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Malnutrition and Health Education

David Mitchell ^a & Harriet Forbes ^a

^a Bureau of Educational Experiments , New York , USA

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MALNUTRITION AND HEALTH EDUCATION

By DAVID MITCHELL and HARRIET FORBES, Bureau of Educational Experiments, New York

ORGANIZATION OF CLASSES

The conclusion of our work last year led us to the decision that it would be wise both to carry on the work with some of the same children, and also to set up an entirely new experiment. To carry out the first purpose the principal of the school¹ arranged for two open air classes, of which the children should be, as far as possible, those who had been in our nutrition classes the previous year and who were still seven per cent or more underweight for their height. Altogether in these two open air classes 48 children of this type were included. The number of children with various percentages underweight are shown in Table I. The first column gives the distribution of percentages underweight from 21 to seven per cent. Columns two and three show the number of children in the two groups who were the various percentages underweight, while the final column gives the total number in the two classes. There were 13 children ranging from seven to nine per cent underweight; three of the 48 were from 19 to 21 per cent underweight for their height.

In arranging for the new experiment we selected the fifth grade children as the most desirable since they were about the

TABLE I
DISTRIBUTION OF PERCENTAGES UNDERWEIGHT AT CLASS ENTRANCE

Per cent	Open Air		Total
	Group 1	Group 2	
—21 —19	1	2	3
—19 —17	2	..	2
—17 —15	3	..	3
—15 —13	6	4	10
—13 —11	3	3	6
—11 — 9	3	8	11
— 9 — 7	8	5	13
Total	26	22	48

¹ Public School 64, Manhattan, is for boys only and has an enrollment of over 3,000. Mr. Louis Marks is principal. See PED. SEM., xxvi, 1919, pages 1-26.

TABLE II
DISTRIBUTION OF PERCENTAGES OVERWEIGHT AND UNDERWEIGHT

Percentages	Fifth Grade Classes		Total
	5A-X	5A-Y	
53 —51	1	..	1
.. .. .	..	..	..
25 —23	1	..	1
23 —21	..	..	..
21 —19	..	..	..
19 —17	..	..	..
17 —15	..	1	1
15 —13	..	2	2
13 —11	2	4	6
11 —9	6	1	7
9 —7	7	..	7
7 —5	8	2	10
5 —3	3	4	7
3 —1	9	6	15
1 —1	16	11	27
— 1 —3	13	6	19
— 3 —5	19	4	23
— 5 —7	12	7	19
— 7 —9	21	10	31
— 9 —11	9	8	17
—11 —13	5	..	5
—13 —15	5	1	6
—15 —17	1	..	1
—17 —19	..	..	..
—19 —21	1	..	1
Total	139	67	206

same age as the majority of the other children, and also, up to the time of this measurement of them they had had no training through our nutrition classes. The children were organized in two groups in the school system. In one group there were 139 and in the other 67. The distribution of the percentages overweight and underweight is shown in Table II. They ranged from 53 per cent over- to 21 per cent underweight. In one group, 17 children are seven per cent or more overweight, 80 are within seven per cent of average, and 42 or 30 per cent are as much as seven per cent underweight.

Owing to the epidemic of influenza and necessary rearrangement in the school organization the classes of fifth grade children were not organized for approximately seven weeks after the initial weighing. At this time 39 of the 42 5A-X children were again weighed. The distribution of weight is shown in Table III. The second column gives the distribution at the first weighing. None of the children is less than seven per cent underweight. As shown in the third column, the children seven weeks later had increased so that they were markedly nearer the average weight. Twelve of the children were within five

to seven per cent underweight. Nine of them were from three to five per cent, while one had come up to within three per cent of average weight. A total of 22 children at this first class meeting would according to our accepted standards be considered as being above the "dead-line" of undernourishment.

Several reasons for this progress might be given. In the first place, regularity in school life, as contrasted with the irregularity and unsatisfactory conditions of city living during the summer time, might be advanced as a possible cause. On

TABLE III
PERCENTAGE UNDERWEIGHT AT FIRST WEIGHING AND FIRST
CLASS MEETING

Percentages	Fifth Grade Group 1st Weighing	1st Class
1 — 3	..	1
3 — 5	..	9
5 — 7	..	12
7 — 9	19	8
9 — 11	11	4
11 — 13	4	1
13 — 15	4	2
15 — 17	..	1
17 — 19	1	1
Total	39	39

the other hand, there is some reason to believe that this increase in weight was apparent rather than real. The first weighing of the children occurred in the latter part of September, a time of great heat with consequent light clothing. The second weighing occurred in November when the temperature had dropped considerably, and in some cases, if not in all, the children had commenced wearing heavier clothing. If the latter explanation is the true one, and it undoubtedly is a contributing factor, we are led to the consideration of the reliability of fine determinations. It is possible that increases or decreases in weight may be due to variations in the clothing rather than to the observance or neglect of prescribed conditions.

Physical Examinations. Each child in the class was given a physical examination, which was planned to cover such features as bore definitely on the nutrition of the child. In all cases which seemed to show naso-pharyngeal obstruction, the advice of a specialist was obtained. The open mouth, mucus discharge, granular throat, dull or retracted ear drums, and enlarged, buried or cryptic tonsils were indicators. Throughout the school year operations were performed in 23 of the 32 necessary cases.

Social Environment. The section in which the school stands is somewhat removed from the worst slums. In none of the 87 families visited has there been evidence of inflated incomes due to war industry. Rather has it been true that with the majority there was increased hardship due to loss of their wage earning members and to the increased cost of living.

School Environment. The children were housed in a modern building equipped with shops, baths, auditorium, and yard space, while a well conducted eye clinic which served the district under the Department of Health was given room in the building. The daily use of the nearby park and the social activities represented by the Boys' Club, the Settlement, and the Library, enriched the curriculum considerably. The school had stood for many years as one of the most progressive in the city.

Weekly Weighing and Interviews. At the time of the weekly weighing, there was an interview of five to ten minutes with each boy. Data were collected under the following heads: weight, rest periods, lunches, number of hours sleep the previous night, amount of food, coffee or tea, water at meals, windows open, lack of breakfast, rapid eating, excessive fatigue, colds, clothing, and any other significant facts.

Charting. Charting of the weekly gain or loss together with data such as the number of daily rest periods and lunches, the use of stimulants and the number of calories, was done prior to the class exercises.

Measured Feeding. A record of the kind and amount of food taken for forty-eight hours was kept weekly by each boy in a book in which there was a table showing 100 calorie portions of various foods. This table was a source of interest and most of the children chose to figure their own caloric intake and did so with considerable care and success. The use of this book made it possible to introduce gradual changes and increases in diet along the line of least resistance. Thus, by the addition of a few prunes, a pat of butter, an extra glass of milk, or a slice of bread, a child can easily obtain the amount of food required.

Class Periods. For the instruction the charts were arranged with the one showing greatest gain for the week placed first and the others following in regular order. The children took seats in the relative position of the charts. A half hour was then spent analyzing the records and taking up questions such as; what constitutes good nutrition, the uses of food, the significance of measured feeding, the value of certain foods, and food habits.

Home Visits. Because it proved too difficult to persuade the mothers to attend the class periods regularly as is done at the hospital nutrition clinic, it was necessary to increase the number of home visits considerably and miniature charts were carried into the home to be studied there.

Control Investigation. For two reasons we wished to study a group of normal children. In the first place, we could not tell whether the underweight of some of our children was temporary or chronic. By selecting a group of children who were approximately average weight for their height at the time of the first weighing, and by repeated measurement, we could determine the extent of the variability. In the second place, in order to check up on our psychological investigation of the undernourished child we must have similar data secured through experimentation with wellnourished children. Table IV shows the results for 35 children. The first column of this table indicates the percentage over- and underweight. The second column shows the distribution at the time of the first weighing, the second and third columns for two other weighings, at the beginning of the second school term, and in the final week of May. Unfortunately in this third weighing eight of the children could not be secured, so our results are for 27 instead of 35. The variability is quite marked. Whereas at the first weighing all of the children were within three per cent of average weight for their height, on the second weighing they varied from nine per cent under- to 12 per cent overweight, and on the final weighing the 27 children ranged from eight per cent underweight to five per cent overweight.

Results

In tabulating the results we have considered the gain as a percentage of the normal gain rather than a percentage of gain in excess of normal. The expected gain for any child is determined by taking the yearly increment for children of his age and finding a proportionate amount of increase for the period the child was in the class. Determinations were made for the first twelve weeks of the class, for the first nineteen weeks and the final weight which was for the open air class approximately thirty-two weeks, and for the fifth grade class approximately twenty-seven weeks. Besides this, there was calculated for the fifth grade class the percentage of gain for the seven weeks which elapsed between the original weighing and the first meeting of the class.

The results for both groups are shown in Chart 1. On the base line is indicated the periods for which results were calcu-

CHART I

TABLE IV

PERCENTAGES UNDERWEIGHT FOR THREE WEIGHINGS

Percentage	Control Group		
	1st Weighing	2nd Weighing	3rd Weighing
9	..	1	..
8	..	..	1
7	..	..	1
6	..	..	3
5	..	1	1
4	..	..	1
3	7	3	..
2	7	1	3
1	4	3	3
0	6	5	6
1	4	4	..
2	3	3	4
3	4	3	2
4	..	1	1
5	..	2	1
6	..	4	..
7	..	1	..
8	..	1	..
9	..	1	..
10	..	..	..
11	..	..	..
12	..	1	..

lated; A, the first seven weeks for the fifth grade classes; B, the first twelve weeks of instruction; C, the nineteen week period; and D, the final result. The figures at the left hand side of the chart are percentages of normal gain. The height of the columns shows the average per cent of gain, the shaded column indicating the fifth grade group and the plain column the open air classes. The open air classes in the first twelve weeks increased 274 per cent of the normal gain, whereas in nineteen weeks it was 125 per cent, and in the entire period 111 per cent. The difference is not so great for the children of the fifth grade classes. In the first seven weeks between the original weighing and the first meeting of the class, the average percentage gain in relation to normal was 208. In the first twelve weeks of the classes it had decreased to 156 and was approximately the same for nineteen weeks, but for the entire period it was only 106 per cent. In other words, the effect is marked in the beginning of the work, but constantly decreases until the expected rate of gain is reached.

Chart 2 shows the percentage gain for the children of the

CHART II

fifth grade classes for each week. It is constructed so that the base line indicates weeks and the figures at the left show the percentage of gain on the original weight. The gain for the entire period is approximately nine per cent. If the gain had been calculated from the two weights given at the beginning and the end of the period, it would have been approximately ten per cent, but we wished to have the record of the weekly gains so that we might if possible show the relation of various school periods to the children's progress. At promotion time the children register a loss of approximately 0.6 per cent. The recovery, however, is fairly rapid, an almost equal gain being registered the week following. In the same way, for parade week when there was a special holiday, the children lost.

A Physical Handicap. The effect of enlarged tonsils and adenoids on the nutrition of a child has long been suspected. A good indication of it may be obtained by comparing progress in a period previous to correction and in a similar period following operation. Of the 23 children for whom operations were arranged, only ten are available for this comparison. The reason was that we wished to have a period of at least five weeks after the child had returned to his original weight, that is, when he had recovered from the loss consequent on the operation. The relation of the gain during the second period to the progress during the first period is graphically shown in Chart 3. In this chart the percentage of gain is shown on the ordinate. The position at which the children were at the beginning of the first five week period is shown by the zero point. The average loss of four-tenths of one per cent for five weeks before the operation is shown by the first section

CHART III

of the curve. The elapsing of four and six-tenths weeks during which the children recovered the weight which they lost at the time of the operation, is shown by the dotted lines. The average gain for the five weeks following this recovery is shown in the third and final part of the curve. The rapid rise in this part of the curve is in sharp contrast to the direction in the first part.

Other Factors. We made investigations of the relation of caloric intake, the number of rest periods observed and the number of lunches taken, to the percentage of gain. In none of these cases did we find a clear cut correlation. Had our groups been much larger we might have been able to isolate one factor but with our small numbers it was impossible to make classifications in which only one factor was operative. In reference to these conditions we must wait for further evidence.

CHART IV

Individual Children. The record of Chart 4 is one where the evidence seems to be conclusive that the method of the nutrition classes is effective. The physical defects of this child had been to a large extent remedied before the beginning of this class period. His teeth were in good condition and enlarged tonsils had been removed before the beginning of this class. In other particulars his physical condition was fairly satisfactory. For postural defects a certain amount of correctional

gymnastics was prescribed. So satisfactory was this child in observing the requirements that he insisted on keeping a record of calories at vacation time. Backing up this co-operation on the part of the boy, was that of the home. His parents were in fairly good circumstances and intelligently assisted in all the efforts which the school put forth for the progress of the boy.

The record of Chart 5 is of possibly greater interest. The conditions with which we have to deal are apparently similar. In this case the physical defects were minor. An operation for the removal of tonsils had been performed about four

CHART V

months before the beginning of the class. At the time of the examination certain conditions were noted which may have been the remaining effects of this abnormal condition. The anterior cervical glands were enlarged, the throat was granular and the ear drums were dull. The mother reports that no great progress was noted even after the operation and the record which we here present corroborates her statement. The curve for his actual increase in weight runs almost parallel with the line for the expected increase. In co-operation he was not so satisfactory as the previous child, as the record of mid-morning lunches and rest periods indicates. One condition which he did fulfill was to slightly increase the amount of food taken. The caloric intake of the last week is slightly higher

than during the first part. This child shows very clearly the need for extensive investigations in the problems of nutrition. As a hypothesis, we may say that some children are biologically lighter in weight than other children of the same height. This child may be one of the extremes in that normal variation.

The record of Chart 6 is similar. At the time of the physical examination he had five carious teeth, four of which had been treated by the time of the class opening. Tonsils had been removed the previous year. The physician reported that the child was a mouth breather, that his throat was granular and

CHART VI

that the cervical glands were considerably enlarged; also that the ear drums were dull and retracted. At an examination toward the end of the nutrition class period, his throat was reported in satisfactory condition, the tonsils presenting no difficulty, but four other teeth needed treatment. His general health seems to have been fair, the only diseases which he had had were whooping cough at four years and measles at five years of age. His record for rest periods, lunches and caloric intake is fairly satisfactory. His caloric intake for the first three weeks was lower than expected but later the amount seems to have been sufficient. Co-operation from the mother was very poor, the investigator reporting that illness, indifference, and ignorance, were the chief characteristics of the family.

We have shown in the general discussion that the removal of enlarged or diseased tonsils was followed by a rapid increase in weight. Chart 7 shows one of the cases where there was a fairly good increase, even while the child suffered from this physical defect. Nevertheless, the gain in this case is more rapid in the first than in the later weeks. In the first two the child gained four pounds. He was then four and one-half pounds underweight. At the end of the class period, he was five pounds underweight. In other words, from the begin-

CHART VII

ning of the third week of the nutrition class to the end, the gain was less than the expected gain. It may be that the removal of the diseased tonsils would have remedied the condition and this child would have reached the average weight for his height. There are, however, certain other factors to be considered. The child's stepmother was not particularly co-operative and according to the social investigator would be described as "queer." It may be that her attitude toward the boy was a possible factor in the progress. The child himself co-operated fairly well. In only three cases out of the total number of weeks did he fail to observe all the requirements of rest periods and mid-morning lunches. The caloric intake increased with the continuance of the nutrition classes. In the first few weeks the amount ranged from 1300 to 2100 calories, in the last few weeks from 2200 to 3000.

In some ways the conditions shown in Chart 8 are identical with those of the previous one. The child suffered from diseased tonsils throughout the year. He increased somewhat the caloric intake, going up from 2200 to over 3000 calories. He got his mid-morning lunch every day of every week. Other conditions, however, are quite different. He lived in a good home where the co-operation was good, but they feared the result of having an operation performed for the removal of the diseased tonsils. His throat was reported granular, the

CHART VIII

cervical glands enlarged and the ear drums dull. He had certain postural defects such as round shoulders and winged scapulae. It may be that the diseased tonsils were responsible for this child's failure to gain. Obviously it is necessary before any other conclusion is reached to have this physical defect removed.

The child whose record is shown in Chart 9 is one of those for whom we succeeded in having an operation for enlarged tonsils during the class period. He is also one of those whose gain after the operation was very good. In the beginning he was eight per cent underweight. By the end of the period he had come up to within half a pound of being the average weight. In the family situation there were certain other conditions which militated against rapid progress. Emotional

CHART IX

conditions, primarily antagonism on the part of other children because of favoritism to this child, seemed to play some part in determining the rate of progress.

Chart 10 gives the record of a child who was apparently in very bad condition at the time the class was organized. He

CHART X

was 17 per cent underweight. He had had an operation for diseased tonsils. The physical defects were insignificant, there being only one carious tooth. This child was, however, handicapped by the attitude of the family toward him. The investigator reports that he was "petted and spoiled." He was also one of the few children who succumbed to the temptation of tea or coffee. Nevertheless, these factors did not seem sufficient to explain his failure to make better progress. He has just failed to make the expected gain, being one pound more underweight at the end of the class period than he was at the beginning.

CHART XI

The child whose record is shown on Chart 11 presents serious difficulties. He has improved considerably, but he still shows symptoms of nervous instability. He is one of those children of whom it is suspected that there is a greatly increased basal metabolism. In other words, the amount of food necessary to counteract the waste due to the ordinary functions of living, such as respiration, heart action and so on, is very great. This child shows clearly the necessity of more information concerning the nutrition processes. His highly excitable and nervous condition may be a symptom or a cause. It is necessary that we understand some of the physiological and psychological processes before the diagnosis in this case is possible.

PHILOSOPHY OF NUTRITION CLASSES

At one time it was rather generally assumed that the fundamental cause of malnutrition was lack of sufficient food. Somewhat recently this notion has been considerably modified. Malnutrition is not unknown among children of the well-to-do, and in cases where children were receiving sufficient food there has been serious undernourishment. We have, therefore, been led to look for other causes than poverty.

It was with the consideration that undernourishment may be the result of ignorance and faulty education, that the Bureau of Educational Experiments was concerned when it planned to carry on the nutrition classes. As a tentative hypothesis we decided to assume that either the children had a sufficient amount of food or the necessary quantity could be procured. For the undernourished condition we might assume as a casual factor, ignorance, both on the part of the parent and child as to the desirable conditions under which food should be taken. From this point of view education is obviously a solution of the problem.

But this was not the only consideration urging us to set up an experiment in nutrition. First hand experience and opportunities for self-expression are as valuable in nutrition as in other fields. We believed that the approach to health education, where children had an opportunity to experiment and make original observations would inevitably lead to the most desirable results.

The instruction in our classes was concerned with what we may call certain positive or helpful conditions and certain negative or detrimental factors. The children were brought into the class room and there were displayed prominently before them charts of which those numbered four to eleven in this report are typical. The child who made the greatest gain for the week had his chart in what was recognized the head position in the line of charts. The other charts were arranged in the order of decreasing gain until at the opposite end of the line, the chart of the child who had made the least gain was placed.

The desirability of our class procedure must be seriously considered. We assume that a certain number of conditions were responsible for a child's failure to gain and that with the removal of these conditions, progress would be inevitable. Among the conditions which we considered detrimental were lack of sufficient rest, use of stimulants such as tea and coffee, failure to take time to properly masticate the food while one was in a restful position, the presence of carious teeth or diseased tonsils, and also excessive expenditure of energy in

violent exercises or overwork. When a child had made progress, one of these factors where he had lived up to our requirements was sometimes emphasized as the reason. We told him that he was doing well and he should continue in the way in which he had been going.

The fact that the children made progress at times when they did not fulfill conditions militated seriously against the acceptance of our judgment. At the same time we reported to the children that the failure on the part of others to make progress was due to their lack of observance of the conditions which we prescribed. We spoke about the failure of a child to gain for whom an operation had been recommended for the removal of enlarged or diseased tonsils, and we emphasized that condition as being the one which made his progress impossible. Nevertheless, the children were able to see from the charts that gains were not made only by children free from enlarged or diseased tonsils, but that some children, as for instance the child whose record is shown in Chart 6, made progress despite the handicap. We found also children who consistently failed to make more than the normal rate of progress and who as far as we were able to determine, more faithfully observed our conditions than other children whose progress was more rapid. Considering all these facts, it is evidently necessary for us to reconsider our hypothesis and procedure and to question the effect of our instructions on the child.

We shall consider first the revision of the hypothesis. Unfortunately our group of children is not large enough that we are able to classify them in such a way that we may get an indication of the effect of one isolated factor. The fact, however, that some of our children consistently failed to make more than normal progress, leads us to the question of a possible biological variation which may be a perfectly normal condition for them. It is obviously necessary in order to answer this question to consider the progress of such children over a long period of time when the conditions which we consider important may be constantly observed and when the general health of the child may be definitely known. If, as we suspect is possible, a child may continue markedly under the average weight for his height and still show no physical defects nor an insufficiency of energy for meeting all the demands which life makes on him, it seems necessary for us to conclude that this child's condition is normal, or in other words is certainly not diseased even though he be so greatly different from the average of his group.

The second question which we propounded to ourselves was concerning the effect of our class procedure and our discussion upon the children themselves. On the one hand we spoke about the result of observing certain conditions as shown in the child's gain, at the same time that another child who had observed those conditions, failed to gain. Taking for granted that the children have some ability at analysis and judgment, it is inevitable that their inference is that it is largely a matter of chance whether one makes progress and that the observance of these conditions then becomes a matter of preference;—they may or they may not gain. On the other hand we have children who are consistently failing to make progress greater than the expected rate and who are honestly endeavoring to do all that is required of them.

We hold up before them the record of a failure. The child sees his normal weight line shown far, far above his actual weight line and week after week goes by in which he sees no progress being made in decreasing the distance between the two lines. The psychology of success is as applicable here as it is in any other situation. The accomplishment of a purpose is a stimulus to a greater effort. Constant failure on the other hand leads to indifference and lack of effort. The psychology of failure is as significant as the psychology of success. Persistent failure develops lack of confidence and makes for the cessation of all effort.

We are therefore faced with the problem in our nutrition classes of deciding on causal factors. We must know the amount of food necessary not only to maintain life, but also to supply the energy which is used up in various life activities. We would also have to consider the effect of various physical defects and living conditions on the child's nutrition. Obviously it would be desirable to be free from all physical defects, but there are probably some which interfere but little, if at all, with the nutritive processes. It is highly probable that diseased tonsils are detrimental in nutrition. It is extremely improbable that such physical defects as Darwinian tubercle or a supernumerary finger would have anything to do with nutrition. An evaluation, however, of the influence of physical defects is highly desirable.

Not by any means is the psychological aspect the least important one. This we may consider under two heads: (a) the attitude of the child toward food, and (b) the emotional characteristics of the children and their associates. It has been clearly shown that the former of these factors is highly important. People have thought they were starving because the type of food taken had been changed, even though the caloric

or nutrition value of the food taken was much greater than that of the food to which they were accustomed. In other words, one could "starve"² despite the fact that more nourishing food was provided.

These factors were not seriously considered in preparing a diet for our children and in many cases the only thought given in the preparation of a diet was to include certain forms of food which were deemed desirable or necessary in order to offer an all round food supply. It will be necessary in further experimentation to consider the psychological factors of prejudice and preference in order to be able to say definitely what the effect of more food is on the undernourished child.

In reference to the second fact, that of emotional conditions, it has been shown very clearly by experimentation that certain emotional factors, such as rage or fear, have a marked effect on nutrition processes. Cannon reports the cessation of the churning movements of the stomach when these feelings are aroused. These two emotions are dominant, but many other emotional characteristics such as irritation, jealousy, worry, envy and so on, are probably important even if not such great factors as either rage or fear. In order to answer this question we need extensive investigations of the influence of these conditions on digestion or the other nutritive processes.

Despite such conditions, we would strongly recommend the inauguration and the continuance of nutrition classes for health education. It may be that we are not able to solve the problem in this generation by this particular method, but certain results indicate the far-reaching effect of the procedure. The children who are thus being taught the desirability of regularity of habits and the necessity of eating proper food and the necessity of eliminating harmful stimulants, will undoubtedly influence the nutrition of the next generation. How well they will do this may be indicated by the following illustration: One of the boys in the class came to the instructor with the remark that he had been trying to persuade his mother that "an ounce of prevention is worth a pound of cure." The instructor did not get the significance of the comment at first and asked the boy what he had been trying to do. His reply was that he had been interested in the class work, he had been reading about nutrition and had come across this statement. He concluded, "I tried for two hours to show my mother what that meant, and at the end of the time she did not know a thing about it." If attempts at the education of

² See Baylis, *The Physiology of Food*.

parents are made in this way, what may we not hope for in the education of children? We may not cure malnutrition by education, but we can develop habits and methods of living which will have a decided influence for good with our next generation.

MENTAL ABILITY OF UNDERNOURISHED CHILDREN.*

Some experiments seem to demonstrate that the undernourished child is less fit mentally than other children. He has been supposed to be less able to make progress in school subjects and to be less alert in adapting himself to the requirements of new situations. In order to test the validity of these conclusions we decided to experiment with our nutrition class children.

Our work had two parts: (a) the study of the emotional characteristics, particularly as they were shown in the home situation so that we might see if certain emotional characteristics were associated, if not definitely causal factors, in undernourishment; (b) a careful measurement of mental and physical qualities so that we might know in what way and to what extent the children in the nutrition classes differed from wellnourished children.

In order to make an interpretation of our results possible, we decided to work with a "control" group. We, therefore, selected those children in the remaining portions of the fifth grade classes who were nearest the average weight for their height. We found thirty-five children whose variation was not greater than three per cent.

The tests were both individual and group and consisted of the following: *Individual* 1. Rapidity of Movement or Tapping, 2 Control of Movement or Steadiness, 3. Strength of Grip or Dynamometer, 4. Dearborn Reconstruction Form Board, 5. Knox Cubes, 6. Memory Span, 7. Free Association. *Group* 1. Trabue Completion, 2. Following Directions, 3. Cancellation.

The selection of these tests was determined by two considerations, first we wished to get a measure of the pupil's mental and physical endurance together with an indication of his ability to adapt himself to various situations, and second, we wished to have a group of tests in which it might be possible to get a second result after a period of approximately six months without the factor of practice or learning having too great an influence.

* The experimental work was carried on by Dr. B. J. Johnson, but she is not to be held responsible for any errors or the interpretation of results.

Rapidity of Movement. The apparatus used for this experiment was the "tapping board" described by Whipple in his manual of mental and physical tests.

The score used in tabulating the results of this test was the total number of taps for forty-five seconds. These were divided into three periods of fifteen seconds each. The time was limited to forty-five seconds because in comparing results of a longer record, the third fifteen-second period shows little variation from the fourth or fifth fifteen-second period.

The results are shown in Table VIII.

TABLE VIII

TAPPING

		Nutrition		Control	
		First Trial	Second Trial	First Trial	Second Trial
Right Hand	1st period	79.2	82.2	81.8	83.6
	3rd "	68.5	68.6	72.1	69.2
Left Hand	1st "	71.1	72.7	70.3	74.1
	3rd "	60.9	64.7	59.8	61.4

The nutrition group on the first trial made a score of 79.2 in the first period and 68.5 in the third period. The control group is slightly superior, but the decrease in the third period does not differ greatly for the two groups. In the same way for the left hand there is but little difference in the groups, and the decrease in efficiency in the third period is almost the same.

In the second trial both groups are slightly superior to the first trial in the first 15-second periods. There is not so much difference between the scores for the two groups, and their decrease in efficiency during the 45-second period is almost the same. The remaining figures in this table showing the results for the left hand are in every case less than those for the right hand in the corresponding trial, but do not show any significant features.

From the standpoint of rapidity of voluntary movement it cannot be said that the undernourished children are either better or worse than the so-called wellnourished children. In five out of the eight results, the control group gives a slightly better record whereas in three of the results the nutrition group is superior. The predominance of one group over the other is not sufficient to warrant any conclusion of superiority either in ordinary capacity, in resistance to fatigue or in rate of improvement.

Steadiness Test. The apparatus used was the Dunlap Model of the Steadiness Tester, the construction of which makes it

possible to have each hole in the same relative position to the subject's arm for each test. The scoring was done by taking the number of the hole in which the subject made more than 12 contacts. Since the holes were numbered from one to ten in the order of decreasing size, the poorer the result the smaller will be the score. In tabulating the results no account was taken of the number of contacts the child made on any particular hole until this number exceeded twelve.

Some variation is shown in the two groups; the control group having a considerably larger number of children making a score of four or less, with both right and left hand. The average scores, however, for the two groups do not differ much. For the nutrition group they are 5.0 and 3.6 for the right and left hand respectively, while for the control group they are 4.2 and 3.2.

In the second trial made at the end of the nutrition class period, the average scores are practically identical for the two groups. With the right hand the scores are 4.6 and 4.7 for the nutrition and control groups respectively, and for the left hand they are 3.5 and 3.6. These differences are shown in Table IX.

TABLE IX

STEADINESS

	Nutrition		Control	
	First Trial	Second Trial	First Trial	Second Trial
Right Hand	5.0	4.6	4.2	4.7
Left Hand	3.6	3.5	3.2	3.6

From these results one would say that the improvement of the control group during the period of the experiment was greater than that of the nutrition group. As an actual fact the nutrition group falls back slightly in the second trial. The scores for the right hand being 5.0 and 4.6 in the first and second trials respectively, while for the left hand they were 3.6 and 3.5. On the other hand the control group shows a slight difference going up from 4.2 to 4.7 for the right hand and 3.2 to 3.6 for the left hand. One is led to the tentative conclusion that the wellnourished children are capable of better progress than the undernourished. A serious obstacle to the acceptance of this conclusion lies in the wide variation shown by individual children. Some of those who made high scores in the first test, made very low scores in the second, while others who had made low scores in the first, increased considerably in the second.

One of the interesting features of this test is the number of children who make a score of zero. With the right hand in the first trial not one child fails entirely. With the left hand three of the nutrition group and six of the control group fail on the first hole. In the second trial two children of the nutrition group have fallen down so much that their score is zero for the right hand. With the left hand the number of children in the nutrition group making a score of zero is the same as in the first trial, but only half the number of children in the control group make a score of zero with the left hand.

Dynamometer Test. The improved form of the Smedley Dynamometer was used. Ten trials with each hand were recorded, a brief pause sufficient to read the scale being allowed between each trial.

The average results for each of the 10 trials for the first experiment with the right hand do not vary materially. In four out of the 10 trials the score for the nutrition group is lower than for the control group. In the ninth trial the score for the control group is very much better than that for the nutrition. The average scores, however, for all 10 trials are identical for the two groups. With the left hand the control group is, with one exception, better than the nutrition. The average score in this case is 15.2 for the nutrition group and 15.6 for the control. In the second experiment at the end of the nutrition class period, the control group shows a more marked superiority, but both groups give a record which is inferior to that of the first trial. For the right hand two curves showing the results are almost parallel, that for the nutrition group being always lower than the one for the control group. The scores in this trial are 15.2 and 15.8 for the nutrition and control groups respectively, while in the first trial each group had an average score of 16.8. The scores for the left hand show a smaller dropping off from that of the first trial, the averages being 14.4 and 14.8 as compared to 15.2 and 15.6.

For the right hand in the first experiment curves of distribution almost coincide. For the left hand there is less similarity. The average scores do not differ much, but the difference in distribution is quite marked. In the second experiment average scores have a similar relationship but the distribution with the right hand is from 11 to 24 with the majority of the nutrition group ranging from 13-16, whereas in the control group the majority lies between 14-18. With the left hand the range is greater, but central tendencies are more clearly defined.

Fatigue effects may be seen by comparing the average of the first five trials with that of the last five. For the control

group in the first experiment these are 17.3 and 16.2 respectively, while for the nutrition group they are 17.6 and 15.9 with the right hand. For the first five trials with the left hand the scores are 16.1 and 16.5 for the nutrition and control groups respectively, and for the second five trials 14.3 and 14.8. In the second experiment there is a greater divergence in the two groups, but the average scores are not so markedly different. For the nutrition group for the first five trials and the second five trials the average scores are 15.8 and 14.6, while for the control group they are 16.3 and 15.2. With the left hand the scores are 14.9 and 13.8 for the nutrition group and 15.4 and 14.2 for the control group.

TABLE X

DYNAMOMETER

	Nutrition		Control	
	First Experiment	Second Experiment	First Experiment	Second Experiment
Right Hand	16.8	15.2	16.8	15.8
Left Hand	15.2	14.4	15.6	14.8
Right Hand 1st 5 trials	17.6	15.8	17.3	16.3
Right Hand 2nd 5 trials	15.9	14.6	16.2	15.2
Left Hand 1st 5 trials	16.1	14.9	16.5	15.4
Left Hand 2nd 5 trials	14.3	13.8	14.8	14.2

These numbers are collected in Table X so that a direct comparison is possible. In the 12 results given, for the two groups they are equal once. In only one case does the nutrition group give a result superior to that of the control. In ten cases the control gives the better record. From this it seems possible to conclude that as far as the qualities and capacities tested here are concerned the control group is superior.

The number of times in which the result for the second experiment is poorer than for the first is exactly 12. An explanation for this condition is highly desirable. We have considered the possibility of the child's attitude, but have found no satisfactory answer. In every case the children seemed interested and anxious to exert the maximal effort. There was no evidence of indifference or fatigue. They were as anxious to make a good record in the second experiment as they had been in the first.

The influence of the attitude of the examiner has also been considered. It may be that we assume that the child understands the necessity for doing his best as a result of the instructions given in the first experiment. This does not seem a satisfactory explanation, but until we are more familiar with

the effect of attitude upon a performance, it is not possible to entirely eliminate this hypothesis. The effect of a greeting, an expression or an intonation must be considered before we can evaluate the effect of the experimenter's attitude.

Dearborn Reconstruction Tests. The form board in this experiment was described by Dearborn, Anderson and Christianson in the Journal of Educational Psychology for October, 1916. The score used is the time required to complete the performance, 360 seconds being the maximum allowed. In the first experiment 12 of the nutrition group and eight of the control group failed. The distribution of the remaining children shows wide variation ranging from periods less than 60 seconds to periods over 330 seconds, with the children almost equally distributed in the various periods. The average time for the two groups, eliminating the children who failed, was 139 seconds for the nutrition and 144 seconds for the control group.

Some improvement is shown in the results for the second experiment, in so far as the number of failures is concerned. Seven in each group failed on this second attempt. The distribution shows a more marked central tendency, the curves approximating normal distributions. The average time for both groups is greater than in the former experiment, being 163 seconds and 153 seconds for nutrition and control classes respectively. No decision can be reached concerning the relative merits of the two groups since the average scores differ so little and the number of failures does not indicate any marked difference.

Knox Cubes. The procedure for this experiment was that recommended by Pintner and Patterson. The results for the two groups are nearly alike although for the second experiment the nutrition class has a very large number of children making the same score. In the first experiment the average score for the two groups is 7.4 and 7.8, the control group being superior. In the second, the control group is again superior, the scores being 6.4 and 6.8. Besides the greater number of children in the nutrition class who make the same score in the second trial, certain other variations are noted. The distribution extends over a wider range of scores, three of the children in the two groups for the second trial making a lower score than that made by any child in the first. On the other hand, one child makes a score of 11 and none had made a score higher than 10 on the first. As far as the standing of the two groups is concerned the children of the control class seem slightly superior.

Memory Span. The material for this test were series of digits, two trials being allowed for each series of from four to ten numbers. The memory span was the longest series on which a child succeeded on one of the two trials given, and previous to which he had not failed on both trials of any series. The nutrition group is slightly superior in the first experiment, the average score being 6.5, while that of the control group was 5.9. In the second, they are much more nearly alike, the score of the nutrition group decreasing to 6.3, while that of the control group increased to 6.2. The results indicate a slight superiority of the nutrition class children.

Free Association. The stimulus words were selected for the Association Test with the purpose of bringing out instinctive tendencies and general environmental influences. Words that had been used by other experimenters thus offering some standard of comparison, were given the preference. The lists used contained 49 words of which 14 are found in the Kent-Rosanoff list, two in the Woodrow & Lowell additions to this list and six in Jung's list of 100 words. Exact responses were recorded. In case the subject said, "I don't know," failure was recorded.

Tabulations made in this test include the frequency of response, the number of rhyming words, the number of meaningless words, the number of repetitions of stimuli, the time for the reaction to the different words, the time of the reaction for the five longest delayed responses, the number of individual responses and the average time of reaction per child. With our limited number of cases it turned out that no conclusion could be derived from most of these tabulations. The scattering of responses and various other factors made many of them of little value.

The average reaction time shows a decided difference in the two groups. The time for the nutrition children is considerably shorter than for the control group, being 2.7 as compared with 3.2 seconds. For the second experiment, the general results are not so dissimilar, but the relation of the two groups as far as the average time is concerned, is almost identical. For the nutrition group the average time is 2.5 seconds, while for the control group, it is 3.0 seconds.

Certain progress is shown in these results. The children are keener and more ready for response at the time of the second experiment than they were at the first. The difference being only 0.2 seconds on the average, we are not justified in considering it of great value. Less than a 10 per cent decrease in time, considering the number of children, is not of great significance.

Trabue Completion Scales. Scales B and D, which are described by the author in the publication entitled, "Completion Test Language Scales," were used for this experiment

In the first experiment the children do not show a very great difference, although one child in the control group scores zero and another child makes a score of only three. With this exception the distributions do not diverge materially. The average score for the control group is greatly influenced by the score made by the two exceptional children: it is only 8.8, whereas the average for the nutrition class is 9.1.

In the second experiment the divergence is considerably greater. In this case no child makes a score of less than six, but the number of the control group making the smaller scores is greater than the number in the nutrition class. The difference is shown in the average score which for the control group is only 8.9, while for the nutrition class, it is 11.0.

Since the results for the nutrition class are superior in both instances, it would seem justifiable to conclude that these undernourished children have made better progress in their school work and have more intelligence than the wellnourished children. The fact that the improvement of the nutrition children is greater than that of the control class might indicate that their intelligence is better, that they profit more by school training and have derived greater benefit from the year's work.

Following Directions. The material was devised for this particular purpose, some of it being modifications of earlier Directions tests. Using an "all or none" method of scoring, the results for the first experiment show variability in performance, the record for the nutrition group being slightly better than that for the control class. The superiority is also shown in the average score, which is 3.5 for the former and 2.9 for the latter.

By the time the class period was over, the nutrition children apparently had made no progress, their average score being identical with that of the former experiment. The children in the control group had made material progress, the average score increasing to 3.7.

Judging from the results in the first experiment, the undernourished children are better, but during the year they make no progress, whereas the children in the control group make such progress that they excel those of the nutrition class. From these conditions it is impossible to make any conclusions as to the superiority of one or the other group.

Cancellation. The material for this test was also devised for use in this experiment. There were ten questions, the

words of which were arranged in an irregular way, so that the subject had to rearrange them in order to form a question. He was then requested to check the correct answer in terms of yes or no. The number of questions correctly answered, omissions being counted as errors, was used as the score. According to these results, the nutrition group is superior, the average score being 7.4, while for the control group it is only 6.1. The superiority shows itself, also in the second experiment, although the distributions are not so clearly different. It is shown in the average scores, which are 6.5 for the nutrition group and only 5.8 for the control group.

The lower score in the second experiment is again a prominent feature. The nutrition class maintains its superiority, but has decreased somewhat more than the control group. It remains, however, at a higher point of efficiency than was reached by the control group in the first experiment.

The numerical results for the last seven tests are collected in Table XI.

TABLE XI
Nutrition Control
First Trial Second Trial First Trial Second Trial

Dearborn Reconstruction	139	163	144	153
Knox Cubes	7.4	6.4	7.8	6.8
Memory Span	6.5	6.3	5.9	6.2
Association	2.7	2.5	3.2	3.0
Trabue Completion	9.1	11.0	8.8	8.9
Directions	3.5	3.5	2.9	3.7
Cancellation	7.4	6.5	6.1	5.8

From these results it seems impossible to conclude that there is a marked difference between the two groups. We cannot say that undernourished children are as capable as better nourished children, neither can we affirm the reverse.

One of the conditions which we must remember in drawing conclusions from these results is the condition of the children included in the two groups. We must remember that 39 children who were in the nutrition class group had made great progress by the time the first nutrition classes were held, at which time the psychological testing began. We have at the same time to remember that the children of the control group, who at the beginning of the experiment were within three per cent of the average weight for their height, varied considerably before the expiration of the year.

In going over the individual records we find that the children who were most undernourished as determined by the height-weight index have made among the best records for both groups.

In formulating the program and deciding on the series of tests to use we aimed to secure a measure of the relative improvement of the two groups of children and also to have a group of tests where practice with that particular test would be a negligible factor.

It would seem that if we had fulfilled our conditions there should be a slight increase in the performance ability of the pupils, which would be in some way a measure of the improvement expected during a period of six months.

The contradictory results in a number of these cases lead us to serious considerations concerning the factors determining them. A number of these might be mentioned. We have first the attitude of the children in working with approximately the same material which they had tried six months before. It does not seem that this is a valid hypothesis since the experience of many investigators has been that the interest of the children in these performance tests is not decreased on a second attempt. They come to the performance with as keen an interest in the experiment as they had at the first time.

A second hypothesis to account for these results would be that our tests are not of equivalent value. It does not seem possible to accept this hypothesis because of the fact that in many cases the material is identical and in other cases the two sets of material have been given to similar groups of children and have given almost identical results.

Another hypothetical explanation is that the unconscious attitude of the examiner influences the child's performance. Having gone over the experiment once with the child, one might think that the problem had been presented in exactly the same way. The influence of the past experience, however, may dominate to such an extent that unconsciously one fails to inspire the same enthusiasm or generate the same energy as in the first experiment. Before accepting this hypothesis, it will be necessary to investigate at length the effectiveness of an examiner's attitude on the emotional drive which determines a child's performance. It will be necessary to know the effect of an intonation or a facial expression.

A final hypothesis might be that these children had less vitality owing to the effects of the year's school work. This would argue that the strain of the school work was too great for any of the children of the school. It would not simply mean that the strain was too great for the undernourished child, but it would also mean that it was too great for the normal average-weight child, since the children of the control group show a result quite similar to that obtained from the nutrition class children. If such an hypothesis is open to consideration it is

obviously necessary to study our children more closely. A school procedure should be devised which would permit a healthy progress so that at the end of the school period the child may go on to other activities, well equipped physically for the strains which will be placed upon him.

One fact stands out clearly. It is that we are in approximately the same condition in respect to the problem of the mental development of undernourished children as we are in considering the causal factors in undernourishment. A frank confession of ignorance is all that we are able to make. We do not know why many children fail to gain in weight, neither do we know that between the failure to gain in weight and school progress is there any clear cut connection. It may be that biological variations shown in decreased weight may be compensated for by greater ability and adaptation, i. e., by greater readiness of response to the stimuli of new situations. An answer to these questions will require much more extended and at the same time intensive investigation.

EMOTIONAL CHARACTERISTICS

In formulating a study of these children it seemed desirable to consider emotional characteristics and habit reactions. We did not plan to formulate a routine experimental technique from the results of which conclusions might be drawn. What we planned to do was to study the child in the environment of the class room, of the street, and of his home. Unfortunately the carrying out of this plan was seriously interfered with by rearrangements in our own program. It was impossible to observe much that we had hoped to observe as to these particulars.

Certain characteristics indicative of the neurotic instability were noted in a number of children and the proportion in the nutrition class who showed these characteristics was slightly greater than in the control class. The difference was not sufficient to enable us to draw any conclusion as to the specific effects of this neurotic instability on nutritional processes. On the other hand, in our discussion of the child whose record was shown in Chart 11, we spoke of a neurotic instability in which one of the chief characteristics seemed to be an increased basal metabolism. This means that for the carrying on of the simple automatic functions of living a greater supply of nourishment is necessary.

Not only is the digestion of a certain amount of food necessary for proper nourishment, but there is also a necessity for it being taken under proper conditions, with desirable emotional attitudes and in certain ways. It has been shown that

disturbances in the emotional life of animals resulted in a disturbance of certain nutritional processes. In making a comparative study of these two groups of children it would be necessary to carry on a considerably more intensive investigation than has so far been possible. We found certain conditions which seemed to bear out the general hypothesis that an emotional disturbance is a causal factor in undernourishment. We do not mean to say that the emotional disturbance actually changed the processes which are necessary for satisfactory digestion. It may only be that the emotional disturbance results in a failure of desire to take sufficient nourishment. With the lack of sufficient nourishment, a decrease in weight would almost necessarily result.

The promotion period in the school gave considerable information concerning these factors. At that time the children in the classes showed an actual loss in weight, while both previous to and following the promotion period a marked increase was recorded. This loss in weight might be due to excessive expenditure of energy during that period, but it is quite possible and indeed probable, that it was due to the worry or other emotional disturbance which influenced the child's desire to take food.

Frankness on the part of our children as well as on the part of parents would enable us to make a much more satisfactory study of the influence of these factors. The desire to conceal quarrels or antagonisms has been pretty thoroughly drilled into all of us, especially when these antagonisms are between members of one family. It has been left to the insight of the social investigator to determine how far there was sympathetic co-operation among the members of the family group. In many cases there was co-operation, but it was not necessarily the type which involves an understanding of the child by the parents or of the parents by the child. The parents were usually willing to furnish food of the right kind and at the right time. They were also willing to make rearrangements in the living conditions and to take what steps were necessary to improve the child's physical condition. They were, however, not quite so alert to the importance of maintaining a happy and tranquil disposition. Continual fault-finding or criticism may arouse in the child an antagonism which would militate against a desirable progress. While it is impossible to present statistical information of the effect of this attitude, it seems certain that in a number of our cases, such an attitude prevented the effects of the nutrition class instructions being as marked as they might otherwise have been.