ELSEVIER

Journal of Adolescent Health 43 (2008) 387–393

JOURNAL OF ADOLESCENT HEALTH

Original article

Adoption of Risk-Related Factors Through Early Adolescence: Associations with Weight Status and Implications for Causal Mechanisms

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Manuscript received November 13, 2007; manuscript accepted February 15, 2008

Abstract

Purpose: To examine cross-sectional and longitudinal associations between weight status and measures of risk and protective factors in youth.

Methods: Participants included 3010 students (72.1% white, 27.9% nonwhite), with a baseline mean age of 12.7 years from the Teens Eating for Energy and Nutrition at School (TEENS) study. Surveys were administered in grades 7 and 8. Cross-sectional and longitudinal mixed-effects regression analyses were conducted to determine the association between body mass index *z*-score percentiles (BMI) and risk and protective factors (including substance use, depression, fighting, optimism, and spirituality).

Results: Only depression was associated with BMI at the beginning of grade 7. However, by the end of grade 8, binge drinking, alcohol, tobacco, and other drug (ATOD) use, fighting, and depression were all cross-sectionally associated with BMI. Longitudinally, BMI in grade 7 did not predict risk and protective factors in grade 8. However, ATOD use, fighting, depression, and optimism in grade 7 predicted BMI in grade 8.

Conclusions: This study suggests there is a notable co-occurrence of unhealthy factors (including weight status, ATOD use, depression) which appears to develop during the critical transition period through early adolescence. Specifically, earlier ATOD use, depression, increased fighting, and decreased optimism may lead to unhealthy increases in weight status, whereas early indicators of increased weight status do not appear to predict increases in these factors. This work yields important insights into the causal mechanisms underlying adolescent behavior patterning and the progression with which these unhealthy risk factor profiles are adopted during this critical age.

Keywords: Obesity; Risk and protective factors; Substance use; Depression

Overweight and obesity has been increasing among youth, with the prevalence of overweight among children and teens in the United States tripling since 1980 [1]. In 2003–2004, 17.1% of U.S. youth were overweight [2]. The prevalence of other health-compromising behaviors in 2006 was also high, with 33.6% of 8th graders using alcohol and 11.7% using marijuana in the past-year and almost 10% smoking cigarettes in the past month [3]. Fighting was also common, with 43.5% of 9th graders having been in a physical fight at least once in the past year [4]. Although health compromising behaviors are prevalent among youth, previous research suggests these behaviors may co-occur, and thus it is important to understand the patterning of these behaviors and their de-

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1054-139X/08/$ – see front matter
doi:10.1016/j.jadohealth.2008.02.009

velopmental progression [5–10]. In addition, it is important to understand the role of potentially health-protective attributes (e.g., spirituality and optimism), particularly within the context of these other health compromising behaviors; however, little work to date has explored such issues.

Research has explored the relationships between risk behaviors; however, the relationship between risk and protective factors and weight status among youth has not been well explored. Studies have shown the initiation of smoking is more likely among overweight female adolescents as compared with their healthy weight counterparts [11] and has been associated with trying to lose weight [11,12]. In addition, Lytle et al found that smoking, poor food choices, and lower activity patterns clustered together among adolescents; prevalence rates for weekly smoking among 12th-grade males was 8.8 times higher in males reporting poor eating and activity levels as compared with males reporting healthy eating and activity. Alcohol intake has also been associated with the over-consumption of calories [13], and previous research has shown that chronic heavy drinkers during the ages of 10–24 years were nearly four times more likely to be overweight or obese and/or have high blood pressure at age 24 [14]. A recent study found that adolescents with alcohol use disorders were more likely to smoke and less likely to exercise regularly or eat a balanced diet; however they were not found to be more overweight than adolescents without these disorders [15].

Although these studies have individually explored relationships between risk and protective factors and body mass index, an analysis of a wide range of these factors and body mass index has not been conducted. As the prevalence of overweight and obesity continue to increase, it is important to explore potential mechanisms and correlates of this increase. To date, most research examining the covariance of behaviors has been cross-sectional in nature and lacks the ability to detect the temporality of the relationship. Longitudinal research may provide more insight into possible causal mechanisms responsible for any co-occurrence of these behaviors and may provide important clues to intervention needs to promote adolescent health.

Other important factors also may be interwoven in the development of adverse risk behavior patterns. For example, psychological distress has been associated with overweight among adolescents [16]. The Youth Risk Behavior Surveillance Study found overweight youth were 1.3 times more likely to have thoughts of suicide than youth of a healthy weight [17]. Dine et al found depression in childhood to be positively associated with adult body mass index, suggesting depression may lead to increases in body mass index as youth age. To date, little research has examined the role of potentially protective factors (e.g., spirituality and optimism) in the development of these complex behavioral patterns; however in one study, increased importance of spirituality/religion among girls was found to decrease the risk of smoking and binge drinking [18]. Although hopelessness has been found to predict risk behaviors [19,20], research on optimism has not been conducted and the influence of either construct on body mass index has not been explored. Additional work is needed in order to provide a more comprehensive understanding of the relationships between risk and protective factors and weight status, as well as the development of these factors over time.

The purpose of this study was to explore the associations between body mass index and measures of risk and protective factors in both cross-sectional and longitudinal analyses, in order to better understand the co-variation of health behaviors as well as the temporal association of the relationships. Using data from a large, longitudinal cohort of early adolescents we examined three specific research questions: (1) Are body mass index and measures of risk and protective factors correlated? (2) Does body mass index in grade 7 predict measures of risk and protective factors in grade 8? (3) Do measures of risk and protective factors in grade 7 predict body mass index in grade 8?

Methods

Study design and sample

These data are drawn from the Teens Eating for Energy and Nutrition at School (TEENS) intervention [21]. TEENS was a 2-year intervention study conducted in 16 middle schools in the Twin Cities, Minnesota metropolitan area (1997–2000). The primary goal of TEENS was to increase student's intakes of fruits/vegetables and lower fat foods. The intervention included classroom curricula, a family component, and school-level environmental changes [22]. Surveys were administered in the fall of grade 7 and the spring of grade 8. Of the 4050 eligible grade 7 students, 3878 (95.8%) completed the baseline survey. At the end of grade 8, 3010 (77.6%) of baseline participants completed the follow-up survey.

Data for this study are limited to the cohort who completed both baseline and follow-up surveys. This resulted in a cohort of 3010 students (72.1% white, 27.9% non-white), with a baseline mean age of 12.7 years. Approximately 20% of students received free/reduced price lunch and 51.1% were male. Students who did not complete the follow-up survey were more likely to be minority students, from single-parent households, enrolled in the free/reduced price lunch program, less likely to have two parents working full-time, and less likely to have parents with higher educational attainment [21]. The Institutional Review Board at the University of Minnesota approved all study methods.

Measures

Body mass index. Body mass index was calculated using self-reported height and weight and transformed into age- and sex-specific body mass index *z*-score percentiles (hereafter referred to as BMI) using CDC/NCHS 2000 growth charts [1].