

Anemia in Preschool Children in the United States of America^[9]

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Extract

Hematocrit values were determined for nearly 7000 preschool children from low socio-economic backgrounds in five cities of the United States: Gainesville, Chicago, Houston, Jacksonville and Augusta. The mean hematocrit for the entire group was $36.32\% \pm 2.8\%$. Although severe anemia was unusual, the incidence of significant anemia (hematocrit $< 31\%$) showed considerable variation from city to city, ranging from 0.6 to 7.7% and was unaffected by iron supplementation.

Speculation

Generalizations concerning the national incidence of nutritional anemia in preschool children on the basis of isolated local studies may not be warranted. Mass programs of dietary supplementation with hematinics are not indicated nationally; however, regional studies may reveal local needs.

If simple, definitive and reliable laboratory techniques can be devised for use in suitably organized population groups, critical information on national health status may be obtained.

Detection of a relatively large number of children with markedly elevated hematocrits is intriguing and should be investigated for relation to adult polycythemia.

Introduction

Anemia, predominately nutritional anemia secondary to dietary iron deficiency, is very common during the first two years of life in the United States [1, 7]. However, little information concerning its prevalence in older children is available [3]. Throughout the United States during the past two summers, large numbers of 4- to 6-year-old children from socioeconomically deprived backgrounds have been enrolled in a program of educational enrichment called Operation Head Start. As part of the medical aspects of this program, hematocrit or hemoglobin determinations were usually done. The present report presents hematocrit data from the Head Start programs of five different geo-

graphic areas. To the best of our knowledge, this represents the first wide-spread survey to determine the incidence of anemia in nonhospitalized, preschool children from a specific segment of the American population. The data to be presented indicate that although severe anemia is uncommon in the 4- to 6-year-old American child, significant regional differences do occur in the incidence of anemia.

Materials and Methods

Children 4 to 6 years of age in five American cities were studied. Standard economic guides were used for eligibility for inclusion of children in Head Start programs.

Namely, the mean family income was less than the nationally established poverty line [2]. The five cities were: 1. *Gainesville, Florida*. Approximately half of the children in this program lived in Gainesville, a small southeastern city with a population of about 50,000, and the rest resided in the surrounding country. Ninety-eight percent were Negro. Blood studies were completed within three weeks of the start of the program. 2. *Jacksonville, Florida*. This southeastern city has a population of about 500,000. Ninety-eight percent of the children enrolled were Negro. In this city, iron was routinely administered to all children. Ferrous fumarate in an oral dose of 10 mg/day of elemental iron in a multivitamin tablet was given. Blood examinations were done throughout the summer program, so some of the children had been receiving iron for 4 to 6 weeks when their blood was studied. 3. *Augusta, Georgia*. This south-

eastern city has a population of about 70,000. Ninety-five percent of the children enrolled in the Head Start program were Negro. Blood examinations were performed throughout the summer. No hematinics were given. 4. *Chicago, Illinois*. This large northern city enrolled about 15,000 children in the Head Start programs. A 20 percent sample of charts was randomly chosen from the entire group for this study. The blood examinations were performed during the first month of the program. No medications were given. About 75 percent of the children were Negro. 5. *Houston, Texas*. This large southwestern city enrolled about 2000 children in the Head Start program. Approximately 50 percent of these were Negro, and most of the others were of Mexican descent. Blood studies were performed in the first 3 weeks of the program. No hematinic medications were given.

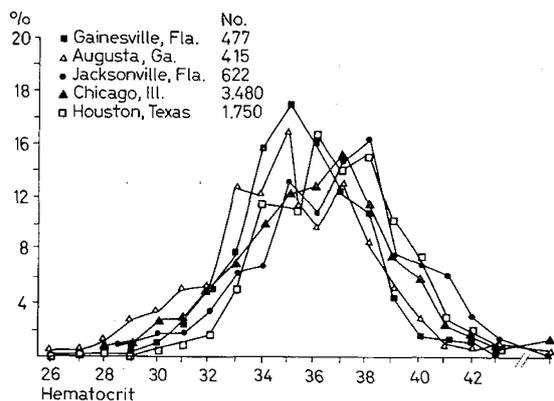


Fig. 1. Normalized distribution of hematocrit values by cities.

Validity of Hematocrit as a Measure of Anemia

Microhematocrit determination performed on capillary blood was used as the indicator of anemia. The determination of microhematocrit is a reliable reproducible technique and does not share the variability and methodologic difficulties of hemoglobinometry or inaccuracies of gravimetric techniques. That the hematocrit is a valid indicator of anemia in this age group has been confirmed by two observations. First, in Gainesville, Florida, in 1965, complete hematologic studies were done on 100 preschool children. Studies included hemoglobin, hematocrit, red blood cell counts, serum iron, serum folate and starch block hemoglobin electrophoresis. Three children had hemoglobin levels less than 10.0 g %, and hematocrits less than 30 %. One

Table I. Hematocrit data

City	A (Chicago)	B (Gainesville)	C (Jacksonville)	D (Augusta)	E (Houston)
Number	3480	477	622	415	1750
Mean (%)	36.01	35.14	36.68	34.98	36.61
Standard deviation (\pm %)	3.0	2.3	2.9	2.9	2.6
Significance of differences in means					
Significant: at <0.05 level					
	A+B	B+C	C+D	C+D	D+E
	A+C	B+E			
	A+D				
	A+E				
	B+D and C+E not significantly different				

was identified as having moderate iron deficiency anemia. The other two anemic children were shown to have thalassemia trait. Second, in the Chicago Head Start program, both hemoglobin and hematocrit determinations were done. The incidence of anemia using the criterion of a hematocrit less than 31 percent was 4.5 per cent. When a hemoglobin level of less than 10.0 g % was used to define anemia, an incidence of 3.2 % was seen. Thus it is felt that the microhematocrit determination represents a valid indicator of anemia in these children.

Results

Mean hematocrits with standard deviations for the five cities are indicated in table I. The data are depicted in figure 1. The means were very similar and ranged between 34.98 and 36.68 percent. To test the significance of the differences in these means, the multiple comparison method of SCHEFFE was used at an overall level of significance of 0.05¹ [6]. As indicated in table I, significant differences were seen between eight pairs of cities. Because of the very large numbers involved, these differences in mean hematocrits are statistically significant. However, it is evident that such minor differences are of little physiological significance.

Incidence of Anemia

The mean hematocrit value of the entire group of nearly 7000 children was 36.32 % with a standard deviation of ± 2.8 %. Thus 95 percent of this population had hematocrits between 30.7 and 41.9 percent. The incidence of significant anemia (Hct <31 %) was low in Houston (0.6 %), Gainesville (1.7 %), and Jacksonville (2.8 %); but considerably higher in Chicago (4.5 %) and Augusta (7.7 %).

Discussion

This survey indicates that in most areas studied anemia is relatively uncommon in 4- to 6-year-old children. It cannot be assumed that all anemic children suffer from nutritional deficiencies. Significant hemoglobinopathies and thalassemias have an incidence of at least 1 percent in the American Negro [5, 8]. Also, anemia may accompany a number of non-nutritional diseases. When an incidence of anemia in the order of only 1-2 percent is found, such etiologies are as likely as nutritional deficiencies. This is especially true when screening certain ethnic groups. For example, in 100

extensively studied Negro children from Gainesville, thalassemia trait was a more common cause of hypochromic microcytic anemia than iron deficiency. The increased frequency of anemia in children from Chicago, and especially Augusta, may reflect unique local factors. Moore has shown that regional differences in iron content of soil and methods of food preparation may dramatically affect the quantity of iron intake [4]. Further, local dietary practices may vary considerably. It is likely that these or other as yet unidentified factors might be responsible for the significant geographic variability documented. Only by means of systematic regional surveys using reliable methodology can such information, with its broad implication for nutritional adequacy, be obtained for evaluation.

It is not known whether medicinal iron supplementation can appreciably affect hematocrit levels in large groups of preschool children. Of relevance was the observation that in Jacksonville, where iron was routinely administered, the distribution of hematocrits was remarkably similar to that found in the other cities where this was not done. Therefore, there appears no justification for the mass administration of iron to preschool children in the United States. However, in discrete geographic regions, local practices or conditions may require specific therapeutic programs.

Hematocrit data described a Gaussian distribution about a relatively fixed mean. Individual variation within this broad range must be considered normal.

Nearly 100 children in the entire group of 7000 had hematocrits exceeding three standard deviations above the mean (<45 %). Investigation of this polycythemia in young children demands investigation. However, iron supplementation does not appear to be critical since the percent of children with these very high hematocrits in Jacksonville was comparable to that found in other cities.

References and Notes

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