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Trends in Weight Management Goals and Behaviors Among 9th–12th Grade Students — United States, 1999–2009

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Abstract

Objective—To examine trends in weight management goals and behaviors among U.S. high school students during 1999–2009.

Methods—Data from 6 biennial cycles (1999–2009) of the national Youth Risk Behavior Survey were analyzed. Cross-sectional, nationally representative samples of 9th–12th grade students (approximately 14,000 students/cycle) completed self-administered questionnaires. Logistic regression models adjusted for grade, race/ethnicity, and obesity were used to test for trends in weight management goals and behaviors among subgroups of students.

Results—Combined prevalences and trends differed by sex and by race/ethnicity and weight status within sex. During 1999–2009, the prevalence of female students trying to gain weight decreased (7.6%–5.7%). Among female students trying to lose or stay the same weight, prevalences decreased for eating less (69.6%–63.2%); fasting (23.3%–17.6%); using diet pills/powders/liquids (13.7%–7.8%); and vomiting/laxatives (9.5%–6.6%) for weight control.

During 1999–2009, the prevalence of male students trying to lose weight increased (26.1%–30.5%). Among male students trying to lose or stay the same weight, the prevalence of exercising to control weight did not change during 1999–2003 and then increased (74.0%–79.1%) while the prevalence of taking diet pills/powders/liquids for weight control decreased (6.9%–5.1%) during 1999–2009.

Conclusion—Weight management goals and behaviors changed during 1999–2009 and differed by subgroup. To combat the use of unhealthy weight control behaviors, efforts may be needed

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to teach adolescents about recommended weight management strategies and avoiding the risks associated with unhealthy methods.

Keywords

Adolescent; Weight control; Trend; Gender differences; Ethnic groups

Introduction

The prevalence of obesity among adolescents has more than tripled since the 1970s [1] and in 2009–2010, nearly one-fifth (18.4%) of U.S. adolescents (12–19 years) were obese [2]. Obesity affects all racial/ethnic, sex, and socioeconomic subgroups [3]; however, racial/ethnic minorities and low income children and adolescents are more likely to be obese [2, 4]. Obesity in youth may have both short-term and long-term negative health effects, including high blood pressure, high cholesterol, type 2 diabetes, metabolic syndrome, sleep disturbances, orthopedic problems, and social and psychological problems [3, 5]. In addition, obese adolescents are more likely to become overweight or obese adults, resulting in increases in chronic diseases and premature death [3, 5]. In 2002–2005, obesity among youth (6–19 years) was associated with \$2.9 billion in increased annual direct medical expenditures [6, 7]. As a result, weight management among adolescents is an important public health concern. The reduction of obesity prevalence among children and adolescents is a high priority issue for the United States and is a Healthy People 2020 objective [8]. Population-level changes in weight management can help achieve this national goal.

Weight management involves at least two dimensions: a weight goal and behaviors employed to reach the goal [9]. The weight goal for overweight and obese adolescents (12–18 years) is to achieve a body mass index (BMI) less than the 85th percentile for age and sex [10]. The *Expert Committee Recommendations Regarding the Prevention, Assessment, and Treatment of Child and Adolescent Overweight and Obesity* recommend overweight adolescents (85th percentile BMI < 95th percentile) achieve a healthy weight by maintaining their current weight while stature increases; obese adolescents (BMI ≥ 95th percentile) can pursue weight loss that is not to exceed an average of 2 pounds per week [10]. For obese and overweight adolescents, all weight management strategies should be supervised by a health care provider [10]. Recommended behaviors for weight management for overweight and obese youth include increasing intake of fruits and vegetables, participating in 1 or more hours of physical activity each day, decreasing television viewing to less than 2 hours per day, and reducing sugar-sweetened beverage intake [11]. In addition, adolescents should eat breakfast daily, eat meals prepared at home, and eat the majority of meals with their family. Family members should be encouraged to engage in healthy lifestyle changes along with their child [11].

In 2005–2006, a national study found that more than 80% of obese adolescent females and 60–80% of obese adolescent males, varying by race/ethnicity, wanted to weigh less and had tried to lose weight in the past year [12]. For both sexes, the percentage of adolescents who wanted to lose weight and who had tried to lose weight increased with body mass index [12].

While adolescents engage in both healthy and unhealthy weight management behaviors, unhealthy methods can have both negative psychosocial and physical health effects and may be counter-productive to weight loss [13–15]. Unhealthy weight management methods include skipping meals; purging; fasting; excessive exercise; and use of diet pills, laxatives, and supplements [10]. Community-based studies have found that, in the adolescent population, obese adolescents are more likely than normal weight adolescents to use healthy and unhealthy weight control behaviors [16–18].

One longitudinal community-based cohort study of adolescents in Minnesota has provided evidence that unhealthy weight control behaviors may persist over time, indicating that behaviors utilized in adolescence may track into adulthood [19]. The study found that approximately 45% of female students and 17% of male students persistently used (at both at baseline and follow-up) unhealthy weight control behaviors from 1998–1999 (when in junior or senior high school) to 2003–2004 (when in high school or post-high school). Only 10% of female students and 15% of male students persistently used healthy weight control behaviors over this same time period. Another study out of Minnesota observed decreasing secular trends in unhealthy weight control behaviors among middle and high school students [20].

No study to date has examined trends in these unhealthy behaviors over time among cross-sectional samples of 9th–12th grade school students nationally. Our study examined the trends of weight management goals and behaviors among students in grades 9–12 in the United States during 1999–2009 by sex, race/ethnicity, and weight status. This trend data may be useful for public health and school professionals conducting needs assessments and planning and implementing programs related to obesity and weight management, and also to clinicians and families who may also be addressing these issues among adolescents. The data may be used to identify changing at-risk populations, aid in targeting intervention efforts, and help assess the progress the nation is making in addressing this public health issue.

Methods

Study design and participants

Data were obtained from six biennial cycles (1999, 2001, 2003, 2005, 2007, 2009) of the national Youth Risk Behavior Survey (YRBS), a cross-sectional, school-based survey that has monitored six categories of priority health risk behaviors, obesity, and asthma since 1991. The sampling frame included all regular public and private schools that enrolled students in at least one of grades 9–12 in the 50 states and the District of Columbia. A three-stage cluster sample design was used to select nationally representative samples of students (ranging in size from 13,601 in 2001 to 16,410 in 2009). Overall response rate ranged from a low of 63% in 2001 to 71% in 2009. Additional detail about the study design is described elsewhere [21, 22]. Participation by schools and students was voluntary. Before survey administration, parental permission was obtained following local procedures. Questionnaires were completed anonymously and study protocols were designed to protect student's privacy. Students completed the self-administered questionnaire during a regular class period and recorded their responses on a computer-scannable booklet or answer sheet.

Psychometric properties of the questionnaire items have been published elsewhere [23]. The YRBS study protocol was reviewed and approved by the Institutional Review Board of the Centers for Disease Control and Prevention.

Measures

Students' weight management goal was measured with the question "Which of the following are you trying to do about your weight?" The response options included "lose weight," "gain weight," "stay the same weight," and "I am not trying to do anything about my weight." Five weight control behaviors were assessed during 1999–2009. In separate questions, students were asked if during the past 30 days they had engaged in each of the following behaviors to lose weight or keep from gaining weight: 1) exercising; 2) eating less food, fewer calories, or foods low in fat; 3) going without eating for 24 hours or more (i.e., fasting); 4) taking diet pills, powders, or liquids without a doctor's advice; and 5) vomiting or taking laxatives. Response options for each question were "yes" and "no." Two of these behaviors are considered healthy when engaged in appropriately (exercising; eating less food, fewer calories, or foods low in fat) and three are considered unhealthy (fasting; taking diet pills, powders, or liquids without a doctor's advice; and vomiting or taking laxatives). Other variables used in the analysis include sex (female, male), race/ethnicity (non-Hispanic black or African-American, Hispanic, non-Hispanic white, and other or multiple race), grade in school (9th, 10th, 11th, or 12th), and weight status (obese, non-obese). Weight status was determined by BMI, calculated from self-reported height and weight. Students were asked "How tall are you without your shoes on?" and "How much do you weight without your shoes on?" Students were considered obese if their BMI was 95th percentile based on age- and sex-specific growth charts from the CDC [24]. All other students (overweight, normal weight, and underweight) were categorized as non-obese.

Statistical methods

The year 1999 was chosen as the first year for trend analysis as height and weight assessment was first conducted in 1999. The year 2009 was chosen as the end year as this was the last year that healthy weight control behaviors were included on the YRBS questionnaire. Trends in the prevalence of weight management goals were analyzed among all students, while weight management behavior trends were analyzed among those students trying to lose weight or stay the same weight. To analyze trends over time, time was modeled as a continuous variable with both linear and non-linear (quadratic) components. The time variables were created using orthogonal coefficients that reflected the biennial spacing of the surveys. Linear and quadratic time effects were assessed simultaneously in logistic regression models that tested for trends separately for male and female students in sex-combined models (using interaction terms) adjusted for race/ethnicity, grade, and weight status. Additional sex-stratified analyses were conducted to assess trends in weight management goals and behaviors among racial/ethnic and obesity subgroups. Each model was examined separately including all records with complete data on the variables included in that specific model.

Trends were reported by sex due to evidence of sex differences in weight management goals and behaviors among adolescents [12, 20, 25]. Trends for students from other or

multiple-race subgroups are not presented because the numbers for any given year were too small for meaningful analysis. Models were adjusted for weight status because weight management goals and behaviors may change over time resulting from changes in weight status. For example, the goal of trying to lose weight may increase if there is an increase in obesity prevalence (which national studies show has occurred in recent years [2, 21]).

Data were weighted to calculate national estimates [22], and all analyses were conducted using SUDAAN, a statistical software package accounting for the complex sampling design. Biennial prevalence estimates were unadjusted. Adjusted odds ratios (ORs) for the main effects of sex, race/ethnicity, and weight status on weight management goals and behaviors were calculated for 2009 and were considered statistically significant if the 95% confidence intervals (CI) did not include 1. The linear and quadratic time effects were considered statistically significant when the regression coefficient (β) had a p-value of <0.05 . A significant linear β in absence of a significant quadratic β indicated there was an overall linear increase or decrease in the variable during 1999–2009. A significant quadratic β in absence of a significant linear β indicated there was a non-linear change (i.e., an acceleration, leveling off, or change in direction) during 1999–2009. Significant linear and quadratic β s indicated a non-linear change in addition to an overall increase or decrease during 1999–2009 and are described by the quadratic trend. Non-significant linear and quadratic β s indicated no significant variation in the prevalence over time.

Results

Main effects, 2009

In 2009, female students had higher odds of trying to lose weight and lower odds of trying to gain weight, stay the same weight, or do nothing about their weight as compared to male students (Table 1). Among both sexes, black students had lower odds of trying to lose weight and higher odds of trying to gain weight as compared to white students. However, the association for black male students trying to lose weight did not reach statistical significance. Hispanic students of both sexes had lower odds of doing nothing about their weight. Among both female and male students, obese students had higher odds than non-obese students of trying to lose weight and lower odds of trying to gain weight, stay the same weight, or do nothing about their weight.

Among those trying to lose or stay the same weight, female students had higher odds as compared to male students of engaging in all weight control behaviors except exercising to control weight (Table 2). Among females, as compared to white students, black and Hispanic students had lower odds of both healthy behaviors. In addition, black students had lower odds of taking diet pills, powders, or liquids without a doctor's advice. Black male students had lower odds of healthy weight control behaviors as compared to white male students. Hispanic male students had higher odds exercising to control weight as compared to white male students. Among both sexes, obese students had higher odds of eating less, fewer calories, or foods low in fat. Exercising to control weight only differed by weight status among male students. Fasting to control weight and taking diet pills, powders, or liquids without a doctor's advice only differed by weight status among female students.

Trends over time, weight management goals

Significant trends in weight management goals were observed (Table 1). The prevalence of trying to gain weight decreased during 1999–2009 among all female students (7.6%–5.7%), non-obese female students (6.6%–5.5%), and white female students (5.2%–2.8%). The prevalence of trying to stay the same weight increased during 1999–2009 for both black and Hispanic female students. Among non-obese female students, this prevalence increased during 1999–2009 (19.0%–19.9%), and among obese female students, the prevalence decreased during 1999–2005 (5.9%–1.9%) and then did not change during 2005–2009 (1.9%–3.2%).

During 1999–2009, among male students, increases in the prevalence of trying to lose weight were found among all students (26.1%–30.5%), obese students (67.6%–73.2%), and non-obese students (19.1%–23.0%). Among black male students, the prevalence of trying to gain weight increased during 1999–2003 (34.7%–41.8%) and then decreased during 2003–2009 (41.8%–34.0%). The percent of male students doing nothing about their weight did not change during 1999–2007 (24.3%–20.8%), and then increased during 2007–2009 (20.8%–23.6%). The same pattern was observed for non-obese male students.

Trends over time, healthy weight management behaviors

Significant trends in healthy weight management behaviors occurred during 1999–2009 (Table 2). Eating less food, fewer calories, or foods low in fat to control weight decreased during 1999–2009 among all groups of female students. Among male students overall, the prevalence of exercising to control weight did not change during 1999–2003 and then increased during 2003–2009 (74.0%–79.1%). Among Hispanic male students, this behavior increased during 1999–2009 (75.8%–83.8%).

Trends over time, unhealthy weight control behaviors

Significant trends in unhealthy weight management behaviors occurred during 1999–2009 (Table 2). Fasting to control weight decreased during 1999–2009 among all groups of female students except for obese female students. Taking diet pills, powders, or liquids without a doctor's advice to control weight decreased during 1999–2009 among all groups of female students. However, among white female students and non-obese female students, the prevalence decreased only during 2003–2009 and 2001–2009, respectively. Vomiting and taking laxatives to control weight decreased during 1999–2009 among all groups of female students except obese students. During 1999–2009, using diet pills, powders, or liquids without a doctor's advice to control weight decreased among all groups of male students except black students.

Discussion

During 1999–2009, prevalences and trends in weight management goals and behaviors differed between female and male students and between race/ethnicity and obesity subgroups among the sexes. One positive finding regarding weight management goals is that obese students of both sexes consistently had goals in line with weight control: higher odds of trying to lose weight, lower odds of trying to gain weight, lower odds of trying to

stay the same weight, and lower odds of doing nothing about one's weight as compared to non-obese students of the same sex. This is positive because it is recommended that obese students pursue weight loss in order to achieve a healthy weight. Race/ethnic differences in weight management goals may result not only from potential differences in obesity status, but from cultural differences in body image and social norms surrounding preferred body size [26–28]. These social influences may also influence weight control behaviors [29]. In line with previous literature [17, 18], obese students also had higher odds of using both healthy and unhealthy weight control behaviors, though the associations were not consistently significant. We highlight important trend findings for these behaviors below.

We found that students in grades 9–12 use both healthy and unhealthy behaviors to control weight. Physical activity promotes a healthy body weight among all youth and can reduce adiposity in obese youth [30, 31]. In 2009, more than half of both female students (79.0%) and male students (79.1%) trying to lose or stay the same weight used exercise as a method to manage their weight. However, during 1999–2009, the prevalence of exercising to control weight only changed among overall and Hispanic male students. Given that a small proportion of high school students, on a whole, meet physical activity recommendations [32], more research is needed to identify barriers to increasing exercise, specifically among obese students, and develop appropriate interventions to address these barriers.

Reducing calories, reducing food intake, and choosing a low-fat diet are healthy dietary changes that help with weight management [33]. However, the prevalence of eating less food, fewer calories, or foods low in fat to control weight decreased among all groups of female students and did not change among male students during 1999–2009. Students of racial/ethnic minority groups were less likely to eat less food, fewer calories, or foods low in fat as compared to white students. Literature shows that culture influences food choices and that food choices differ by race/ethnicity [34–36]. These cultural influences may play a role in an adolescent's choice of using dietary methods for weight control. Previous research has also shown that the prevalence of weight control behaviors, including dietary methods, differs by race/ethnicity among adolescents [25]. It is important that these cultural differences be understood in order to develop culturally-relevant interventions and programs.

Unhealthy weight control behaviors, such as fasting; diet pills, powders, or liquids; and vomiting/taking laxatives to control their weight, should be avoided by all students due to their negative psychosocial and physical health effects [13–15]. In addition to the negative consequences of these unhealthy methods, they are counter-productive to weight control by increasing one's risk of being obese through a variety of mechanisms [14, 37]. Fortunate news is that the data presented here indicate that these behaviors are decreasing, especially among female students. The reasons for these trends are speculative. The changes could be influenced by efforts from health providers and school or community interventions on healthy ways for students of this age to manage their weight and changing social norms on weight management.

There are at least four limitations to this study. First, data are only collected among adolescents who attend school and, therefore, are not representative of all persons in this age group. Nationwide, in 2008, of persons aged 16–17 years, approximately 4% were not

enrolled in a high school program and had not completed high school [38]. Second, YRBS data are self-reported and students may under- or over-report these behaviors. However, YRBS dietary behavior questions, which includes the weight management behaviors, generally have moderate test-retest reliability [23]. Third, BMI based on self-reported height and weight data tends to underestimate the prevalence of obesity [39]. Lastly, this study was descriptive and was not designed to explain the reasons for the observed trends.

It is important to note a few other issues. First, the healthiness of weight management goals depends on individual factors such as age and obese status. Also, the weight control behaviors classified as healthy may not be healthy among all students. It may be unhealthy for students who are underweight to engage in these behaviors for the purpose of losing or maintaining weight. Also, if these behaviors are taken to extremes (e.g., skipping meals, reducing food intake severely, or exercising excessively), it is no longer a healthy behavior. Further, these weight control behaviors may not be used in isolation. Students combine the use of healthy and unhealthy weight control behaviors, which can also be unhealthy.

In conclusion, some improvements in weight management goals and behaviors were seen during 1999–2009. Differences in weight management goals and behaviors by sex, race/ethnicity, and weight status were observed. Healthy methods of weight control were more prevalent among both sexes than unhealthy methods. Obese students were more likely than non-obese students to engage in weight control behaviors. A significant reduction in all unhealthy weight control behaviors occurred during 1999–2009 among females. Though declines have occurred, still too many adolescents, especially females, are using unhealthy weight control behaviors. More research is needed to inform intervention strategies, including factors that influence adolescent weight control behaviors and the level of knowledge regarding the negative consequences of using unhealthy weight control behaviors. These strategies involve the development of messages that counter negative advice that students receive regarding weight management and unhealthy social norms and should be responsive to cultural factors related to weight management goals and behaviors. A variety of healthcare, community, school, and home-based strategies may be needed to ensure adolescents receive appropriate evidence-based information about weight management and understand the risks of unhealthy weight control behaviors. Unhealthy weight control behaviors may be indicators of current or future eating disorders [15]; therefore, both medical and psychiatric clinicians may inquire regarding adolescent weight control behaviors and use the opportunity to educate about their negative effects, encourage healthy behaviors such as healthy eating and regular physical activity, deemphasize body dissatisfaction, and address any weight stigmatization/discrimination [40, 41]. Clinicians and families can work together to develop a home environment supportive of healthy choices [40].

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References

1. Ogden C, & Carroll M Prevalence of obesity among children and adolescents: United States, trends 1963–1965 through 2007–2008. Retrieved November 7, 2011, from http://www.cdc.gov/nchs/data/hestat/obesity_child_07_08/obesity_child_07_08.htm.
2. Ogden CL, Carroll MG, Kit BK, & Flegal KM (2012) Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. *JAMA*, 307(5), E1–E8.
3. Institute of Medicine. (2005). *Preventing Childhood Obesity: Health in the Balance*. Washington, DC: The National Academies Press.
4. Ogden CL, Lamb MM, Carroll MD, & Flegal KM (2010). Obesity and socioeconomic status in children: United States 1988–1994 and 2005–2008. NCHS data brief no 51. Hyattsville, MD: National Center for Health Statistics.
5. Centers for Disease Control and Prevention. (2011). School health guidelines to promote healthy eating and physical activity. *Morbidity and Mortality Weekly Report*, 60(5), 1–76.
6. Trasande L, & Chatterjee S (2009). Corrigendum: The impact of obesity on health service utilization and costs in childhood. *Obesity*, 17(7), 1473.
7. Trasande L, & Chatterjee S (2009). The impact of obesity on health service utilization and costs in childhood. *Obesity*, 17(9), 1749–1754 [PubMed: 19300433]
8. U.S. Department of Health and Human Services. *Healthy People 2020*. Washington, DC: U.S. Department of Health and Human Services. Retrieved November 7, 2011, from <http://www.healthypeople.gov/2020/LHI/default.aspx>.
9. Roy M, & Gauvin L (2009). Casting weight goal as a function of weight status among a representative population-based sample of adolescents. *Body Image*, 6, 277–284. [PubMed: 19560411]
10. Spear BA, Barlow SE, Ervin C, Ludwig DS, Saelens BE, Schetzina KE, et al. (2007). Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics*, 120(Suppl 4), S254–S288.
11. Barlow SE, & the Expert Committee. (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*, 120(Suppl 4), S164–S192. [PubMed: 18055651]
12. Yan AF, Zhang G, Wang MQ, Stoesen CA, & Harris BM (2009). Weight perception and weight control practice in a multiethnic sample of US adolescents. *South Med J*, 102(4), 354–360. [PubMed: 19279513]
13. Neumark-Sztainer D, Wall M, Story M, & Perry CL (2003). Correlates of unhealthy weight-control behaviors among adolescents: implications for prevention programs. *Health Psychol*, 22(1), 88–98. [PubMed: 12558206]
14. Neumark-Sztainer D, Wall M, Larson NI, Eisenberg ME, & Loth K (2011). Dieting and disordered eating behaviors from adolescence to young adulthood: findings from a 10-year longitudinal study. *J Am Diet Assoc*, 111, 1004–1011. [PubMed: 21703378]
15. Daee A, Robinson P, Lawson M, Turpin JA, Gregory B, & Tobias JD (2002). Psychologic and physiologic effects of dieting in adolescents. *South Med J*, 95(9), 1032–1041. [PubMed: 12356104]
16. Vander Wal JS (2012). Unhealthy weight control behaviors among adolescents. *Journal of Health Psychology*, 17(1), 110–120. [PubMed: 21652614]
17. Boutelle K, Neumark-Sztainer D, Story M, & Resnick M (2002). Weight control behaviors among obese, overweight, and nonoverweight adolescents. *J Pediatr Psychol*, 27(6), 531–540. [PubMed: 12177253]
18. Neumark-Sztainer D, Story M, Hannan PJ, Perry CL, & Irving LM (2002). Weight-related concerns and behaviors among overweight and nonoverweight adolescents. *Arch Pediatr Adolesc Med*, 156, 171–178. [PubMed: 11814380]
19. Larsen NI, Neumark-Sztainer D, & Story M (2009). Weight control behaviors and dietary intake among adolescents and young adults: longitudinal findings from Project EAT. *J Am Diet Assoc*, 109, 1869–1877. [PubMed: 19857628]

20. Neumark-Sztainer D, Wall MW, Larson N, Story M, Fulkerson J, Eisenberg ME, et al. Secular trends in weight status and weight-related attitudes and behaviors in adolescents from 1999 to 2010. *Prev Med* 2012; 54: 77–81. [PubMed: 22024221]
21. Centers for Disease Control and Prevention. (2010). Youth risk behavior surveillance — United States, 2009. *Morbidity and Mortality Weekly Report Surveillance Summaries*, 59(No. SS–5).
22. Centers for Disease Control and Prevention. (2004). Methodology of the Youth Risk Behavior Surveillance System. *Morbidity and Mortality Weekly Report*, 53(RR–12), 1–13. [PubMed: 14724557]
23. Brener ND, Kann L, McManus T, Kinchen SA, Sundberg EC, & Ross JG (2002). Reliability of the 1999 Youth Risk Behavior Survey questionnaire. *J Adolesc Health*, 31(4), 336–342. [PubMed: 12359379]
24. Kuczumski RJ, Ogden CL, Grummer-Strawn LM, Flegal KM, Guo SS, Wei R, et al. (2000). CDC Growth Charts: United States. Advance data from vital and health statistics; no. 314. Hyattsville, MD: National Center for Health Statistics.
25. Neumark-Sztainer D, Croll J, Story M, Hannan PJ, French SA, & Perry C (2002). Ethnic/racial differences in weight-related concerns and behaviors among adolescent girls and boys. Findings from Project EAT. *J Psychosom Res*, 53, 963–974. [PubMed: 12445586]
26. Rafiriou AC, Sargent RG, Parra-Medina D, Valois R, Drane JW (2007). Trends and subgroup differences in overweight perception and weight-control behaviors among high school adolescents. *Am J Health Stud*, 22, 199–210.
27. Haff DR Racial/ethnic differences in weight perceptions and weight control behaviors among adolescent females. (2009). *Youth Soc*, 41, 278–301.
28. Gluck ME & Geliebter A (2002). Racial/ethnic differences in body image and eating behaviors. *Eat Behav*, 3, 143–151. [PubMed: 15001011]
29. Eisenberg ME, Neumark-Sztainer D, Story M, & Perry C The role of social norms and friends; influences on unhealthy weight-control behaviors among adolescent girls. (2005). *Soc Sci Med*, 60, 1165–1173. [PubMed: 15626514]
30. Physical Activity Guidelines Advisory Committee. (2008). *Physical Activity Guidelines Advisory Committee Report*. Washington, DC: U.S. Department of Health and Human Services.
31. U.S. Department of Health and Human Services. (2008). *2008 Physical Activity Guidelines for Americans*. Washington, DC: U.S. Department of Health and Human Services.
32. Centers for Disease Control and Prevention. (2011). Physical activity levels of high school students --- United States, 2010. *Morbidity and Mortality Weekly Report*, 60(23), 773–777. [PubMed: 21681173]
33. Dubnov-Raz G, & Berry EM (2010). Dietary approaches to obesity. *Mt Sinai J Med*, 77, 488–498. [PubMed: 20960551]
34. Caprio S, Daniels SR, Drewnowski A, Kaufamn FR, Palinkas LA, Rosenbloom AL, et al. (2008). Influence of race, ethnicity, and culture on childhood obesity: implications for prevention and treatment. *Diabetes Care*, 31, 2211–2221. [PubMed: 18955718]
35. Kirkpatrick SI, Dodd KW, Reedy J, & Krebs-Smith SM (2012). Income and race/ethnicity are associated with adherence to food-based dietary guidance among US adults and children. *Journal of the Academy of Nutrition and Dietetics*, 112, 624–635. [PubMed: 22709767]
36. Cutler GJ, Flood A, Hannan P, & Neumark-Sztainer D (2011). Multiple sociodemographic and socioenvironmental characteristics are correlated with major patterns of dietary intake in adolescents. *J Am Diet Assoc*, 111, 230–240. [PubMed: 21272697]
37. Neumark-Sztainer D, Wall M, Guo J, Story M, Haines J, & Eisenberg M (2006). Obesity, disordered eating, and eating disorders in a longitudinal study of adolescents: how do dieters fare 5 years later? *J Am Diet Assoc*, 106, 559–568. [PubMed: 16567152]
38. Chapman C, Laird J, & KewalRamani A (2010). *Trends in High School Dropout and Completion Rates in the United States: 1972–2008*. Washington, DC: U.S. Department of Education, National Center for Education Statistics.
39. Brener ND, McManus T, Galuska DA, Lowry R, & Wechsler H (2003). Reliability and validity of self-reported height and weight among high school students. *J Adolesc Health*, 32, 281–7. [PubMed: 12667732]

40. Neumark-Sztainer D (2011). Prevention of eating disorders in children and adolescents. In: Le Grange D, Lock J (Eds), *Eating Disorders in Children and Adolescents: A Clinical Handbook*. New York, NY: The Guilford Press.
41. American Psychological Association. Promoting healthy behaviors to prevent obesity and unhealthy weight control in our youth. Retrieved June 24, 2013 from, <http://www.apa.org/pi/families/resources/prevent-obesity.aspx>.

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Table 1
Trends in weight management goals^a among 9th – 12th grade students—United States, 1999–2009

Subgroup	2009 Main effect		Prevalence by year (%)							Trend β^b	
	OR (95% CI)		1999	2001	2003	2005	2007	2009	Linear	Quadratic	
			Lose weight								
All females	4.51 (4.00, 5.07)		59.4	62.3	59.3	61.7	60.3	59.3	-0.009	-0.001	
All males	referent		26.1	28.8	29.1	29.9	30.4	30.5	0.018 ^c	-0.002	
Black females	0.50 (0.40, 0.62)		48.3	49.4	46.7	52.7	49.5	47.3	-0.004	-0.001	
Hispanic females	1.03 (0.90, 1.18)		63.6	63.4	61.7	64.1	62.1	62.4	-0.014	0.003	
White females	referent		61.4	65.4	62.6	63.5	62.3	61.3	-0.009	-0.003	
Black males	0.79 (0.62, 1.00)		23.6	23.6	22.7	24.4	24.9	26.3	0.013	0.006	
Hispanic males	1.78 (1.53, 2.08)		37.3	39.1	37.4	38.6	38.5	41.8	0.015	0.007	
White males	referent		24.9	27.9	27.9	28.8	29.0	28.4	0.016	-0.004	
Obese females	5.84 (3.99, 8.54)		85.3	88.7	86.8	91.8	89.5	88.0	0.025	-0.012	
Non-obese females	referent		59.3	60.5	58.6	58.7	58.0	57.6	-0.009	-0.000	
Obese males	9.17 (7.36, 11.43)		67.6	67.7	67.8	74.4	74.7	73.2	0.037 ^d	-0.001	
Non-obese males	referent		19.1	22.6	22.0	21.5	22.3	23.0	0.013 ^d	-0.002	
			Gain weight								
All females	0.13 (0.11, 0.16)		7.6	5.9	10.3	6.3	6.0	5.7	-0.025 ^d	-0.011	
All males	referent		29.5	26.3	30.1	27.1	26.9	26.2	-0.013	-0.001	
Black females	6.32 (4.64, 8.62)		18.6	15.2	17.7	13.0	14.7	14.1	-0.028	0.001	
Hispanic females	2.37 (1.77, 3.17)		9.7	8.3	9.7	7.8	7.7	7.1	-0.029	-0.007	
White females	referent		5.2	3.4	8.3	4.1	3.3	2.8	-0.041 ^d	-0.022	
Black males	1.67 (1.31, 2.12)		34.7	35.0	41.8	38.7	38.5	34.0	0.002	-0.011 ^c	
Hispanic males	0.91 (0.72, 1.15)		25.9	22.4	26.6	22.3	22.9	22.2	-0.018	-0.003	
White males	referent		28.5	25.4	28.6	25.3	25.3	25.0	-0.016	0.001	
Obese females	0.13 (0.05, 0.33)		2.3	1.4	4.1	0.7	0.6	0.9	-0.152	-0.021	
Non-obese females	referent		6.6	5.8	9.0	6.7	5.8	5.5	-0.027 ^d	-0.011	
Obese males	0.13 (0.09, 0.18)		6.0	5.3	10.1	4.7	4.7	5.3	-0.035	-0.011	
Non-obese males	referent		33.4	29.9	32.7	31.2	31.1	29.8	-0.011	-0.000	

Subgroup	2009 Main effect		Prevalence by year (%)								Trend β^b		
	OR(95% CI)		1999	2001	2003	2005	2007	2009	Linear	Quadratic			
			Stay same weight										
All females	0.86 (0.77, 0.97)		18.0	16.0	17.2	17.7	18.4	18.5	0.012	0.002			
All males	referent		20.1	21.5	19.4	21.1	21.8	19.8	0.003	-0.003			
Black females	1.54 (1.27, 1.87)		19.9	20.0	22.2	21.2	19.8	23.7	0.020 ^d	-0.000			
Hispanic females	0.97 (0.80, 1.17)		14.2	13.6	18.3	15.9	18.1	16.8	0.039 ^c	-0.008			
White females	referent		18.8	15.6	15.5	17.4	18.3	18.3	0.008	0.005			
Black males	1.11 (0.87, 1.42)		24.8	22.2	21.2	22.9	20.1	21.3	-0.015	0.003			
Hispanic males	0.89 (0.75, 1.04)		18.9	20.8	17.5	22.9	23.2	17.9	0.007	-0.007			
White males	referent		20.1	21.2	20.0	20.6	21.9	20.5	0.008	-0.002			
Obese females	0.13 (0.07, 0.23)		5.9	2.7	2.3	1.9	2.9	3.2	-0.049	0.031 ^c			
Non-obese females	referent		19.0	16.9	18.7	19.3	20.6	19.9	0.014 ^d	0.001			
Obese males	0.40 (0.30, 0.54)		12.3	11.8	11.3	10.3	10.6	10.0	-0.025	0.001			
Non-obese males	referent		21.4	22.7	21.7	23.3	23.8	21.6	0.005	-0.003			
			Do nothing										
All females	0.61 (0.53, 0.70)		14.9	15.8	13.2	14.3	15.3	16.5	0.012	0.004			
All males	referent		24.3	23.5	21.5	22.0	20.8	23.6	-0.005	0.005 ^d			
Black females	0.86 (0.64, 1.15)		13.2	15.4	13.4	13.1	15.9	14.9	0.010	0.000			
Hispanic females	0.76 (0.61, 0.93)		12.6	14.6	10.3	12.1	12.1	13.8	-0.000	0.006			
White females	referent		14.6	15.6	13.5	15.0	16.1	17.6	0.016	0.005			
Black males	0.63 (0.50, 0.80)		16.9	19.2	14.4	14.0	16.6	18.5	0.002	0.007			
Hispanic males	0.63 (0.52, 0.76)		18.0	17.7	18.5	16.2	15.4	18.0	-0.007	0.003			
White males	referent		26.5	25.5	23.5	25.3	23.7	26.1	-0.005	0.005			
Obese females	0.44 (0.29, 0.66)		6.5	7.2	6.8	5.6	7.0	7.9	0.019	0.006			
Non-obese females	referent		15.1	16.8	13.7	15.3	15.5	17.0	0.011	0.004			
Obese males	0.40 (0.30, 0.54)		14.1	15.1	10.8	10.6	9.9	11.6	-0.027	0.007			
Non-obese males	referent		26.1	24.7	23.6	24.1	22.8	25.7	-0.003	0.005 ^d			

^aIn response to the question, "Which of the following are you trying to do about your weight?"

^b β indicates logistic regression coefficient. Sex-stratified models are adjusted for race/ethnicity, grade, and weight status (body mass index 95th percentile is considered obese). The initial sex comparison models include sex as a covariate.

$p < 0.05$
 $p < 0.10$
 $p < 0.05$

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Trends in weight management behaviors among 9th-12th grade students trying to lose or stay the same weight—United States, 1999–2009

Table 2

Subgroup	2009 Main effect OR(95% CI)	Prevalence by year (%)								Trend β^a	
		1999	2001	2003	2005	2007	2009	Linear	Quadratic		
		Exercised ^b									
All females	1.06 (0.92, 1.23)	80.1	81.4	78.3	79.0	78.4	79.0	79.0	-0.011	0.003	
All males	referent	76.0	75.8	74.0	76.1	76.7	79.1	0.017 ^c	0.006 ^c		
Black females	0.42 (0.32, 0.56)	76.4	70.1	63.9	70.2	66.4	67.1	-0.033	0.010		
Hispanic females	0.70 (0.56, 0.88)	78.9	78.8	75.1	79.4	77.4	77.1	-0.008	0.002		
White females	referent	81.1	83.8	81.5	80.9	81.6	82.7	0.000	0.002		
Black males	0.66 (0.51, 0.85)	66.7	67.2	67.8	71.4	74.2	72.3	0.024	0.003		
Hispanic males	1.30 (1.00, 1.68)	75.8	74.2	75.0	83.1	76.3	83.8	0.048 ^d	0.005		
White males	referent	77.9	78.1	74.9	75.4	76.8	79.2	0.002	0.007		
Obese females	1.09 (0.81, 1.47)	84.5	84.5	80.6	83.5	80.1	79.1	-0.032	-0.001		
Non-obese females	referent	80.1	81.2	78.7	78.5	78.4	79.6	-0.007	0.004		
Obese males	1.88 (1.42, 2.48)	87.3	83.7	81.3	86.3	86.8	85.9	0.015	0.010		
Non-obese males	referent	72.9	74.5	73.0	72.5	74.3	77.4	0.016	0.005		
		Ate less, fewer calories, or foods low in fat ^b									
All females	2.09 (1.88, 2.33)	69.6	71.7	67.9	66.2	65.0	63.2	-0.037 ^e	-0.001		
All males	referent	46.2	48.4	48.5	45.8	46.8	48.2	0.001	0.001		
Black females	0.37 (0.29, 0.47)	59.8	54.7	52.7	50.7	48.0	45.8	-0.053 ^e	0.003		
Hispanic females	0.63 (0.54, 0.73)	63.0	69.9	63.6	64.0	62.3	58.4	-0.035 ^c	-0.005		
White females	referent	73.2	75.2	72.3	69.8	69.9	68.3	-0.035 ^d	0.000		
Black males	0.61 (0.45, 0.82)	41.5	41.9	35.1	37.5	35.0	39.1	-0.013	0.008		
Hispanic males	0.87 (0.71, 1.07)	46.0	49.0	48.9	46.3	45.3	48.0	-0.007	0.001		
White males	referent	49.7	48.9	51.3	46.6	49.2	50.0	-0.003	0.001		
Obese females	2.07 (1.66, 2.59)	82.9	80.0	75.2	78.5	73.5	74.5	-0.049 ^c	0.004		
Non-obese females	referent	69.1	71.4	67.3	64.6	64.4	62.1	-0.035 ^e	-0.001		
Obese males	2.06 (1.73, 2.46)	62.7	63.6	65.6	58.8	66.7	61.1	-0.004	-0.001		

Subgroup	2009 Main effect										Prevalence by year (%)			Trend β^a		
	OR(95% CI)	1999	2001	2003	2005	2007	2009	Linear	Quadratic	Non-obese males	Obese males	Non-obese males				
Non-obese males	referent	40.8	44.4	43.2	40.8	40.9	43.9	0.002	0.001							
All females	1.99 (1.71, 2.32)	23.3	23.1	21.6	20.9	19.4	17.6	-0.036 ^e	-0.003							
All males	referent	11.2	12.2	11.8	11.8	10.9	10.4	-0.013	-0.003							
Black females	0.92 (0.72, 1.19)	23.6	20.0	19.1	17.7	17.1	16.7	-0.042 ^d	0.006							
Hispanic females	1.02 (0.84, 1.24)	21.5	28.0	20.7	21.1	19.7	17.9	-0.037 ^d	-0.002							
White females	referent	22.9	23.4	21.5	21.5	19.9	17.8	-0.035 ^e	-0.004							
Black males	1.27 (0.91, 1.77)	14.5	16.1	12.0	12.5	11.0	11.9	-0.039	0.005							
Hispanic males	1.31 (0.92, 1.87)	9.7	11.8	10.3	10.3	14.6	11.6	0.030	0.000							
White males	referent	10.4	11.1	10.9	12.4	8.9	9.6	-0.018	-0.007							
Obese females	1.64 (1.30, 2.06)	29.8	28.4	24.1	22.6	28.2	24.1	-0.019	0.007							
Non-obese females	referent	22.6	22.8	21.3	20.5	18.2	16.5	-0.038 ^e	-0.004							
Obese males	1.10 (0.80, 1.52)	13.6	14.9	12.2	14.6	14.8	10.5	-0.012	-0.007							
Non-obese males	referent	10.3	11.0	11.0	10.4	9.4	9.7	-0.013	-0.002							
Took diet pills, powders, or liquids without a doctor's advice^b																
All females	1.68 (1.29, 2.20)	13.7	15.6	13.0	9.6	8.7	7.8	-0.086 ^e	-0.005							
All males	referent	6.9	8.6	8.2	5.9	6.0	5.1	-0.051 ^e	-0.007							
Black females	0.48 (0.35, 0.68)	9.2	10.5	5.3	6.1	5.1	4.4	-0.094 ^e	0.005							
Hispanic females	1.00 (0.80, 1.25)	14.1	17.0	12.5	9.0	8.6	8.5	-0.090 ^e	0.001							
White females	referent	14.3	16.3	15.0	10.7	9.6	8.6	-0.081 ^e	-0.008 ^c							
Black males	0.87 (0.48, 1.59)	7.5	7.0	6.0	5.4	4.9	5.3	-0.064	0.006							
Hispanic males	0.96 (0.59, 1.57)	9.2	10.1	7.1	7.4	6.6	5.2	-0.062 ^c	-0.000							
White males	referent	7.0	8.1	8.8	5.5	5.3	5.4	-0.048 ^c	-0.006							
Obese females	1.85 (1.43, 2.40)	24.0	25.1	17.0	14.7	13.4	11.8	-0.098 ^e	0.001							
Non-obese females	referent	13.1	14.8	12.4	8.8	8.0	7.0	-0.084 ^e	-0.006 ^c							
Obese males	1.20 (0.86, 1.67)	11.2	12.9	10.9	8.4	9.8	5.7	-0.070 ^e	-0.009							
Non-obese males	referent	5.4	6.9	6.8	4.8	4.2	4.7	-0.040 ^c	-0.006							

Subgroup	2009 Main effect		Prevalence by year (%)							Trend β^a		
	OR(95% CI)		1999	2001	2003	2005	2007	2009	Linear	Quadratic		
			Vomited or took laxatives ^b									
All females	2.38 (1.80, 3.13)	9.5	9.4	9.0	7.5	7.5	6.6	6.6	-0.044 ^e	-0.003		
All males	referent	3.2	4.2	3.5	3.7	2.9	3.1	3.1	-0.025	-0.004		
Black females	0.69 (0.40, 1.19)	9.3	5.2	6.3	4.6	4.9	4.5	4.5	-0.050 ^c	0.004		
Hispanic females	1.31 (0.97, 1.78)	7.9	13.3	9.3	7.8	7.5	8.3	8.3	-0.035 ^c	-0.003		
White females	referent	8.6	9.8	9.4	8.1	8.2	6.3	6.3	-0.038 ^d	-0.008		
Black males	2.40 (1.38, 4.17)	4.8	5.1	5.2	3.5	3.1	5.4	5.4	-0.016	0.014		
Hispanic males	2.09 (1.18, 3.70)	5.1	4.9	4.2	4.7	4.5	4.4	4.4	-0.019	0.007		
White males	referent	2.6	3.4	3.1	3.0	2.1	2.2	2.2	-0.042	-0.008		
Obese females	1.10 (0.69, 1.75)	10.9	11.7	8.5	7.9	9.3	6.8	6.8	-0.047	-0.000		
Non-obese females	referent	9.2	9.1	8.8	7.4	7.1	6.4	6.4	-0.043 ^e	-0.003		
Obese males	1.17 (0.68, 2.02)	3.0	3.0	2.5	3.8	3.3	3.2	3.2	0.016	-0.000		
Non-obese males	referent	3.2	4.3	3.4	3.4	2.4	2.7	2.7	-0.041	-0.006		

^a β indicates logistic regression coefficient. Sex-stratified models are adjusted for race/ethnicity, grade, and weight status (body mass index 95th percentile is considered obese). The initial sex comparison models include sex as a covariate.

^b To lose weight or keep from gaining weight, during the 30 days before the survey.

^c $p < 0.05$.

^d $p < 0.01$.

^e $p < 0.001$.

^f Going without eating for 24 hours or more.