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Sociocultural pressures and adolescent eating in the absence of hunger

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Abstract

Parental feeding practices and sociocultural pressures theoretically influence eating behavior. Yet, whether these factors relate to eating in the absence of hunger (EAH) is unknown. We assessed if sociocultural pressures were associated with EAH among 90 adolescents (M_{age} = 15.27, SD = 1.39; 48% female). Parents completed the Child Feeding Questionnaire. Adolescents completed the Perceived Sociocultural Pressures Scale, Sociocultural Attitudes Towards Appearance Questionnaire-3, and Multidimensional Body Self-Relations Questionnaire-Appearance Scales. On two occasions, EAH was assessed as snack food intake after adolescents ate to satiety. Controlling for body composition and demographics, parental restriction and family pressure to be thin were associated with greater EAH. Media pressure was related to more EAH in girls. Appearance orientation and preoccupation with becoming overweight mediated links between sociocultural pressures and EAH. Findings support the notion that sociocultural pressures and their links to body image may contribute to the course of disinhibited eating behaviors during adolescence.

Keywords

Body image; Adolescence; Eating in the absence of hunger; Pressure to be thin; Obesity

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Introduction

Disinhibited eating describes a range of eating behaviors that involve a lack of appropriate restraint over consumption (Shomaker, Tanofsky-Kraff, & Yanovski, 2011). One prevalent form of disinhibited eating among youth is eating in the absence of hunger (EAH), characterized by eating when not feeling physiologically hungry (Kral & Faith, 2009). The Western diet, rich in energy-dense palatable foods, is quite conducive to EAH (Hill, Wyatt, Reed, & Peters, 2003). Typically, EAH is measured in a laboratory paradigm by observing energy intake of snack foods after youth eat a meal to satiety (Fisher & Birch, 2002), and EAH also has been assessed by questionnaire report (Shomaker et al., in press; Tanofsky-Kraff et al., 2008). Observed and reported EAH is greater among overweight than non-overweight children and adolescents, and is positively associated with body mass index (BMI; kg/m^2) and adiposity (Birch, Fisher, & Davison, 2003; Cutting, Fisher, Grimm-Thomas, & Birch, 1999; Faith et al., 2006; Fisher & Birch, 2002; Fisher et al., 2007; Francis, Ventura, Marini, & Birch, 2007; Moens & Braet, 2007; Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010; Shunk & Birch, 2004; Tanofsky-Kraff et al., 2008).

EAH patterns show familial aggregation. Mothers' reports of their own disinhibited eating (Francis et al., 2007) and EAH (Zocca et al., 2011) are related to their children's observed EAH. EAH appears, however, to be only moderately heritable ($h2 = .51$; Fisher et al., 2007) suggesting that the propensity to engage in EAH results from a combination of genetic factors and environmental influences. Sociocultural theoretical perspectives on eating behavior underscore the roles that family, peers, and social media may play in transmitting values about appearance and influencing eating patterns (Fallon, 1990; Heinberg, 1996; Thompson & Heinberg, 1999). Most research about sociocultural influences on EAH has focused on how parental feeding pressure influences young girls' EAH. For instance, high levels of mothers' reported restriction of their daughters' food intake have been associated with young daughters' greater observed EAH and greater increases in EAH during childhood (Birch & Fisher, 2000; Birch et al., 2003). Restrictive feeding practices, in particular, appear to be related to disinhibited eating behaviors in children (Faith, Scanlon, Birch, Francis, & Sherry, 2004). In theory, restrictive feeding pressures inadvertently promote children's disinhibited eating by undermining their ability to self-regulate their appetite, weakening reliance on satiety cues to govern intake, and making restricted food more attractive and rewarding (Birch & Fisher, 1998). Such pressures may discourage intuitive eating, which has been conceptualized as trusting in and connecting with physiological cues for hunger and fullness to govern food intake (Tribole & Resch, 2003; Tylka, 2006). At the same time, children who are overweight or have difficulties with self-regulation of food intake elicit parents' greater restriction. Parents report that they more frequently restrict food for their higher-weight than their lower-weight children (Keller, Pietrobelli, Johnson, & Faith, 2006). Similarly, children's weight gain predicts increases in parental control over food intake (Rhee et al., 2009). Therefore, parental restrictive feeding practices and children's EAH likely interact in a bi-directional manner. Parents purportedly continue to play an important role in eating behavior and food choice during adolescence (Birch & Fisher, 1998); yet, to our knowledge, the relationship between parental feeding pressure and EAH in adolescence has not been established experimentally.

External pressures facing adolescents may take many forms. Adolescence is marked by the onset of puberty and is notable for the emergence of body dissatisfaction, especially in girls (Cash & Green, 1986; Moore, 1993). Therefore, sociocultural pressures surrounding physical appearance emerge as salient during this developmental period. Sociocultural pressure to be thin, in particular, may encourage disinhibited eating by emphasizing a thin or lean ideal of beauty that is unattainable without extreme dieting (The McKnight

Investigators, 2003). Theoretically, such pressure may promote greater investment in physical appearance, feelings of unattractiveness or dissatisfaction with one's appearance, and preoccupation with weight and eating (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). In turn, eating is likely to become disinhibited when individuals become overly focused on appearance, weight, and eating and believe that they cannot achieve such ideals (Thompson et al., 1999). According to the acceptance model of intuitive eating, sociocultural and/or interpersonal environments that scrutinize physical appearance as opposed to offering support and acceptance of one's body disrupt healthy, intuitive eating (Avalos & Tylka, 2006). In adolescent girls, sociocultural pressure to be thin has been associated with other forms of disinhibited eating, including disordered eating behaviors such as binge eating (Stice & Agras, 1998; Stice, Presnell, & Spangler, 2002); however, to our knowledge, the relationships of sociocultural pressure to be thin and body dissatisfaction with EAH are not known.

In the current study, we investigated the relationships among sociocultural pressures, body image, and EAH in adolescents. We expected that parental pressure around eating and sociocultural (e.g., parental, peer, and media) pressure to be thin would be associated with greater observed EAH in the laboratory. We hypothesized that the links between these pressures and EAH would exist even after accounting for demographic and anthropometric variables known to affect eating behavior, including body composition, age, race, and puberty (Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010; Tanofsky-Kraff et al., 2009). Consistent with sociocultural theoretical models of disinhibited eating behavior, we further hypothesized that several core dimensions of body image – namely, investment in appearance, preoccupation with weight, and dissatisfaction with appearance – would mediate the relationships between sociocultural pressures and EAH, as body image is considered to be one variable that accounts for the link between sociocultural pressure to be thin and disinhibited eating behavior in these models (e.g.,Thompson et al., 1999). In addition, we predicted that sex would act as a moderator of the associations between pressures and EAH such that the connection between pressure and EAH would be stronger among adolescent girls compared to adolescent boys. This expectation was based upon extant data suggesting that sociocultural pressure to be thin is more pronounced among adolescent girls relative to boys (Ackard & Peterson, 2001) and that thinness pressure mostly has been associated with other forms of disinhibited eating (e.g., binge eating) in girls as opposed to boys (Stice & Agras, 1998; Stice et al., 2002).

Method

Participants

Ninety 13–17 year olds (M_{age} = 15.27, SD = 1.39) participated in the study. Approximately half (47.8%) were female. The racial/ethnic composition of the sample approximated that of the DC metro area, with 46.7% of youth being Non-Hispanic White, 40.0% non-Hispanic Black, 6.7% Asian, 3.3% Hispanic White, and 3.3% multiple races (U.S. Department of Commerce, 2011). Average percent body fat was 24.54% (SD = 12.62%; range 6.20–57.85) and fat-free body mass was 50.21 kg (SD = 9.57 kg; 30.90–71.25), with an average BMI (z) standardized score for age and sex of 0.77 (SD = 1.07; range −1.53 to 2.57). The majority of adolescents were non-overweight (59.6%); 40.4% were overweight or obese (BMI percentile ≥85th percentile), which is slightly higher than national norms (Ogden et al., 2006). Most adolescents (83.3%) were in late puberty, with the remainder in early/mid- (15.5%) or pre-puberty (1.1%). For analyses taking pubertal development into account, prepubertal children were therefore combined with the early/mid group.

Measures

Child Feeding Questionnaire (CFQ) – Adolescent Version

Parents of adolescents completed the CFQ – Adolescent Version to assess parental behaviors and attitudes around feeding their adolescent daughter or son (Kaur et al., 2006). We examined three relevant subscales: (a) Restriction (eight items) – the parent's attempts to control his/her adolescent's eating by restricting access to palatable foods; (b) Concern (three items) – the extent to which a parent is concerned or worried that his/her child is or will become overweight and be forced to diet; and (c) Monitoring (four items) – how much a parent tracks a child's consumption of sweets, snack foods, high-fat foods, and sugared beverages. All items were rated on a 5-point scale (1 = *never*, 5 = *always*), and scales were created by averaging items. CFQ scales have demonstrated good internal reliability and convergent validity estimates with adolescent weight status among samples of adolescent boys and girls (Kaur et al., 2006). CFQ scales also demonstrated adequate internal reliability estimates in the current sample (αs = .88, .88, and .96 for Restriction, Concern, and Monitoring, respectively).

Perceived Sociocultural Pressures Scale (PSPS)

Adolescents reported perceived pressure to be thin from familial, peer, and media sources on the PSPS. The three scales of Family Pressure to be Thin, Friend Pressure to be Thin, and Media Pressure to be Thin contain two items each (e.g., "I've felt pressure from my family to lose weight" and "I've felt pressure from my family to have a thin body"). Items were answered on a 5-point scale (1 = *none*, 5 = *a lot*), and subscales were calculated by computing the items' average. The PSPS scales have demonstrated satisfactory internal consistency and good test–retest reliability estimates over two weeks in samples of female undergraduate students (Stice & Agras, 1998; Stice, Nemeroff, & Shaw, 1996). Internal reliability estimates for all scales were satisfactory in the current sample (αs = .85, .78, and .80 for Family, Friend, and Media Pressure to be Thin, respectively).

Sociocultural Attitudes Towards Appearance Questionnaire-3 (SATAQ-3)

Adolescents' reports on the SATAQ-3 were used to measure two dimensions of media-specific sociocultural pressure (Thompson, van den Berg, Roehrig, Guarda, & Heinberg, 2004). The Pressures scale indicates the degree of pressure perceived from the media to be thin (seven items; e.g., "I've felt pressure from TV or magazines to have a perfect body"). The Information scale reflects how greatly adolescents use media sources as key informants on what is beautiful/ideal (nine items; e.g., "TV programs are an important source of information about fashion and being attractive"). Items were rated on a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*), and scales were calculated by averaging item responses. The SATAQ-3 has exhibited strong convergent validity estimates with measures of body image and eating disturbance in undergraduate females (Thompson et al., 2004). The SATAQ-3 has also shown acceptable test–retest reliability estimates over a one-month interval in adolescent boys and girls (Wilksch & Wade, 2012). Both scales were internally reliable in the current sample (αs = .95 and .96, Pressures and Information, respectively).

Multidimensional Body-Self Relations Questionnaire-Appearance Scales (MBSRQ-AS)

Three scales from the MBSRQ-AS were used to assess the following dimensions of body image: (a) Appearance Orientation (12 items; e.g., "It is important that I always look good"), (b) Overweight Preoccupation (four items; e.g., "I constantly worry about being or becoming fat"), and (c) Appearance Evaluation (seven items; e.g., "I like my looks just the way they are"). All items were answered on a 5-point Likert scale (1 = *definitely disagree*, 5

= *definitely agree*) and averaged to calculate each scale. Higher scores reflected greater investment in and importance placed on appearance (Appearance Orientation), greater preoccupation with weight and eating (Overweight Preoccupation), and greater body satisfaction (Appearance Evaluation). The MBSRQ-AS has demonstrated acceptable internal consistency and stability estimates in late adolescent males and females over a one-month test–retest interval (Cash, 2000). In the current sample, internal reliability estimates were acceptable for Appearance Orientation (α = .87), Overweight Preoccupation (α = .78), and Appearance Evaluation (α = .87). The MBSRQ-AS was originally developed for use in adolescents as young as 15 years; among the slightly younger adolescents (ages 13–14 years) in the current sample, internal reliability estimates were acceptable for all scales (αs = .89, .74, and .85, for Appearance Orientation, Overweight Preoccupation, and Appearance Evaluation, respectively).

Observational Assessment of EAH

Observed EAH was assessed on two separate days (M = 3.2, SD = 4.0 days apart) using validated laboratory paradigms that differed only in the type of meal served prior to EAH measurement – a standardized lunch meal consisting of 50% of estimated required daily energy intake or a buffet meal (10,000 kcal) of lunch-type foods, presented in random order (Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010). These paradigms both have demonstrated convergent validity evidence with adolescent girls' and boys' body weight (Fisher et al., 2007; Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010), and EAH in the two paradigms was significantly related in the current sample (r = .57, p < .001). Validation of these paradigms for assessing EAH was previously reported in 78 of the 90 adolescents from the current sample (Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010). Both meals were served at 11:00 a.m. in a private room, and the participant was given the tape-recorded instructions to eat until no longer hungry. On both days, after completing the meal, participants were escorted to a separate room where they completed hunger and fullness ratings on visual analog scales (1 = *none* to 100 = *extremely*). One half-hour after meal termination, participants were escorted back to the test meal room where they were provided with a 4055-kcal array of highly palatable snack food items in generous portions (Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010). Participants were instructed to "taste each of the foods" and to rate his or her preferences on a 10-point scale (1 = *I hate the food*, 10 = *I love the food*). Consistent with other laboratory studies of EAH (Fisher et al., 2007), adolescents were encouraged to "try and take at least two bites of each of the foods," they were invited to eat as much of the foods as they would like, and they were offered use of activities in the room including a handheld computer game, playing cards, magazines, word and drawing games, paper, and crayons/markers. Each adolescent was left alone for a 15-min period.

Standardized meal intake and buffet meal intake were measured by calculating the difference in weight (g) of each food and beverage item before and after the meal. Likewise, EAH after the standardized meal and EAH after the buffet meal were calculated as the difference in weight (g) of each snack before and after the snack period. Energy intakes (kcal) for standardized meal intake, buffet meal intake, EAH after the standardized meal, and EAH after the buffet meal were calculated with data from the US Department of Agriculture (USDA) National Nutrient Database for Standard Reference (USDA, Agricultural Research Service, Beltsville, MD) and food manufacturer nutrient information obtained from food labels.

Procedure

Volunteers were recruited for a study examining eating behaviors in adolescents (ClinicalTrials.gov ID: NCT00631644) primarily through flyers posted at the National Institutes of Health (NIH), local libraries, and supermarkets, and through postings to school parent e-mail listservs in Washington DC and the greater metropolitan area. Adolescents were included if they were between the ages of 13 and 17 years old and had good general health as indicated by medical history and physical examination, negative urine glucose, and normal electrolytes, hepatic, and thyroid function. Exclusion criteria were chronic illnesses, pregnancy, ongoing weight-loss treatment, use of medications likely to affect energy intake, or a psychiatric condition that would impede adherence to study procedures. Participants provided written assent and parents/guardians gave written consent. Adolescents were financially compensated for their participation. The study was approved by the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Institutional Review Board.

Participants completed outpatient appointments on three separate days at the NIH Clinical Research Center. Adolescents were instructed to adhere to a fast (only water) initiated at 10:00 p.m. the night prior to all visits. Participants were screened for eligibility at an initial visit. At this first appointment, they completed questionnaires. The visit also included a medical history and a physical examination performed by an endocrinologist or nurse practitioner. Testicular volume (mL) was measured using a set of orchidometer beads as standards according to Prader (Tanner, 1981), and breast development was assigned according to the five stages of Tanner (Marshall & Tanner, 1969, 1970). Testicular volume for males and Tanner breast staging for females were used to categorize adolescents as those in pre-puberty (for boys: testes ≤ 3 mL; for girls: Tanner stage I), early/mid-puberty (for boys: testes 4–15 mL; for girls: Tanner stages 2–3) or late puberty (for boys: testes ≥15 mL; for girls: Tanner stages 4–5). Height was measured three times to the nearest millimeter by a stadiometer, calibrated before each participant's measurement. Fasting weight was measured to the nearest 0.1 kg with a calibrated digital scale. Height and weight were used to compute BMI. BMI standard deviation (BMI *z*) scores for sex and age were calculated according to the Centers for Disease Control and Prevention 2000 standards (Kuczmarski et al., 2000). Overweight status was dichotomized into non-overweight (BMI < 85th percentile) and overweight or obese (BMI ≥ 85th percentile; Ogden & Flegal, 2010). Fat-free mass (kg) and percent body fat were assessed with air–displacement plethysmography (Life Measurement Inc., Concord, CA). Body composition measurements were obtained as recommended, with participants fasted, wearing only underclothes or a form-fitting bathing suit (Nicholson et al., 2001). Eligible participants returned on a second day and a third day to complete test meals assessing EAH. The order in which participants completed the two types of EAH test meal paradigms (i.e., standardized meal or buffet meal served prior to EAH measurement) was counterbalanced.

Statistical Analyses

Analyses were conducted with SPSS 18.0 or STATA 11.0. A sample size of 90 with repeated measures was estimated to have 83% power to detect significant associations between sociocultural pressures and EAH. Data were screened for problems of outliers, skewness, and kurtosis (Behrens, 1997). To prepare data a priori for analyses, outliers (<3% of all data points) were adjusted to fall 1.5 times the interquartile range below the 25th percentile or above the 75th percentile (e.g., to the whiskers in Tukey's boxplot; Tukey, 1977). We routinely utilize this strategy because it minimizes outliers' influence on the characteristics of the distribution, minimally changes the distribution overall, and avoids potential bias associated with eliminating outliers altogether. Skewness and kurtosis were satisfactory on all variables. Descriptive information was generated on parental feeding

pressure (CFQ Restriction, Concern, and Monitoring), sociocultural pressure to be thin (PSPS Family, Friends, and Media, SATAQ-3 Pressures and Information), body image (MBSRQ-AS Appearance Orientation, Overweight Pre-occupation, and Appearance Evaluation), and observed EAH in the laboratory.

Preliminary analyses included the use of multivariate analyses of variance to describe sex differences in parental feeding pressure, sociocultural pressure to be thin, and body image. We also ran Pearson correlations to describe the relationships among parental feeding pressure, sociocultural pressure to be thin, and body image in adolescent girls and in adolescent boys.

For the primary analyses, a series of linear mixed modeling analyses were conducted to evaluate the associations between parental feeding pressure or sociocultural pressure to be thin and EAH. Mixed modeling refers to a set of statistical tools for handling data in which there are non-independent assessments, including repeated assessments nested within individuals (Demidenko, 2004). The advantages of this approach over traditional repeated measures analyses of variance are its better estimates for standard error, greater flexibility with unbalanced designs, and handling of missing data with iterative maximum likelihood estimation techniques (Demidenko, 2004). The criterion variable was EAH measured as the amount of snack energy intake (kcal) on two repeated occasions (after a standardized meal and after a buffet meal). The fixed-effects predictor variables in the models were parental feeding pressure or sociocultural pressure to be thin, sex, and the interaction of parental feeding pressure or sociocultural pressure to be thin with sex. The repeated measure was meal type (standardized meal or buffet meal). Body composition (fat-free mass in kg, percent fat mass, and height in cm) was included as a covariate in all models to determine whether the relationship of pressure with EAH existed independent of body composition. Consistent with other studies of EAH, we accounted for intake (kcal) at the meal prior and meal order (standardized meal or buffet meal condition first; Fisher et al., 2007; Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010). Additionally, as is typical for laboratory studies of food intake, we included as covariates age (years), race (Non-Hispanic White, Other), and puberty (early/mid-puberty, late puberty) because these factors have been shown to uniquely relate to energy intake (Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010; Tanofsky-Kraff et al., 2009). The continuous predictor variables (i.e., parental feeding pressure and sociocultural pressure) were mean-centered in these models prior to their entry into the interaction terms, as recommended (Aiken & West, 1991). Although we were interested primarily in the relationship of parental feeding pressure and sociocultural pressure to be thin with EAH, for comparative purposes we also ran parallel linear mixed modeling analyses with meal intake (kcal) as the criterion variable.

A product of coefficients approach was utilized to assess whether body image dimensions (MBSRQ-AS Appearance Orientation, Overweight Preoccupation, and Appearance Evaluation) acted as mediators of parental feeding pressure or sociocultural pressure and observed EAH. Product of coefficients approaches to testing mediation has better statistical power and less likelihood of Type I errors than traditional measures (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). The product of two coefficients was derived: α = the effect of the predictor variable (i.e., parental feeding pressure or sociocultural pressure) on the intervening variable (body image dimensions) and β = the effect of the intervening variable (body image dimensions) on the criterion variable (EAH). Estimates of $\alpha\beta$, its standard error, and confidence intervals were derived in STATA 11.0 from a multi-level modeling bootstrapping approach using 1000 iterations (Ender, 2011; Krull & MacKinnon, 2001). We conducted these mediational tests on the whole sample, and

subsequently tested mediation in girls and boys separately only in cases where sex served as a significant moderator of pressure to be thin and EAH.

Results

Sex Differences in Parental Feeding Pressure, Sociocultural Pressure to be Thin, and Body Image

There were a number of mean-level sex differences in parental feeding pressures, sociocultural pressure to be thin, and body image. Overall, parents of girls reported greater feeding pressures (CFQ) than parents of boys, $F(3, 86) = 4.34$, partial $\eta^2 = .13$, $p = .007$. Specifically, compared to parents of boys, parents of girls reported greater concern about their child becoming overweight ($M = 3.10$, $SE = .22$ vs. $M = 2.08$, $SE = .21$, partial $\eta^2 = .12$, $p = .001$). Trend-level differences were observed in parents' greater restriction of food intake in girls compared to boys ($M = 2.89$, $SE = .16$ vs. $M = 2.46$, $SE = .16$, partial $\eta^2 = .04$, $p = .06$) and more frequent monitoring of food consumption in girls compared to boys ($M = 3.07$, $SE = 0.18$ vs. $M = 2.62$, $SE = 0.17$, partial $\eta^2 = .04$, $p = .07$).

Overall, girls reported feeling greater pressure to be thin from sociocultural sources than boys on the PSPS, $F(3, 86) = 8.32$, partial $\eta^2 = .23$, $p < .001$. Specifically, girls reported greater family pressure to be thin ($M = 1.73$, $SE = 0.11$ vs. $M = 1.30$, $SE = 0.11$, partial $\eta^2 = .08$, $p = .016$), friend pressure ($M = 1.46$, $SE = 0.08$ vs. $M = 1.24$, $SE = 0.07$, partial $\eta^2 = .05$, $p = .04$), and media pressure ($M = 3.34$, $SE = 0.21$ vs. $M = 1.90$, $SE = 0.20$, partial $\eta^2 = .22$, $p < .001$) than boys. Similarly, girls expressed greater media influences on the SATAQ-3, $F(2, 87) = 10.95$, partial $\eta^2 = .20$, $p < .001$. Girls reported greater perceived media pressure to be thin ($M = 3.15$, $SE = 0.18$ vs. $M = 1.99$, $SE = 0.17$, partial $\eta^2 = .19$, $p < .001$) and more reliance on information about thinness from media sources than boys ($M = 3.02$, $SE = 0.17$ vs. $M = 2.21$, $SE = 0.17$, partial $\eta^2 = .11$, $p = .001$).

Overall, there were significant sex differences in dimensions of body image as assessed on the MBSRQ-AS, $F(3, 86) = 9.83$, partial $\eta^2 = .26$, $p < .001$. Girls reported greater importance of appearance ($M = 3.78$, $SE = 0.09$ vs. $M = 3.25$, $SE = 0.09$, partial $\eta^2 = .16$, $p < .001$) and greater preoccupation with becoming overweight than boys ($M = 2.51$, $SE = 0.14$ vs. $M = 1.88$, $SE = 0.13$, partial $\eta^2 = .11$, $p = .001$). Boys, on the other hand, evaluated their appearance more highly than girls ($M = 3.70$, $SE = 0.11$ vs. $M = 3.18$, $SE = 0.11$, partial $\eta^2 = .11$, $p = .001$).

The correlations among parental feeding pressure, sociocultural pressure to be thin, and body image for girls and boys are displayed in Table 1.

Parental Feeding Pressure and Sociocultural Pressure to be Thin as Predictors of EAH

Table 2 depicts a summary of the linear mixed modeling analyses examining the main effects of sociocultural predictors on meal intake and EAH and the interactional effects of sociocultural predictors by sex. Accounting for all covariates, a number of sociocultural constructs were related to EAH. Adolescents whose parents reported more restriction (CFQ) displayed greater EAH in the laboratory (Cohen's $d = 0.48$). Every 1-unit increase in parental restriction was associated with adolescents consuming 31.61 more kcal ($SE = 14.90$ kcal) in the absence of physiological hunger, $F(1, 77) = 4.50$, $p = .04$). Similarly, adolescents whose parents reported more concern about their eating tended to show greater EAH, $F(1, 75) = 3.54$, Cohen's $d = 0.43$, $p = .06$). There was no effect of parental monitoring on EAH, $F(1, 75) = 0.35$, $p = .56$). The relationships of parental feeding pressures with adolescent EAH were not significantly moderated by sex (ps > .24).

Additionally, adolescents who felt greater family pressure to be thin (PSPS) demonstrated more EAH (Cohen's $d = 0.52$). Every 1-unit increase in family pressure was related to adolescents consuming 53.80 more kcal ($SE = 24.17$) in the absence of hunger, $F(1, 74) = 4.96$, $p = .03$). This effect was not significantly moderated by sex, $F(1, 76) = 1.73$, Cohen's $d = 0.40$, $p = .09$). Neither friend nor media pressure to be thin (PSPS) had a significant main or interactional effect by sex on EAH (ps > .14).

By contrast, the effects of pressure and information from media (SATAQ-3) on EAH were significantly moderated by sex (ps < .05). Among girls, those who felt more media pressure to be attractive consumed 48.57 more kcal ($SE = 21.47$) when not hungry, $F(1,32) = 5.12$, Cohen's $d = 0.80$, $p = .03$), but the relationship of media pressure and EAH was not significant among boys ($M = -17.87$, $SE = 17.57$; $F[1,35] = 1.04$; Cohen's $d = -0.34$, $p = .32$). Similarly, adolescent girls who endorsed more reliance on information obtained from the media about appearance tended to display more EAH ($M = 34.71$, $SE = 19.02$; $F[1,32] = 3.33$; Cohen's $d = 0.65$, $p = .08$); the association between media information and EAH was not significant among boys ($M = -17.73$, $SE = 17.26$; $F[1,35] = 1.06$; Cohen's $d = -0.35$, $p = .31$).

No sociocultural variable had a significant main or interactional effect by sex in the prediction of meal intake. As shown in Table 2, the only trend-level association was that Restriction (CFQ) tended to be positively associated with adolescents' meal energy intake, $F(1, 79) = 3.60$, Cohen's $d = 0.43$, $p = .06$).

Body Image as a Mediator of Sociocultural Predictors and EAH

Table 3 summarizes the product of coefficient analyses examining MBSRQ-AS body image dimensions-Appearance Orientation, Overweight Preoccupation, and Appearance Evaluation – as potential mediators of the associations between parental feeding pressure or sociocultural pressure to be thin and adolescent EAH. Appearance Orientation (MBSRQ-AS) was a significant mediator of two of the three CFQ measures of parental feeding pressure (zs = −4.81 and −1.96, Restriction and Concern, respectively, ps < .05) and all measures of sociocultural pressure to be thin as assessed on the PSPS (zs = 3.14, 4.55, and 4.20, Family, Friend, and Media, respectively, ps < .01) and the SATAQ-3 (zs = 3.96 and 4.37, Pressures and Information, respectively, ps < .001) in their prediction of EAH. Said differently, parental feeding pressure and sociocultural pressure to be thin had significant indirect effects on adolescent EAH via appearance orientation. Adolescents who experienced greater pressure around food intake or appearance (CFQ, PSPS, SATAQ-3) placed more importance on physical appearance (MBSRQ-AS). Adolescents who highly valued physical appearance (MBSRQ-AS), in turn, displayed greater EAH in the laboratory.

Parallel findings were observed for Overweight Preoccupation (MBSRQ-AS). Overweight Preoccupation was a significant mediator of all measures of parental feeding pressure and sociocultural pressure to be thin in their prediction of EAH (ps < .05). Adolescents who felt greater pressure (CFQ, PSPS, SATAQ-3) were more preoccupied with their weight and eating (MBSRQ-AS), and greater preoccupation with weight and eating was related, in turn, to more EAH.

Because sex was a significant moderator of Pressures and Information (SATAQ-3) with EAH (Table 2), we ran the mediational analyses for these variables separated by sex. Among adolescent girls, Appearance Orientation (MBSRQ-AS) was a significant mediator of the contributions of SATAQ-3 Pressures to EAH ($z = 5.04$, $p < .001$, 95% C.I. = 14.41, 32.77) and SATAQ-3 Information to EAH ($z = 5.85$, $p < .001$, 95% C.I. = 14.05, 28.21). Likewise, Overweight Preoccupation was a significant mediator of the contributions of SATAQ-3 Pressures to EAH ($z = 2.69$, $p = .007$, 95% C.I. = 4.23, 27.01) and SATAQ-3

Information to EAH ($z = 3.63$, $p < .001$, 95% C.I. = 5.69, 19.07). Adolescent girls who felt more media pressure (SATAQ-3) were more oriented toward physical appearance and more preoccupied with weight and eating (MBSRQ-AS). Girls with these attitudes, in turn, showed more EAH. Conversely, among adolescent boys, neither Appearance Orientation nor Overweight Preoccupation (MBSRQ-AS) was a significant mediator of media pressure or information (SATAQ-3) and EAH ($ps > .13$). Appearance Evaluation was not a significant mediator of media pressure or information (SATAQ-3) and EAH in girls ($ps > .72$) or in boys ($ps > 37$).

Discussion

Sociocultural theory and prior data indicate that interpersonal and cultural pressures significantly predict adolescent attitudes around eating and food (Thompson et al., 1999). Consistent with this theory, the current results support a number of links between sociocultural factors and eating in the absence of hunger (EAH) in adolescents. Adolescent girls as well as boys who felt more familial pressures displayed greater EAH in the laboratory, even after adjusting for body composition and relevant demographic factors. Specifically, adolescents whose parents reported more restriction over food intake consumed more snacks in the absence of perceived physiological hunger. These findings are consistent with past literature supporting that parental feeding pressures are related to young girls' EAH (Birch & Fisher, 2000; Birch et al., 2003). Although the link between parental restriction and EAH previously has been examined only in girls, we found that restriction was associated with EAH in boys as well as girls. Despite parents' intentions to encourage consumption of "good" foods and limit or restrict "bad" foods, highly stringent controls over feeding may result in greater EAH as "bad" foods become more appealing when restrictions are lifted or when adolescents have access to such foods when parents are not present. Adolescents may over-compensate for the ordinary absence or restriction of these foods with greater consumption, despite a lack of hunger. These findings are consistent with the trust model of eating, which posits that parents promote intuitive eating by assuming a non-controlling role surrounding food intake that emphasizes attention to satiety signals rather than focusing on predetermined portion sizes or calorie counting (Satter, 2005).

Likewise, adolescents who reported greater pressure to be thin from family members displayed greater snack intake. Prior literature has identified perceived pressure to be thin as a prospective risk factor for other forms of disinhibited or disordered eating behavior in girls (e.g., binge eating; Stice et al., 2002). The current results suggest that familial pressure to be thin also may play a role in adolescents' propensity for EAH. Parents and families are a central domain in which adolescents learn and develop healthy – or unhealthy – eating behaviors (Birch & Fisher, 1998). Children are purportedly born with an innate ability to intuitively self-regulate food intake according to satiety signals (Johnson, 2000; Kral et al., 2007; Tribole & Resch, 2003). Yet, this ability weakens, on average, as individuals grow older (Ello-Martin, Ledikwe, & Rolls, 2005; Orlet Fisher, Rolls, & Birch, 2003; Rolls, Engell, & Birch, 2000). Furthermore, intuitive eating may become especially dyresgulated in an interpersonal context that emphasizes physical attractiveness as opposed to body acceptance (Avalos & Tylka, 2006). In theory, feeding pressures and pressure to be thin from family members may promote eating patterns like EAH that could encourage a positive energy balance and excessive weight gain. However, the association between such pressures and EAH almost certainly operates bi-directionally, such that adolescents who display high levels of EAH are likely to elicit greater restriction from parents and more familial pressures to be thin (Faith et al., 2004). Longitudinal studies of family pressures during adolescence are needed to help disentangle the directionality of these links.

Adolescent girls, but not boys, who felt more media pressure to be thin as measured on the SATAQ-3, though not the PSPS, had greater EAH, even when accounting for body composition and demographic factors. Similarly, girls' reported use of media as key informants on beauty ideals tended to relate to greater EAH. Mass media are often cited as one of the strongest influences on adolescent body image (Levine & Smolak, 1996; Mazur, 1986; Raphael & Lacey, 1992; Silverstein, Perdue, Peterson, & Kelly, 1986), and media are particularly relevant during a time period when body image is a central dimension of adolescent self-esteem (Levine & Smolak, 2002). Western society's ultra-thin ideal of attractiveness primarily targets females, rather than males (Cusumano & Thompson, 1997; Nemeroff, Stein, Diehl, & Smilack, 1994), which may explain why the relationships between media influences and EAH were observed only in girls.

Two dimensions of body image mediated the effects of parental feeding pressure and sociocultural pressure to be thin on adolescents' EAH. Although satisfaction with appearance (MBSRQ-AS Appearance Evaluation) was not a significant mediator, the extent to which adolescents were invested in their appearance – also considered to reflect the degree to which physical appearance plays role in self-esteem (Cash & Smolak, 2011) – mediated the links between parental feeding pressure or sociocultural pressure to be thin and EAH. Said differently, adolescents who felt more pressure reported greater investment in their appearance, which in turn was related to engaging in more EAH in the laboratory. Likewise, adolescents' preoccupation with weight and eating served as a significant mediator of pressures to be thin and EAH. Adolescents who felt more pressure were more concerned about their weight and eating; these attitudes, in turn, were related to consuming more snacks in the absence of hunger.

Both the direct and indirect effects of media pressure on EAH via body image were significant among girls only. Given the stark contrast between the ideal lean or muscular body and most adolescents' actual bodies, adolescents who view appearance as ultra-important and focus on attaining such unrealistic standards of beauty may be more prone to EAH (Fallon, 1990; Heinberg, 1996; Rodin, Silberstein, & Striegel-Moore, 1985). Taken together, these results suggest that body image may be one psychological mechanism explaining how sociocultural pressures are linked to EAH.

Consistent with models recognizing sociocultural influences on binge eating or disordered eating (Stice et al., 2002; Thompson et al., 1999), sociocultural pressure to be thin may promote disinhibited eating by encouraging adolescents to focus ineffectively on physical appearance to guide food consumption as opposed to hunger cues. It is striking that the observed associations between sociocultural pressures and measured eating behavior were only apparent for EAH specifically, and not for eating during the meal portion. Thus, sociocultural pressures and body image may be particularly relevant for disinhibited eating behaviors. Furthermore, given that girls experience an increase in adiposity during adolescence (Siervogel et al., 2003), this time period may be particularly salient, putting girls at higher risk for hyperfocus on appearance, preoccupation with body weight, and disinhibited eating.

Implications for Practice

Eating in the absence of hunger (EAH) is not an eating disorder in and of itself (Shomaker et al., 2011). Yet, it is robustly associated with being overweight (Birch et al., 2003; Cutting et al., 1999; Faith et al., 2006; Fisher & Birch, 2002; Fisher et al., 2007; Francis et al., 2007; Moens & Braet, 2007; Shomaker, Tanofsky-Kraff, Savastano, et al., 2010; Shomaker, Tanofsky-Kraff, Zocca, et al., 2010; Shunk & Birch, 2004; Tanofsky-Kraff et al., 2008). EAH is thought to result from poor responsiveness to physiological, internal cues for hunger and fullness and high responsiveness to environmental, external cues such as smell, taste,

and sight, or high responsiveness to internal cues other than hunger and fullness such as negative emotions (Schachter, Goldman, & Gordon, 1968). Although more research is needed to disentangle the construct of EAH from related constructs such as motivation to eat or food craving (French, Epstein, Jeffery, Blundell, & Wardle, 2012), preliminary data suggest that EAH may be an important component of dysfunctional eating, as it represents the antithesis of intuitive eating (Mathieu, 2009; Tribole & Resch, 2003; Tylka, 2006), overlaps with disordered eating behaviors such as binge eating (Zocca et al., 2011), and is often a characteristic of eating episodes described by youth at-risk for binge eating disorder (Tanofsky-Kraff et al., 2007, 2008). Interventions aimed at reducing EAH have been shown to decrease caloric intake (Boutelle et al., 2011). Tentatively, if external pressures perceived from family and media sources play a role in encouraging or perpetuating EAH, professionals working with overweight adolescents can assist family members in more effective and supportive strategies for communicating weight-related concerns and encouraging healthy eating behaviors. Similarly, if adolescents prone to EAH rely on external cues to govern food intake, interventions that restructure the home food environment to include exposure to healthy, low energy-dense foods may be helpful in reducing excessive weight gain.

Areas for Future Research

Study limitations include the cross-sectional nature of the data. Although we observed a number of links between sociocultural factors and EAH, it is not possible to conclude whether sociocultural factors influence EAH, vice versa, or whether their relationship is caused by other factors not included in our models. For example, research shows that individuals who diet are likely to engage in disinhibited eating behavior (Polivy & Herman, 1985). Exploring the restrictive eating behavior of adolescents prone to EAH is important for future work. Additionally, individual differences in EAH are likely influenced by a myriad of factors, including genetic susceptibility and/or variations in brain reward circuitry (Born et al., 2010; Nolan-Poupart et al., 2013; Rutters et al., 2010). Further investigation of the interaction between biological and environmental factors in the etiology and course of EAH during adolescence are warranted.

Longitudinal studies are required to examine how sociocultural pressures and body image relate to adolescent EAH over time and whether such factors directly or indirectly predict increases in weight or adiposity. Likewise, experimental paradigms modeling the effects of sociocultural pressures on EAH in the laboratory would help to disentangle the direction of influences. Another shortcoming is that the measures we utilized to assess sociocultural pressures may have been more relevant to female than male participants. Additional research is necessary to study pressures pertaining to pursuit of muscularity, which may be a more salient sociocultural ideal for adolescent males (McCabe & Ricciardelli, 2001). While the laboratory paradigm ensures precision in food measurement, it may not be entirely reflective of how adolescents eat in their natural environment.

Although our sample size of 90 with repeated measures had sufficient power to examine associations among sociocultural pressures, body image, and EAH, replication of the findings in larger samples of adolescents will be important. In particular, a larger sample size would permit the use of confirmatory factor analytic approaches to identifying latent constructs of sociocultural pressure and body image dimensions. Also, the use of structural equation modeling, particularly with longitudinal data, would permit a more parsimonious examination of the mediational factors (such as body image) that might explain sociocultural pressures' effects on EAH.

Similarly, in the current study we included a number of measurements of feeding pressure, pressure to be thin, and body image, which led to a large of number of statistical tests being

conducted and could have inflated Type 2 error. Yet, this limitation should be considered in light of the a priori nature of the hypotheses and the many consistencies observed in the associations among pressures, body image, and EAH. Although we found substantial support for body image as a mediator of pressures and EAH, it will be important in future studies to explore other potential mediators, such as internalization of cultural ideals of beauty. Finally, while our sample included males as well as females and was diverse in race/ethnicity and body composition, the slight overrepresentation of overweight adolescents may limit generalizability.

Conclusions

In summary, the current study provides evidence that sociocultural pressures, as assessed both from the perspective of parents and adolescents, are relevant for eating in the absence of hunger (EAH). Further research is needed to elucidate the psychological and/or genetic attributes that may contribute to adolescents' vulnerability to these pressures and the ensuing influences on food intake patterns. Since interventions aimed at reducing EAH have been shown to decrease caloric intake (Boutelle et al., 2011), clarifying the sociocultural factors that influence EAH may be useful for developing effective weight gain prevention and intervention strategies.

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Table 1

Correlations among parental feeding pressure, pressure to be thin from family, friends, and media sources, and body image among adolescent girls and boys.

	Feeding pressure			Pressure to be thin					Body image		
	CFQ restriction	**CFQ concern**	**CFQ monitoring**	**PSPS family**	**PSPS friends**	**PSPS media**	**SATAQ-3 pressure**	**SATAQ-3 information**	**MBSRQ orientation**	**MBSRQ preoccupation**	**MBSRQ evaluation**
Feeding pressure											
CFQ restriction	–	.65*	.33	.20	−.12	.05	.13	.02	−.16	.12	−.17
CFQ concern	.72*	–	.27	.27	−.04	.10	.23	.04	−.13	.36	−.29
CFQ monitoring	.61*	.39*	–	.01	−.06	−.20	.04	.10	.06	−.04	.17
Pressure to be thin											
PSPS family	.49*	.59*	.35	–	.63*	.23	.25	.08	.22	.59*	−.25
PSPS friends	.21	.37	.17	.43*	–	.17	.20	.08	.21	.42*	−.03
PSPS media	.10	.40*	.00	.50*	.35	–	.65*	.24	−.13	.19	.13
SATAQ-3 pressure	.12*	.43*	−.02	.58*	.35*	.72*	–	.51*	−.20	.32*	−.07
SATAQ-3 information	−.11	.03	−.03	.34	.35	.24	.59*	–	.39*	.26	−.01
Body image											
MBSRQ orientation	−.07	−.04	.05	.24	.43*	.28	.21	.38	–	.17	.19
MBSRQ preoccupation	.35	.50*	.38	.64*	.40	.43	.61*	.35	.36	–	−.51*
MBSRQ evaluation	−.57*	.62	−.41*	−.69*	−.21	−.33	−.43*	−.06	−.02	−.49*	–

Note. Correlations below the diagonal depict the estimates among girls ($n = 43$); correlations above the diagonal depict the estimates among boys ($n = 47$). CFQ = Children's Feeding Questionnaire; PSPS = Perceived Sociocultural Pressures Scale; SATAQ-3 = Sociocultural Attitudes Towards Appearance Questionnaire, Version 3; MBSRQ-AS = Multidimensional Body-Self Relations Questionnaire-Appearance Scales.

*$p < .01$.

Table 2

Series of linear mixed modeling results examining sociocultural predictors of meal energy intake and eating in the absence of hunger (EAH).

	Meal intake (kcal)			EAH intake (kcal)		
Model	***F* (df)**	**Estimate (*SE*)**	***p***	***F* (df)**	**Estimate (*SE*)**	***p***
Parental feeding pressure						
1. CFQ restriction	3.60 (1, 79)	65.82 (34.71)	.06	4.50 (1, 77)	31.61 (14.90)	.04
CFQ restriction × sex	0.95 (1, 78)	−70.41 (72.17)	.33	0.00 (1, 75)	0.43 (30.96)	.99
2. CFQ concern	1.10 (1, 79)	33.58 (32.09)	.30	3.54 (1, 75)	25.46 (13.52)	.06
CFQ concern × sex	0.00 (1, 78)	−0.50 (51.76)	.99	1.42 (1, 74)	25.75 (21.55)	.24
3. CFQ monitoring	1.61 (1, 79)	39.63 (31.22)	.21	0.35 (1, 75)	7.96 (13.47)	.56
CFQ monitoring × sex	2.35 (1, 78)	−91.37 (59.55)	.13	3.66 (1, 76)	15.75 (26.04)	.55
Pressure to be thin						
4. PSPS family	0.02 (1, 79)	−9.14 (58.62)	.88	4.96 (1, 74)	53.80 (24.17)	.03
PSPS family × sex	3.75 (1, 78)	182.37 (94.20)	.06	2.99 (1, 76)	68.42 (39.59)	.09
5. PSPS friends	0.00 (1, 79)	−2.66 (71.07)	.97	0.75 (1, 75)	26.05 (30.12)	.39
PSPS friends × sex	1.62 (1, 78)	178.17 (140.18)	.21	2.12 (1, 75)	86.70 (59.61)	.15
6. PSPS media	0.02 (1, 79)	−3.51 (27.50)	.90	1.60 (1, 74)	14.64 (11.59)	.21
PSPS media × sex	0.00 (1, 78)	1.36 (52.33)	.98	2.18 (1, 73)	32.08 (21.74)	.14
7. SATAQ-3 pressures	0.03 (1, 79)	−5.90 (33.44)	.86 0	.80 (1, 74)	12.67 (14.17)	.37
SATAQ-3 pressures × sex	0.70 (1, 78)	−22.42 (58.47)	.70	10.38 (1, 73)	74.67 (23.18)	.00
8. SATAQ-3 information	1.22 (1, 79)	33.07 (29.96)	.27	0.41 (1, 75)	8.28 (12.88)	.52
SATAQ-3 information × sex	0.00 (1, 78)	3.49 (60.49)	.95	6.26 (1, 74)	62.27 (24.89)	.02

Note: $N = 90$. All models included as covariates age (years), sex, race (Non-Hispanic White vs. Other), stage of puberty (early/mid vs. late), fat-free mass (kg), percent fat mass, height (cm), meal type, and meal order. The models predicting EAH as the criterion also included meal intake (kcal). CFQ = Children's Feeding Questionnaire; PSPS = Perceived Sociocultural Pressures Scale; SATAQ-3 = Sociocultural Attitudes Towards Appearance Questionnaire, Version 3.

Table 3

Product of coefficient analyses examining appearance orientation, overweight preoccupation, and appearance evaluation as mediators of sociocultural predictors and eating in the absence of hunger (EAH).

Predictor	Body image mediator											
	MBSRQ-AS Appearance Orientation				MBSRQ-AS Overweight Preoccupation				MBSRQ-AS Appearance Evaluation			
	Product *z*	*p*	95% C.I.	*d*	Product *z*	*p*	95% C.I.	*d*	Product *z*	*p*	95% C.I.	*d*
Feeding pressure												
CFQ restriction	−4.81	<.001	−5.33, −2.24	1.18	2.27	.02	0.17, 2.39	0.49	−1.37	.17	−6.19, 1.10	0.029
CFQ concern	−1.96	.05	−1.58, 0.00	0.42	3.98	<.001	2.31, 6.78	0.92	−1.53	.13	−6.50, 0.79	0.33
CFQ monitoring	−0.60	.55	−1.00, 0.53	0.13	3.77	<.001	1.11, 3.54	0.87	−0.04	.97	−1.44, 1.38	0.01
Pressure to be thin												
PSPS family	3.14	.002	4.36, 18.89	0.70	2.25	.02	1.81, 26.04	0.49	−1.57	.12	−10.53, 1.15	0.34
PSPS friend	4.55	<.001	11.67, 29.35	1.09	4.00	<.001	8.65, 25.31	0.93	−0.06	.96	−0.34, 0.32	0.01
PSPS media	4.20	<.001	2.00, 5.50	0.99	4.22	<.001	2.78, 7.61	0.99	−0.39	.70	−2.02, 1.35	0.08
SATAQ-3 pressure	3.96	<.001	1.53, 4.53	0.92	4.10	<.001	5.10, 14.45	0.96	−0.05	.96	−1.15, 1.09	0.01
SATAQ-3 information	4.37	<.001	5.64, 14.81	1.04	4.19	<.001	3.95, 10.88	0.98	0.06	.95	−0.19, 0.21	0.01

Note: $N = 90$. CFQ = Children's Feeding Questionnaire; PSPS = Perceived Sociocultural Pressures Scale; SATAQ-3 = Sociocultural Attitudes Towards Appearance Questionnaire, Version 3; MBSRQ-AS = Multidimensional Body-Self Relations Questionnaire.