THE VALUE OF THE BANANA IN THE TREATMENT OF CELIAC DISEASE*

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Some years ago I treated a child, aged 3 years, who suffered from a severe case of anorexia nervosa. She had reached a serious state of depletion and weakness from her self imposed starvation, refusing all food and regurgitating that fed to her by gavage. She finally accepted a banana, with the result that other food was taken in a more or less normal amount within forty-eight hours. There was a complete relapse when the banana was withheld, and food was taken normally only with bananas.

This experiment was repeated to test the validity of the observation, always with the same result, until a time came when her appetite was normal whether bananas were included in the diet or not. The action was such as is attributed to a hormone. It was natural, therefore, to test bananas in a case of celiac disease where anorexia was a prominent symptom.

Celiac disease is probably the most troublesome disturbance of nutrition of late infancy and early childhood. The consensus of opinion is that it is a functional disease characterized by inability to utilize properly carbohydrates and fats. To what extent the carbohydrate or the fat is at fault is not quite so clear. Herter,[1] who studied these cases from a laboratory standpoint probably more carefully than any one else, found intolerance of carbohydrates to be the most important feature, resulting in the deprivation of the organism of the foodstuff on which it mainly depends for its caloric needs, and stated that: "In the severest forms of 'Infantilism' the total quantity of carbohydrates which can be tolerated may be very small, and it may be possible to supply in this form less than one-fifth of the calories required by the organism instead of nearly one-half as in health. The fats are, on the whole, better tolerated than the carbohydrates." The difficulty in treating these cases is proverbial, relapses even after marked temporary progress being the regular experience. Ten cases are reported here; eight of the patients were clinically cured by the form of therapy described below. The two patients not treated died.

TREATMENT

The treatment of this condition has always been troublesome. Up to the present time there has been no method reported which has been

* Received for publication, June 25, 1924.

1. Herter, C. A.: Infantilism from Chronic Intestinal Infection, New York, The Macmillan Company, 1908.

consistently successful. One of the striking peculiarities of this disease is that now and again some treatment is instituted for a patient which leads to a remarkable improvement resulting in a complete cure, yet when the same method is applied to an apparently parallel case it results in failure.

The treatment may be divided into two parts: (1) Keeping the gastro-intestinal tract as free from toxic accumulations as possible. This is best accomplished by a full dose (15 gm.) of castor oil once each week, and irrigation of the colon daily with as many liters of bicarbonate of soda solution (15 gm. to a liter of warm water) as may be necessary to obtain a clear return.

(2) Dietetic. Plain milk should not be given; the most satisfactory substitute is protein (albumin) milk. In several cases protein milk prepared with calcium caseinate was accepted after protein milk prepared in the usual way had been refused. Lactic acid milk may be used in some cases. Dry milk, especially such as has been prepared with a fat free milk, is sometimes tolerated. Unsweetened and rarely sweetened condensed milk may be used successfully. Pot cheese prepared from whole milk is usually as well borne as when it is prepared from skimmed milk. Broths may be used; white of eggs may also be used. Gelatin is refused by some children, but when taken seems especially desired. After improvement has set in, meat is often well borne. The above constitutes the list of foods from which the protein ration is selected.

Carbohydrates should be vigorously avoided except as they occur in the before mentioned milk products. Saccharin should be used for all sweetening. Bread, crackers, potatoes and cereals may not be used. In extreme cases every trace of sugar except as it may occur in protein milk prepared according to Finkelstein's formula or in pot cheese, must be eliminated before success in treatment is attained.

There is one exception, i. e., sucrose as it occurs in the extremely ripe banana. This is tolerated perfectly, and herein lies the crux of the entire matter. Heretofore it has been impossible in the severe cases to give any carbohydrate without damage, whereas banana is not only well tolerated, but rapidly changes the entire picture of the disease to one of well being.

An under-ripe banana is a starch, an over-ripe banana is a sucrose with an invert sugar,[2] and like most sugars easily assimilated. The banana has been the victim of one of those curious antagonisms so frequent in medicine, which made it difficult of acceptance by lay people, as a suitable infant food, although in the tropics it has been so used for generations.

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2. Pease, M. C., and Rose, A. R.: Banana as a Food for Children, Am. J. Dis. Child. **14**:379 (Nov.) 1917.

Of interest in connection with the present paper is the statement that in Porto Rico the town dwellers who eat much bread suffer from sprue, the farmers who live largely on bananas never.[3]

A ripe banana usually has a brown skin, or brown mottling. It must have a bland sweet taste, not acrid, and should never pucker the mouth. The number of bananas offered to a child may be quickly increased by one or two daily until the patient's demand for carbohydrate is satisfied. In the earlier cases only a small quantity was used, and the number increased slowly. With added experience this was found to be unnecessary, and rapid increase in number was made so that in a recent case an infant, aged 24 months, took sixteen bananas daily, a short time after they had been prescribed. The anorexia in some cases is so extreme that even banana is refused at the beginning, only protein milk being acceptable. Sooner or later the banana is relished. Then it is to be increased to the maximum which the child will take, usually from four to eight daily.

TABLE 1.—*The Typical Diet*

	Amount, Ounces	Protein, Gm.	Carbohydrate, Gm.	Fat, Gm.	Calories
Albumin milk	40	36	20	30	500
Pot cheese (milk 16 oz.)	..	20	5	17½	250
Banana	6	6	90	3	410
Orange	1	..	10	..	40
Vegetables	2	1	2	..	10
Gelatin	⅓	10	..	..	40
Meat	1	8	..	2	50
Total	50⅓	81	127	52½	1,300

Fats should be avoided as carefully as carbohydrates. They are exceedingly harmful, except as they occur in protein milk and pot cheese. Cod liver oil is no exception, and is often the cause of trouble. When improvement has taken place, butter may be tried and is often successful. Vegetables may be added early but carefully.

The caloric requirement, as shown by the charts, is from two to three times the normal, approximately one hundred calories per pound being required in the early stages of treatment. This diminishes with improvement, as does the voracious appetite of this stage.

Treatment to be successful should be continued for an indefinite period. Some cases present a tolerance early for bread crust or rusk, some not for a long period. Only experience with the individual child will set the time. Up to the present moment it seems that all these cases sooner or later will react normally to most foods.

Blood transfusion, although it failed in our case, is a very valuable procedure.

3. Ashford, quoted by Siler, J.: Proc. Pan-Am. Sc. Cong., 1915-1916, **10**:12-18, 1917.

It is not to be expected that the institution of the above treatment will be successful at once. On the contrary, in severe cases the first four or six weeks are apt to be most discouraging. The first sign of improvement is change in disposition. The infant becomes happier and smiles, the appetite improves, and only after hunger has been established may a gain in weight be expected. Renewed growth comes much later. An early sign of improvement is yellow stools. Once improvement has set in there are rarely any setbacks and these only slight, usually dependent on some intercurrent infection to which these children seem prone.

The treatment as applied to a specific case presents a composite picture somewhat as follows. In a case of moderate severity there is usually an immediate history of vomiting and diarrhea, more or less edema, the child is peevish and querulous to the last degree, refusing food, crying constantly, not sleeping, with the weight stationary or declining. A half ounce (15 c.c.) of castor oil is administered, protein milk offered. If this is refused, protein milk prepared with one of the several preparations of calcium caseinate, and colonic irrigations of sodium bicarbonate twice daily are given. Under this treatment there is very little visible improvement for the better part of a week. The best that can be hoped for is that the diarrhea is controlled, the child becomes a little more comfortable, and the protein milk taken with some degree of relish, the weight usually declining. Other foods are now offered, orange juice, broth, banana, gelatin and cottage cheese. One or more of these may be accepted, possibly none. The stools, however, improve, become yellow, and the child is definitely less unhappy. This condition may persist anywhere from four to eight weeks until the child accepts banana which should be offered daily, and sooner or later bananas will be taken. Then only does the weight begin to improve, although in every other respect improvement may have already taken place. From this time on there is rarely any interruption in the gain, nor are there relapses unless owing to an intercurrent infection or some gross fault in management, and the relapse is never a complete one, as it is seen so characteristically in this condition, but is represented chiefly by a loss in weight which is rapidly recovered, the entire relapse being relatively not more than may be expected in a normal child passing through an acute infection. An illustrative case may be of value in showing the difficulties which confront one. Case 5, R., a girl, aged 12 months, was first seen Oct. 10, 1922, when she weighed 12 pounds 4 ounces (5 kg.). Castor oil was given at regular intervals, sodium bicarbonate irrigation carried out daily. The diet such as outlined above was attempted, but everything was refused excepting the albumin milk, with the result that it was not until two months after treatment started that any real gain was made, her weight on December 12 being 12 pounds

14 ounces (5.9 kg.). It was at this time that she began to take a single banana in addition to the albumin milk, pot cheese and broths in which vegetables had been cooked, although the stools were normal. From this time forward the result was better, so that by Jan. 15, 1923, the weight had risen to 15 pounds 2 ounces (6.8 kg.), and she was taking four bananas in addition to her previous feeding.

The following histories will illustrate the effects of treatment.

REPORT OF CASES

CASE 1.—A girl, aged 15 months, first seen, June 3, 1919. At birth she weighed 6½ pounds (2.7 kg.). Her weight June 3 was 18 pounds, 10 ounces (8.2 kg.). She was the first and only child of normal birth. At 10½ months she weighed 17 pounds (7.7 kg.). The gain was slow.

Previous diet.—She was never breast fed, but was given first simple milk mixtures. Jan. 20, 1919, skimmed milk, water, dextrimaltose, farina, beef juice. January 30, she had malt soup mixture, farina, beef juice. June 4, fruit, cereal, egg, vegetables, split pea soup. Formula: milk lime water, dextri maltose. June 22, she had malt soup, potato and vegetable soup.

There was a history of periodic gain with attacks of diarrhea and anorexia and rapid loss of weight.

Physical examination showed an extremely pale child, markedly protuberant abdomen, very peevish, with fontanel almost closed. She had four teeth. The spleen and liver were palpable; the patient walked with the body thrown backward from the hips to compensate for the large abdomen. The diet at this time was: whole milk, 25 ounces, imperial granum, 1½ ounces given by bottle, each of 8 ounces, dextrimaltose, 1 ounce, water, 15 ounces.

The schedule was: at 7 a. m., bottle; at 9 a. m., orange; at 11 a. m., egg and bottle; at 3 p. m., broth, 5 ounces of potato and bottle; at 7 p. m., bottle.

Approximately 1,000 calories or 55 per pound.

This diet, with unimportant changes, was continued as the child was being taken to the country from which she did not return for three months, during which time she grew worse. At this time the treatment which has proved successful in all of our cases, was begun. The drop in the weight curve during the second year was due to an attack of measles and pneumonia. The flattening during the third year was due to an insufficient caloric intake. At the present time this child is entirely normal. She takes upward of 20 ounces (591 c.c.) of milk daily, an occasional egg, cereal and bread regularly, and occasionally ice cream. At the age of 6 years her height is 47 inches (119 cm.), her weight 50½ pounds. (22.7 kg.). There is no protuberance of the abdomen, the stools are normal, and she is in all respects a healthy child.

CASE 2.—D. S., a boy, aged 4 years, was presented for treatment Oct. 10, 1921. His weight at that time was 20 pounds, 14 ounces (9 kg.). His height, 33 inches (84 cm.).

He had been brought to the office Oct. 7, 1920, presenting the same symptoms only to a less degree. At that time his weight was 19 pounds (8.6 kg.) and his height 33 inches (84 cm.). During the year there had been practically no gain in weight, the discrepancy being due to the increased edema, and no gain in the height. The family history was negative, the patient was the first of two children, born at full term, and a forceps delivery. There was bleeding from the umbilicus, and generalized subcutaneous hemorrhages, lasting several days. There were no bleeders in the family. The patient had scurvy (?) when 7 months old, for the duration of two weeks. Again at the age of 2 years, while on a general diet, which however contained no vegetables, and again when 2 years and 3 months old. The hands, feet and face swelled up and there was a history of vomiting, anorexia, and thin stools during attacks. When the

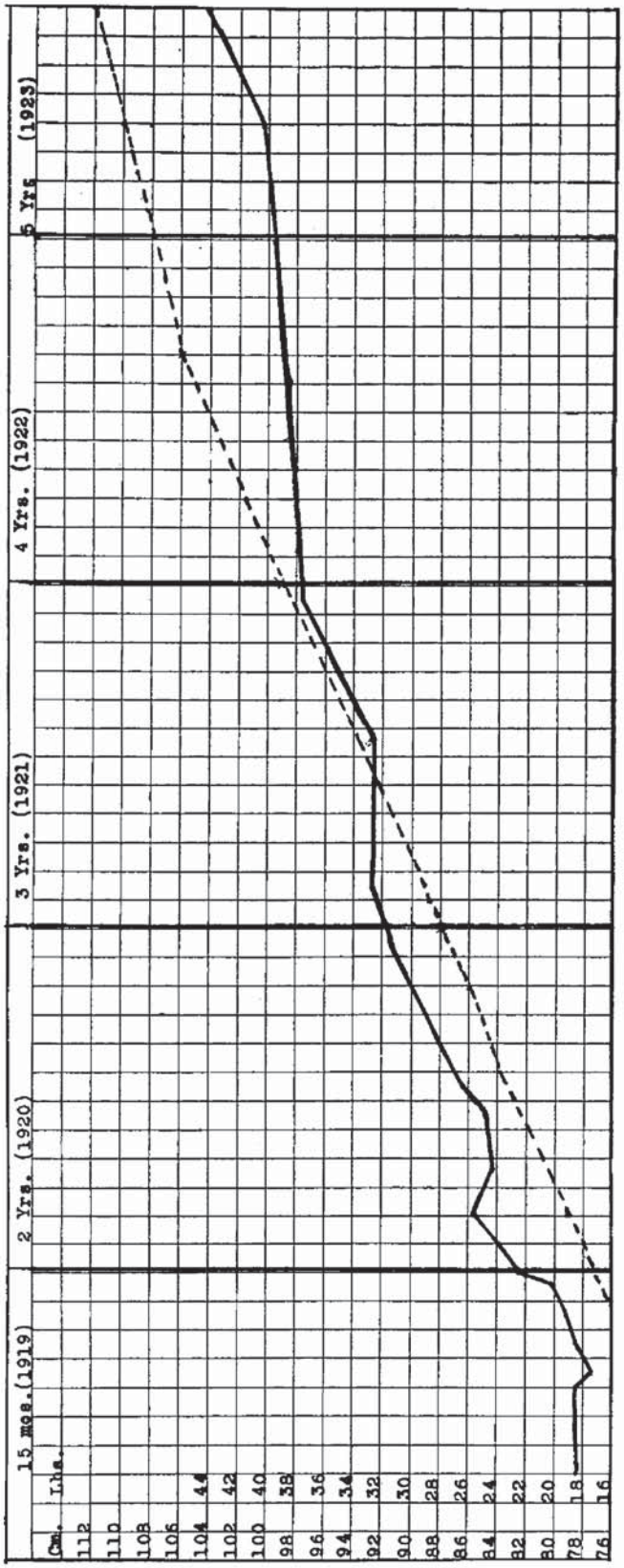

Fig. 1 (Case 1).—Progress of R. L. Broken line indicates height, straight line, weight.

patient was brought the second time, he was receiving the following daily diet: At 6 a.m., 8 ounces of protein milk, at 10 a.m., farina, bread and butter, protein milk, at 2 p.m., strained vegetable soup, rice and carrots, hard boiled egg, cottage cheese, at 6 p.m., cottage cheese, protein milk, bread and butter, and at 10 p.m., protein milk.

The physical examination at this time showed a child, who although 4 years old, seemed to be an infant in arms, being carried in on a pillow. He had never stood or walked. The most striking feature was the intense pallor, and the unhappy facies, the patient whimpering constantly. When stripped, the abdomen showed great distention, (circumference 63 cm.). His legs were flexed, the thighs abducted in a frog posture. They were practically without power. Handling seemed to cause him pain. The mouth was sore and the child seemed to avoid the light. The edema was marked. There was considerable free fluid in the abdominal cavity. The following diet was ordered.

At 6 a. m., 9 ounces (266 c.c.) of albumin milk; at 8 a. m., orange and one banana; at 9 a. m., one banana, 7 ounces (207 c.c.) of albumin milk; at 12 noon,

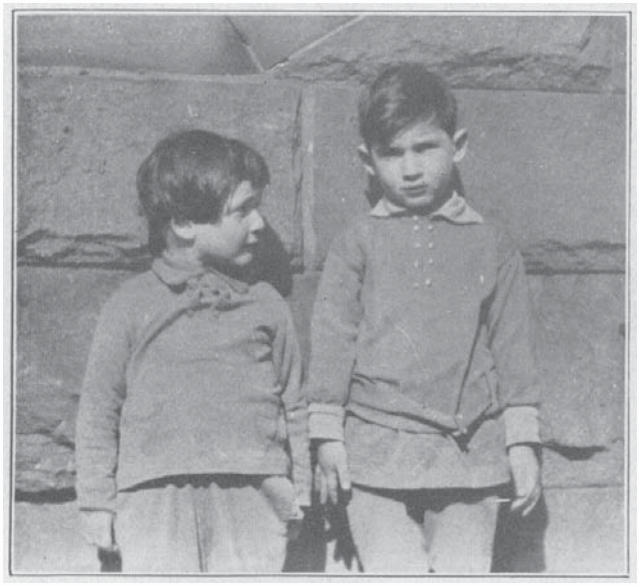

Fig. 2 (Case 2).—D. S., aged 5½ years, to the left. Compare with a younger brother, aged 4½ years.

scraped meat, two tablespoonfuls. Albumin milk, 7 ounces; 3 p. m., 9 ounces albumin milk; 6 p. m., whites of two eggs. Gelatin, ½ ounce (15 c.c.). Albumin milk, 7 ounces; 10 p. m., albumin milk and banana.

This was soon increased, more bananas being given, and pot cheese added as detailed in the chart. Sodium bicarbonate irrigations were used once or twice daily, and a dose of castor oil given once a week. On this diet the edema, tenderness, anorexia, and diarrhea disappeared. The child became happy, began to have a healthy color, and progressed uninterruptedly as Figure 3 shows, excepting for a short period of underfeeding last summer when his weight fell off slightly, but with no symptoms of disease. At the present time he is a ruddy looking child, playful, walks and runs, and is quite normal in every respect except that he is underweight and undersized for his age; and that carbohydrates with the exception of banana, must be very carefully restricted, and milk as such omitted entirely. When last seen on May 26, 1924, at the age of 6½ years his weight was 45 pounds (20 kg.) and his height 43½ inches (111 cm.)

CASE 3.—J. R., a girl, aged 17 months, came under observation April 14, 1922. Her birth weight was 7 pounds 2 ounces (3.2 kg.). She was the second child, of instrumental delivery. She was not breast fed. She had solid food at the age of 7 months. The child had been for some time at the Baby's Hospital, where she was seen in consultation by a number of physicians. The diagnosis made was tuberculous peritonitis.

There was a history of alternate attacks of diarrhea accompanied by vomiting, and massive stools. The symptoms when first seen were: diarrhea, vomiting, edema, protuberant abdomen, hyperesthesia, photophobia and marked irritability. The child at this time was receiving a liberal diet including cereals. She was then ordered ½ ounce (15 c.c.) of castor oil to be repeated weekly, and colonic irrigations of bicarbonate of soda, to be given twice daily. Protein milk was prescribed, to be sweetened with saccharin. In addition pot cheese, broth, gelatin, banana, orange, and scraped meat were ordered. For a short time, as is usually the case, there was little taken except protein milk. Within a short time the irritability, tenderness, edema and photophobia disappeared. The child smiled and was happy and contented. The stools became yellow, and as time went on she took more of the food allowed, so that after a few months the diet

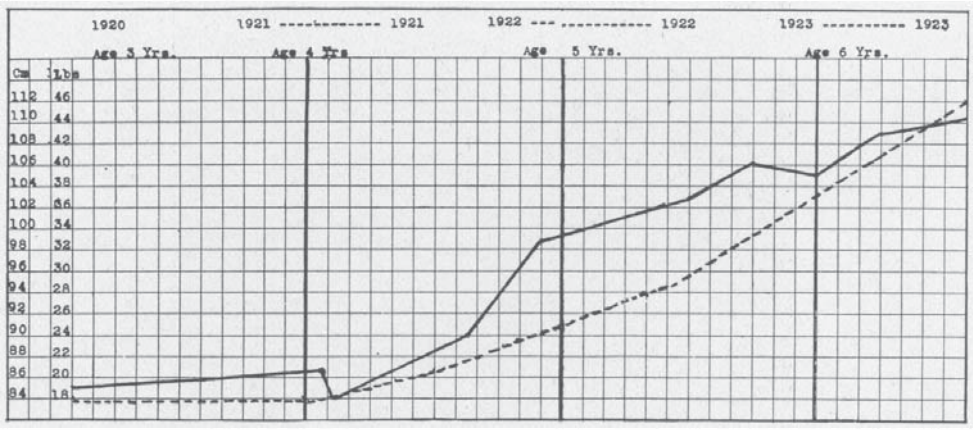

Fig. 3 (Case 2).—Progress of D. S. Broken line indicates height, straight line, weight.

was as follows: 6 a. m., whites of 2 eggs, and 12 ounces (355 c.c.) of albumin milk; 8 a. m., 1 orange; 10 a. m., three tablespoonsful of finely minced meat, with a tablespoonful of spinach, peas or beans, albumin milk, 12 ounces (355 c.c.); 2 p. m., gelatin 8 ounces (236 c.c.), 2 bananas; 6 p. m., 3 bananas, albumin milk 12 ounces; 10 p. m., albumin milk 12 ounces. The total albumin milk was 48 ounces (1,419 c.c.), and 5 bananas daily.

No patient had more marked hydrolability than this child. The daily fluctuation in weight in the early weeks was often 1 pound (0.5 kg.) or more, and long after she was well on the road to recovery, the degree of perspiration was amazing. While watching the skin, drops the size of a split pea could be seen to form, coalesce with others, and run down literally in a stream. Large quantities of water were also passed by the kidneys. This was regular for all the patients. Figure 4 shows a drop in weight at the age of 25 months which was due to an acute infection. The flattening, which occurred at the age of 31 months and lasted to the age of 35 months, resulted from underfeeding while away for the summer. When last seen, Feb. 4, 1924, the weight was 35 pounds 2 ounces (15.9 kg.) and the height 94 cm. She was well and appeared ruddy, happy and healthy. This child was taking small amounts of carbohydrate other than banana.

CASE 4.—R. S., a girl, aged 1 month, was first observed June 27, 1918, at the Home for Hebrew Infants. Her weight was 6 pounds 9 ounces (2.7 kg.). She was given albumin milk for two weeks, then put on a simple milk modification. Physical examination at this time revealed a slightly undernourished baby, but nothing to suggest a future disturbance, unless the loose bowels and scalded buttocks could even at this early date have represented a carbohydrate intolerance. The progress was slow but steady until the age of 9 months, when an attack of grip occurred, and at the age of 13 months an attack of enteritis, with rather considerable loss of weight. At 9 months cereal was added to the diet. Her condition at this time showed symptoms of rickets. She was underweight

TABLE 2.—*Height and Weight of Case 2*

Age, Years	Intake		Weight			Height				
								Normal		Difference
	Total Calories	Per Pound	In Pounds	Normal	Difference	In.	Cm.	In.	Cm.	Cm.
4 1/12	1,300	67	19½	37	17½—	33	83½	40	101½	18—
4 2/12	1,250	62	20½	37½	17—	..	..	..	...	....
4 3/12	1,300	56	23¾	38	14¼—	..	..	..	...	....
4 5/12	1,200	49	24½	39	14½—	33	83½	41½	105	21½—
4 7/12	1,500	48	30¾	40	9¼—	33	83½	42	106	22½—
4 11/12	1,500	48	33	42	9—	37	94	42½	107	13—
5	.....	..	..	..	...	..	..	....	...	....
5 1/12	.....	..	34	43	9—	37	94	43	109	15—
5 5/12	1,620	44	39	45	6—	37½	95	44½	113	18—
5 8/12	.....	..	40	46	6—	39	99	45	114	15—
6	1,400	35	39½	48	8½—	41	104	46	117	13—

TABLE 3.—*Height and Weight of Case 3*

Age, Months	Intake		Weight			Height				
								Normal		Difference
	Total Calories	Per Pound	In Pounds	Normal	Difference	In.	Cm.	In.	Cm.	Cm.
17	600	..	15¼	23½	8¼—	29¼	74	31	79	5—
18	1,250	78	15¾	24	8¼—	29¼	74	31½	79¾	5¾—
19	1,375	78	19	24	5—	29¼	74	31½	80	6—
20	.....	..	21¾	24½	2¾—	30	76	32	81	5—
21	.....	..	22	25	3—	..	..	..	..	...
22	1,050	44	23½	25½	2—	30¼	77	32½	82	5—
23	1,100	44	25	26	1—	30½	77½	33	83	5½—
24	1,140	42	26¾	26½	¼+	31¾	80½	33½	85	4½—
25	840	33	26½	27	½—	32	81	33¾	86	5—
26	950	35	27	27½	½—	32	81	34	86½	5½—
27	.....	..	..	..	....	..	..	..	..	.....
28	1,050	36	29	28	1+	32	81	34¾	87	6—
29	1,000	33	30½	28½	2+	32½	82½	35	88½	6—
30	1,000	33	30	29	1+	33	84	35¼	89¾	5¾—
..	.....	..	..	..	...	..	..	..	..	...
..	.....	..	..	..	...	..	..	..	..	...
..	.....	..	..	..	...	..	..	..	..	...
..	.....	..	..	..	...	..	..	..	..	...
35	800	27	29¾	31	1¼—	35¼	89½	36¾	93	3½—
39	.....	..	33¾	32¾	1+	36¾	94	37¾	96	2—

and in a generally unsatisfactory condition. Distended abdomen was noted at this time, but was supposed to be part of the rachitic picture. From then forward, as seen in Chart 4, there were numerous fluctuations in weight, with practically no increase up to the third year when the condition was fully recognized. From the age of 2 years edema was present, on and off. The child was peevish and unhappy and would sit on the floor watching the other children at play. There was definite photophobia as though she were suffering from keratitis, although this was not present. Anemia was marked. The patient was tender to the touch, with occasional skin manifestations such as urticaria and erythema. A severe stomatitis existed most of the time. The urine at intervals showed

albumin and granular hyalin casts. Anorexia was marked. All kinds of diets were tried, and in all combinations. Autogenous vaccines were made from intestinal contents. There was blood transfusion. At intervals the symptoms subsided and the appetite and weight would improve. There was always a relapse, until the end of 1921 when the diet described in this paper was instituted with the result that there was considerable improvement, which however was lost later on the addition of high sugar. At the end of 1922 a rigid diet was instituted, from which carbohydrates were as completely excluded as was possible, with the result shown in Chart 4. This child is doing well, growing and gaining weight. Departure from the diet or regimen is accompanied by some return of symptoms. The drop in weight in the middle of 1923 represented a

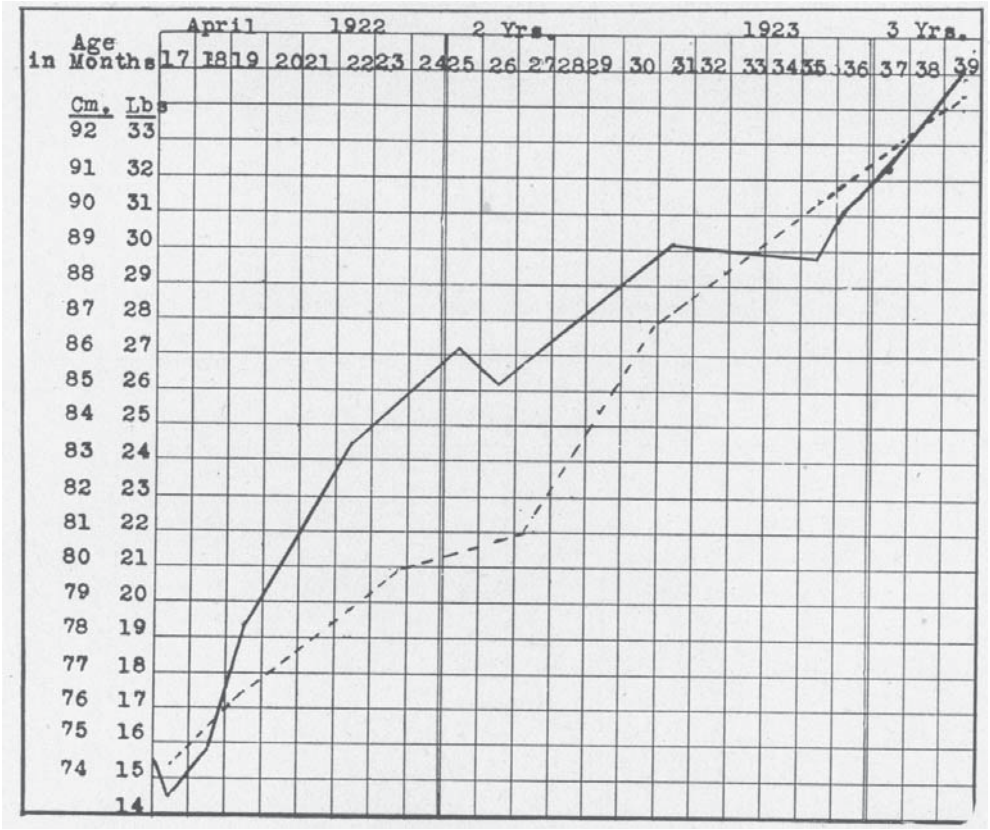

Fig. 4 (Case 3).—Progress of J. R. Broken line indicates height, straight line, weight.

period of bad management owing to my absence from the service, and the disinclination of those in charge to modify the orders. So far as I am aware this is one of the few cases, if not the only case under steady observation from birth, for such a long period.

CASE 5.—R. G., a girl, aged 1 year, came under observation Oct. 10, 1922. Her birth weight was 8 pounds 3 ounces (3.6 kg.). She was the first child, of normal labor. She was never breast fed. Her diet consisted of Dryco for three weeks. Milk, lactose, lime water, barley water. Malt soup. Milk, water and cane sugar. Evaporated milk, granum and Eskay's food.

At the age of 6 months final radium application was made for the removal of an obstructive thymus gland. The patient's highest weight was at 8 months when she weighed 13 pounds 5 ounces (5.9 kg.). She had been gaining 1 pound

Fig. 5 (Case 4).—Dec. 15, 1922. Patient in the center. Contrast with normal children of the same age.

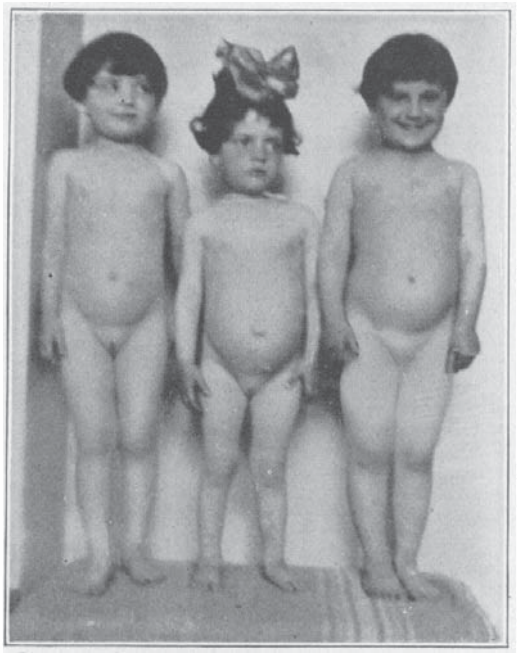

Fig. 6 (Case 4).—May 30, 1923. The same group as Figure 5. Note the progress of the patient, R. S., in the center.

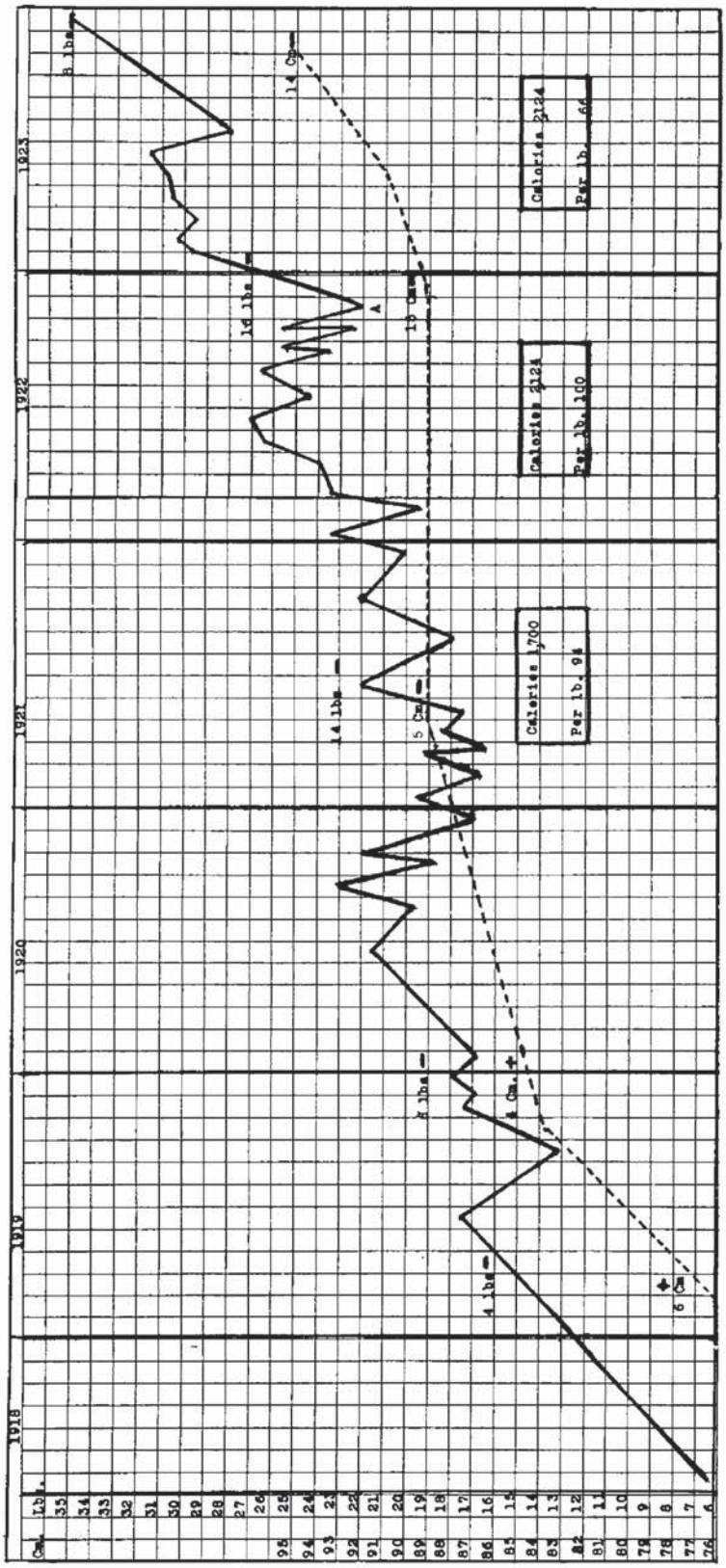

Fig. 7 (Case 4).—Progress of R. S. Weight, straight line, length, broken line.

(0.5 kg.) a month up to the fifth month. Her diet when first seen was, barley, 5 tablespoonfuls; Dryco, 20 tablespoonfuls; glucose, 1 ounce (30 c.c.); water, 40 ounces (1,183 c.c.), divided into 5 bottles; orange, farina, beef and broth, 750 calories, or 62 per pound.

Physical examination: Slight edema was seen. One hand and sometimes other parts showed an erysipeloid-like urticaria. The child had a markedly distended abdomen. This case, as well as Case 4 showed a most marked photophobia. There was considerable tenderness on handling. There was loss of power in the extremities. The patient seemed dangerously ill. Fuller details of this case were given in the foregoing. When last seen Feb. 26, 1924, at the age of 28½ months, her length was 86 cm., and her weight 26 pounds 12 ounces (11.8 kg.). A recent attempt to feed one tablespoon of oatmeal daily produced anorexia and diarrhea.

Case 6.—R. S., a boy, aged 13 months, came under observation Nov. 6, 1922. He was the first child of cesarean birth, with a weight of 9 pounds (4.1 kg.). He was breast fed for three weeks. He then received alternately, evaporated milk and granum; milk, barley water, dextri maltose; malt soup; Dryco. The gain was slow until the age of 8 months. Malt soup mixture. Malt soup mixture plus Dryco. His highest weight was 14 pounds 9 ounces (6.4 kg.) at 8 months.

Table 4.—*Height and Weight of Case 5*

Age, Months	Intake		Weight			Height				
								Normal		Difference
	Total Calories	Per Pound	In Pounds	Normal	Difference	In.	Cm.	In.	Cm.	Cm.
12	.....	..	11½	20½	9—	26½	67	29	74	7—
13	850	71	12	21	9—	....	..	..	..	...
14	1,080	83	13¼	21¾	8½—	....	..	..	..	...
15	1,095	74	15	22¼	7¼—	26¾	68	30	76	8—
16	1,200	75	17¾	22¾	5—	28	71	31	78½	7½—
17	1,275	67	....	....	...	..	..	..	..	.....
18	.....	..	18¾	24	5¼—	28	71	31½	80	9—
19	1,150	57	20½	24½	4—	29	73½	32	81	7½—
20	1,200	52	22¾	24¾	2—	29¼	73½	32	81½	8—
21	.....	..	23½	25¼	1¾—	30¼	76	32½	82½	6½—
22	.....	..	....	....	.....	....	..	....	....	...
23	1,200	48	24¾	26	1¼—	31	79	33	84	5—
24	1,200	50	25½	26½	1—	32	81	33½	85	4—

He then had diarrhea, anorexia and reduced in weight to 12 pounds (5.4 kg.). When first seen he was receiving Larosan milk for three weeks, cereal, toast, broth, one tablespoon of dextri maltose in each of five 8 ounce (236 c.c.) bottles.

Physical examination: The child showed marked irritability. There was slight edema and tenderness on handling. The abdomen was distended.

When the diarrhea was controlled the stools became massive. On the treatment outlined, recovery was prompt. The stools became yellow. The baby began to look happy. Jan. 9, 1924, he was 84 cm. tall, and weighed 26 pounds 10 ounces (11.8 kg.) and was receiving Larosan milk with 1 ounce (30 c.c.) of cream removed from the top of the bottle, 6 bananas, a good portion of vegetable, meat, whites of two eggs, one slice of bread, broth, and three teaspoonfuls of butter.

Case 7.—M. R., a boy, aged 23 months, was presented for treatment April 27, 1923. His birth weight was 7 pounds (3.2 kg.) He was the second child. The first infant was normal. This patient was breast fed for two months, then breast and bottle fed, and after that had innumerable changes in diet. There was history of frequent attacks of diarrhea, occasional vomiting, excessive irritability and peevishness. He had otitis at about the age of 1 year, croup at the age of 18 months, and was said to have had an attack of intestinal grip at the age of 1 year. He had never walked. Roentgen-ray examination of the legs

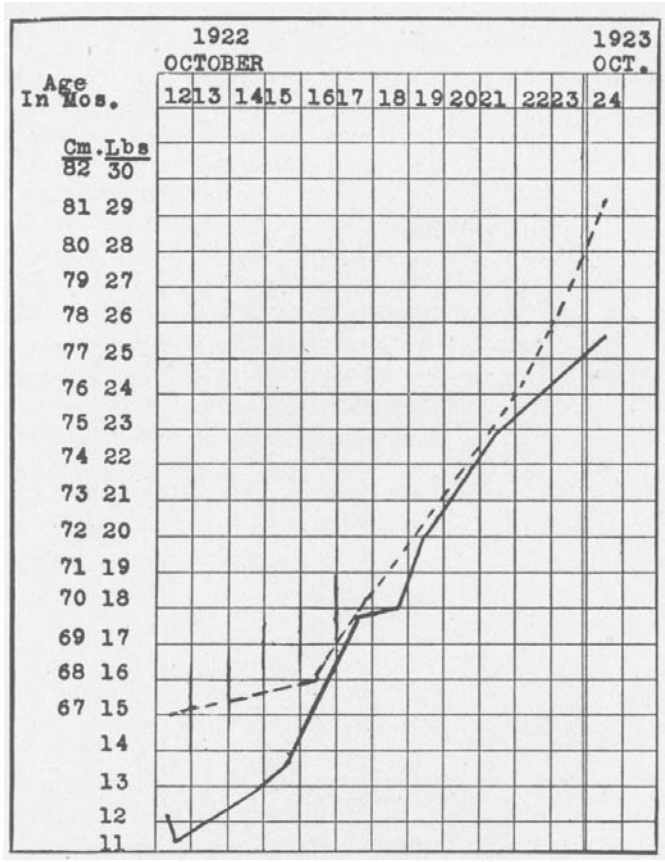

Fig. 8 (Case 5).—Progress of R. G. Broken line indicates length, straight line, weight.

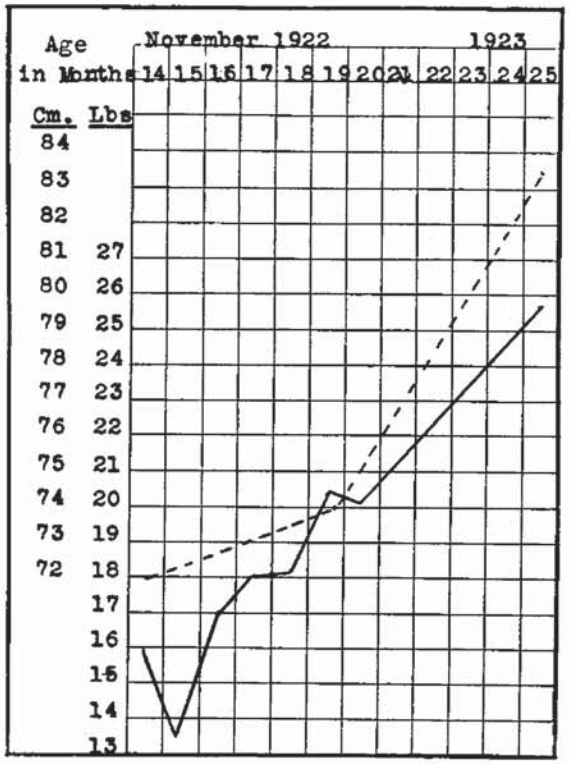

Fig. 9 (Case 6).—Progress of R. S. Length indicated by broken line, weight by straight line.

is said to have shown scurvy and rickets. When he came under observation he was receiving the following diet: 6 a. m., milk, 5 ounces (148 c.c); 8 a. m., orange juice; 10 a. m., farina and milk; 12 noon, soup, meat, vegetables and stewed fruit; 6 p. m., cereal, junket or custard and milk. The total amount of milk daily was 24 ounces (710 c.c.). Total calories 900, or about 53 per pound.

Examination showed a desperately sick baby who looked as though he could not possibly survive. Very marked edema from the hips down was present. This was somewhat less marked in the upper extremities. The abdomen was markedly distended, 48½ cm. in circumference, and contained free fluid. The pallor was extreme. The child whimpered, was peevish and cried when touched. He did not move the lower extremities, and had a tendency to keep the hands over the eyes. The urine contained albumin with several hundred granular and granulohyalin casts to the field. The blood showed a distinct secondary anemia,

TABLE 5.—*Height and Weight of Case 6*

Age, Months	Intake		Weight			Height				
								Normal		Difference
	Total Calories	Per Pound	In Pounds	Normal	Difference	In.	Cm.	In.	Cm.	Cm.
14	900	56	16	22	6—	28½	72	30½	77	5—
15	1,025	70	13½	23	9½—	....	..	..	..	...
16	1,155	68	17	23½	6½—	28½	72	31	79	7—
17	1,000	55	18	24	6—	....	..	..	..	...
18	1,000	50	18	24½	6½—	29	74	32	81	7—
19	1,000	50	20½	25	4½—	....	..	..	..	...
20	.....	..	20	25½	5½—	....	..	..	..	...
21	1,000	45	21½	26	4½—	30½	77	33	84	7—
22	1,000	44	22½	26½	4—	....	..	..	..	...
23	1,100	46	24½	27	2½—	....	..	..	..	...
24	.....	..	25	27½	2½—	32	81	34	86	5—
25	1,300	50	25½	28	2½—	33	83½	34	87	2½—

TABLE 6.—*Height and Weight of Case 7*

Age, Months	Intake		Weight			Height				
								Normal		Difference
	Total Calories	Per Pound	In Pounds	Normal	Difference	In.	Cm.	In.	Cm.	Cm.
23	900	53	20½	27	6½—	29	74	34	86	12—
24	1,100	64	17	27	10—	..	..	..	..	....
25	1,580	72	22	28	6—	29	75	34	87	12—
26	1,760	80	24	28	4—	30	76	34¾	88	12—
27	1,680	62	27	29	2—	30½	77	35	89	12—
28	1,525	55	29	29	Normal	31	79	35½	90	11—
29	1,625	54	30	30	Normal	32	81	36	91	10—

3,400,000 erythrocytes. The hemoglobin was 40 per cent. There was no abnormal cytology. Within four weeks the urine became normal. May 11, the patient was less irritable, smiled for the first time in weeks, the stools were improved, and the edema was much less. May 26, four weeks after coming under observation, there were from four to five stools daily, large, yellow and occasionally green. The child's appetite was ravenous. He was happy and smiled constantly. He received eight bananas, pot cheese made from one quart of milk, 24 ounces (710 c.c.) of milk converted into protein milk by means of calcium caseinate, broth, the juice of an orange, and the white of one egg. June 27, 1923, he was taking from 14 to 16 bananas daily. August 6, 1923, the stools were normal except for an occasional slight amount of mucus. The child was no longer ravenous, and he was able to stand. The perspiration was profuse, with the odor of lactic acid. He was so fat that he looked edematous; he gained almost 3 pounds in eighteen days. October 13, the hemoglobin was 60 per cent.

and the erythrocytes 5,000,000. This child made very rapid progress, and when last seen, Jan. 12, 1924, his height was 85 cm., his weight 32 pounds 14 ounces (14.5 kg.). The stools were yellow and normal. He walked and was happy and well. His diet is still restricted.

SUMMARY

Celiac disease is a nutritional disturbance of late infancy and early childhood, due to inability to utilize fats and carbohydrates in a normal manner. The treatment has presented discouraging difficulties. Carbohydrate in the form of ripe bananas appears to be tolerated perfectly, making it possible to bring about a clinical cure in practically all cases.

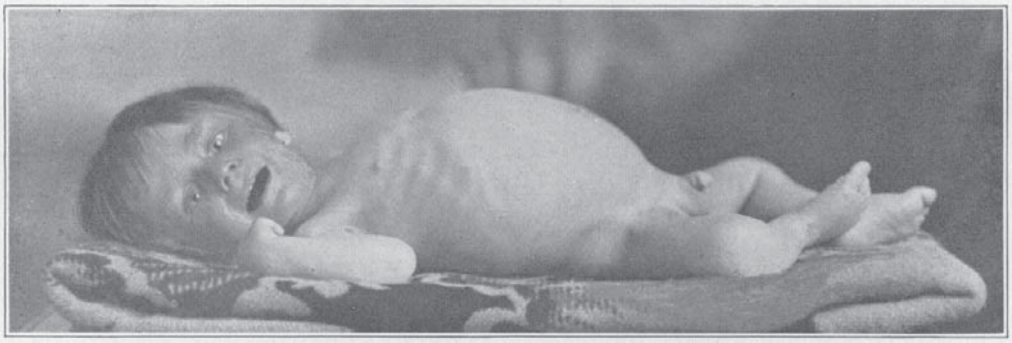

Fig. 10 (Case 7).—M. R., aged 2 years. Recovery begun.

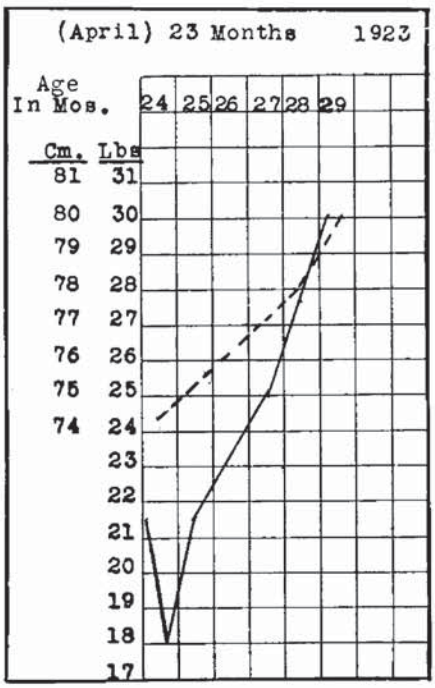

Fig. 11 (Case 7).—Progress of M. R. Length indicated by broken line, weight by straight line.

Whether there is a factor in the banana other than the carbohydrate content which results in this cure is unknown. The treatment of this disease requires a high caloric diet from two to three times the normal. Milk is replaced by one of the lactic acid forms. No other fat is used, and no carbohydrate except ripe bananas, and that present in the lactic acid milk. Proteins may be used in all forms and apparently in any quantity. The maximum number of bananas used in any one case was 16 daily by a child, aged 26 months. In addition to the dietary treatment, a full dose of castor oil is given once a week, and colonic irrigations of sodium bicarbonate daily. Of ten patients, eight so treated have made a clinical recovery. Two patients not so treated died.