Problems In the Nutritional Assessment of Black Individuals

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Abstract: Nutritional assessment of American Negro (Black) individuals of largely-African ancestry is complicated by differences that transcend socioeconomic status (SES). These include smaller size at birth but greater size from 2 to 14 years, advanced skeletal development ("bone age"), advanced dental development, a larger skeletal mass and bone "density" and a lesser rate of adult bone loss in the Black female from age 40 on as shown in a variety of bone-losing situations, including renal osteodystrophies. Thus, appropriate dimensional *and* radiographic and radiogrammetric measures must be employed.

Differences in hemoglobin concentration approximating 1.0g/100ml and in hematocrit levels also indicate the need for population-specific standards, otherwise gross errors will be made in calculating the per cent "deficient" and "low". Since self-assignments to racial categories are commonly used, the problem of racial identification is minimal. Failure to employ appropriate standards will result in underestimating the dimensional, radiographic and radiogrammetric effects of undernutrition in Blacks after the 2nd year, underestimating adult bone loss to a large degree, but overestimating the severity of hematologic responses from the 1st year through the 9th decade. (Am. J. Public Health 66:262–267, 1976)

Nutritional surveys conducted outside of the United States have long employed North American dimensional, hematological and biochemical standards with both expectable and demonstrated results. Undernourished and parasite-ridden populations on the borderlines of protein adequacy have proved smaller in size, slower in growth, later in maturation than our norms, and lower in serum and urinary levels of vitamins ingested in lesser amounts. Given such findings it has scarcely seemed necessary to inquire into the appropriateness of the norms, although some "recalibration" has been suggested for various national groups.

Now that we have given attention to our own nation, since 1968, and in a variety of nutritional surveys, we are beginning to appreciate the existence of differences which may have major bearing on our standards and their application. For the American Negro (Black) population, numerically larger than many member nations of the United Nations, the dimensional standards appropriate to North American Whites may not be fully appropriate. White standards for skeletal maturation and dental development are certainly not appropriate for Blacks. White standards for the skeletal mass and bone mineral are certainly not appropriate for Blacks (either in nutrition surveys or in clinical appraisal), and conventional White hematologic standards may not be appropriate either.

In making these statements, we must be fully aware of the socioeconomic differences between Blacks and Whites, so that we do not confuse the products of poverty with the intentions of the genes. We must be aware that dietary differences may transcend economic levels (as with Japanese-American professionals who still favor rice over potatoes). What we have to suggest is the need for population appropriate standards for half a dozen key parameters before we can properly and intelligently evaluate nutritional status in the Black population of the United States.

Dimensional Differences

Within populations, dimensions reflect nutritional status during the growing period, and even in adulthood they summarize long-term nutritional status during growth. It is therefore important to recognize dimensional differences between Blacks and Whites, over and apart from those that reflect body proportions, as with length of leg relative to length of trunk.

We have long known that Black infants are smaller than White infants at birth, even though Black infants are at the same time developmentally advanced. Some part of the difference is of course socioeconomic, and both directly and indirectly related to gestation length. However, even at term

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Black neonates are smaller than White neonates in both weight and length, and these dimensional birth differences hold after income-matching. In Figures 1 and 2 birth size comparisons from the National Collaborative Survey are presented, showing the differences that must be taken into account.

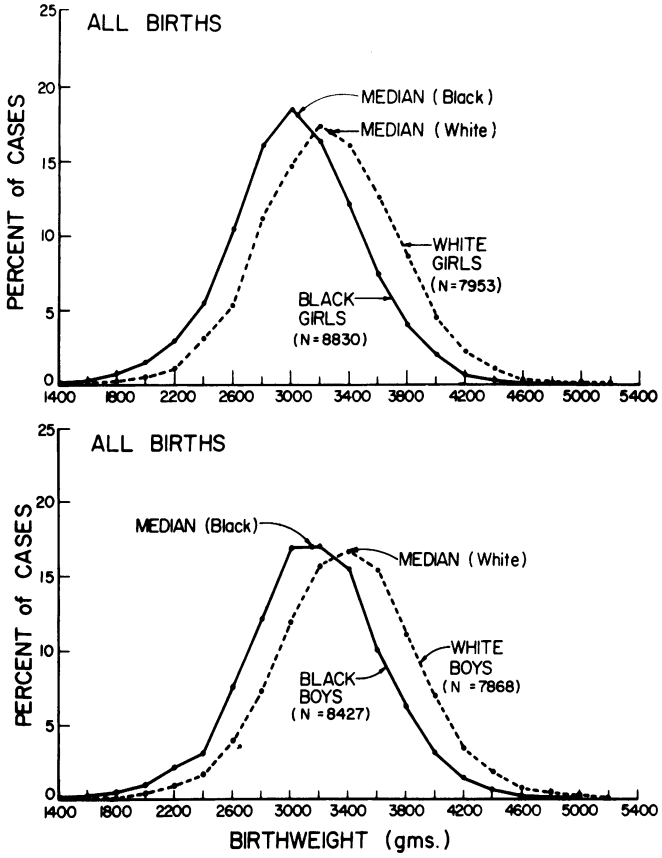

FIGURE 1—Birth-weight comparison of Black newborns (solid line) and White newborns (broken line) of the 33,078 participants in the National Collaborative Survey of the National Institute of Neurological Communicative Disorders and Stroke.

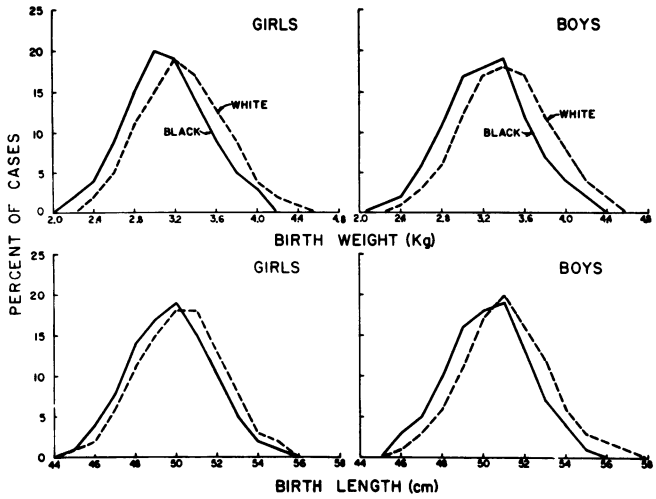

FIGURE 2—Birth weight and birth length comparisons of Black and White neonates at term.

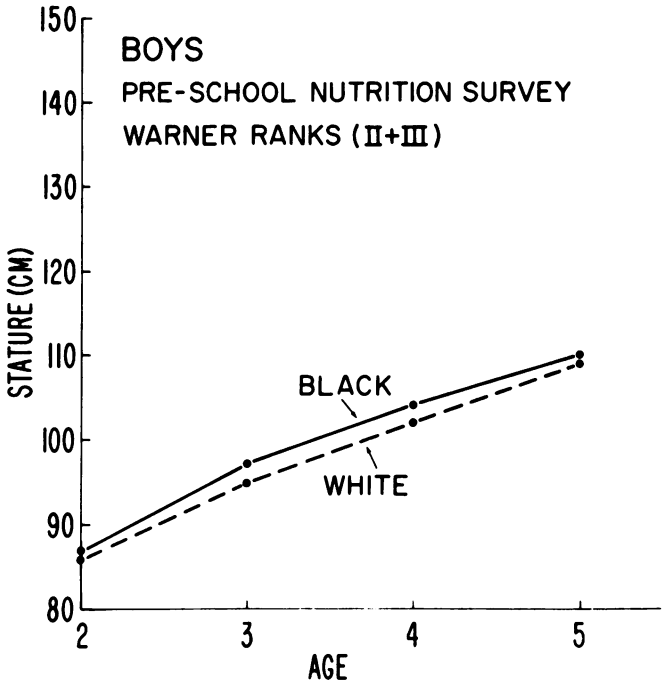

FIGURE 3—Stature comparison of Black and White boys in the Pre-School Nutrition Survey (PNS).

These dimensional differences at term are reversed within the next few years, however, and from the second year of life through the fourteenth, both Black boys and Black girls stand taller than their White age-peers. Greater stature of Black children is apparent in the Pre-School Nutrition Survey (PNS),[1] in the data of the National Collaborative Survey,[2] in the Ten-State Nutrition Survey,[3] in the Kaiser-Permanente data from California,[4] and in the National Health Examination data collected on a national probability basis.[5] These trends are summarized in Figures 3, 4 and 5, and they indicate the need for population-specific dimensional data in nutritional evaluation.

The pattern or path of Black-White dimensional differences is summarized in Figure 6, expressing stature and differences in stature during the growing period, relative to stature at age 20. If the data were less complete, extending only to the early teens, one might be tempted to project a greater secular trend for Blacks and ultimately greater adult stature. But, as can be seen, adult statures are indeed the same, but Black boys and Black girls attain a greater proportion of their adult stature earlier.

If White norms are alone employed, then the proportion of Black neonates adjudged small for term will be unduly large. But from the second year on, if White standards are exclusively used, then some proportion of Black children ac-

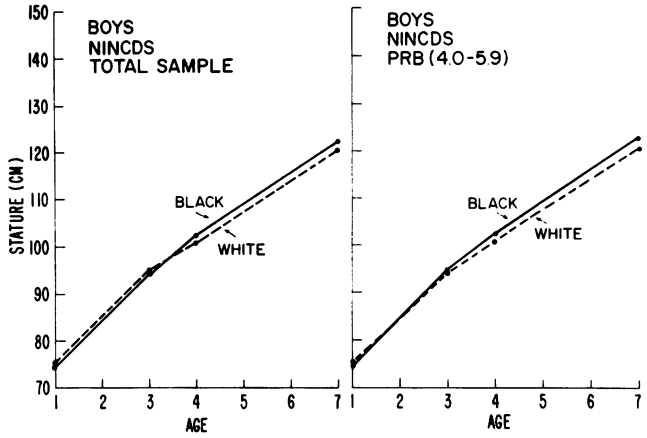

FIGURE 4—Stature comparison of Black and White boys in the National Institute of Neurological Communicative Disorders and Stroke sample.

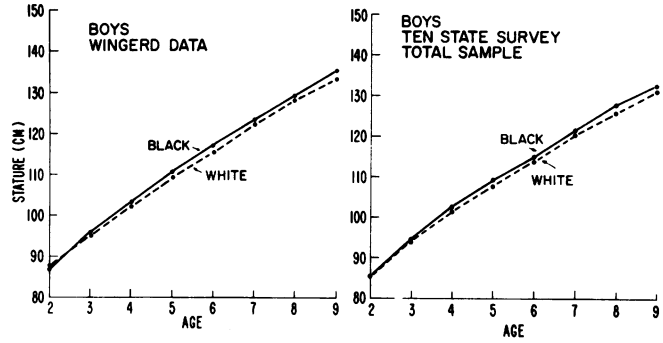

FIGURE 5—Greater stature of Black infants and pre-adolescent children as shown in the Kaiser-Permanente data (left) and the data of the Ten-State Nutrition Survey (right).

tually at nutritional risk will then be improperly judged satisfactory or normal, to their long-term disadvantage.

Developmental Differences

More than 30 years ago it was realized that Black neonates are developmentally advanced over White neonates, just as girls are developmentally advanced over boys, even at birth. We now know that this early developmental advancement of Blacks is no transient phenomenon, but persists into the teens.

For the 28-30 postnatal ossification centers of the hand, Black boys and girls are systematically advanced over their White age peers.[6] Black boys and girls are also dentally advanced, taking eruption of 28 out of the 32 permanent teeth into account.[7, 8] Black dental advancement is apparently also characteristic of the later-appearing deciduous teeth, the deciduous molars.[9]

These differences in postnatal ossification timing and in tooth emergence timing are apparent even before income-matching, and even more evident when per-capita income or

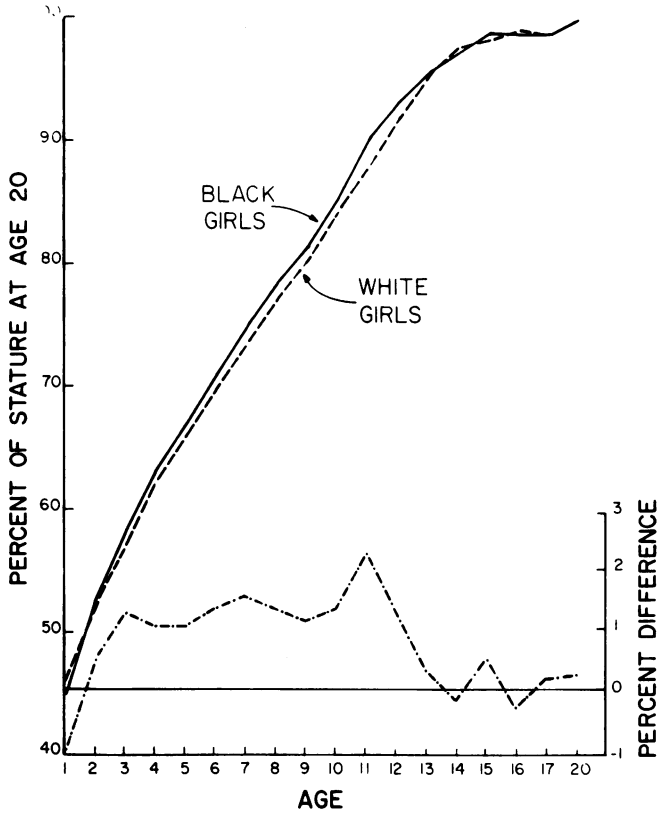

FIGURE 6—Statures of Black and White girls expressed as a per cent of adult size.

income relative to needs is taken into account. They indicate the need for population-specific norms and standards in nutritional assessment, since nutritionally-retarded Black children may still appear "advanced" by White standards. They further indicate the need to take developmental (skeletal) age into account when making comparisons. Just as girls can not be properly evaluated against dimensional standards for boys, developmental progress of Black children can not be properly evaluated using standards appropriate for White children.

To state the investigative problem in somewhat different and more dramatic terms, some proportion of Black children actually at nutritional risk will appear both satisfactory and even normal, if White developmental standards are employed.

Hematological Differences

The measurement of the hemoglobin concentration (gm/100ml) and of the hematocrits (packed red-cell volume) has long been a useful part of nutritional assessment. We now have evidence that "normal values" are not the same for Blacks and Whites.

This statement is based on upward of 100,000 determinations, in a great many recent surveys. It is true for the Ten-State Nutrition Survey, the Pre-School Nutrition Survey,

the National Health Examinations, the Kaiser-Permanente data, and for several regional surveys.[10, 11, 12] Overall, the difference is of the order of 1.0gm/100ml for hemoglobin concentrations, and 3 per cent in the hematocrits (packed-cell volume). It exists at all ages, from infancy through the 7th decade, and in males and females alike (Figure 7).

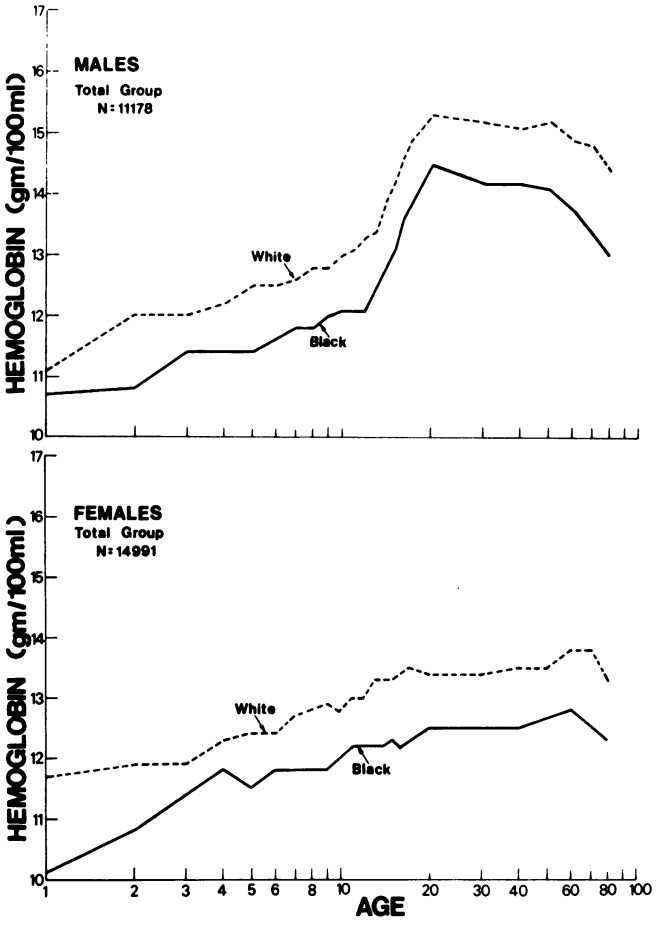

FIGURE 7—Hemoglobin comparison of White and Black individuals from infancy through old age showing an average 1.0gm/100ml hemoglobin difference at all ages.

We have tried to explain the 1.0gm/100ml difference in terms of per-capita income and socioeconomic status. Yet income-matched, the Black-White hemoglobin difference is still 1.0gm/100ml. It exists even at high levels of reported iron intake, it exists in athletes (who have higher Hgb and HcT values),[13] it exists in pregnant women (in the first and second trimesters), and it exists in supplemented infants supplemented for the first 18 months.[12]

Although we are reluctant to propose a purely genetic explanation for these differences in hemoglobin concentration (Hgb) and packed-cell volumes (HcT), the implications to nutritional survey and nutritional assessments seem clear enough. Equally-"low" hemoglobins do not have the same nutritional implications in both Blacks and Whites alike; the "cut-off" values should not be the same. If the scholastic implications of low hemoglobins are under consideration, attention must be given to population-appropriate norms.

Using the same cut-off values, in common clinical usage, a much larger proportion of Blacks than Whites have been deemed low or unsatisfactory. In view of what we now know about hemoglobins and hematocrits alike, there is reason for population-specific standards, and a reappraisal of the judgments just cited. If Black boys and girls are both taller than White boys and girls and developmentally advanced after income matching, their 1.0mg/100ml lower hemoglobins may not be indicative of poorer nutritional status.

Differences in Skeletal Mass

From the fetal period onward, through childhood and into old age, individuals of largely-African ancestry have a greater skeletal mass, a larger mineral mass, and a higher whole bone density. This generalization is based upon studies of fetal skeletons, skeletalized material of both sexes, and finally on radiogrammetric measurements of all 26,000 hand radiographs in the Ten-State Nutrition Survey and the Pre-School Nutrition Survey.[14] The consistency and the magnitude of Black-White differences in the skeletal parameters is indicated in Figure 8.

This population difference in the magnitude of the skeletal mass and the mineral mass has major implications to nutritional diagnosis, to the diagnosis of metabolic disorders involving the skeletal mass, in the interpretation of adult "osteoporosis," and in the osteodystrophies of renal origin.

One of the clinical manifestations of protein-calorie malnutrition, by way of example, is a diminution in the mineral mass both in childhood protein-calorie malnutrition and adult protein-calorie malnutrition (to say nothing of adult malabsorption states). But with a greater skeletal mass at all ages, the use of White norms for Black skeletal and mineral masses would tend to conceal bone loss until long after the bone loss was clinically present.

A similar problem arises in other bone-losing situations, including the osteodystrophies of renal origin, using techniques other than radiogrammetry, specifically direct-photon absorptiometry. When chronic renal disease patients are studied, whether they be transplant patients or dialyzed patients, two general observations may always be made. First, the chronic renal disease patients evidence considerable bone loss. Second, despite the bone loss that has obviously occurred, age, sex, and treatment-matched Black patients show systematically more bone that the patients who are White (Figure 9).[15]

These findings would indicate the need for separate Black norms for bone mineral and bone mineral/bone width when using direct-photon absorptiometry and the Cameron-Norland equipment. Indeed, we have made some beginning attempts in this direction with results as shown in Figure 10. The larger skeletal masses of American Negro (Black) people compared with the White norms shows the need for norms that are not just equal, but bigger.

With appropriate norms for skeletal mass, bone mineral,

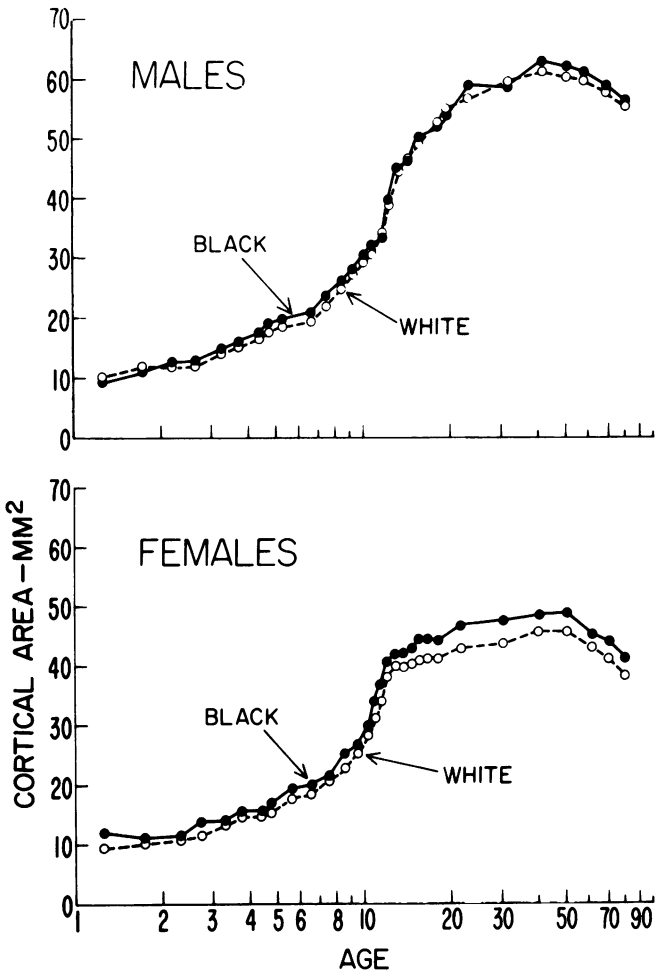

FIGURE 8—Cortical area of Black individuals and White individuals compared from infancy through old age.

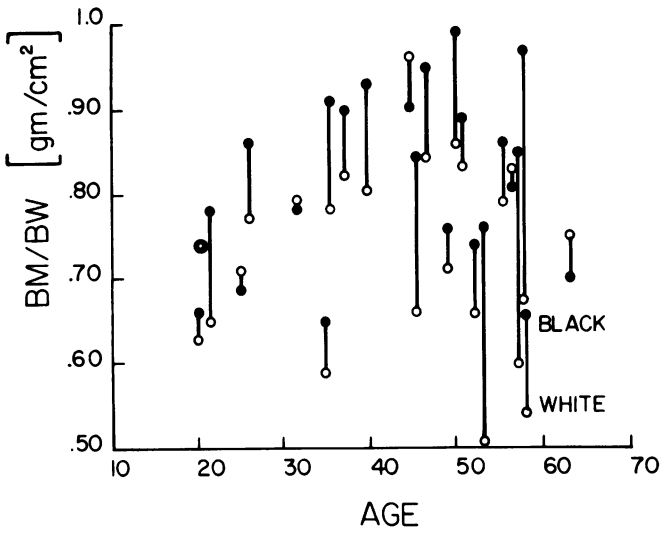

FIGURE 9—Comparison of bone density in age-matched and treatment-matched Black and White chronic renal disease (CRD) patients.

and bone density we may then be able to investigate bone-losing situations in American Negroes of largely-African ancestry which we cannot now adequately do without such standards. Given lactose deficiencies and hemoglobinopathies, city-ghetto situations where osteomalacia may well be common, the probability that protein-calorie malnutrition exists more commonly in our ghettos than we have seen reported, and adult protein-calorie malnutrition in the impoverished elderly, necessary new bone-mass norms for Blacks should provide us with the requisite information.

Conclusions

The evidence accummulated so far designates particular differences between American Blacks and American Whites that are crucial in nutritional assessment and to the measurement of nutritional status. With such differences in size at birth, in later dimensions, in the skeletal mass, and in hemoglobin and hematocrit concentrations, it is not appropriate to measure one group's status by another group's standards. And these are not differences brought about by poverty or the lack of privilege, but rather appear to be fundamental differences we can ill afford to neglect.

Given differences in stature during the growing period, differences in ossification timing and skeletal maturation, some part of the American Black population at nutritional risk would be missed using White standards. Some proportion of older Black women are ignored as bone-losing because the radiographic appearance of their bones is "normal" by conventional White standards.

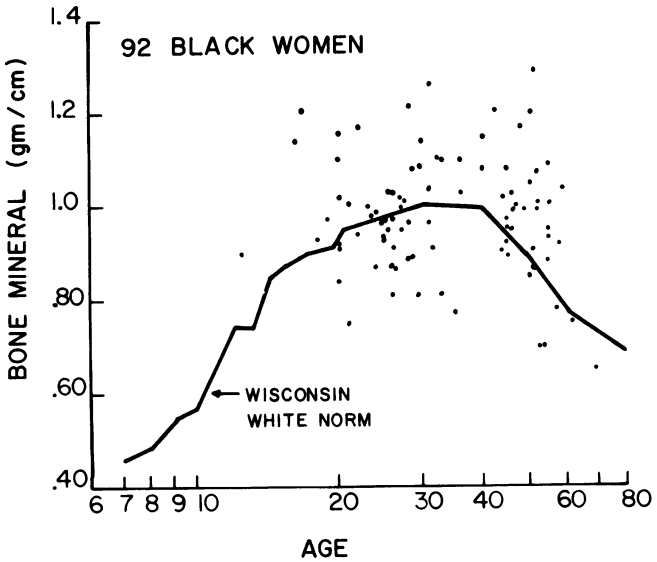

FIGURE 10—Bone mass measurements obtained by direct photon absorptiometry (using the Cameron-Norland equipment) in 92 normal adult Black women as compared with the White standards.

The hematological differences we report are important both from the standpoint of normal evaluation (and normal standards) and in interpreting low hemoglobin values and their relationship to school performance. With a 1 gram difference in hemoglobin concentration, we cannot pool hematological data in nutritional surveys and surveillance programs.

Previously, when we were more concerned with nutritional status in countries other than our own, a single set of White-appropriate nutritional standards seemed both appropriate and practical. Now with the new interest in minority populations in our own country, we see the need for population-specific standards in the assessment of ethnic minority groups.

It should be pointed out, finally, that except for the size differences at birth the dimensional differences between Blacks and Whites favor the former even before matching for socioeconomic status and to a larger and more definitive extent thereafter, except in the neonatal period.

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