to no other factor in the pathogenesis of infant feeding.
  3. Overfeeding presents an easily recognizable, definite symptom-complex.
  4. The percentage method is inadequate to prevent overfeeding, the well-known feeding "schedules for an average healthy infant" of a given age fostering it by recommending excessive amounts; and, moreover, mere percentage leaves undetermined the amount of food the baby gets.
  5. To feed rationally and especially to prevent overfeeding it is necessary to know how much food the baby is getting in proportion to its body weight, best expressed in terms of energy quotient.
  6. The disturbing element in overfeeding with cow's milk is the fat.
  7. Fat in excessive amounts regularly produces constipation—proteids never do so.
  8. It is never necessary to give more fat than proteids of cow's milk.
  9. The interval between feedings should be 4 hours.
- 6857 Wentworth Avenue.

**Rising by Another's Downfall.**—A man may become grasping and avaricious, remarks the *Chicago Clinic*, even in the pursuit of knowledge, but when that avarice begins to work destruction to others, he becomes a menace to the general weal, however virtuous his quest. No individual in the medical profession has the right to pursue any course for his own benefit which is carried on at the expense of others and without their consent.

## CHOICE OF METHODS FOR DILATING THE GRAVID UTERUS.

EDWARD P. DAVIS, M.D.

PHILADELPHIA.

During the early months of gestation the induction of labor by gradual dilatation is not indicated. Circumstances arising which make the emptying of the uterus necessary, demand that this should be done as a surgical operation under anesthesia. Dilatation by graduated metal bougies, aided by bladed dilators and followed by curetting and gauze packing form the procedure most available in these cases. The indications for this procedure are pernicious nausea with fulminant toxemia, incomplete abortion, and hemorrhage from the uterus caused by or accompanying disease of the ovum. Gradual dilatation should be declined in these cases, because of the inefficiency of the gradual method and its danger of septic infection.

After the early months of gestation it may be necessary to dilate the uterus artificially for acute and threatened toxemia, placenta prævia and for the premature separation of the normally situated placenta.

#### IN TOXEMIA.

In selecting indications for this procedure we must distinguish between the nephritis of pregnancy and acute toxemia of hepatic origin. The nephritis of pregnancy is not an indication for the rapid emptying of the uterus. These cases can be safely managed by other means. Should treatment not prove successful, placental changes will occur which will ultimately bring about the death of the fetus and be followed by its expulsion. Should treatment be successful, the mother may proceed to full term, while in some cases the treatment addressed to the condition results in exciting labor. The presence, then, of albumin in considerable quantity and of casts in the urine with symptoms of nephritis does not indicate a rapid emptying of the uterus.

When the patient has altered pulse tension, however, the nervous disturbances of toxemia, obstinate constipation and evidences of disintegration of the blood which accompany this condition, the uterus should be emptied as soon as is consistent with the patient's safety. Remembering the tendency to thrombosis and embolism and the hepatic congestion in these cases, that method must be selected which will do the least violence to the patient's tissues, thus avoiding the products of such violence, which received into the circulation increase the danger of thrombosis and embolism in the viscera. For rapid dilatation of the uterus, in these cases, whenever possible, the hand should be the instrument of choice. If one finger can not be introduced, metal bougies or bladed dilators may be employed until one or two fingers can be inserted. Bimanual dilatation with one or more fingers of each hand working synchronously in opposite directions is, in my experience, the most efficient method. This may be carried to the point where the membranes may be ruptured and version performed, or the membranes ruptured and the forceps used for delivery. Should the cervix prove unmanageable by the fingers, in my experience, Bossi's dilator employed to one-half or two-thirds its full capacity during thirty to forty-five minutes with anesthesia has proven harmless and efficient. Except in rare cases, full dilatation with Bossi's dilator should be avoided, because of the danger of serious laceration. Should these methods not prove sufficient, incisions of the cervix have given good results.

Vaginal Cesarean section for acute toxemia or threat-