

RESEARCH ARTICLE

Dietary and Physical Activity Factors Related to Eating Disorder Symptoms Among Middle School Youth

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ABSTRACT

BACKGROUND: Dietary and physical activity (PA) behaviors can predict disordered weight control behaviors (DWCB) among youth. This study examines dietary and PA correlates of DWCB and differences by race/ethnicity and weight status in a diverse sample of youth.

METHODS: Self-reported data on dietary weight management behaviors, strengthening/toning exercises, moderate-to-vigorous physical activity, and DWCB (vomiting, taking laxatives, and/or taking diet pills without a prescription) were obtained from 15,260 sixth to eighth graders in 47 middle schools participating in the Massachusetts Healthy Choices Study at baseline (2005). Generalized estimating equations were used to estimate odds of DWCB associated with dietary and PA behaviors and to examine for differences by race/ethnicity and weight status, adjusting for covariates and clustering of individuals within schools.

RESULTS: Disordered weight control behaviors were reported by 3.6% of girls and 3.1% of boys. Youth who engaged in strengthening/toning exercises 7 days per week versus 0-3 days per week had increased odds of DWCB (girls odds ratio [OR] = 1.9; 95% confidence interval [CI] = 1.3-3.0; boys OR = 1.5; 95% CI = 1.0-2.2). Dietary weight management behaviors were associated with increased odds of DWCB (girls OR = 1.2; 95% CI = 1.1-1.3; boys OR = 1.3; 95% CI = 1.2-1.4) for each additional behavior. These associations did not differ by race/ethnicity or weight status.

CONCLUSIONS: Persons promoting healthy dietary and PA behaviors among youth should consider the co-occurrence of strengthening/toning and dietary weight management behaviors with DWCB and the consistency in these associations across racial/ethnic and weight status groups.

Keywords: disordered weight control; youth; diet; physical activity.

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Disordered weight control behaviors (DWCB), such as vomiting, taking laxatives, and taking diet pills without a prescription, are a growing concern among youth. In contrast to clinical eating disorders (ie, anorexia nervosa and bulimia nervosa) which are defined and diagnosed by strict physiological and psychological criteria, DWCB broadly refer to methods of weight control or management that are considered disordered. DWCB often occur prior to the onset of eating disorders and have been found to be as much as

20 times more common (prevalence of 14-28%) than clinical eating disorders in community samples¹ and are associated with numerous detrimental outcomes, such as esophagitis, gastric rupture, impairment of digestive functioning,² and low self-esteem and depression.³

A growing body of literature addresses dietary risk factors associated with DWCB. Studies indicate that the majority of youth start to diet or engage in various healthy or unhealthy dietary behaviors

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before engaging in DWCB⁴⁻⁶ and before the onset of other eating disorder symptoms.^{7,8} Adolescents participating in Project Eating Among Teens (EAT) who reported unhealthy dietary behaviors (defined as fasting, eating very little food, using a food substitute or skipping meals to lose or keep from gaining weight) at baseline were more likely to engage in binge eating, self-induced vomiting, diet pill use, laxative use, or diuretic use at the 5-year follow-up than youth who did not report unhealthy dietary behaviors at baseline.⁹ Additionally, engaging in healthy weight control behaviors (ie, exercising, eating more fruits and vegetables, eating fewer high-fat foods, or eating fewer sweets) at baseline were also associated with increased risk for binge eating among girls (OR = 4.64, $p = .025$) and binge eating, self-induced vomiting, diet pill use, laxative use, or diuretic use among boys (OR = 3.28, $p = .024$) at follow-up. These results suggest that both unhealthy and healthy dietary behaviors may lead to more DWCB among youth.

Few studies have explored the association between PA and DWCB, although this association merits further attention, because PA is a common and recommended method for weight loss and/or management among youth and adults.^{10,11} Some studies suggest that engaging in certain types or levels of PA may protect against DWCB. Valois and colleagues¹² found that among high school youth, not meeting recommendations for several types of PA, such as strengthening/toning exercises, vigorous PA, and moderate PA, were associated with low emotional self-efficacy (defined as perceived inability to cope with negative emotions or negative affect), which may be associated with maladaptive behaviors such as DWCB to escape from unwanted negative states.¹³ Additionally, girls participating in organized sports report fewer self-objectification and body image concerns,¹⁴ which are associated with DWCB. However, extreme PA practices or engaging in certain types of PA can increase risk for DWCB. Participating in sports and activities

that have a strong focus on appearance are associated with increased risk for body image concerns and eating disorder symptoms for both male and female adolescents.¹⁴ Among overweight adolescent girls, more hours of moderate-to-vigorous physical activity (MVPA) predict increased prevalence and incidence of disordered eating.¹⁵

Factors that may influence the associations between dietary and PA behaviors and DWCB include race/ethnicity and weight status. Dietary and PA behaviors to lose or maintain weight and/or achieve a certain body shape may vary according to cultural and racial/ethnic differences in perceptions of ideal body size and shape.^{16,17} Some studies suggest that White and Latina female youth are at greater risk for DWCB than African American female youth, potentially through varying cultural standards of body image and ideals with greater social pressure from family, peers and/or media among the former to adhere to a thinner body type.^{16,18,19} Less is known about racial/ethnic differences in body ideals among males. The co-occurrence of overweight and DWCB has been documented in several studies,^{9,15,20,21} with overweight adolescents, particularly girls, having increased risk for DWCB compared to their healthy weight peers.^{9,15,22} Youth who are overweight and obese are more likely to experience low self-esteem, negative body image, and body dissatisfaction, which are associated with DWCB,^{23,24} and may feel increased family, peer, and societal pressure than healthy weight peers to engage in multiple methods, both healthy and unhealthy, to lose weight.¹³

Few studies have examined differences in the associations between weight-related behaviors and DWCB by race/ethnicity or weight status. This study aims to extend the literature by exploring 3 domains of self-reported weight-related behaviors (strengthening/toning exercises, MVPA, and dietary weight management behaviors) and their associations with DWCB and examining for differences by

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race/ethnicity and weight status among a diverse sample of middle school youth. We hypothesized that frequency of strengthening/toning exercises and number of dietary weight management behaviors are positively associated with DWCB and that frequency of MVPA is protective against DWCB for boys and girls. The identification of dietary and PA behaviors related to DWCB and how these associations differ, if at all, between various subgroups, can guide the development of interventions that prevent DWCB and promote healthy eating and PA practices among youth.

METHODS

Participants

The Massachusetts Healthy Choices (HC) Study is a 3-year, school-based obesity prevention intervention initiated by the Massachusetts Department of Public Health and Massachusetts Blue Cross Blue Shield.²⁵ In 2004, all Massachusetts middle schools were notified about the HC study, with 108 schools consenting to participate. Of the 51 schools that entered the study in 2005, 47 collected baseline, cross-sectional self-report survey data from 20,691 students (9.2% of the Massachusetts public middle school student population). The racial/ethnic composition of students in these schools (Table 1) was comparable to that of students attending Massachusetts public schools in 2005 (72.4% white, 4.6% Asian, 12.9% Hispanic, 8.3% African American, 0.3% Native American, 0.1% Native Hawaiian/Pacific Islander, 1.4% multiracial).²⁶ The percentage of students in the sample eligible for free or reduced-priced school lunch (27.6%) was similar to the 2005 state average of 28.2%.²⁷

Instruments and Measures

Items on DWCB and the primary predictors of interest were modified from the Youth Risk Behavior Surveillance (YRBS) questionnaire and validated among middle school students.²⁸

Outcome variable. The primary outcome for analysis was DWCB, which was measured as a checklist of behaviors in the past 30 days to lose or maintain weight: (1) vomiting ($\kappa = 64.3$); (2) taking diet pills without a prescription ($\kappa = 62.0$); and (3) taking laxatives ($\kappa = 64.3$).²⁸ Youth were classified as having DWCB if they responded yes to at least 1 of the 3 behaviors.²⁵

Predictor variables. The primary predictors for this analysis are 3 domains of weight-related behaviors (dietary weight management behaviors, strengthening/toning exercises, and MVPA). Items on dietary weight management behaviors had a kappa statistic of 66.1, and PA items averaged a kappa of 72.4.²⁸ Four dietary weight management behaviors, including reducing caloric, fat and snack intake, and increasing fruit and vegetable intake over the past 30 days,

Table 1. Sample Characteristics of Middle School Students Participating in Healthy Choices and Differences by Gender (N = 15, 260)

| | Girls (N = 7511) N(%) | Boys (N = 7749) N(%) | p-value* |
|--|-----------------------------|----------------------------|-----------|
| Race/ethnicity | | | p = .2739 |
| White | 6190 (82.4) | 6350 (81.9) | |
| Asian | 316 (4.2) | 328 (4.2) | |
| Hispanic | 518 (6.9) | 530 (6.8) | |
| Black | 315 (4.2) | 337 (4.4) | |
| Native American | 73 (1.0) | 103 (1.3) | |
| Hawaiian/Pacific Islander | 32 (0.4) | 34 (0.4) | |
| Multiracial | 67 (0.9) | 67 (0.9) | |
| Grade | | | p = .0401 |
| Sixth | 2130 (28.4) | 2310 (29.8) | |
| Seventh | 2700 (35.9) | 2785 (35.9) | |
| Eighth | 2681 (35.7) | 2654 (34.2) | |
| Menarche (girls only) | | | |
| Yes | 4019 (53.5) | — | |
| Weight status | | | p < .01 |
| Underweight | 677 (9.0) | 615 (7.9) | |
| Healthy weight | 3860 (51.4) | 3858 (49.8) | |
| Overweight | 603 (8.0) | 930 (12.0) | |
| Obese | 314 (4.2) | 580 (7.5) | |
| Missing | 2057 (27.4) | 1766 (22.8) | |
| Strengthening and toning | | | p < .01 |
| Low (0-3 days/week) | 5471 (72.1) | 4418 (57.0) | |
| Moderate (4-6 days/week) | 1527 (20.3) | 2133 (27.5) | |
| High (7 days/week) | 567 (7.6) | 1198 (15.5) | |
| Disordered weight control behaviors | | | p = .1005 |
| Yes | 269 (3.6) | 237 (3.1) | |
| Mean (SD) | Mean (SD) | Mean (SD) | |
| # of dietary weight management behaviors in past 30 days | 1.7 (1.3) | 1.4 (1.4) | p < .01 |
| # of days engaged in MVPA per week | 3.3 (2.1) | 4.0 (2.2) | p < .01 |

SD, standard deviation; MVPA, moderate-to-vigorous physical activity.

*p-values are from bivariate regression models using generalized estimating equations to account for the clustering of individuals within schools.

were coded as yes/no responses and analyzed as an ordinal variable ranging from 0 to 4 behaviors. Youth were asked how many days per week they engaged in strengthening/toning exercises, which was analyzed as a categorical variable (“low” [0-3 days per week], “moderate” [4-6 days per week], and “high” [7 days per week]). Youth were also asked how many days per week (range of 0-7) they engaged in MVPA, measured continuously and defined as “exercising for at least 60 minutes per day that increased heart rate and made you breathe hard some of the time.”

Sociodemographic variables. Self-reported data were collected assessing gender (male/female), height (feet and inches), weight (pounds), race/ethnicity, grade (sixth, seventh, or eighth), and menarche status for girls (yes/no). For race/ethnicity, youth were asked to check all that apply for the following categories: White, Hispanic/Latino, American

Indian/Alaska Native, Asian, Black/African American and Native Hawaiian/Pacific Islander. Youth have been found to report height and weight data of moderate validity.²⁹ Weight status categories were based on the Centers for Disease Control and Prevention (CDC) 2000 age- and sex-specific body mass index (BMI)- based growth trajectories (www.cdc.gov/growthcharts) with those at or below the 15th percentile defined as underweight; between the 16th and 84th percentile inclusive as healthy weight; between 85th and 94th percentile inclusive as overweight; and at or above the 95th percentile as obese.

Statistical Analysis

Out of the 20,691 surveys collected at baseline, those in fifth grade (N = 324), boys who reported having menses (N = 237), girls who reported an age at first period that was older than they currently were (N = 30), and boys who reported age at menses (N = 46) were excluded. Surveys missing data on 1 or more of the following variables: gender, grade, strengthening/toning exercises, MVPA, and dietary weight management behaviors (N = 4794) were also excluded. No respondents were missing information on the primary outcome (DWCB) after these exclusions. Our final analytic sample consisted of 15,260 sixth to eighth graders, representing (6.8% of the Massachusetts public middle school student population in 2005).

A large percentage of respondents were missing self-reported anthropometric data, with 27.4% (N = 2057) of girls and 22.8% of boys (N = 1766) who did not report height and/or weight data or had implausible BMI values based on CDC growth charts. Because restriction of the analyses to those with non-missing data would likely produce biased results, multiple imputation was used to estimate missing BMI values. The Markov Chain Monte Carlo (MCMC) method³⁰ was used to impute 5 measured variables related to BMI missingness (age, self-reported height, self-reported weight, self-perceived weight status, race/ethnicity, and menarche status for girls). These variables were used as predictors to impute BMI using the regression method with gender-stratified models, yielding 5 multiple imputed data sets. The CDC code for BMI percentiles was used to calculate the appropriate BMI percentiles. The MIANALYZE procedure in SAS version 9.2 (SAS Institute, Cary, NC) was used to combine the results and create a single coefficient, confidence interval, and p-value for each parameter in the final model. Such weighted methods do not currently exist for simple descriptive statistics; thus Table 1 includes a missing category for weight status.

Descriptive statistics were conducted to assess gender differences across the primary predictors, outcome and covariates. Probability values were

Table 2. Results From Multivariable GEE Models* Estimating Odds of Disordered Weight-Control Behaviors Associated With Dietary and Physical Activity Behaviors in Middle School Students Participating in Healthy Choices (N = 15, 260)

| | Girls (N = 7511) OR (95% CI) | Boys (N = 7749) OR (95% CI) |
|---|------------------------------------|-----------------------------------|
| Race/ethnicity | | |
| White (referent) | 1.00 | 1.00 |
| Asian | 1.2 (0.6, 2.3) | 1.7 (0.9, 3.0) |
| Hispanic | 1.9 (1.3, 2.9) | 2.2 (1.5, 3.4) |
| Black | 2.3 (1.4, 3.7) | 3.5 (2.3, 5.3) |
| Native American | 11.3 (6.4, 20.0) | 2.9 (1.3, 6.4) |
| Hawaiian/Pacific Islander | 9.5 (4.0, 22.4) | 7.8 (3.1, 19.6) |
| Multiracial | 2.2 (0.9, 5.6) | 4.5 (2.0, 10.3) |
| Grade | | |
| Sixth (referent) | 1.00 | 1.00 |
| Seventh | 1.2 (0.8, 1.7) | 0.7 (0.5, 1.0) |
| Eighth | 1.7 (1.2, 2.5) | 1.2 (0.8, 1.6) |
| Menarche (girls only) | | |
| Weight Status | | |
| Underweight | 2.0 (1.2, 3.3) | 1.2 (0.5, 3.2) |
| Healthy weight (referent) | 1.00 | 1.00 |
| Overweight | 1.1 (0.7, 1.6) | 1.2 (0.9, 1.6) |
| Obese | 2.1 (1.4, 2.9) | 1.4 (0.8, 2.5) |
| Strengthening and toning | | |
| Low (referent, 0-3 days/week) | 1.00 | 1.00 |
| Moderate (4-6 days/week) | 1.5 (1.1, 2.1) | 1.1 (0.8, 1.6) |
| High (7 days/week) | 1.9 (1.3, 3.0) | 1.5 (1.0, 2.2) |
| # of Days engaged in MVPA per week | 1.0 (0.9, 1.0) | 1.0 (0.9, 1.0) |
| # Dietary weight management behaviors in past 30 days | 1.2 (1.1, 1.3) | 1.3 (1.2, 1.4) |

OR, odds ratio; CI, confidence interval; MVPA, moderate-to-vigorous physical activity. *p-values are from multivariate regression models using generalized estimating equations (GEE) to account for the clustering of individuals within schools.

generated from bivariate regression models using generalized estimating equations (GEE) to account for the clustering of individuals within schools. Gender-stratified crude and adjusted GEE models were used to estimate odds of DWCB associated with the 3 domains of weight-related behaviors. Each of the primary predictors of interest was added separately to examine for covariation between the primary predictors. Interaction terms (each of the 3 domains of weight-related behaviors with race/ethnicity and with weight status) were added separately to examine for differences in the primary associations of interest. The final model (Table 2) controlled for race/ethnicity, grade, weight status, and menarche (girls only), as the interaction terms were not significant. SAS version 9.2 (SAS Institute) was used for all analyses.

RESULTS

Table 1 presents the characteristics from the analytic sample and the p-values for gender differences in the characteristics. There were no differences in prevalence of reported DWCB by gender (3.6% of girls and 3.1% of boys) (p = .1005). Girls reported

fewer days engaging in MVPA during the past week (mean = 3.3 days, SD = 2.1) compared with boys (mean = 4.0 days, SD = 2.2) ($p < .01$) and reported an increased number of dietary weight management behaviors (mean = 1.7, SD = 1.3) than boys (mean = 1.4, SD = 1.4) ($p < .01$). In addition, 15.5% of boys reported engaging in high frequency of strengthening/toning exercises in the past week vs. 7.6% of girls ($p < .01$).

In the final model (Table 2), engaging in high and moderate strengthening/toning exercises and increased number of dietary management behaviors were found to be risk factors for DWCB after adjusting for potential confounders. Youth who engaged in strengthening/toning exercises 7 days per week versus 0-3 days per week had greater odds of DWCB (girls OR = 1.9; 95% CI = 1.3-3.0; boys OR = 1.5; 95% CI = 1.0-2.2). Girls who engaged in moderate strengthening/toning behaviors (4-6 days per week) were also at increased risk for DWCB compared to those with low strengthening/toning (OR = 1.5; 95% CI = 1.1-2.1). Dietary weight management behaviors were associated with increased odds of DWCB (girls OR = 1.2; 95% CI = 1.1-1.3; boys OR = 1.3; 95% CI = 1.2-1.4) for each additional behavior. *F* tests of the overall interaction effects did not yield significant results ($p > .05$) and thus were not included in the final model. Sensitivity analyses in the study subpopulation with non-missing data for height and weight ($N = 11,930$) examining descriptive statistics on the primary predictors and DWCB and results from the final model yielded no substantively different results than the findings reported in Tables 1 and 2.

DISCUSSION

Increased number of dietary weight management behaviors and engaging in high or moderate frequency of strengthening/toning exercises were associated with increased odds of DWCB for boys and girls in this study. MVPA was not found to be associated with DWCB for either gender. These associations persisted after adjusting for race/ethnicity, grade, weight status, and menarche (girls only) for both genders. This finding indicate that greater participation in common and recommended methods of weight management or health promotion (eg, increasing fruit and vegetable consumption, decreasing caloric, fat and snack intake, and engaging in more frequent strengthening/toning exercises) was associated with increased risk of unhealthy behaviors such as vomiting, taking diet pills and/or taking laxatives.

Similar results have been found in previous research,^{9,15} with healthy weight management behaviors such as exercising, eating more fruits and vegetables, eating less high-fat foods, or eating less sweets, being associated with increased risk for binge eating

among girls and increased risk for taking laxatives, diet pills, vomiting, or taking diuretics among boys. In this study, MVPA was not found to be associated with DWCB for girls or boys, although a 5-year longitudinal study found that MVPA predicted higher risk for disordered eating among overweight adolescent girls.¹⁵

Girls in this study who were underweight or obese had twice the odds for DWCB than their peers in the healthy weight range. This finding is consistent with existing literature indicating a high prevalence of overweight adolescents, particularly girls, who report disordered eating behaviors,¹⁵ Dieting, unhealthy weight control behaviors, defined as skipping meals, eating very little, smoking, fasting and using food substitutes, and increased hours engaged in MVPA predicted onset of disordered eating among overweight adolescent girls at 5-year follow-up.¹⁵ Weight status was not significantly associated with DWCB among boys in the current study.

In contrast to other studies that have examined older adolescents,^{18,31,32} the prevalence of DWCB (girls [3.6%]; boys [3.1%]) did not differ significantly by gender in this sample of middle school youth. These percentages are concerning as early adolescence is a sensitive period for healthy physiological development as well as the establishment of weight-related behaviors. Additionally, risk for DWCB appeared to increase with grade in this study, even after adjusting for the primary predictors and other covariates. The increasing prevalence of DWCB with age, apparent even in early adolescence, indicates a need for interventions aimed at prevention and early identification of DWCB for both boys and girls prior to early adolescence.

Results from multivariable gender-stratified models indicated that DWCB varied by race/ethnicity, with some racial/ethnic minority youth having higher risk for DWCB than White youth, as previously shown.²⁵ However, the associations between DWCB and dietary weight management behaviors, MVPA and strengthening/toning exercises did not vary by race/ethnicity or weight status, indicating that the magnitude of increased risk for DWCB associated with higher frequency of strengthening/toning exercises and number of dietary weight management behaviors is consistent across racial/ethnic and weight status groups. These results remained significant after adjusting for grade, weight status and menarche (girls only), suggesting that other unmeasured factors, such as emotional self-efficacy, self-esteem, family connectedness, peer and other environmental influences,³³⁻³⁶ may be driving these disparities.

Health professionals and developers of prevention programs that emphasize healthy dietary and PA behaviors for an early adolescent population should consider that certain commonly accepted and/or

recommended healthy lifestyle behaviors, such as strengthening/toning exercises and dietary weight management behaviors, may co-occur with unhealthy weight management behaviors such as DWCB. Furthermore, these associations are not limited to one single racial/ethnic or weight status category but found across racial/ethnic and weight status groups. This finding underscores the importance of understanding how and why such disparities exist, since they do not seem to be explained by dietary weight management and PA behaviors. Thus, results from the current study should be further explored using qualitative and quantitative methods to understand the mechanisms underlying these racial/ethnic disparities and to guide the development of programs that address these disparities.

Findings from the current study in conjunction with existing literature provide justification for comprehensive programs that address weight-related behaviors, including those associated with obesity and DWCB, among youth from all racial/ethnic groups. Results from this study and others^{9,21} indicate that dietary and PA behaviors are related to both obesity and DWCB; thus, interventions designed to address these shared risk and protective factors of obesity and DWCB may effectively target multiple weight-related issues simultaneously. Randomized controlled trials indicate that Planet Health, a school-based obesity prevention program for middle school youth, prevented both obesity and DWCB among girls.^{37,38} Similarly, results from a randomized controlled trial of the high-school-based program “New Moves,” which aimed to prevent overweight and unhealthy weight control behaviors among adolescent girls, found improvements in sedentary activity, eating patterns, unhealthy weight control behaviors, and body and self-image among girls in the intervention schools.³⁹ The design, implementation, evaluation and dissemination of similar interventions are needed to promote healthy ways to lose or maintain weight while preventing or decreasing unhealthy weight control methods.

A major strength of this study is the large school-based sample of middle-school youth in Massachusetts. Imputing missing BMI values through multiple imputation, as we did in our study, is a methodologically strong approach⁴⁰ for analyzing the associations of interest, as multiple imputation allows for utilization of a larger sample size, thus increasing power, and allows for analysis of a more representative sample of the entire study population, thus producing less biased results. Furthermore, this is the first study to the authors’ knowledge that examined differences in the associations between weight-related behaviors and DWCB by race/ethnicity and weight status in a diverse sample of youth. However, the cross-sectional nature of the data does not allow for the establishment of temporality between the hypothesized predictors and

DWCB; therefore we cannot infer any causal associations. All data were collected via self-report and may not reflect the true behaviors and characteristics of interest in this study. Further research is needed to understand how and why racial/ethnic disparities in DWCB exist using qualitative and quantitative methodologies.

Conclusion

Findings from this study indicate that behaviors such as strengthening/toning and dietary weight management behaviors may also occur in conjunction with unhealthy behaviors such as DWCB and that these patterns are consistent across race/ethnicity, and weight status. To promote healthy weight control behaviors and prevent DWCB, programs should target a wider range of weight-related problems, including both obesity and DWCB, rather than focusing on only 1 issue. Furthermore, the understanding of behavioral risk and protective factors of DWCB can help inform the development of culturally appropriate intervention and prevention programs for youth.

IMPLICATIONS FOR SCHOOL HEALTH

Results from this study indicate that healthy weight management behaviors, such as dietary and PA practices, are correlated with DWCB among boys and girls and that these patterns are consistent across race/ethnicity and weight status. In developing or implementing school-based obesity prevention and/or healthy eating and PA practices among youth, program planners and teachers should consider methods that encourage youth to engage in healthy ways to lose or maintain weight while also discouraging unhealthy weight control methods. Furthermore, school nurses and teachers should recognize that DWCB are not limited to White female adolescents but are a growing concern for both boys and girls and for youth across racial/ethnic groups. Programs in school settings that target a wider range of weight-related problems may be valuable in producing multiple preventive effects among large populations of youth.

Human Subjects Approval Statement

The Harvard School of Public Health Human Subjects Research Board approved the study protocol with passive parental consent and passive adolescent assent procedures.

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