Ethnic Differences in Growth and Nutritional Status: a Study of Poor Schoolchildren in Southern New Jersey

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Synopsis

The growth and nutritional status of 2,056 schoolchildren from a poor community in southern New Jersey were assessed. Age-adjusted differences in growth among black, white, and Hispanic children were examined. Black youths were 2.5 centimeters (cm) taller ($P < .001$) and 0.9 kilograms (kg) heavier than white youths ($P < .05$). Black girls were 4.1 cm taller ($P < .001$) and 2.8 kg heavier than white girls ($P < .01$). Hispanic girls were 1 kg heavier ($P < .05$) and 0.9 cm taller (not significant) than white girls. There was little difference in growth between Hispanic and white youths.

Children were assessed with the use of the Centers for Disease Control's nutritional surveillance cutpoints; less than 5 percent of each ethnic group fell below the fifth percentile, according to the National Center for Health Statistics' weight-for-height standards. White and Hispanic youths were twice as likely as blacks to fall below the 5th percentile for stature or to be overweight (above the 95th percentile for weight-for-height). Compared with black girls, white and Hispanic girls were three to four times more likely to fall below the fifth percentile for stature. The prevalence of short stature was also higher among white girls (15.9 percent) compared with Hispanics (10.3 percent). There was little difference in the prevalence of overweight by ethnic group for girls. These data show that white children from poor communities have decreased growth and suggest that they may be at increased risk of nutritional problems.

IN DEVELOPING COUNTRIES, weight and height are sensitive and specific indicators of a child's nutritional status (*1,2*). In industrialized nations, where clinical malnutrition is rare, the utility of growth as an indicator of nutritional status depends upon the population surveyed. In a prosperous community, healthy children with height and weight below norms for age and sex are likely to be well-nourished offspring of small parents (*3,4*). In economically disadvantaged areas such as the inner city, it has been shown that "the dimensions of poverty could be spelled out in smaller size and lesser growth" (*5*).

In the United States, it is believed that the effects of poor nutrition are felt most keenly by black and Hispanic children from the inner city. Many studies of ethnic differences in growth support this belief by showing that white children are taller and heavier than Hispanics and about equal in growth to black children (*6,7*). However, the studies most often compare middle-class white children (or standards generated from this group) with less affluent black and Hispanic children, thus mixing ethnic and socioeconomic effects on growth and nutritional status.

Nutrition monitoring and surveillance data (*8*) that compare the growth of poor children participating in various social welfare programs show different results. Black children grow better than either white or Hispanic participants (*8*). The problem with those data is the existence of potential bias among groups in the criteria for program enrollments. Black children, for example, become eligible for the Women, Infants, and Children (WIC) Program if they have a reduced hemoglobin level. Yet it is documented that the 0.5 to 1.0 grams per deciliter reduction in hemoglobin found in black children of all socioeconomic

groups represents nonnutritional differences in the hemoglobin molecule rather than nutritional anemia (*9*). The prevalence of hemoglobinopathies is lower among white and Hispanic children (*10*). Thus, their anemias are more likely to be nutritional in origin (mostly iron deficiency). Iron deficiency anemia, in turn, is associated with growth retardation (*11*). The overinclusion of otherwise well-nourished black children may decrease the prevalence of low weight- and height-for-age and low weight-for-height found among blacks. Therefore, ethnic differences in the growth of poor children, as judged by those participating in social programs, may not be representative of ethnic differences of the population from which participants are drawn.

In this study, we examined a multiethnic group of children in a poor inner-city community. Our objective was to determine whether differences in growth exist among black, white, and Hispanic (Puerto Rican) schoolchildren by performing these two activities: identifying the children's growth patterns and comparing them to the NCHS standards. We comment on possible and probable origins of the differences we found.

Study Subjects

Subjects of the study were schoolchildren ages 5–12 years who lived in an economically depressed area in southern New Jersey. According to a recent study (*12*), the area is one of three extremely blighted suburbs with populations in excess of 25,000 persons in the United States. This dubious distinction is based on changes in ethnic composition of the community, as well as social and economic markers of distress such as low levels of education, high unemployment rates, and high dependence on welfare.

The nutritional status of 2,056 public and parochial elementary and middle schoolchildren was assessed with the cooperation of 9 neighborhood schools. With the exception of a few chronic absentees (less than 1 percent), all children attending the schools were included. The procedures used had been approved by the Institutional Committee for Protection of Human Subjects.

Of the population studied, a total of 1,076 were male and 980 were female; 52.6 percent were Hispanic, 31.9 percent were black, and 15.5 percent were white (table 1). Hispanic children (Puerto Rican origin) were identified by Spanish surname or because they were Spanish speaking. Black and Hispanic children lived in the same neighborhood and attended the same schools. White children, for the most part, lived nearby on the fringes of this mixed ethnic neighborhood.

Table 1. Number of subjects, by sex, ethnicity, and age, in a poor community in southern New Jersey

Age group (years)	Males			Females		
	Hispanic	Black	White	Hispanic	Black	White
5.0–5.9.....	66	67	15	85	60	17
6.0–6.9.....	85	73	45	85	56	35
7.0–7.9.....	78	37	36	80	35	33
8.0–8.9.....	88	33	42	88	41	34
9.0–9.9.....	81	50	16	73	46	7
10.0–10.9....	62	51	14	72	42	8
11.0–11.9....	62	31	7	40	22	2
12.0–12.9....	26	5	6	10	6	3
Total..	548	347	181	533	308	139

The median family income by census tract of residence (1980 census) was used as an indirect measure of income status. The census tracts with white families had slightly higher incomes than those with black and Hispanic families (median family income $13,211 versus $10,060). However, the median income of households headed by women with children less than 18 years of age in black and Hispanic tracts was slightly higher than the median income of such households in white tracts ($6,928 versus $5,786).

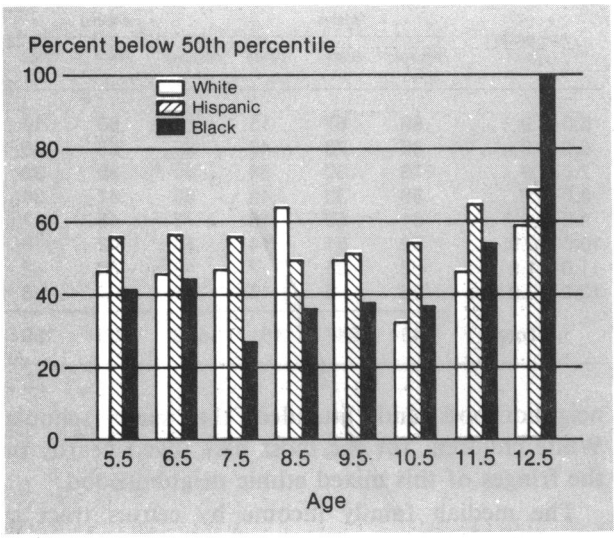
Methods

The children were weighed, after removing their shoes and heavy clothing, on a platform beam balance scale. Weight was recorded to the nearest quarter pound and then converted to kilograms (kg).

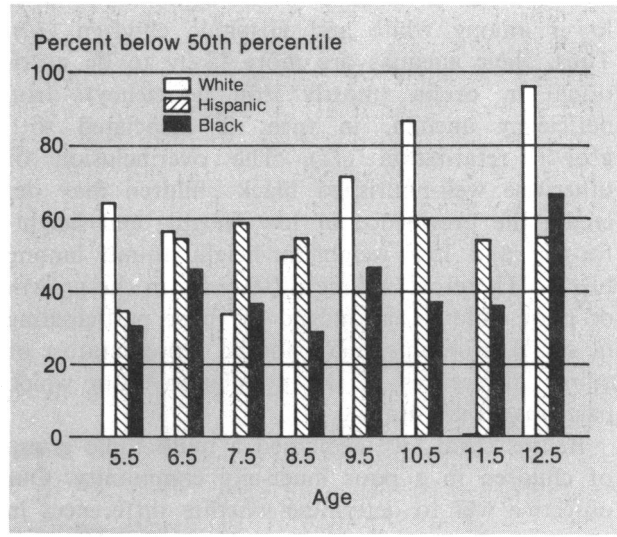
Height was measured with the use of a stature measuring board. After removing his or her shoes, the subject would stand on a flat floor with feet parallel and with heels, buttocks, shoulders, and back of head touching the measuring board. The head was held comfortably erect, with the lower border of the orbit in the same plane as the external auditory meatus. The arms were hanging at the side in a natural manner. The headpiece—a rectangular wooden block—was lowered gently, crushing the hair and making contact with the top of the head. The measuring scale was capable of measuring to an accuracy of 0.25 inches. The data were subsequently converted to centimeters (cm).

Age was computed by subtracting the child's date of birth (obtained from school records) from the date of assessment. Age to the nearest tenth of

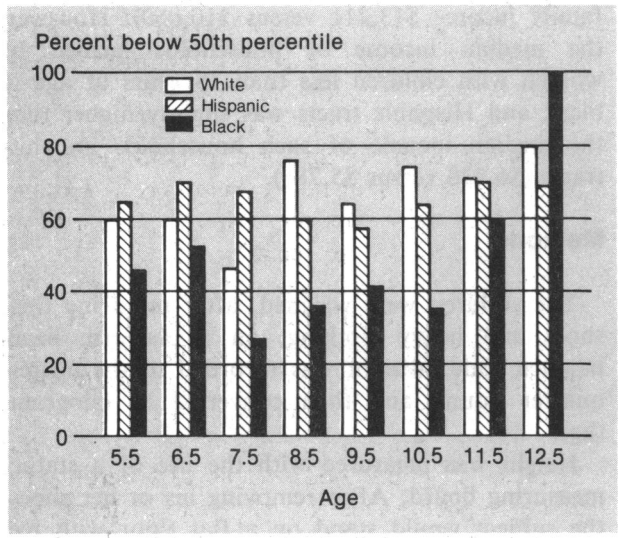
Prevalence of measures of growth below the 50th percentile, NCHS standards, among school children in a poor community in southern New Jersey



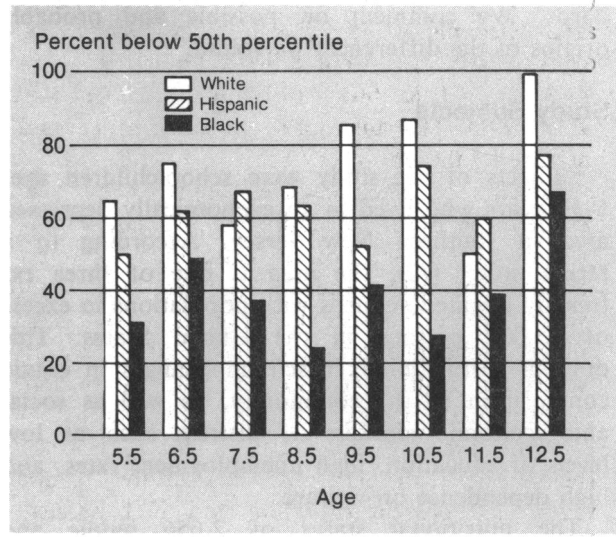
Prevalence of weight-for-age below 50th percentile, boys



Prevalence of weight-for-age below 50 percentile, girls



Prevalence of height-for-age below 50th percentile, boys



Prevalence of height-for-age below 50 percentile, girls

a year was used for the application of NCHS cutpoints.

Analysis of covariance (*13*) with age as the covariate (ANCOVA) and planned, pairwise contrasts were used to compare the weight and height of black, white, and Hispanic children. Comparisons with NCHS standards (*14*) were made with the use of the Centers for Disease Control's nutrition surveillance cutpoints (*8*). These included height-for-age and -sex below the 5th percentile (short stature) and weight-for-height and -sex below the 5th percentile (underweight) or above the 95th percentile (overweight). The Z test (*15*) was used to test for differences between ethnic groups in the proportion falling below these points. The 50th percentile, NCHS standards, was also used to describe the age-, sex-, and ethnic-specific prevalence of weight and height below this cutpoint.

Results

Black children, both boys and girls, weighed more than either Hispanic or white children. After adjustment for age (using ANCOVA), there were

significant weight differences by race ($P < 001$.) Black youths weighed 0.9 kg more than Hispanic youths ($P < .05$) and 0.9 kg more than white youths ($P < .05$). The age-adjusted weights were exactly the same for Hispanic and white youths. Black girls weighed 1.7 kg more than Hispanic girls ($P < .001$) and 2.8 kg more than white girls ($P < .001$). The weights of Hispanic girls also exceeded those for white girls by 1 kg ($P < .05$).

The age-specific prevalence of weight-for-age below the 50th percentile, NCHS standards, was consistently less than 50 percent for black children of both sexes. Prevalence usually was close to 50 percent for Hispanic and white youths but sometimes greater than 50 percent, particularly for white girls (see figures).

Black children were consistently taller than either Hispanic or white children. After adjustment for age (using ANCOVA) there were significant differences in height by ethnic group ($P < .001$). Black youths were 3.0 cm taller than Hispanics ($P < .001$) and 2.5 cm taller than whites ($P < .001$). The 0.5 cm difference between white and Hispanic youths was not statistically significant. Black girls were taller than either Hispanic (3.2 cm, $P < .001$) or white girls (4.1 cm, $P < .001$). Hispanic girls exceeded white girls in stature by 0.9 cm ($P < .15$).

Heights of black children approximated or exceeded the 50th percentile, NCHS standards for stature. The proportion of white and Hispanic girls and youths below the 50th percentile for stature was elevated consistently (see figures). Table 2 presents the proportion of each ethnic-sex group screening positive for short stature, underweight, or overweight according to NCHS standards.

Approximately 5 percent of black youths fell below the fifth percentile for stature, compared with 11.0 percent of white and 11.1 percent of Hispanic youths. Differences between black and white ($P < .05$) and black and Hispanic youths ($P < .05$) were statistically significant. A total of 3.8 percent of black girls versus 10.3 percent of Hispanic girls ($P < .001$) and 15.9 percent of white girls ($P < .001$) fell below the fifth percentile for stature. Although the proportion of white girls below the fifth percentile exceeded the proportion of Hispanic girls, the difference was not statistically significant.

The proportion of children surveyed who were below the NCHS fifth percentile in weight-for-height was less than or equal to 5 percent for each ethnic group. None of the comparisons indicated an important or a statistically significant difference in underweight when ethnic groups were compared with one another (table 2).

Table 2. Prevalence of underweight, overweight, and short stature among Hispanic, black, and white inner-city schoolchildren in a poor community in southern New Jersey

Category	Hispanic	Black	White
	Percent of males		
Underweight [1]	2.0	3.2	1.1
Overweight [2]	9.7	5.5	9.8
Short stature [3]	11.1	5.5	11.0
	Percent of females		
Underweight [1]	2.9	4.9	4.5
Overweight [2]	10.3	8.9	7.5
Short stature [3]	10.3	3.8	15.9

[1] Less than 5th percentile for height and sex, NCHS standards.
[2] Greater than 95th percentile for height and sex, NCHS standards.
[3] Less than 5th percentile for age and sex, NCHS standards.

On the other hand, apart from black youths, the proportion of overweight children in the survey was greater than 5 percent. The proportion of overweight white youths (9.8 percent) and Hispanic youths (9.7 percent) exceeded the proportion of overweight black youths ($P < .01$ for each group). For girls, none of the ethnic differences in the proportion with weight-for-height above the 95th percentile was statistically significant. However, for each ethnic group, more than 5 percent of girls were above the 95th percentile.

White children who resided in the mixed black and Hispanic neighborhoods ($N=26$) were compared with white children residing in only white neighborhoods. There were no statistically significant differences in the proportion of the children with short stature (15.4 percent for white children in mixed neighborhoods versus 13.5 percent from white neighborhoods) or who were underweight (0 percent mixed neighborhoods versus 3.1 percent white neighborhoods) or overweight (7.7 percent mixed neighborhoods versus 9.3 percent white neighborhoods).

Discussion

One advantage of assessing growth and nutritional status of unselected schoolchildren is the avoidance of potential bias associated with data obtained exclusively from participants in social welfare programs.

Our survey of school-aged inner-city children suggests that, as a group, they are at a greater risk than the NCHS reference population for growth

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differences. These differences may reflect underlying nutritional abnormalities. Typically, 5 percent of children are expected to fall below the 5th percentile or over the 95th percentile of NCHS standards. We found the prevalence of low weight-for-height (below the fifth percentile) to be less than 5 percent in all ethnic groups surveyed. Apart from black youths, where the prevalence of overweight is low, we found the proportion of overweight children to be greater than 5 percent. Short stature (low height-for-age)—again, except for blacks youths—is a problem for white and Hispanic inner-city children.

In this study, being underweight occurred in less than 5 percent of the children surveyed and therefore does not appear to be a special problem in the inner city. The observation that overweight and short stature are higher than expected, while underweight is lower, suggests that the quality and the quantity of the diet may be problematic. That is, the diet of inner-city schoolchildren could have qualitative deficiencies—for example, in essential micronutrients or in high quality protein—while supplying an excessive amount of energy (calories) (*16*). The provision of a quality diet to promote optional growth may, in turn, depend upon ethnic, sociocultural, or behavioral factors (*17*).

The study also focuses attention on the decreased growth of white schoolchildren residing in low income neighborhoods. Differences in growth were demonstrated when the white children were compared with NCHS standards, as well as with Hispanics and blacks. Children were not chosen because of participation in social welfare programs. Thus, ethnic differences are not attributable to this selection bias.

The findings were the same regardless of whether white children lived in the mixed ethnic neighborhood or in the white neighborhood on its fringes. Growth in stature was reduced, and the proportion overweight was increased in comparison with NCHS standards.

The NCHS standards are based on measurements made on large, nationally representative samples of children mostly from white populations (*14*). Therefore, arguments about ethnic differences in growth potential (*18*) are unlikely to explain the divergence of white children from these standards.

Data from this study also show differences between inner-city white and Hispanic children. After adjustment for age, white females were shorter and weighed less than Hispanic females; white males had heights and weights nearly identical to those of Hispanic males. Previous research (*6*) has shown that although the growth of poor white children is below NCHS standards, those children are taller and heavier than Hispanics living in the same neighborhood.

Hispanic children typically grow below the 50th percentile, NCHS standards (*6,19*). This has caused some researchers to suggest that Hispanic children's small size is due to reduced genetic potential for growth (*18*). The observation that inner-city white children have weights and heights comparable to inner-city Hispanic children suggests the operation of environmental influences. It is an unlikely argument that whites with decreased growth potential are attracted to inner-city life.

Previous studies have shown that the growth of low income black children is comparable to that of middle-class white children and compares well with NCHS standards (*5,7*). In the present study, growth of blacks surpassed growth of whites from slightly more affluent neighborhoods (on the basis of census data). However, these aggregate data may not adequately reflect incomes of study participants. Black children were less likely to exhibit short stature and (for males) to be overweight than whites or Hispanics. This finding may suggest differences in growth potential (*18*) and is compatible with the better nutritional status of black inner-city children.

Ethnicity is a rubric which is often used to summarize effects of diet, education, housing—a host of factors collectively known as lifestyle—as well as biological or genetic influence on growth and development. The identification of differences in growth among ethnic groups often leads to the assumption that the cause is solely biological or genetic. In fact the differences probably are largely environmental in origin (*20,21*). We are reminded of the data from Great Britain that show signifi-

cant differences in growth of white children by another proxy variable: social class (*22*).

Growth is an indicator of nutritional status (*23*). It is possible that differences in growth among the ethnic groups discussed in this study reflect differences in nutritional status. Ethnic differences in behavioral factors associated with child nutrition and growth have been documented (for example, breast feeding, utilization of pediatric health services) (*24,25*). For American children living in the inner city, factors influencing growth are ill-defined. But differences in growth among ethnic groups do exist—a fact that suggests a need to evaluate how these three groups of people, white, black, and Hispanic, have adapted to urban life.

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