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An Environmental Intervention to Prevent Excess Weight Gain in African American Students: A Pilot Study

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Abstract

Purpose—Examine the influence of an environmental intervention to prevent excess weight gain in African American children.

Design—Single-group repeated measures.

Setting—The intervention was delivered to a school composed of African American children.

Subjects—Approximately 45% (N = 77) of enrolled second through sixth grade students.

Intervention—The 18-month intervention was designed to alter the school environment to prevent excess weight gain by making healthier eating choices and physical activity opportunities more available.

Measures—Body Mass Index Percentile was the primary outcome variable. Body mass index Z-score was also calculated, and percent body fat, using bioelectrical impedance, was also measured. Total caloric intake (kcal), and percent kcal from fat, carbohydrate, and protein were measured by digital photography. Minutes of physical activity and sedentary behavior were self-reported.

Analysis—Mixed models analysis was used, covarying baseline values.

Results—Boys maintained while girls increased percent body fat over 18-months (p = .027). All children decreased percent of kcal consumed from total and saturated fat, and increased carbohydrate intake and self-reported physical activity during the intervention (p values < .025). body mass index Z-score, sedentary behavior, and total caloric intake were unchanged.

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Conclusion—The program may have resulted in maintenance of percent body fat in boys. Girl's percent body fat steadily increased, despite similar behavioral changes as boys. School-based interventions targeting African American children should investigate strategies that can be effective across gender.

Keywords

blacks; obesity; children; nutrition; physical activity; Manuscript format: research; Research purpose: intervention testing/program evaluation; Study design: quasi-experimental; Outcome measure: behavioral; Setting: school; Health focus: weight control; Strategy: environmental change; Target population age: youth; Target population circumstances: race/ethnicity

PURPOSE

African American children, especially girls, have high rates of childhood obesity (1). Several negative health consequences are associated with childhood overweight, most notably increased risk for type 2 diabetes (2). Despite the higher rates of overweight in African American children, only a limited number of primary prevention studies have targeted this population (3). Most studies have been limited by short treatment length (11 and 12 weeks) and only one resulted in decreases in body mass index (4). Thus, there is a need for long-term, primary prevention studies applied to this population. This manuscript reports the findings of an 18-month pilot excess weight gain prevention program applied to African American children in elementary school.

This pilot study was part of a randomized controlled trial, entitled Wise Mind. Wise Mind compared a Healthy Eating and Exercise (HEE) program designed to prevent excess weight gain to a Substance Use Prevention program (5). A school in which almost all of the children self-classified as African American agreed to participate in the current study, but was not randomized into the larger study. This school, however, received the same HEE program utilized in the Wise Mind study.

METHODS

Sample

Seventy-seven 2nd through 6th grade students (mean age = 9.26; 50% boys) agreed to participate in the pilot study, representing approximately 45% of the eligible student body. Tuition was required at this private Catholic school, though no socioeconomic data were collected. Informed consent was obtained from the parents, and assent was given by the students. The study was reviewed and approved by the Institutional Review Board of Louisiana State University and the Pennington Biomedical Research Center.

Measures

Body mass index was calculated by measuring height with a wall-mounted stadiometer and weight with the Tanita Body Impedance analyzer (TBF-310) scale. Body mass index values were converted to z-scores and percentiles using data from the Centers for Disease Control based on gender and age. The TBF-310 also calculated percent body fat (percent body fat).

Each student had three days of lunch meals digitally photographed at each measurement period before and after eating. Trained dietitians independently estimated the percent of the food served and eaten in reference to a standard portion of each food in units of 10%. The Pennington Center nutrient database calculated the total kilocalories and kilocalories consumed from each macronutrient. Physical activity and sedentary behavior was measured by the Self-Administered Physical Activity Checklist (6).

Intervention

The social learning theory guided the development of the program. According to this theory, health behavior change (increased physical activity, healthy nutrition choices) is promoted through environmental change (cafeteria, classroom) that is supported by social influence (teachers, parents, peers). In addition, direct experience (teaching) and modeling (teachers, parents, peers) result in the development of specific attitudes and beliefs that coincide with the environmental changes. Therefore, we sought to alter the classroom and cafeteria environments while simultaneously providing materials to the teachers through twelve, two-month long campaigns that could be used to increase children's knowledge of healthy eating and exercise habits. Because this was the same program delivered in the randomized trial, it was not culturally tailored.

Dietary component—The overarching goal of the dietary component was to increase the consumption of fruits, vegetables, and grains and to decrease consumption of dietary fat. School cafeteria menus were modified consistent with the stated dietary goals, were hung in the classrooms, and healthy choices were announced via loudspeaker. Teachers were provided with healthy nutrition tips.

Physical activity component—The overarching goal of the physical activity component was to increase physical activity to 60 minutes per day. Each classroom was provided with physical activity equipment that could be used indoors and outdoors. Teachers were encouraged to provide 5 minutes of physical activity after every 30 minutes of instruction, to model daily physical activity tips which engage students in short bouts of physical activity, and to discuss ways to promote physical activity outside of school.

Parental component—The goal of this component was to encourage families to make changes to the home environment that promote increased physical activity and healthy food options. These messages were primarily communicated via the program's website. A bimonthly newsletter echoing information from each campaign was sent home.

Statistical Analysis

Mixed linear models were used to test if the change from baseline in each outcome variable differed significantly by gender and weight status over time. Gender, body mass index percentile group [overweight (body mass index $\geq 85^{th}$ percentile) or normal weight (body mass index $< 85^{th}$ percentile)], and time were fixed effects and the repeated factor was time. A separate mixed model was used for percent body fat, with height, age, and baseline percent body fat serving as covariates. All secondary outcome variables were analyzed in the same fashion, with baseline values of the respective dependent variable as covariates.

RESULTS

Primary Endpoints

Weight status—There were no significant interaction or main effects for body mass index Z-score or body mass index percentile change, although there was a Gender X body mass index percentile X Time interaction for percent body fat change ($F(2,113) = 3.71$, $p = .028$) (Figure 1). The percent body fat change was greatest in overweight boys at 18-months. Post-hoc analyses showed that normal weight boys' percent body fat changed the least of all children at both 12 and 18 months. The significant differences between baseline and adjusted percent body fat values occurred for normal weight boys at 12 months, overweight boys at 12 months, normal weight girls at 12 and 18 months, and overweight girls at 6 months (p values < .044). There was also a Gender X Time interaction ($F(2,113) = 4.02$, $p = .021$) and a Gender main effect ($F(2,78) = 8.93$, $p = .004$).

Secondary endpoints

There were no significant interaction effects for any secondary variable. Except for carbohydrate intake, sedentary behavior, and total kilocalories, there were no significant main effects for gender or weight status. Only the significant mixed model effects are reported below. Table 1 shows the baseline and follow-up data for all variables.

Physical activity—Student reported minutes of physical activity at each assessment period was significantly greater (p values < .018) than baseline.

Sedentary behavior—On average, there was greater than an hour difference in change scores (71.6 ± 26.1) between girls and boys ($F(1,74) = 7.54$; $p = .008$). Girls spent an average of 50 fewer minutes in sedentary behavior compared to baseline ($p = .008$).

Digital photography reliability—Approximately 10% of all digital photographs were over sampled to test for inter-rater (dietician) agreement. Intra-class correlations ranged from .90 – .94

Total kcal—On average, there was a difference in the change scores ($F(1,75) = 4.17$; $p = .045$) of nearly 50 kilocalories (47.4 ± 23.2) between normal and overweight children. Overweight/obese children tended to consume 30 more kilocalories compared to baseline ($p = .095$).

Fat—Students had a larger decrease in total fat at 12 months compared to 18 months ($F(2,111) = 3.82$; $p = .025$). Students also had larger decreases in saturated fat at 12 and 18 months compared to 6 months ($F(2,115) = 16.18$; $p < .001$). Percent of kilocalories from total and saturated fat at each assessment period were significantly lower than baseline levels (all p values < .001).

Carbohydrate—Students had a larger decrease at 12 months compared to 18 months ($F(2,119) = 4.18$; $p = .017$). On average, girls change score (2.4 ± 0.87) was greater than males ($F(1,76) = 7.31$; $p = .008$). Percent of kilocalories from carbohydrates, and the values for both genders, were significantly higher at each assessment period in comparison to baseline (p values > .001).

Protein—There were no significant changes.

Baseline covariates—The baseline value of each outcome measure was entered as a covariate in each analysis. These baseline values were significant covariates in each analysis, and negative correlations were evident for all analyses. For example, those children consuming the greatest amount of percent fat from calories at baseline had the greatest decreases, while children consuming the fewest had virtually no change or slight increases.

DISCUSSION

African American boys' percent body fat remained unchanged, while girls' percent body fat increased after 18 months. In this study, girls' percent body fat increased steadily, and overweight boys' percent body fat increased during the first 12 months before a large decrease at 18 months. This decrease may be due to normal fluctuations in percent body fat, measurement error, or that a full year of intervention may have been necessary to produce behavior changes needed to influence body composition. Therefore, it is possible that the intervention may have produced percent body fat maintenance in males because an increase in percent body fat was expected, based on previous studies (10). The largely environmental/structural aspects of the

program may have been better suited for boys than girls (7), who seem to respond to more direct education (e.g. Planet Health; 8). However, without a control group, firm conclusions about our intervention cannot be drawn.

The intervention may have also resulted in positive changes in nutrient intake. At baseline, the children's percent total fat (37%) and percent saturated fat (15%) intakes that were outside recommended levels of 25%–35% and <10%, respectively. By 18 months, the children had reduced both total fat and saturated fat intake to be within and 1% outside of recommended levels, respectively. Carbohydrate intake moved from the bottom to the middle of recommended levels.

Few programs demonstrate weight reduction in African American children (4,8,9). Both Wadden (9) and Gortmaker (8) developed programs that produced weight loss in preadolescent girls. A 2-year intervention targeting preschool children (4) resulted in weight loss across genders. Two of these studies (4,8) were school-based. Therefore, it appears that school-based programs have potential to be effective for African American children. However, these programs have yet to show long-term effectiveness across gender. This lack of significant long-term effects may be related to methodological limitations including short treatment lengths, small sample sizes, and lack of cultural tailoring.

Two major limitations of the current investigation were that there was no control group and a randomized controlled methodology was not employed. These design limitations make it impossible to determine whether the program resulted in excess weight gain prevention and limits generalizability. Other limitations include that only half of the student body enrolled, there was low parental website utilization, process measures were not collected, only catholic schools were included, and that self-report data were collected. In addition, only school lunch meals were measured, and it is unknown if the consumption changes generalized outside of school. Despite these limitations, this environmentally-based program showed potential beneficial effects on body composition in African American boys. Future interventions should use stronger methodological designs (e.g. cluster randomization), assess maturation status, and find ways to blend environmental and education components to increase the likelihood of effectiveness across genders.

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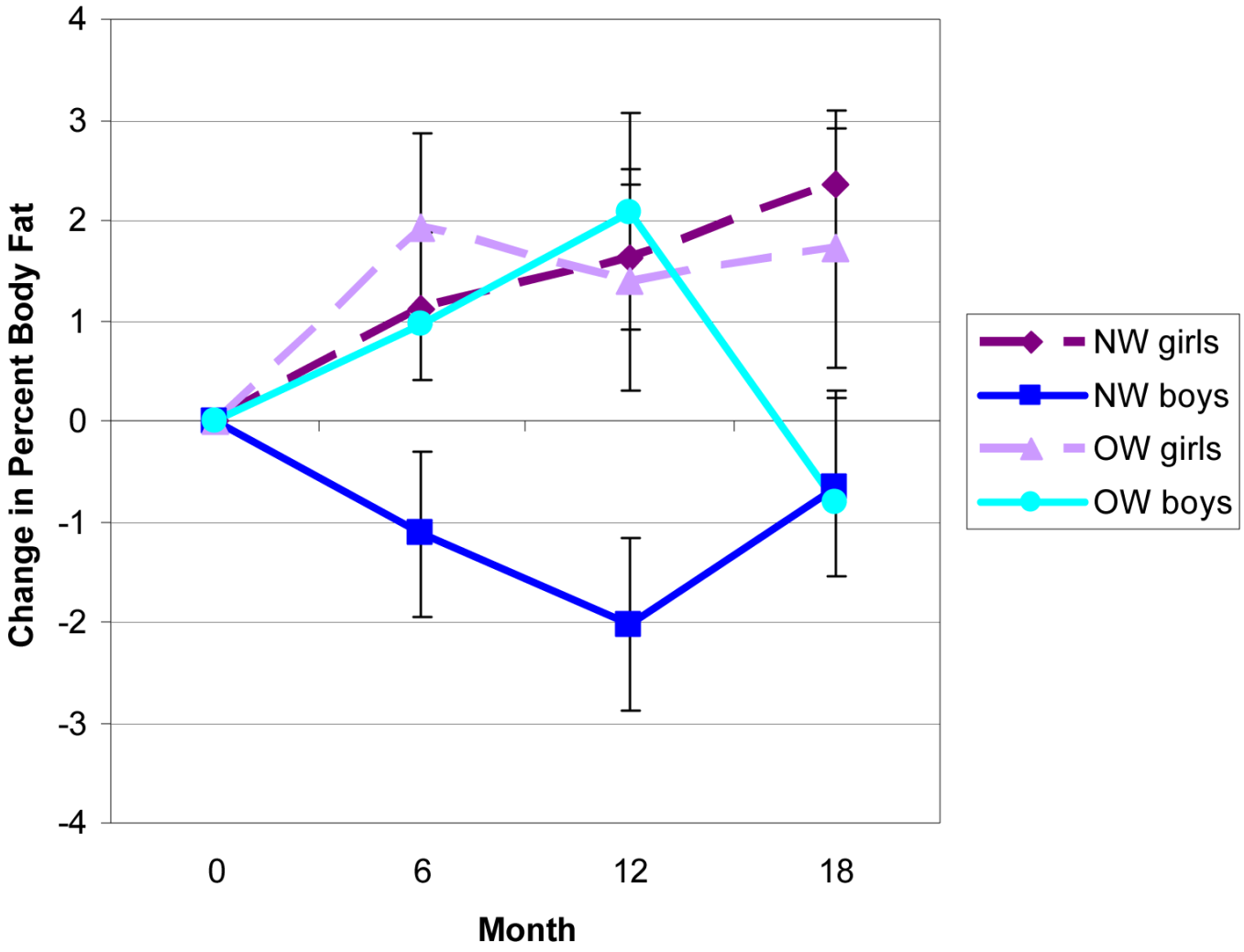

Figure 1. Change in percent body fat for boys and girls by body mass index percentile category

There was a three way interaction for percent body fat (p = .027). At the end of treatment, girls had significantly increased their percent body fat, whereas there was no significant change in boys. Error bars refer to standard error. For each measurement period, the sample sizes were 77, 59, and 55, respectively.

Table 1

Baseline and follow-up data for demographic characteristics[†].

Variable	Baseline (N = 77)	Month 6 (N = 77)	Month 12 (N = 59)	Month 18 (N = 55)
BMIZ	0.8 ± 0.1	0.8 ± 0.1	0.9 ± 0.2	0.8 ± 0.2
BMI percentile	70.5 ± 3.3	70.4 ± 3.3	71.7 ± 3.8	70.9 ± 3.9
%BF (%)	25.0 ± 1.3	25.5 ± 1.3	25.1 ± 1.5	25.3 ± 1.5
SAPAC minutes	54.9 ± 5.7	101.9 ± 9.3***	76.8 ± 7.8*	86.5 ± 9.7**
Sedentary minutes	207.8 ± 17.8	186.1 ± 17.7	197.8 ± 19.5	204.2 ± 19.1
Caloric intake (kcal)	504.6 ± 15.5	494.8 ± 14.8	524.6 ± 16.8	503.3 ± 16.7
% Fat	37.9 ± 0.6	33.0 ± 0.5***	32.0 ± 0.4***	33.3 ± 0.5***
% Saturated Fat	15.3 ± 0.3	12.3 ± 0.2***	11.0 ± 0.2***	10.8 ± 0.3***
% Carbohydrate	45.6 ± 0.6	50.5 ± 0.5***	51.3 ± 0.6***	49.4 ± 0.7***
% Protein	17.9 ± 0.3	17.4 ± 0.3	17.6 ± 0.4	18.2 ± 0.4

Note. Values are raw values. BMIZ = Body mass index z-score; %BF = percent body fat as measured by Tanita; SAPAC = Self-administered physical activity checklist; Nutrient values are averages over three days of measurement.

[†]Significance tests refer to main effects of change over time, as reported in text. Main effects for gender (sedentary behavior; carbohydrates) and BMI %ile group (total kcals) are discussed in text. The 3-way interaction for %BF is illustrated in Figure 1.

* $p < .05$

** $p < .01$

*** $p < .0001$