

## AN EXPERIMENT IN SUPPLEMENTING THE DIET OF SCHOOL CHILDREN

By GEORGE C. PAYNE, M. D., and EZEQUIEL MARTÍNEZ RIVERA, M. D.

The problem of nutrition has always attracted a considerable amount of attention in Porto Rico and many ills, including some of those now known to be caused by animal parasites, have been attributed to the classes of food available to the peasant. In spite of the discussion which has centered about this subject there have been surprisingly few accurate observations and until the most recent years practically no experimental work has been done to elucidate the problem. It is not the purpose of this article to review the work on the subject but merely to report the results of a short and incomplete experiment in order that the information may be available for those who may wish to go more deeply into the question in an experimental way.

At various times since the present school system was established there have been physical examinations of school children including weighing and measuring. Tabulation of the results and comparison with the standard height-weight-age tables of the Continental United States have shown varying proportions of the children more than ten per cent under weight by these standards. The number of underweight children shows a wide variation between different municipalities and different parts of the island and there has been doubt whether these standards could be safely used as a guide in work with the school children of Porto Rico. The work conducted by Miss Grace Powers and the teachers of the Practice School of the University of Porto Rico indicate that in children of the social stratum from which these children come, the simple addition of a moderate amount of milk to the diet will ultimately bring practically the entire group to within ten per cent of the standards required by the tables used on the continent. For the purposes of the observations to be described the usual Wood-Baldwin tables have been accepted as the standard.

The present experiment was planned as the first of a series in

<sup>1</sup> This experiment was conducted under the auspices of the Municipal Health Unit of Río Piedras, Porto Rico, in which the Insular Department of Health, the Municipality of Río Piedras, and the International Health Division of the Rockefeller Foundation participate. The funds for the purchase of supplementary food used in the experiment were supplied from private sources and the valuable assistance rendered by the donors and by the teachers in the school where the experiment was conducted is gratefully acknowledged by the authors. The teachers, Miss Inés Herpen and Miss María Martínez complied most readily with every request for additional assistance.

search of some article of food which might be used in school lunches for the poorer classes to improve the general health and to reduce the evidence of under-nutrition. Since all of the cheaper foods, are already utilized to a greater or less extent by the poor, the question is resolved into whether the observed under-nutrition is due to quantitative or qualitative deficiency in diet. Would the defect be corrected by administering a larger quantity of the food now consumed, or is there a lack in definite elements so that success will depend on the addition of articles of food not now generally used?

Two foods were chosen for this preliminary experiment, milk and bananas of the variety known as "gigantes". There were two experimental groups of children, those of the morning session of School A, receiving milk, and those of the morning session of School B, receiving bananas. The children of the afternoon sessions of the same schools were the controls. All of the children were of the first grade, all were of the same neighborhood and were from families of comparable economic status. The numbers were small and the time of the experiment was short so the results can only be regarded as suggestive.

*Materials used.*—The milk used was prepared from freshly opened cans of "Klim" whole milk powder about two hours before use. It was not possible to have the bananas of such uniform quality but the best in the market were purchased within twenty-four hours of the time of administration.

*Methods.*—The children of School A had been weighed and measured by the health officer in the routine of school work on March 27, 1928. School B had been examined on April 10, 1928. The results of these examinations were accepted as the basis from which to start, but a second examination was made of the experimental groups on the fifth day of the experiment. All weights and measurements were made by one of us. Since the children were all lightly clad, no clothing was removed for weighing and no allowance was made for its weight. In the case of the children who wore shoes, one-fourth to one-half inch was deducted from the measured height, according to the height of the heels.

Work in School A began on April 30, 1928, and in School B on May 1. It ended in both schools on June 8, 1928, a period of six school weeks. The supplementary food was given immediately after assembling the children for the morning session and it was administered to all children present who desired it, regardless of the state of their nutrition as shown by the standard tables. With the exception of three days of the experiment, one of us was pres-

ent to supervise the administration of the supplementary food and to record the amount taken by each child. On the other days this work was done by a competent health visitor from the Department of Health.

The milk was administered in quantities of approximately four ounces in paper cups. Each child was allowed three cups but the majority could drink only one or two. There were a few children who refused the milk. No effort was made to coerce them and they are included among the control groups. In the banana group there were no refusals. The allowance in this case was one banana a day and it was eaten immediately after it was received. In order that there should be no unavoidable extraneous factors influencing the weights of the children no health instruction was given and there was no encouragement of competition among the children for gaining weight.

*Complicating factors.*—There was a slight lag in the starting of the milk group due to slowness in developing a taste for the beverage. A few cases of parotitis and of respiratory infection developed during the experiment as part of general epidemic, but it is believed that their number was not sufficient to affect the results. During the last three weeks of the experiment toxin-antitoxin was administered to many of the children and during the last two weeks many of them had to take treatment for uncinariasis. The possible effect of these complications will be discussed later.

*Results.*—For the first comparison, the children of each group have been subdivided according to the relation of their weights to the standard weight for age and height at each weighing. Heights are considered to the nearest inch in the table and children whose weight is within one pound of the standard are rated as "normal".

TABLE NO. 1

**CHILDREN CLASSIFIED ACCORDING TO THE RELATION OF THEIR WEIGHTS TO THOSE GIVEN IN THE STANDARD TABLES**

Group	Original Examination			May 18, 1928			June 18, 1928		
	Total	Number normal or above	Number 10 per cent or more below standard	Total	Number normal or above	Number 10 per cent or more below standard	Total	Number normal or above	Number 10 per cent or more below standard
Milk .....	26	11	7	25	15	4	26	14	4
Bananas .....	30	17	5	26	13	2	26	16	2
Control A .....	26	13	5	23	13	4	24	13	4
Control B .....	23	9	5	21	7	3	21	10	3

It will be observed that there is a tendency in all of the groups toward a reduction in the number of children ten per cent or more below the standard. These were entering the higher subdivisions regardless of any supplement to the diet. There is an increase in the "normal or above" subdivision of the group receiving milk, the numbers being 11, 15, and 14, respectively. There is an increase of one in this subdivision in Control B, but in Control A this subdivision remains unchanged, and in the banana group the numbers are 17, 13, and 16. The change in this subdivision suggests that the group receiving milk has fared better than its neighbors, but for such small numbers the method of study is not sufficiently delicate for valid conclusions.

In order to approach the question from a slightly different angle, the changes in weight of individual children and of the different groups during each period between weighing has been studied. The results by groups have been tabulated in Table II. A few children were absent from some of the weighings and consequently could not be considered in every period. In each case the number considered is the number who were weighed at the beginning and at the end of the particular period. In the experimental groups the period from the first weighing to May 4, the weighing immediately after the experiment started, has been omitted from the table since it cannot be compared with a similar period in the two control groups. During this pre-experimental period the milk group showed a net gain of 0.131 pounds per child per week and the banana group showed a net gain of 0.173 pounds per child per week.

TABLE No. II

**CHANGES IN WEIGHT IN POUNDS IN EACH PERIOD BETWEEN WEIGHINGS WITH NET CHANGES IN WEIGHTS OF GROUPS**

	Total	Weight un- changed	Gained	Lost	Net change	No. of weeks	Change per child per week
<i>First weighing to May 15</i>							
Milk .....	24	2	21	2	+30.00	7	+ 0.171
Bananas .....	28	2	15	5	+13.75	5	+ 0.120
Control A .....	25	2	20	3	+22.50	7	+ 0.128
Control B .....	21	1	13	7	+ 3.50	5	+ 0.032
<i>May 15 to June 5</i>							
Milk .....	26	5	11	10	- 0.50	3	- 0.066
Bananas .....	24	4	8	11	- 6.75	3	- 0.497
Control A .....	22	3	6	13	- 4.00	3	- 0.060
Control B .....	20	3	9	8	- 2.25	3	- 0.037
<i>First weighing to June 5</i>							
Milk .....	26	2	20	4	+28.25	10	+ 0.109
Bananas .....	23	5	12	6	+ 7.50	8	+ 0.040
Control A .....	24	3	15	6	+17.75	10	+ 0.074
Control B .....	22	1	13	8	+ 0.25	8	+ 0.001

The results show that up to May 18 all groups were gaining in weight but that the gain shown by Control B was small. The next period shows that there was some unidentified influence at work which produced a net loss in weight in all of the four groups, but it was smallest in the group taking milk and was largest in the group receiving bananas. The milk group is the only one showing a gain for the entire period which compares with the rate of gain in the pre-experimental period.

The results which have been summarized indicate that the adverse condition which was interfering with the normal increase in weight apparently began to be operative about May 18 but there is reason to suspect that Control B was affected by it prior to that date. Since the loss of weight in the group receiving milk was small as compared with that in the other group, and we know of no other condition in which the two groups differed, it appears that the milk, small though the quantity was, must have acted as a protective against the unknown adverse condition.

In an effort to identify the adverse condition, inquiry was made into the occurrence of illness among the children and it was found that an epidemic of a respiratory infection was beginning and one of parotitis was in progress, but neither had affected a sufficient number of children to account for the failure of the groups to gain in weight. Comparison of those who took treatment for uncinariasis with those who did not take it showed no significant difference in net gain between the two groups.

#### SUMMARY AND CONCLUSIONS

1. Data are presented showing net changes in weight of four small groups of school children. One group received a small amount of milk as a supplement to its diet, one received bananas, and two groups were controls.
2. An unknown adverse condition affected all groups during a portion of the experimental periods, causing net loss in weight in all groups.
3. The group receiving milk showed a smaller net loss than any other group.
4. The group receiving bananas showed as great a net loss as the control groups.
5. The results suggest that the addition of a small amount of milk, which is absent from the daily diet of many of the children observed, may exercise a protective influence against adverse con-

ditions which manifest themselves in failure to gain weight at the normal rate. The addition of bananas, which constitute a quantitative but not a qualitative change in the child's diet, did not show a protection corresponding with that shown by the administration of milk.