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 JOURNAL OF  
**ADOLESCENT  
 HEALTH**


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Original article

## Characteristics of a Favorable Weight Status Change From Adolescence to Young Adulthood


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Article history: Received June 16, 2015; Accepted September 3, 2015

Keywords: Adolescent obesity; Young adulthood; Weight loss

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 See Related Editorial p. 380
 

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## A B S T R A C T

**Purpose:** To explore 10-year longitudinal predictors (personal, psychological, behavioral, and socioenvironmental) of exiting obesity from adolescence to young adulthood.

**Methods:** Data were collected from a population-based cohort of adolescents ( $n = 2,287$ ) attending middle/high schools in Minneapolis–St. Paul in 1998–1999 (mean age = 14.9) and again in 2008–2009 (mean age = 25.3) participating in Project Eating and Activity Among Teens and Young Adults. Self-reported height and weight were used to calculate weight status change between adolescence and young adulthood, among participants with obesity at baseline ( $n = 175$ ). Questionnaires assessed personal, psychological, behavioral, and socioenvironmental factors hypothesized to play a role in obesity. Modified Poisson regressions estimated adjusted relative risks (RRs) for exiting obesity as a function of each baseline and 10-year change in predictor, controlling for relevant covariates.

**Results:** Thirty-two percent of adolescents exited obesity in young adulthood. Reductions in fast food intake ( $RR = .73$ , 95% confidence interval [CI] = .61–.87) and screen time ( $RR = .98$ , 95% CI = .96–.99), and increases in fruit/vegetable intake ( $RR = 1.06$ , 95% CI 1.01–1.12), moderate-to-vigorous physical activity ( $RR = 1.06$ , 95% CI = 1.00–1.12), home fruit/vegetable availability ( $RR = 1.58$ , 95% CI = 1.19–2.09), family meals ( $RR = 1.12$ , 95% CI = 1.03–1.22), and serving vegetables at dinner ( $RR = 1.45$ , 95% CI = 1.10–1.92) were associated with exiting obesity. Not dieting as an adolescent and improvements in body satisfaction, depressive symptoms, self-esteem, and weight teasing were also associated with exiting obesity.

**Conclusions:** Promoting healthy eating and activity, and improving the healthfulness of home food environments may be promising intervention targets for promoting healthier weights in adolescents and young adults with obesity. Addressing dieting behavior and the psychosocial health of adolescents with obesity may also be needed throughout the transition to young adulthood.

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**IMPLICATIONS AND  
 CONTRIBUTION**

This study identified several intervention targets for adolescents with obesity that may help promote healthier weight status in young adulthood. These include: reducing fast food intake, screen time, dieting, body dissatisfaction, depressive symptoms, low self-esteem, and weight teasing; and increasing fruit and vegetable intake, moderate-to-vigorous physical activity, home availability of fruits and vegetables, serving vegetables with dinner, and family meals.

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**Conflicts of Interest:** The authors have no conflicts of interest or financial disclosures to report.

**Disclaimer:** The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Heart, Lung, and Blood Institute or the National Institutes of Health.

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Parts of these results were presented at the Annual Meeting of the International Society for Behavioral Nutrition and Physical Activity in Edinburgh, Scotland.

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Current estimates suggest that 20% of US adolescents have obesity [1], a weight status that increases their risk of experiencing negative psychosocial and health consequences [2]. Unfortunately, intervention programs that target weight-related behaviors (e.g., diet, activity) have had limited success in reducing adolescent obesity with no strong evidence of long-term effectiveness [3]. Furthermore, weight control practices commonly used by adolescents (e.g., overly restricting food intake through dieting) are counterproductive and have been found to increase weight gain over time [4]. Some behavioral strategies that might be effective in promoting successful weight loss come from adult participants of the National Weight Control Registry and include fat restriction, dietary restraint, regular self-weighing, and high levels of physical activity [5]. In nonadult populations, past weight loss reported by adolescents has been positively associated with behavioral strategies such as increasing physical activity, drinking less soda, and watching less television [6]. Socioenvironmental factors, such as parent and peer support, modeling behaviors, and parents making positive changes to the home environment have also been identified as important for adolescent weight loss in weight management programs [7–9].

In addition to what we have learned from studies examining individuals who are trying to lose weight, there is an opportunity to examine those who exit obesity in population-based samples, which may be more useful for informing public health strategies to reduce adolescent obesity. In younger US school children, exit from obesity between fifth and 10th grade was associated with higher parent education but not other behavioral/psychological baseline factors such as fast food and soda consumption, exercise, TV watching, and body image [10]. In one study, African American and Latina adolescent girls were more likely to exit overweight or obesity than European American girls when examined at 1-year intervals [11]. Another study using National Health and Nutritional Examination Survey data identified greater physical activity, less sedentary time, and endorsement of efforts at trying to lose weight as correlates of past year weight loss among 16- to 18-year-old adolescents with overweight or obesity [12].

These previous studies did not examine weight loss that was maintained into young adulthood and did not examine many other psychological or socioenvironmental factors that might be important for successful weight loss in a population-based sample. For example, there may be more favorable social (e.g., peer and parent influences) and environmental (e.g., home food environment) contexts in adolescence that support the behaviors and psychological state that lead to weight change. Other factors such as gender, ethnicity, socioeconomic status (SES), dieting, and body dissatisfaction have been implicated in adolescent weight gain [13,14] and may also play a role in weight loss from adolescence to young adulthood.

To address these gaps, this study used data from Project EAT (Eating and Activity Among Teens and Young Adults), an ongoing population-based longitudinal study that includes the collection of weight-related behavior and outcome data from a group of adolescents as they transition to young adulthood. Project EAT provides a unique opportunity to examine a comprehensive set of factors that may influence weight outcomes over a 10-year period. Predictors of incident overweight or obesity have been examined in this dataset to inform obesity prevention efforts [14,15], but very little is known about how to successfully manage adolescents who already have obesity [16]. Therefore, the aim of this study was to examine the personal, psychological,

behavioral, and socioenvironmental contexts of adolescence with obesity and to identify factors associated with exiting obesity. Exiting obesity was examined because it represents a clinically meaningful change in weight-related health risk [17]. The selection of predictor variables examined in this study was informed by social cognitive theory and socioecological models of health behavior [18] and reflects variables that our team have found to be important for adolescent weight-related health through our work over the past decade on Project EAT [15,18]. It was hypothesized that, a range of factors including healthy eating, physical activity, home availability of healthy foods, and a positive body image would predict a favorable weight status change. The identification of key factors that are amenable to change or that can be used to identify individuals at increased risk of maintaining a high body weight will guide intervention strategies during the transition from adolescence to adulthood.

## Methods

### Study design and population

Baseline data were collected from 4,746 Project EAT participants: middle/high school students attending 31 public schools in the Minneapolis/St. Paul metropolitan area of Minnesota who completed in-class surveys in 1998–1999. Among those who could be contacted at 10-year follow-up (2008–2009), 2,287 young adults (66.4% response rate) completed online surveys investigating changes in previously assessed health behaviors. Previous studies have found little impact of mode (paper-and-pencil vs. online surveys) in adolescent reporting of health behavior [19]. At both time points, most surveys were completed during the late fall and winter months (October–March). Informed consent was obtained from all study participants, and protocols were approved by the University of Minnesota's Institutional Review Board.

### Measures

Survey measures were tested in pilot studies (focus groups and test-retest examined over a 2 week period) with adolescents at baseline and young adults at 10-year follow-up. Details are described elsewhere [18].

**Height and weight.** Self-reported height and weight were used to calculate body mass index (BMI) ( $\text{kg}/\text{m}^2$ ), and age- and sex-adjusted BMI percentile based on Centers for Disease Control and Prevention (CDC) growth charts for children and adolescents [20]. At baseline and follow-up, self-reports were highly correlated with measured height and weight in validation studies carried out in a subsample of adolescents ( $r = .88$  males;  $r = .85$  females) and young adults ( $r = .95$  males;  $r = .98$  females). At baseline, adolescents were classified as having obesity (BMI  $\geq$  95th percentile). At follow-up, young adults were classified based on CDC cut points for adults: nonoverweight = BMI  $<$  25  $\text{kg}/\text{m}^2$ ; overweight = BMI  $\geq$  25  $\text{kg}/\text{m}^2$  and  $<$  30  $\text{kg}/\text{m}^2$ ; and obesity = BMI  $\geq$  30  $\text{kg}/\text{m}^2$  [17].

**Psychological.** Body dissatisfaction was assessed using items from the body shape satisfaction scale [21]. Participants described level of dissatisfaction related to 10 different body parts. Responses ranged from “very satisfied” to “very dissatisfied” on a five-point scale for each body feature. All items were summed for an overall score, with higher scores indicating

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