

aid in their prevention.<sup>1</sup> Perhaps the American Medical Association might even see fit to establish a council on infant mortality and morbidity analogous to the other councils which have done such excellent work in their several fields of endeavor. Such a council could issue bulletins advocating certain procedures and broad principles and condemning unwarranted practices; or direct the agencies for child welfare in a manner which is not only suggestive but even authoritative. Thus could its influence be felt in a forceful and useful manner.

One of the greatest duties of this section is the development of the many efficient but little-known men throughout the country into writers of papers and educators of the public. To this end every effort should be put forth to insure the attendance on the sessions of the section of the 1,500 or more who, according to the information in the American Medical Association Directory, either practice pediatrics exclusively or are particularly interested in this branch, instead of the small average of 150 as at present. Our very efficient secretary has made an excellent start this year in sending out an invitation to a thousand to participate in this session and I think this is a start in the right direction which should be continued year by year.

Have I placed an ideal for the pediatrician and this section of this association too high? I think not. We follow a noble calling in the profession of medicine; we study particularly the most important part of the race; we are striving through such study to make the race better physically and to place its members in a position where they can be important members of the human family and not weaklings. Any body of men which has these for its aims cannot have too high an ideal of equipment and service.

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## STARCH DIGESTION IN CHILDREN

WITH SOME CLINICAL OBSERVATIONS \*

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AND

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During the past few years many articles have appeared in the literature concerning the ability of both the infant and child to digest starch. A great deal has been added to our knowledge in regard to starch digestion in infants under a year of age, but few have dealt with the subject in children past infancy. It is our object to review the literature briefly and bring to notice some clinical observations we have made in the study of cases of the latter type.

Of the three different foodstuffs, namely, protein, fat and carbohydrates, which are ingested for the supply of energy, heat and tissue building, the carbohydrates will occupy by far the largest bulk, and if the various kinds of food classified under carbohydrates be compared it is found further that the greater

percentage is ingested in a form which necessitates greater chemical action in its preparation for absorption and assimilation than is required by any of the other members of this group. This form constitutes the starches, whose chemical analysis classifies them as polysaccharids and whose properties are very different from those of the simpler members of this large group.

In order that this more complex form of raw material may be utilized in the body it is necessary that it, like all other forms of food, undergo a change, a breaking down into simpler bodies. This alteration is brought about by the hydrolytic action of certain ferments, which are present in the digestive juices found in the course of the alimentary canal. Considering starch only, we find that by the action of the salivary and pancreatic juices, this substance is converted into dextrin and finally into maltose by the ferment maltase.

In working with these ferments it has been found that they are affected by different conditions; thus the velocity is increased by heat up to a certain point, at which a destruction of the ferment will occur. The introduction of a foreign body will in many cases cause a permanent or transitory inactivation of the ferment.

The digestion of starch commences in the mouth by the action on it of saliva, which contains the two ferments amylase and maltase. The former of these ferments acts on starch, converting it through the various stages of dextrans into maltose.

By the action, then, of maltase, maltose is converted into the more diffusible carbohydrate, glucose. All starches are found to be susceptible to the action of amylase although raw starches are very slowly hydrolyzed.

As human saliva is rich in ferments the large bulk of food entering the mouth should be properly and thoroughly masticated. Thus is seen the importance of teaching the child the advisability of this procedure.

It is important to consider here what action a foreign body has in inhibiting the action of the salivary ferments; thus far little work has been done to ascertain the inhibitory effect which stomatitis, infected tonsils and carious teeth produce.

By far the greater portion of amylaceous foods are attacked after leaving the stomach by the ferments of the pancreatic juice and the succus entericus, and it is interesting to note that if the ferments were entirely absent from the intestinal canal many of the carbohydrates would be capable of being absorbed from the intestines through the action of the cells of the mucosa in converting various sugars to glucose.

The action of the ferments on the carbohydrate continues ordinarily down the alimentary canal so long as any unchanged portion remains; finally the acidity present in the lower bowel becomes sufficient to inhibit or destroy the activating agent. Any portion still remaining unchanged is very liable to fermentation from bacterial action.

The question of the ability of the infant and newborn babe to digest starch has occupied the attention of physiologists and physicians for many years. Forty-four years ago Schiffer, and forty years ago Jacobi, demonstrated that the saliva of the new-born was capable of converting a small quantity of starch to sugar. In 1908 Friedlander in Cincinnati carried on a series of bead experiments in infants of all ages to ascertain the digestibility of various foodstuffs. About this time

1. The Virginia State Board of Health sends a specially prepared bulletin on the care of infants to the mother of every child whose birth certificate is filed in that office.

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Solera and Malay worked on the comparative digestibility of different carbohydrates and showed that the action of the ferments was dependent on the degree of "soluble starch" formed by previous preparation.

In 1912 Hess experimented on pancreatic ferments obtained by the use of the duodenal catheter, showing that amylase was present in infants 12 hours old, increasing greatly in quantity after the first month. Czerny and Kellar were the first to study the ill effects of the prolonged use of starch without the addition of milk and gave us a classification of this condition.

Finkelstein believes too much carbohydrate in the form of sugar has an irritating effect on the mucosa of the stomach and intestines, producing increased peristalsis and diarrhea and interfering with absorption and assimilation.

Hesenius concluded from observations he made that 90 per cent. of the starch given by mouth disappears and that not more than 10 per cent. is recoverable from the feces; he does not assume that this large percentage is digested and absorbed, for the element of bacterial fermentation invariably plays a large rôle in the destruction of undigested starch.

Cammidge states that the digestibility of starch is largely dependent on the way in which it is prepared and cooked. Raw wheat-meal is more rapidly assimilated than raw potato starch, but when the potato has been thoroughly cooked the difference is not nearly

excess of carbohydrate, combined with a deficiency of proteins and that a catarrhal condition of the alimentary tract was set up, varying in severity.

In 1911 Porter, after studying a great number of these cases, read a paper before the California State Medical Society in which he described cases in which the child showed partial or complete inability to digest starches properly. In the former cases the child often presented an urticaria, showed no gain in weight, had an enuresis, especially at night, and was very restless. In the more marked type in which the starch was not split up in the intestines, the child developed a clinical picture not unlike a long-persisting bacterial infection, with brown mucous stools, loss in weight and a large, distended abdomen.

It has been our custom in these cases to make the parents write out a four-day dietary consisting of the food the child has been having, with the quantity and hour of feeding tabulated. During this time the stool would be obtained before any treatment or change in diet began. A sample day's dietary usually ran as follows:

8:30 a. m.—Orange juice, mush and milk, hot cakes.

10 a. m.—Piece of bread and butter.

12:30 a. m.—Sliced tomatoes, baked potato, apple sauce  
glass of milk, bread and butter.

3 p. m.—Bread and jelly.

6 p. m.—Plate of soup, bread and butter.

GRADED AMOUNT OF STARCH AND FOOD REMAINS PRESENT IN THREE HUNDRED AND SEVENTY-TWO STOOLS  
IN CASES WITH DIFFERENT DIAGNOSES \*

Condition	Amount of Food Remains								Amount of Starch							
	None		Small		Large		Excess		None		Small		Large		Excess	
	Stools	%	Stools	%	Stools	%	Stools	%	Stools	%	Stools	%	Stools	%	Stools	%
Hypertrophied tonsils.....	38	13.5	112	39.8	109	38.7	22	8	92	32.7	103	36.6	53	18.8	33	11.9
Digest. disturb.....	11	28.9	19	50	5	13.1	3	8	13	23.6	23	41.8	10	18.1	9	16.5
Enuresis.....	3	27.2	5	45.4	2	18.1	1	9	1	9.1	7	63.6	2	18.1	1	9.2
Rickets.....	4	57.1	3	42.9	0	0	3	42.8	2	28.5	1	14.2	0	0.0	1	14.5
Other conditions.....	4	22.2	8	44.4	6	33.4	0	0	7	38.8	7	38.8	2	11.2	2	11.2

\* For example, of the stools in cases in which there was hypertrophy of the tonsils, thirty-eight stools, or 13.5 per cent., contained no food remains.

so marked. In chronic gastro-intestinal disturbances the absorption and digestion of starch is interfered with so that its use should be carefully regulated and controlled by a microscopic and chemical examination of the stools. Vegetables are better tolerated than bread, potato, rice and simple starchy foods.

During the past four or five years in the outpatient clinic of the division of pediatrics at the Stanford medical school, a routine examination of the urine and stools has been made in the majority of cases, especially in those showing any intestinal trouble, and in all the cases which have been examined for tonsil and adenoid operations. We have observed that there is a certain type of child whose dietary is made up principally of carbohydrates and a low protein content. Their stools show an excess of undigested starch and they are listed on our index cards as the "starch-type of intestinal indigestion."

As far back as 1868 Eustace Smith of London described a series of cases of this type in younger children which he called "mucous disease" and advised the exclusion of starchy foods and the examination of the stools.

Cautley described a condition which he called "carbohydrate fever" in children having more or less digestive disturbance, liability to recurrence and no apparent origin. He thought the condition was produced by an

In the great majority of these dietaries eggs and meat were not given, and bread, jelly, and cakes were invariably given between meals.

With such a dietary, extending over a long period of time, we would expect to find an excess of undigested starch in the stool, and in the case of an intestinal upset with diarrhea, the greater portion of the starchy food would come through the intestine with practically no splitting; this we found true, and such cases presented the distended abdomen, loss of weight, restlessness and the possible urticaria described above.

After studying this type of case we were anxious to know that percentage of starch appeared in the stools of children in fairly normal condition and on a fairly rational dietary. As it was impossible to obtain stools on a large series of children outside of the clinic, a series of fairly normal clinical cases was selected.

Our original series of observations consisted of a tabulation of 372 stool analyses from 338 children ranging from 1 to 14 years of age. The diagnoses were varied and consisted of:

Hypertrophied tonsils .....	267
Digestive disturbances (disturbances throughout the alimentary tract) .....	41
Enuresis .....	10
Rickets .....	6
Other conditions (bronchitis, eczema, jaundice, etc.)....	14

The examination of the stools was made in the clinical laboratory of Lane Hospital, on the same day the stools were passed; this consisted of the microscopic examination of smears stained with Lugol's solution, which stains the starch granules a characteristic dark blue. The amount of food remains was also tabulated for comparison.

These examinations were done under the supervision of one man and for practical purposes was the best method we could follow.

From the table it will be seen that the greatest percentage of excess starch occurs in digestive disturbances, namely, 16.5 per cent., and next is rickets with 14.5 per cent. In considering the tonsils cases, in which we have an excess in 11.9 per cent., I wish to bring out a few points:

First, in 232 of these cases in which the teeth conditions were mentioned in our histories, seventy-six children showed one or more decayed teeth.

Second, the majority of these children had chronically inflamed tonsils, with repeated attacks of tonsillitis.

Third, the reports on the dietaries of this series of cases showed that nearly all of them were fed over a long period of time on a diet rich in starchy food.

Granting the statement of Cammidge that some starch is always found in the feces of infants and children, we feel that the percentage of cases containing much and excess starch (30.7 per cent.) as calculated in the series of hypertrophied tonsils is unusually high.

At a later date it may be possible to submit a tabulation of stools taken from normal children, but this is not possible at present.

We feel after making these examinations and studying cases and dietaries that the following conclusions are worth bringing before you:

1. There is a type of indigestion in children presenting certain clinical manifestations brought on by the continued use of a diet composed principally of carbohydrates.

2. This condition can be cured by eliminating the starches somewhat and giving a mixed diet fed at proper intervals.

3. The successful treatment of these patients cannot be accomplished without giving the parents a written dietary, containing the nature and quantity of the articles to be given and the time of meals.

4. Frequent examination of the stools is absolutely necessary to aid in the diagnosis and check up the progress of the case.

5. Before attempting to correct the dietary errors the oral cavity should be carefully examined, as the presence of carious teeth, chronically inflamed tonsils and nasal secretions play a most important part in the proper digestion of the child's food.

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#### ABSTRACT OF DISCUSSION

DR. F. W. SCHLUTZ, Minneapolis: I would like to ask Dr. Yerington whether many of his patients showed marked skin manifestations; for example, eczema, and whether he noticed any greater tendencies to a catarrhal type of stool in these cases? Many of his cases apparently had hypertrophy of the tonsils. There is a disposition at present to interpret all these phenomena as expressions of a peculiar constitution. Possibly increased peristalsis would have some influence on the starch digestion.

DR. H. D. CHAPIN, New York: I take exception to the statements regarding barley water. Some years ago Dr. Jacobi pointed out that cereal water was exceedingly good as an addition to an infant's food. Its use became popular and it seemed to yield remarkably good results. Then the percentage method of feeding came into vogue and we were taught that it was important to get the percentage of all the food elements, proteins, fats and carbohydrates, in the same proportion as they were found in woman's milk, and we were taught that cereal decoctions were anathema—not at all scientific. It was observed also that those who were using cereal decoctions were getting the best results. So we experimented on dogs and other animals and found that the addition of a little starch made the protein more easily digestible and acted as a good attenuant to casein. As to the practical side of the question, one found it most humiliating, after having attempted to feed an infant according to accepted scientific principles without success, to have the parents go to the corner drug store, get a proprietary food for the infant and find that the baby fattened up in a short time. It is asserted that barley water is not found in mother's milk, but it is also true that the casein of cow's milk is not found in mother's milk. We must study this subject from the same standpoint and in the same way as we study science at large, and we must get the profession to look at the subject in the same way as they look at science at large. I have no sympathy with much that has been taught on the subject of infant feeding. The subject has become so complicated that the student and the general practitioner throw up their hands when they undertake to grapple with it. Each man has a method of his own which no one else can understand and which he himself sometimes forgets. We have been going from one extreme to the other and it is well to have the subject threshed out. We know that there are no cereals in mother's milk, but the casein of mother's milk coagulates differently from that of cow's milk and the cereal decoctions affect the coagulation. The proteins in the milk of different mammals all coagulate in a different way because they have a developmental as well as a nutritional value. Take the ruminant herbivora and we find that the casein coagulates in lumps which are intended to develop the motility of the animal's stomach, because the animal must feed on grass, grains, etc., and the stomach must be prepared to deal with them. In the milk of nonruminant animals the casein coagulates in soft, flocculent, jelly-like coagula which will pass out of the stomach easily. We find the protein of mother's milk midway between that of cow's milk and that of the non-ruminant animals. The enzymes act only by contact, and if they can get at the food elements they act with enormous power, and by adding starch the proteins are broken up into smaller particles exposing a greater surface to the action of the enzymes and are more easily digested. We should study this subject from the practical standpoint and find out what agrees with the baby and then find the scientific reason for its use.

DR. C. G. GRULEE, Chicago: My views are identical with those expressed by Dr. Chapin. I cannot agree with the ideas just expressed in the paper, for digested starch is changed into sugar, and if the starch is not changed into sugar it goes through the digestive tract undigested and acts like a foreign body. In my opinion, barley water as a diluent does no harm.

DR. L. PORTER, San Francisco: It is our practice to make a routine examination of the stools of every infant that comes in merely as a matter of interest and with the possibility in view that we may learn something. When starch is present in large quantities its elimination is always accompanied by symptoms of indigestion, and we find that these clear up following the withdrawal of starch. This seems to show that the disturbance is due to an intolerance of starch. A number of children during the second and third years of life present digestive disturbances due to starch indigestion, but we seem to have concentrated our attention on barley water. Dr. Northrup has given us the touchstone for the solution of these problems in the alliterative expression "feedings to fit." If we could put this up over every doctor's desk we

would accomplish more than by discussion. Some babies digest starch and some do not, and barley water does not agree with a large number of children in the first few weeks of life. Dr. Chapin's point was well taken that by breaking up the gluten a larger surface is exposed, and that if it is finely divided a large surface is created which can be acted on. There are many babies in the second year who cannot digest potato, and we call these potato babies. They have stomach ache and pain referred to the umbilicus, and examination of the stools shows the presence of starch in capsules. If we take the potato away from the diet of the child the stomach aches cease. This is not scientific, but it is a truth. The same babies may later be able to digest potato well. Furthermore, there are different kinds of potatoes, and the way in which they are cooked makes a great difference. There are the old sodden, soggy potatoes that are not good, and new potatoes are not so well taken care of. Then there are old potatoes that are better suited to children. Children who have difficulty in digesting potato may be helped by substituting rice. Another point which Wallace has brought out is that children with bad molar teeth are apt to have starch indigestion because the starchy foods are not properly broken up and become like a foreign body in the digestive tract. It seems a little strange to object to bread, but in babies 1, 2 or 3 years old the bread gets into large masses and there is not a proper surface area exposed and it does not get split up. It is better to give hard crackers or zwieback, since eating these hard foods teaches the child to chew, and this is important in developing the teeth and jaws. I think we should give in the second year hard foods to babies that get intestinal indigestion.

DR. JAY I. DURAND, Seattle: There are many questions in metabolism which are yet to be answered. I have seen many babies in Finkelstein's clinic, which could not be made to gain by increasing the sugar even to 7 per cent. and 9 per cent., who would make a prompt and satisfactory gain when 1 per cent. of starch was added. The relation of fats to the different sugars presents another problem. A large series of cases were put on high fat feedings with 3 per cent. to 5 per cent. of dextrimaltose—*Nahrzucker*, as it is called there. They did very badly, almost all developing nourishment disturbances, which necessitated a change to albumin milk. Approximately an equal number with the same fat percentages and milk sugar did much better. We are now in a position to control, to a certain degree, the bacterial flora of the intestinal tract, and this is a great factor in carbohydrate digestion. The starches and sugars in excess bring a preponderance of the fermentation-producing, acid bacteria, tending to cause diarrhea. The proteins bring the putrefying, alkaline type which counteract the former. The great value of albumin milk is that you can feed much larger carbohydrate percentages and more fat with it than you can with any other nourishment yet devised. In older children there is a type of starch diarrhea often seen which will be corrected by adding beef, cottage cheese and mashed banana to the diet.

DR. H. H. YERINGTON, San Francisco: The discussion of this paper seemed to be on starch digestion in infants; the paper was on starch digestion after the first year, and I am sorry more was not said on this subject. As far as skin conditions are concerned, I do not know what proportion of children having starch indigestion have skin lesions, but many of these patients having urticaria and eczema clear up rapidly when the starch is eliminated from their diets. Dr. Porter has pointed out the correlation between these children and the feeding of certain diets. A mixed diet consisting of such articles as cottage cheese, gelatin jellies, meat, eggs and broths will be found very effective.

#### Early Fumigation

"Bring sulphur straight, and fire," the Monarch cries.  
She hears, and at his word obedient flies.  
With fire and sulphur, cure of noxious fumes,  
He purged the walls and blood polluted rooms.

—*The Odyssey*.

## SYPHILIS OF THE STOMACH

### A CLINICAL STUDY OF TWENTY-SIX INSTANCES OF DYSPEPSIA, ASSOCIATED WITH POSITIVE WASSERMANN-NOGUCHI REACTIONS\*

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This report comprises observations made on twenty-six dyspeptic individuals whose blood serums were Wassermann-Noguchi positive. In these patients the clinical history of lues was definite or highly probable, or at exploratory laparotomy atypical gastric pathology was demonstrated. Dyspepsia was the presenting complaint. The material is from records in my services at the Mayo clinic and at Augustana Hospital.

That syphilis of the stomach is by no means so uncommon as clinicians of a decade ago considered, is evidenced by the fact that within the past six years no less than twenty-five cases have been placed on record in the United States alone. Previously there had been but about seventy authentic instances of the affection reported. This recently indicated prevalence of the ailment is largely a result of the general use of serologic tests as a guide in the differential diagnosis of unusual intra-abdominal complaints.

#### INCIDENCE

Our twenty-six cases occurred in the examination of 7,545 patients affected with all types of dyspepsia. This returns an approximate frequency of one instance out of every 300 gastric cases (0.34 per cent.). Of this number there were 1,603 instances in which the gastric upset was associated apparently with demonstrable pathology in the stomach or duodenum. Of these 1.6 per cent. were luetic. The relative incidence of the syphilitic affection is emphasized by noting that in this group of cases, gastric cancer was found in 15.3 per cent., gastric ulcer in 18.7 per cent., duodenal ulcer in 39 per cent., achylia or gastritis in 24.8 per cent.

#### PATHOLOGY

The lesion may be congenital or acquired. It may be part of a general systemic syphilis or arise as a distinct, local manifestation of the disease. The infrequency of the affection as a part of general syphilis is indicated by the oft quoted observations of Chiari.<sup>1</sup> From necropsies in 243 pathologically demonstrated cases of lues, of which 145 cases were hereditary and 98 cases acquired, he noted that, while *indirect* changes in the stomach wall (circulatory anomalies, interstitial hemorrhages) are relatively common, *lesions directly attributable* to lues (ulceration, gummas and scarring) are infrequent.

Careful descriptions of luetic lesions in the stomach have been made by Flexner,<sup>2</sup> Neumann,<sup>3</sup> Chiari<sup>1</sup> and Weichselbaum,<sup>4</sup> while clinical classifications depending thereon have been advanced by Hemmeter,<sup>5</sup> Einhorn,<sup>6</sup> Kohn,<sup>7</sup> Morgan<sup>8</sup> and Downes and LeWald.<sup>9</sup> It would

\* Read before the Section on Practice of Medicine at the Sixty-Sixth Annual Session of the American Medical Association, San Francisco, June, 1915.

1. Chiari: Internat. Beitr. z. wiss. Med., Festschr. f. R. Virchow, Berlin, 1891, ii, 211.

2. Flexner, S.: Am. Jour. Med. Sc., October, 1898.

3. Neumann: Specielle Pathol. u. Therapie (Nothnagel), xxiii, 351.

4. Weichselbaum: Bericht. d. Rudolfskspitals in Wien, 1883, p. 383.

5. Hemmeter: Diseases of the Stomach, Philadelphia, P. Blakiston's Sons & Co., 1903, p. 596.

6. Einhorn: Med. Rec., New York, March 13, 1915.

7. Kohn: Am. Jour. Med. Sc., May, 1909.

8. Morgan: Am. Jour. Med. Sc., March, 1915, p. 392.

9. Downes, William A., and LeWald, Leon T.: Syphilis of the Stomach, THE JOURNAL A. M. A., May 29, 1915, p. 1824.