Obesity and risk factors for the metabolic syndrome among low-income, urban, African American schoolchildren: the rule rather than the exception?1–3

Carol L Braunschweig, Sandra Gomez, Huifang Liang, Kristin Tomey, Bethany Doerfler, Youfa Wang, Chris Beebe, and Rebecca Lipton

ABSTRACT

Background: Adult obesity is associated with the metabolic syndrome; however, the prevalence of the metabolic syndrome among young children has not been reported. Clinic-based screening efforts for the metabolic syndrome in low-income neighborhoods, where obesity is prevalent, are limited by minimal health insurance coverage and inadequate access to health care. School-based obesity screening programs may effectively target high-risk populations.

Objective: The objective was to describe the prevalence of overweight and features of the metabolic syndrome (defined as the presence of ≥3 of the following risk factors: HDL ≤40 mg/dL, triacylglycerol ≥110 mg/dL, and blood pressure or waist circumference at or above the 90th percentile) in a pilot, school-based screening program.

Design: A cross-sectional study of obesity and the metabolic syndrome was conducted in third- to sixth-grade, low-income, urban, African American children. Lipid and glucose concentrations were measured in fasting capillary finger-stick samples.

Results: Age- and sex-specific BMI percentiles were assessed in 385 students, 90 of whom were full participants in this study (participants) and 295 of whom had only height and weight measurements taken (other students). Risk factors of the metabolic syndrome were assessed in the 90 participants (23%). No significant differences in BMI percentiles were found between the participants and the other students. Overall, 44% of the participants had BMIs at or above the 85th percentile, and 59% had an elevated BMI or one metabolic syndrome risk factor. The metabolic syndrome was present in 5.6% of all participants, in 13.8% of participants with BMIs at or above the 95th percentile, and in 0% of participants with BMIs below the 95th percentile.

Conclusions: Most of the African American children attending 2 urban schools in low-income neighborhoods were overweight or had one or more risk factors for the metabolic syndrome. School-based screening programs in high-risk populations may provide an effective venue for the screening of obesity and related risk factors.

KEY WORDS Obesity, risk factors, metabolic syndrome, African American schoolchildren

INTRODUCTION

In the United States, the prevalence of overweight among children—defined as a body mass index (BMI; weight in kilograms divided by height squared in meters) at or above the 95th percentile on age- and sex-specific growth charts—has tripled in the past 30 y (1–3). Current data indicate that 15% of US children between 6 and 11 y of age are overweight, and nearly 20% of non-Hispanic black children are overweight. Obesity in childhood is a public health concern because it increases the risk of developing hypertension, elevated cholesterol, type 2 diabetes, coronary heart disease, orthopedic disorders, and respiratory disease (4–6); has a significant negative effect on childhood emotional development (7, 8); has been shown to track to adult obesity; and increases the risk of adult mortality (9–11).

Insulin resistance and its associated metabolic characteristics have been proposed as a link between obesity and disease. The metabolic syndrome is a constellation of metabolic abnormalities aligned with insulin resistance that predicts premature coronary artery disease and type 2 diabetes; it affects ∼23% of the US adult population (12, 13). Among adolescents (12–19 y), Cook et al (14) defined this syndrome as the presence of ≥3 of the following risk factors: triacylglycerols >110 mg/dL, HDL cholesterol ≤40 mg/dL, waist circumference (WC) at or above the 90th percentile, fasting glucose ≥110 mg/dL, and blood pressure (BP) at or above the 90th percentile. Using this definition to analyze data from the third National Health and Nutrition Examination Survey (NHANES III, 1988–1994), they estimated the overall prevalence among adolescents to be 4%. According to the National Cholesterol Education Program, the increasing rate of obesity and its association with insulin resistance and type 2 diabetes positions the metabolic syndrome to play a greater role in premature cardiac disease than tobacco use (12). To our knowledge, estimates for the metabolic syndrome among younger children have not been described, possibly because NHANES does not include the biochemical data needed for children aged <12 y.

Given the effect of obesity on a vast array of diseases that track into adulthood, efforts aimed at early detection, treatment, and monitoring of its risk factors are needed. Results from NHANES...
1999–2000 suggest that low-income, African American grade school children likely have greater prevalence rates of obesity and elevated lipid and glucose concentrations and BP than the national average; however, studies in this population are lacking. Clinic-based screening programs in low-income neighborhoods, where these characteristics are highly prevalent, are plagued by minimal health insurance coverage, which limits routine access to health care. Detecting risk in individuals who might not otherwise be assessed is one of the objectives set forth by the National Heart Lung and Blood Institute and the American Heart Association for public cholesterol screening (15). Additionally, a small but growing body of literature suggests that the treatment of obesity tends to be underrecognized and undertreated by physicians, particularly in minority and low-income environments (16–18). A school-based universal health screening program that targets students in low-income minority neighborhoods may provide an optimal environment for early detection and surveillance of obesity and related risk factors.

The purpose of this study was to describe a pilot, school-based screening program in urban, low-socioeconomic, third- to sixth-grade African American schoolchildren for obesity and features of the “presumed” metabolic syndrome.

SUBJECTS AND METHODS

Subjects

All children in grades 3–6 enrolled in the 2002 academic year at 2 public elementary schools in Chicago who had their sex- and age-specific BMIs assessed as part of a school-wide health report card were eligible for participation. Letters inviting interested parents and guardians to provide phone numbers were mailed to the student’s homes. Those who responded were given detailed information about the research project and participation requirements. The study protocol was approved by the Ethics Committee of the Institutional Review Board of the University of Illinois at Chicago. Informed consent was obtained from all parents or guardians, and participating students signed an assent agreement.

Methods

Data collection occurred before the start of the school day. Height and weight measurements were rotated and performed twice for each participant with the use of standardized, recommended techniques (19, 20). Participants were classified as underweight (<5th percentile), normal weight (≥5th and <85th percentile), at risk of overweight (≥85th and <95th percentile), or overweight (≥95th percentile) according to the 2000 Centers for Disease Control and Prevention growth charts (2).

The WC measurement was made at the narrowest observed point between the bottom of the rib cage and the umbilicus; if a point of least circumference was not apparent, measurements were obtained at the umbilicus to the nearest 0.1 cm. Measurements were made by using an inelastic 3/8-in (=1 cm) measuring tape that was calibrated with a metal tape measure on a monthly basis (19). A WC at or above the 90th percentile for age, ethnicity, and sex according to the 2000 Centers for Disease Control and Prevention growth charts (2) was categorized as a risk factor for the metabolic syndrome.

BP measurements were taken twice, after the participant sat comfortably for 5 min, with an appropriately sized cuff on the right arm, which was slightly flexed at heart level. The second BP measurement was used for analysis (21). A systolic or diastolic BP at or above the 90th percentile on the basis of normative BP tables (22) for height, age, and sex was considered a risk factor for the metabolic syndrome.

Fasting finger-stick capillary samples were used to assess total cholesterol, LDL cholesterol, HDL cholesterol, triacylglycerols, glucose, and hemoglobin A1C (Hb A1c). The lipid and glucose concentrations were analyzed by using the Cholestech LDX Lipid Monitoring System (Cholestech Corp, Hayward, CA). This system correctly classified fasting individuals into the appropriate National Cholesterol and Education Program risk groups ≥95% of the time (23), and further, the CVs for between- and within-runs were higher than the National Cholesterol and Education Program standards for accuracy and precision (manufacturer’s information). Hb A1c was analyzed with the use of the DCA 2000 + Analyzer (Bayer Healthcare, Diagnostics Division, Tarrytown, NY). The DCA 2000 analyzer has a within-run reliability intraassay correlation CV of 2.8% and a between-run correlation coefficient of 0.996 (24). Quality control procedures for calibration of the Cholestech LDX and DCA 2000 were performed according to manufacturer guidelines and were recorded daily. Lipid concentrations were categorized on the basis of American Heart Association guidelines for children (25).

The metabolic syndrome was defined as the presence of ≥3 risk factors according to the guidelines developed by Cook et al (14) for adolescents. The 1998 guidelines of the American Academy of Pediatrics were used for the lipid guidelines (26). The criteria used for both lipid concentrations and metabolic syndrome are provided in Table 1. In November 2003, the American Diabetes Association changed the glucose categorization for impaired fasting glucose (IFG) from ≥110 mg/dL to ≥100 mg/dL (27). Despite this change, we retained the earlier cutoff guideline

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Criteria for lipid concentrations and the metabolic syndrome</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol (mg/dL)</td>
<td>Acceptable: &lt;170</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>LDL cholesterol (mg/dL)</td>
<td>Acceptable: &lt;110</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>HDL cholesterol (mg/dL)</td>
<td>Acceptable: &gt;35</td>
<td>≤40</td>
<td></td>
</tr>
<tr>
<td>Triacylglycerols (mg/dL)</td>
<td>Low: &lt;35</td>
<td>≥110</td>
<td></td>
</tr>
<tr>
<td>Glucose (mg/dL)</td>
<td>Desirable: 80–109</td>
<td>≥110</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impaired fasting glucose: 110–125</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diabetes: ≥126</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood pressure (mm Hg)</td>
<td>NA</td>
<td>≥90th percentile</td>
<td></td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>NA</td>
<td>≥90th percentile</td>
<td></td>
</tr>
</tbody>
</table>

1 NA, not applicable.

2 Defined as the presence of ≥3 of the listed risk factors.
TABLE 2  
Age, height, weight, and BMI of the participants and the other third- to sixth-grade students 1

<table>
<thead>
<tr>
<th></th>
<th>Participants (n = 90)</th>
<th>Other students (n = 295)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (y)</strong></td>
<td>10.5 ± 1.3</td>
<td>11.0 ± 1.7</td>
</tr>
<tr>
<td><strong>Height (cm)</strong></td>
<td>145.0 ± 11.2</td>
<td>146.6 ± 12.6</td>
</tr>
<tr>
<td><strong>Weight (kg)</strong></td>
<td>44.1 ± 14.7</td>
<td>46.7 ± 19.8</td>
</tr>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
<td>20.5 ± 4.9</td>
<td>20.9 ± 5.4</td>
</tr>
<tr>
<td><strong>BMI percentile</strong></td>
<td>70.8 ± 27.4</td>
<td>70.6 ± 26.7</td>
</tr>
<tr>
<td><strong>BMI percentile category [% (n)]</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5th</td>
<td>0</td>
<td>1.4 (4)</td>
</tr>
<tr>
<td>5th to &lt;85th</td>
<td>55.6 (50)</td>
<td>57.3 (168)</td>
</tr>
<tr>
<td>85th to &lt;95th</td>
<td>21.1 (19)</td>
<td>19.3 (57)</td>
</tr>
<tr>
<td>≥95th</td>
<td>23.3 (21)</td>
<td>22.4 (66)</td>
</tr>
</tbody>
</table>

1 No significant differences were found.

for IFG of ≥110 mg/dL to allow for comparisons between our population and that of Cook et al (14) and because, to our knowledge, it remains the only study that has defined the prevalence of the metabolic syndrome in a nationally representative sample of children. Because we used the more stringent cutoff, our estimates for elevated glucose should be viewed as a conservative estimate for the prevalence of elevated glucose. Glucose concentrations >125 mg/dL were categorized as indicating diabetes.

All participants received a growth chart with their age- and sex-specific BMI printed on it, a description of how to interpret their measurement, and a phone number for discussion of their results with the research team. They also received a copy of their BP, lipid, and glucose profiles. If a measured value was outside the desirable range, it was repeated. For analysis purposes, the lower of the 2 measurements was used. Participants with concentrations that persisted outside the normal range were provided referral information for free medical evaluation at a neighborhood health clinic as well as individualized diet counseling by the research dietitians (for both parents and children).

Statistical analysis

Standard descriptive statistics (mean, median, range, and SD) were assessed for continuous variables. Nonnormally distributed variables were transformed as necessary. Chi-square tests were used to examine whether the participants’ distributions within the 4 BMI categories (<5th percentile, 5th to <85th percentile, 85th to 95th percentile, and ≥95th percentile) were similar to those of the other third- to sixth-grade students. Wilcoxon’s rank-sum test was used to determine whether the participants’ weights and BMIs were similar to those of the other third- to sixth-grade students. Student’s t test was used to assess differences in age and height of the participants and other third- to sixth-grade students and to detect differences in risk factors between sexes. Prevalence and 95% CIs for individual features of the metabolic syndrome and different numbers of risk factors were calculated and used to assess differences in the prevalence of metabolic syndrome by sex and BMI. All data were entered and cleaned in EPIINFO 6.0 (1997; Centers for Disease Control and Prevention, Atlanta), and statistical analyses were performed by using SAS version 8.2 (SAS Institute, Cary, NC).

RESULTS

Overall, 23% (n = 90) of the 385 eligible students assessed for age- and sex- specific BMI measurements were recruited. All participants were African American and qualified for free school lunch; 28% had private medical insurance, 64% had Medicaid, and 8% had no insurance. Age- and sex-specific BMIs of the participants and the other third- to sixth-grade students are provided in Table 2. No participants were underweight; 1.4% of the other third- to sixth-grade students had BMIs below the 5th percentile. No significant differences in mean age, height, weight, BMI percentiles, or the distribution within the BMI categories were found between the participants and the other third- to sixth-grade students (Table 2). More than 40% of students were categorized as at or above the 85th percentile for BMI, and ≈23% were at or above the 95th percentile. The mean (±SD)

### TABLE 3

Biochemical indexes and the percentage of participants in each classification 1

<table>
<thead>
<tr>
<th>Biochemical index classification</th>
<th>Value 1</th>
<th>Percentage of participants in each classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol (mg/dL)</td>
<td>172.3 ± 28.8</td>
<td>48.3</td>
</tr>
<tr>
<td>LDL cholesterol (mg/dL)</td>
<td>100.0 ± 28.4</td>
<td>67.8</td>
</tr>
<tr>
<td>HDL cholesterol (mg/dL)</td>
<td>56.5 ± 11.7</td>
<td>98.9</td>
</tr>
<tr>
<td>Triacylglycerols (mg/dL)</td>
<td>78.5 ± 43.3</td>
<td>93.3</td>
</tr>
<tr>
<td>Fasting glucose (mg/dL)</td>
<td>99.8 ± 9.3</td>
<td>85.4</td>
</tr>
</tbody>
</table>

1 n = 90,  
2 ± SD.
WC of the participants was 64.8 ± 10.7 cm (range: 48.8–109.0 cm).

Excluding total cholesterol, participants’ mean values for lipids, glucose, and Hb A₁c were within the desirable range (Table 3). When categorized by the American Heart Association guidelines, the prevalence of undesirable concentrations for total cholesterol, LDL cholesterol, and triacylglycerols ranged from 7% to 19%, and cholesterol, LDL cholesterol, and triacylglycerols ranged from 7% to 19%, and <50% of the participants’ total cholesterol concentrations were within the desirable range. Fasting glucose concentrations >125 mg/dL were not observed, and all Hb A₁c concentrations were within the desirable range (<6.5 mg/dL); however, almost 15% of the participants had IFG.

The prevalence of risk factors for the metabolic syndrome is summarized in Table 4. Overall, the metabolic syndrome (presence of ≥3 risk factors) occurred in 5.6% of the participants. No significant difference was found between boys and girls (two-sided $P = 1.0$): 35.6% of the participants had ≥1 more risk factor, 8.9% had ≥2 risk factors, and 0% of the participants had ≥3 abnormalities. All students who met the criteria for the metabolic syndrome were overweight. No normal-weight participant had more than one risk factor. The distribution of each risk factor of the metabolic syndrome is shown in Table 5. Overall, high fasting glucose and triacylglycerol concentrations were most common, whereas abdominal obesity and low HDL cholesterol were the least common and only occurred in overweight participants. Individual risk factors were similar for boys and girls (two-sided $P = 1.0$ for all 5 risk factors).

### DISCUSSION

The metabolic syndrome was included as an entity that warranted clinical intervention in the 2001 National Cholesterol Education Program’s Adult Treatment Panel III (ATP III) guidelines (12). This definition was modified by Cook et al (14) for 12–19-y-olds based on the closest representative values obtainable from the pediatric NHANES III reference data. They found that the prevalence of the metabolic syndrome was 4% overall and 28.7% among overweight adolescents. African American adolescents had the lowest rate (2.0%), followed by whites (4.8%) and Mexican Americans (5.6%). We found that the metabolic syndrome occurred in 5.6% of participants; however, it was found exclusively in those with BMIs at or above the 95th percentile (13.8%), as was abdominal obesity (14.3%) and low HDL-cholesterol concentrations (19%). Elevated BP, triacylglycerol, and glucose concentrations occurred in all BMI categories. The higher overall rates for the metabolic syndrome in our participants than in those of Cook et al probably reflects the increase in obesity prevalence that has occurred since the NHANES III data collection period (1988–1994). The higher prevalence for the metabolic syndrome among overweight 12–19-y-olds (28.7%) compared with our overweight 8–12-y-olds (13.8%) is an expected, age-related, observation. More recently, Weiss et al (28) reported that 49.7% of children (4–20 y old) with BMIs above the 97th percentile had the metabolic syndrome; among African Americans this rate dropped to 39%. Unfortunately, our sample was too small to assess rates for those with BMIs above the 97th percentile. A

### TABLE 4

Prevalence of one or more risk factors for the metabolic syndrome

<table>
<thead>
<tr>
<th>Percentage (95% CI)</th>
<th>≥1 Risk factor</th>
<th>≥2 Risk factors</th>
<th>≥3 Risk factors</th>
<th>≥4 Risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ($n = 90$)</td>
<td>35.6 (23.7, 44.0)</td>
<td>8.9 (3.9, 16.8)</td>
<td>5.6 (1.8, 12.5)</td>
<td>0</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys ($n = 40$)</td>
<td>37.5 (22.7, 54.2)</td>
<td>10.0 (2.8, 23.7)</td>
<td>5.0 (1.6, 20.4)</td>
<td>0</td>
</tr>
<tr>
<td>Girls ($n = 50$)</td>
<td>34.0 (21.2, 48.8)</td>
<td>8.0 (2.2, 19.2)</td>
<td>4.0 (0.5, 13.7)</td>
<td>0</td>
</tr>
<tr>
<td>BMI status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal ($n = 50$)</td>
<td>26.0 (14.6, 40.3)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>At risk ($n = 19$)</td>
<td>36.8 (16.3, 61.6)</td>
<td>5.3 (0.1, 26.0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Overweight ($n = 21$)</td>
<td>57.1 (34.0, 78.2)</td>
<td>33.3 (14.6, 57.0)</td>
<td>13.8 (8.2, 47.2)</td>
<td>0</td>
</tr>
</tbody>
</table>

† Normal, 5th to <85th percentile; at risk, 85th to <95th percentile; overweight, ≥95th percentile.

### TABLE 5

Prevalence of individual risk factors for the metabolic syndrome

<table>
<thead>
<tr>
<th>Percentage (95% CI)</th>
<th>Abdominal obesity</th>
<th>High glucose</th>
<th>High triacylglycerols</th>
<th>Low HDL cholesterol</th>
<th>Elevated blood pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ($n = 90$)</td>
<td>6.7 (2.5, 14.0)</td>
<td>14.6 (8.0, 23.7)</td>
<td>15.7 (8.9, 25.0)</td>
<td>4.5 (1.2, 11.1)</td>
<td>8.9 (3.9, 16.8)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys ($n = 40$)</td>
<td>7.5 (1.6, 20.4)</td>
<td>17.5 (7.3, 32.8)</td>
<td>15.0 (5.7, 29.8)</td>
<td>5.0 (0.6, 16.9)</td>
<td>10.0 (2.8, 23.7)</td>
</tr>
<tr>
<td>Girls ($n = 50$)</td>
<td>6.0 (1.3, 16.6)</td>
<td>12.2 (4.6, 24.8)</td>
<td>16.3 (7.3, 29.7)</td>
<td>4.1 (0.5, 14.0)</td>
<td>8.0 (2.2, 19.2)</td>
</tr>
<tr>
<td>BMI status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal ($n = 50$)</td>
<td>0</td>
<td>10.2 (3.4, 22.2)</td>
<td>10.2 (3.4, 22.2)</td>
<td>0</td>
<td>6.0 (1.2, 16.6)</td>
</tr>
<tr>
<td>At risk ($n = 19$)</td>
<td>0</td>
<td>21.0 (6.0, 45.6)</td>
<td>10.5 (1.3, 33.1)</td>
<td>0</td>
<td>10.5 (1.3, 33.1)</td>
</tr>
<tr>
<td>Overweight ($n = 21$)</td>
<td>28.6 (11.3, 52.2)</td>
<td>19.0 (5.4, 41.9)</td>
<td>33.3 (14.6, 57.0)</td>
<td>19.0 (5.4, 41.9)</td>
<td>14.3 (3.0, 36.3)</td>
</tr>
</tbody>
</table>

† Normal, 5th to <85th percentile; at risk, 85th to <95th percentile; overweight, ≥95th percentile.
Recent pilot study of 1700 multiethnic eighth-grade children found that 13.9% had the metabolic syndrome based on ATP III guidelines (29). These students were ≈3.5 y older than our participants, and only 23% were African American. Furthermore, plasma rather than capillary samples were used to measure lipid and glucose concentrations, and ATP III guidelines for the metabolic syndrome were used for lipid and glucose concentrations, which made direct comparisons of the results between the studies difficult. Despite the differences in design, these studies collectively document that the metabolic syndrome is present in a significant number of fairly young overweight children.

Few studies have examined capillary finger-stick screening for lipid and glucose concentrations in conjunction with anthropometric measurements in a school-based setting, particularly in low-income, urban, African American children. Muratova et al (30) reported nonfasting finger-stick capillary samples in rural, economically disadvantaged Appalachian fifth-grade students were more sensitive than was family history in predicting elevated blood cholesterol concentrations. The same group obtained measurements for BMI and nonfasting finger-stick samples in a school-based obesity screening in (n = 1413; 98% were white) and found that mean total cholesterol was 170 mg/dL, and 25% of the students were presumptively dyslipidemic, defined as a total cholesterol concentration >200 mg/dL or an HDL-cholesterol concentration <35 mg/dL (31). Overall, 15% of their sample had systolic or diastolic hypertension (≥95th percentile), and 45% had BMIs at or above the 85th percentile. Our mean values for total cholesterol and prevalence for elevated total cholesterol and BMI are quite similar to these (mean total cholesterol: 172.3 mg/dL; 19% with elevated total cholesterol, 44% with a BMI at or above the 85th percentile, and 9% with a BP at or above the 90th percentile), despite differences in the fasted state for capillary samples, age, and ethnicity between our studies. Far fewer of our participants had low HDL-cholesterol concentrations (1.1%), as would be expected with a comparison of African American with white populations.

More than 40% of our participants had a BMI at or above the 85th percentile. Very similar rates for BMI categories were found among the other third- to sixth-grade students, which suggests that our participants were a representative sample of the target group. We are currently involved in a larger study of low-income, predominantly African American fifth- to seventh-grade students at 4 other elementary schools in the Chicago area. Among the ≈500 students we have recruited thus far, >40% have BMIs at or above the 85th percentile. A recent survey of 3000 children in kindergarten through fifth grade in New York City public schools reported that 43% of the children had BMIs at or above the 85th percentile (19% at risk of overweight, 24% overweight), results that are strikingly similar to ours (32). The Sinai Health System in Chicago recently completed a door-to-door community health survey of 1700 scientifically selected households in 6 Chicago community areas that represented the racial, ethnic, and socioeconomic diversity of the city (33). On the basis of parental reports of heights and weights for 2–12-y-old children in 3 neighborhoods with the largest African American population (ranging from 47% to 98%), >60% had BMIs at or above the 85th percentile. In the poorest of these neighborhoods, this value increased to 68%. Nationally, 15.3% of 6–11-y-olds are at or above the 95th percentile for sex- and age-specific BMI (3) and among non-Hispanic black children, this value was 19.5%. Overweight and obesity among low-income, urban, African American children are greater than the national averages. Research focused on the reasons for this is needed to effectively design and tailor interventions to meet the needs of this population.

Abdominal obesity was not found in participants with BMIs below the 95th percentile; however, it occurred in almost 30% of students with BMIs at or above this level. All of these measurements were made by a person with extensive training in anthropometrics using quality assurance methods that were tightly defined; thus, we do not believe that our WC data are plagued with systematic errors. Our students were between 8 and 12 y of age and in the midst of pubertal development, a time when body proportions are known to vary among different races. In adults, central obesity is associated with insulin resistance and individual risk factors for the metabolic syndrome (34); however, this relation is not as definitive in younger children. Weiss et al (28) used a threshold BMI z score of ≥2.0 as a risk factor rather than WC in their definition for the metabolic syndrome because of concerns over the changes that occur in body proportions and risk assessment during pubertal development. No associations between waist-to-hip ratios and traditional cardiovascular disease risk factors were reported by Valle et al (35) in 6–9-y-old children. In 8–13-y-old Hispanic children with BMIs at or above the 85th percentile and a family history of type 2 diabetes, central obesity occurred in 62% of participants (36). This is more than twice the level observed among our overweight participants; however, we did not recruit based on a positive family history of type 2 diabetes, which is known to be highly associated with central adiposity. Because the prevalence of elevated WC was lower than expected, it would have diminished rather than inflated our prevalence rates for the metabolic syndrome. Further study is needed on the role of WC on disease risk in this age group.

The cross-sectional design of this study precludes any causal inferences and limits assumptions regarding duration for all of the risk factors. The definition used for the metabolic syndrome was devised for older children; thus, our findings can only be viewed as “presumable” metabolic syndrome rates. Fasting finger-stick capillary samples were used to assess the biochemical indexes; thus, individual concentrations may be higher or lower than plasma samples. However, the manufacturer’s information indicates that these measurements are not affected by systematic error. To reduce error and overestimation of undesirable lipid and glucose concentrations, a second measurement was obtained at a later date in all children with values outside desirable ranges and the lower of the 2 values was used for analysis. Only 23% of the students in the third to sixth grades were included in our analysis for lipid abnormalities and features of the metabolic syndrome. This rate can be partially explained by the numerous independent steps required of the parents and guardians for student participation (5). Specifically, the parent or guardian had to (1) read the letter mailed home describing the study, (2) sign and return the enclosed consent form, (3) and bring their child to school ≈45 min before the beginning of the scheduled start of the school day in a fasted condition on the appointed day for finger-stick measurements. Despite this relatively low participation rate, the similarities in WC, BMI, and demographic backgrounds of our participants suggest that our findings can be generalized to the other third- to sixth-grade students in the 2 participating schools.
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