Health aide measuring school child in Baltimore's nutritional status survey

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Nutritional Status of Primary School Pupils in Baltimore

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Nationwide concern about the general nutritional status of U.S. school children has been increasing. Studies conducted jointly by the Baltimore City Health Department and the Baltimore City Department of Education have generated much interest.

The first study (1), in 1963–65, was a health evaluation of 842 children enrolled in Baltimore's early school admissions program, established in 1962 by the education department for 4-year-old youngsters of low-income families. (The early school admissions program was a forerunner of the national Head Start program.)

This study revealed that the median values for height and weight were below those of like-standard populations and closer to those of malnourished groups from underdeveloped countries. In addition, 25 percent of the children had a smaller head circumference than the lowest 10 percent of the standard population, while 20 percent of the Negro boys had red blood cell volumes that warranted evaluation for anemia.

The second study (*2*) was conducted in 1968. A sample of 2,000 children receiving services in the city health department's four comprehensive pediatric centers revealed that many preschool and school-age children were nutritionally deprived to the point that their normal physical growth was retarded. In this group the number of stunted children in the first 6 years of life was seven times the expectancy, and hemoglobin levels ranged from 1 to 2 gm. per 100 cc. below presumed normals.

Because of these findings, the health department staff urged the mayor to establish a task force on nutrition to study the problem in Baltimore and to take the necessary steps to implement recommendations. Under the health department's guidance the task force was created early in 1969 (*3, 4*). Its membership comprised representatives of every interested agency in the area including the city health department, departments of education and social services, and volunteer groups.

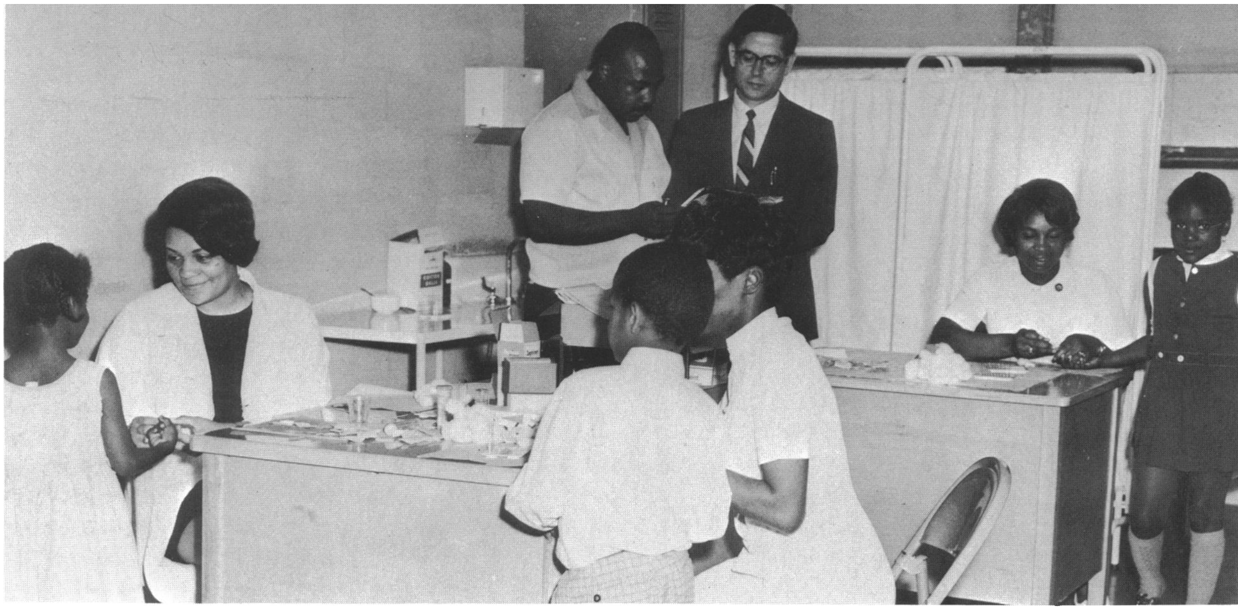
In May 1969 the third and most extensive survey of nutritional status was conducted by the health department's bureau of school hygiene and the education department's division of research and development. The survey was made not only to establish the extent of malnutrition in school children in the primary grades but also to identify those with signs of undernutrition and to set guidelines for principals in determining which children should participate in the free and reduced-cost lunch programs.

Method Considerations

Accurate assessment of nutritional needs in large populations has never been easy. It requires the exercising of considerable judgment. We considered five lines of investigation in our third study: clinical examinations, biochemical and other laboratory investigations, the study of vital statistics, the study of anthropometric data, and dietary surveys.

Clinical examinations. Discerning the difference between the well-nourished and the poorly nourished person might appear to present no difficulties. Obviously, a well-nourished person is alert and active, with firm muscles, bright eyes, and a smooth, elastic skin; and the poorly fed person is inactive and lethargic with flabby muscles and perhaps a rough dry skin. But in practice there are so many ill-defined grades between the well-nourished and the ill-nourished person that assessment is very difficult. Muscle tone and posture are not readily susceptible to measurement nor closely related to nutritional status. Clinical impressions are often erroneous because the judgment of an experienced physician is subject to a high degree of observer error. Even experienced school medical officers were unable to grade British school children consistently in a single inspection (*4*).

Biochemical and other laboratory investigations. Soon after the discovery near the beginning of this century that vitamins are essential to life, a vigorous search was started for a chemical measure of nutrition. Blood and urine were analyzed for their vitamin content and for the presence of intermediary metabolites known to accumulate in deficiency diseases. The results for the most part have been disappointing. Biochemical changes in the blood, like observable clinical changes, do not develop abruptly in clear-cut stages but by a series of gradations. In field studies they are useful only if carried out on a scale sufficiently large for statistical treatment of the data. It can therefore be stated confidently that perhaps the most important laboratory test for measurement of nutrition is one in which the blood is viewed directly through a hemoglobinometer or



More than 40 percent of the 21,617 children tested had microhematocrits of 36 percent or less

after centrifuging a measured quantity of blood, as in the microhematocrit test.

Only through mass testing by one of these two methods or both is it possible to judge the degree of nutritional anemia present in a community. Other more elaborate and costly biochemical equipment may provide useful information but is not essential.

Study of vital statistics. Most countries maintain some vital statistics, and from these it is usually possible to draw certain inferences about the nutrition of its people. The most valuable statistic for this purpose has been the infant mortality rate—the number of babies dying in the first year of life per 1,000 live births. The lower infant death rates are reported from the better nourished populations.

Study of anthropometric data (heights and weights). If children do not get sufficient food they fail to grow properly. Weight scales have been widely used in school medical services as a simple diagnostic tool for the purpose of screening children who may be undernourished. It is important, however, to realize that other factors besides food intake determine weight; notably, constitutional or genetic makeup. The weighing of the child cannot alone determine a child's relative nutritional status. Other physical measurements, particularly height, are useful. Although heights and weights are good anthropometric data to define nutritional status, the fundamental difficulty is in choosing the proper standards for comprehensive purposes. Owing to varying genetic and racial factors and perhaps environmental conditions, no general height and weight standards can be applied universally.

Quantitative information about the food eaten by a people or by a community, if compared with physiological standards of human needs, permits better assessment of nutritional status.

As a result of the preceding considerations and past studies of the public school population in Baltimore, we considered height and weight measurements and the microhematocrit test to be the most important in appraising the nutritional status of the children. The microhematocrit test determines whether a child has nutritional anemia. If the weight and height of a child fall below the 25th percentile by age and sex and if the microhematocrit falls below 36 percent of the red blood cell volume, the child can be considered undernourished.

Test Procedures

A master schedule for the survey was established by the director of school hygiene of the health department in cooperation with school and public health nurse officials. Local technicians were provided by the hospitals for the period of the survey.

The heights and weights of 59,000 school children in the first, second, and third grades of all 73 public elementary schools in Baltimore were measured by health aides. Ten teams of 10 persons each including physicians, laboratory technicians, public health nurses, and health aides also completed blood tests for anemia, in a 7-week period, of 21,617 children from low-income families. Heparinized microhematocrit tubes, calibrated 60 mm. from the end (length 75 mm., inside diameter 0.5–0.6 mm., and outside diameter 1.3–1.4 mm.) were used for drawing blood. About 50 specimens were drawn per hour. The blood samples were centrifuged at the school where the specimens were taken to obtain an accurate hematocrit. Any loss of time in transporting them would have caused deterioration of the blood sample, and inaccurate results would have been obtained.

The studies of height and weight

measurements have not been completed. Of the 21,617 pupils tested for anemia, 8,792 or 40.7 percent had microhematocrits of 36 percent or less (table 1): 4,011 or 41.5 percent of 9,655 boys, 3,389 or 38.5 percent of 8,809 girls, and 1,392 or 44.1 percent of 3,153 children for whom no sex was noted.

Of the 21,617, a total of 541 or 2.5 percent had microhematocrits of 30 percent or less (table 2): 254 or 2.6 percent of 9,655 boys, 168 or 1.9 percent of 8,809 girls, and 119 or 3.7 percent of the children for whom no sex was noted.

The pupils with microhematocrits of 36 percent or less were included in the free lunch program in October 1969. Some 200 selected children in this category later were referred to two Baltimore hospitals for further evaluation of iron deficiency anemia.

In a followup program, public health nurses and nutritionists advised the parents of these pupils regarding adequate diets with high protein and other nutrients. In March 1970, a random sampling of 2,000 children in the outpatient departments of the two hospitals revealed gains of 4 to 10 points in their microhematocrits.

Conclusion

The high percentage of children with microhematocrits of 36 percent or less (40.7) indicated extensive undernutrition in the city's school population. Our 1963–65 study of 4-year-old children enrolled in the early admissions classes revealed that 20 percent of the Negro boys had red blood cell volumes that warranted an evaluation of anemia. Our nutritional status survey is far from complete, and we are in the process of tabulating and correlating the relationship of microhematocrits to school performance.

Schaefer (*5*) in the preliminary report of his national nutrition survey stated that "iron intake was low in over 60 percent of the young population."

Undernutrition was demonstrated in the survey of Baltimore City's school population, especially among the children in the lowest school grades. Of great concern are the undetected detrimental effects of undernutrition on the learning ability, mental capacity, and behavior of these children.

There is a need to review school curriculums for strengthening the nutritional aspects of health study units. School and health authorities should expand school breakfast and lunch programs. There also is an urgent need to educate mothers in planning and preparing nutritious meals for their young children.

Baltimore has made a start toward these ends by working through interdepartmental meetings and school sessions between physicians, nutritionists, public health nurses, and PTA groups and in child health centers.

Other efforts are aimed at improving the nutritional status of the city's children through reduced cost or free breakfasts and lunches in the schools and the recently started iron-enriched milk program for infants in deprived families in selected areas of the city.

REFERENCES

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Aides helped to test first, second, and third graders for anemia

Table 1. School children in first, second, and third grades with microhematocrits of 36 percent or less, Baltimore City, May 1969

Age group (years)	Number of boys tested	Boys with microhematocrits of 36 percent or less		Number of girls tested	Girls with microhematocrits of 36 percent or less	
		Number	Percent		Number	Percent
5½–6	1	1	100.0	1	0	0
6–6½	189	98	51.8	207	83	40.1
6½–7	1,162	315	27.1	1,235	449	36.4
7–7½	1,213	550	45.3	1,166	490	42.0
7½–8	1,244	518	41.6	1,202	518	43.1
8–8½	1,218	522	42.8	1,217	459	37.8
8½–9	1,238	538	43.4	1,276	483	37.9
9–9½	1,072	450	42.0	1,014	380	37.5
9½–10	715	302	42.2	501	187	37.3
10–10½	490	205	41.8	279	116	41.6
10½–11	238	89	37.4	160	57	35.6
11–11½	172	71	41.3	103	39	37.9
11½–12	159	65	40.9	111	30	27.0
12–12½	154	64	41.6	98	24	24.5
12½–13	154	41	26.5	113	29	25.7
13–13½	135	48	35.6	68	26	38.2
13½–14	89	22	24.7	51	15	29.4
14–14½	12	3	25.0	7	4	57.1
Total [1]	9,655	4,011	41.5	8,809	3,389	38.5

[1] Total pupils tested, 21,617; no sex noted for 3,153, of which 1,392 or 44.1 percent had microhematocrits of 36 percent or less.

Table 2. School children in first, second, and third grades with microhematocrits of 30 percent or less, Baltimore City, May 1969

Age group (years)	Number of boys tested	Boys with microhematocrits of 30 percent or less		Number of girls tested	Girls with microhematocrits of 30 percent or less	
		Number	Percent		Number	Percent
5½–6	1	0	0	1	0	0
6–6½	189	7	3.7	207	3	1.4
6½–7	1,162	36	3.0	1,235	26	2.1
7–7½	1,213	31	2.5	1,166	19	1.6
7½–8	1,244	39	3.1	1,202	30	2.4
8–8½	1,218	41	3.3	1,217	19	1.5
8½–9	1,238	29	2.3	1,276	22	1.7
9–9½	1,072	22	2.0	1,014	22	2.1
9½–10	715	17	2.3	501	7	1.3
10–10½	490	11	2.2	279	6	2.1
10½–11	238	2	.8	160	5	3.1
11–11½	172	4	2.3	103	2	1.9
11½–12	159	5	3.1	111	3	2.7
12–12½	154	4	2.5	98	1	1.0
12½–13	154	1	.6	113	1	.8
13–13½	135	3	2.2	68	2	2.9
13½–14	89	0	0	51	0	0
14–14½	12	2	16.6	7	0	0
Total [1]	9,655	254	2.6	8,809	168	1.9

[1] Total pupils tested, 21,617; no sex noted for 3,153, of which 119 or 3.7 had microhematocrits of 30 percent or less.