



HHS Public Access

Author manuscript

Eat Behav. Author manuscript; available in PMC 2018 January 01.

Published in final edited form as:

Eat Behav. 2017 January ; 24: 7–10. doi:10.1016/j.eatbeh.2016.11.003.

Eating in the Absence of Hunger during Childhood Predicts Self-Reported Binge Eating in Adolescence

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Abstract

Objective—The objectives of the current study were to examine whether eating in the absence of hunger (EAH) at age 7 predicted reports of self-reported binge eating at age 15 and to identify factors among girls with high-EAH that moderated risk of later binge eating.

Method—Subjects included 158 girls assessed at age 7 and age 15. Logistic regression was used to predict binge eating at age 15 from calories consumed during EAH at age 7. A series of logistic regressions were used to examine the odds of reporting binge eating given levels of risk factors (e.g., anxiety) among those with high-EAH in childhood.

Results—Girls' EAH intake predicted reports of binge eating at age 15; after adjusting for age 7 BMI, for each additional 100 kcal consumed, girls were 1.7 times more likely to report binge eating in adolescence. Among those with high-EAH, BMI, anxiety, depression, dietary restraint, emotional disinhibition, and body dissatisfaction all predicted binge eating.

Discussion—EAH during childhood predicted reports of binge eating during adolescence; girls with elevated BMI, negative affect, and maladaptive eating- and weight-related cognitions were at increased risk. High-EAH in childhood may be useful for indicating those at risk for developing binge eating.

Keywords

eating in the absence of hunger; binge eating; adolescents

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1. Introduction

Birch and colleagues' measure of Eating in the Absence of Hunger (EAH) was designed as a behavioral measure (i.e., laboratory paradigm) of individual differences in children's intake of palatable food in the absence of hunger (1). In the EAH protocol, children are fed an *ad libitum* standardized meal to ensure lack of hunger. Following the lunch, children are given free access to a variety of palatable foods in addition to non-food (e.g., toys) alternatives. The EAH protocol has been widely used with both children and adolescents. Children who consume more energy in the EAH protocol are at an increased risk for overweight, obesity, and weight gain over time (1–3). EAH assesses a developmental precursor to external dietary disinhibition; in the EAH protocol the presence of palatable foods can act as a disinhibitor, triggering overconsumption that is behaviorally similar to the effects that the presence of palatable foods can have on binge eating in both animals (4) and humans (5, 6). Analogous to EAH, binge eating has been also shown to predict both weight gain and obesity in children and adolescents (7). While EAH and binge eating may be similar behaviorally, whether higher levels of EAH in childhood predict later binge eating has not been explored. Prospective studies in adolescents have identified other psychological (e.g., negative affect, depressive symptoms) and weight-related (e.g., body weight, body dissatisfaction) risk factors for the development of binge eating (8, 9). The primary aim of the current study was to examine whether EAH, measured in childhood, predicted self-reported binge eating in adolescence using a longitudinal sample of girls followed from childhood into adolescence. The secondary aim was to identify other, modifiable factors among girls with high EAH in childhood that could moderate the risk of binge eating in adolescence.

2. METHODS

2.1 Participants

Participants included 158 non-Hispanic, white 15-year-old girls living in Central Pennsylvania recruited as part of a longitudinal cohort study of the health and development of young girls with one of the primary aims to identify predictors of individual differences in behavioral controls of food intake, including dieting. Eligibility criteria for girls' participation at recruitment (age 5) included living with the biological mother and father, the absence of severe food allergies or chronic medical problems affecting food intake, and the absence of dietary restrictions involving animal products. The sample was not recruited based on weight status or eating behavior, and families were recruited for participation into the study using flyers and newspaper advertisements. In addition, families with age-eligible female children within a five-county radius received mailings and follow-up phone calls (Metromail Inc.). Families were then assessed every 2 years from age 5 (n=197) until age 15 (n=167). Attrition was primarily due to family relocation outside of the area. Additional details on the study population can be found elsewhere (10, 11). Girls with complete data on both EAH at age 7 and binge eating at age 15 (n=158) were included in the current study; there were no differences between those included in the current study and those without complete data. The Pennsylvania State University Institutional Review Board approved all

study procedures, and parents provided consent for their family's participation before the study began.

2.2 Measures

The outcome measure (binge eating) was assessed at age 15. All predictor variables were assessed at age 7, with the exception of the anthropometrics which were also measured at age 15.

2.2.1 Outcome (age 15)

Binge eating: Binge eating was assessed using the Binge Eating Scale (BES) (12), a 16-item scale that measures the cognitive and behavioral aspects of binge eating episodes. The BES has been used previously to assess binge eating in adolescents using the following score cut-offs: a score of < 18 indicates no binge eating, scores 18–26 indicate moderate binge eating, and scores > 27 constitute severe binge eating (13–15). Thus, in the current study, girls with BES scores ≥ 18 were classified as reporting binge eating. Good internal consistency was observed ($\alpha = .92$).

2.2.2 Predictors (age 7)

Eating in the Absence of Hunger (EAH) protocol: The EAH protocol was developed to measure children's intake of palatable foods while in the absence of hunger (1). To minimize the influence of hunger on the girls' intake in the EAH protocol, each girl participated in a standard ad libitum lunch before the free-access session with 4–5 other girls of the same age. Each girl was provided with generous portions of bread (2 rolls, 56 g each), sandwich meat (6 slices, 28 g/slice), carrots (20 g), applesauce (4 oz), cheese (2 slices, 21 g/slice), cookies (16 g each), and milk (10 oz.). In addition, a subjective measure of hunger was obtained from each girl immediately after lunch, with the use of 3 figures depicting "hungry," "half-full," and "full." Girls who indicated they were "hungry" after lunch were not included in the analyses. Participants were left alone in a laboratory experimental room for 10 minutes and were told they could play with any of the available toys or eat any of the foods. Generous portions of the following foods were available: popcorn, potato chips, pretzels, nuts, fig bars, chocolate chip cookies, fruit-chew candy, chocolate bars, ice cream, and frozen yogurt. EAH was assessed as total energy intake consumed across all foods.

Psychological well-being predictors: Depression was measured using the 26-item Children's Depression Inventory (16). Anxiety was measured using the 28-item Anxiety subscale on the Children's Manifest Anxiety Scale (17) and was used as a total score. Good internal consistency was observed ($\alpha = 0.75$) for both depression and anxiety.

Eating and weight-related predictors: Dietary restraint, emotional disinhibition, and external disinhibition were measured using the Dutch Eating Behavior Questionnaire (DEBQ), modified to be age-appropriate by simplifying the sentence structure for some questions reducing the response options to no, sometimes, and yes (18). Body dissatisfaction was measured using the Body Satisfaction Scale (19), modified to be age-appropriate. The Body Satisfaction Scale originally consisted of a list of 16 body parts, half involving the head and the other half involving the body. The amended version contains an additional 10

items concerning various body parts and reduced the response set to: “too little,” “too big,” “just right.” Good internal consistency was observed ($\alpha = 0.73$) for all eating and weight-related predictors.

Anthropometric measures (ages 7 and 15): Height and weight were measured in the laboratory at ages 7 and 15 in triplicate by a trained staff member following procedures described by Lohman (20) and were used to calculate body mass index (BMI; weight (kg)/height (m)²) scores.

2.3 Statistical analyses

All data analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC). Statistical significance was defined as $p < 0.05$. The primary aim of this study was to examine whether eating in the absence of hunger during childhood predicted binge eating in adolescence. Binge eating was assessed both as continuous scores on the BES and as a binary variable to aid in interpretability: e.g., absence (scores on the BES below 18), or presence (scores on the BES ≥ 18) of binge eating. As such, linear regression was used to examine whether calories consumed during EAH (assessed in increments of 100 kcal) at age 7 predicted BES scores at age 15, and logistic regression was used to examine whether calories consumed during EAH (assessed in increments of 100 kcal) at age 7 predicted the presence of binge eating at age 15. Due to the known relationship between weight status and binge eating, the models included girls' BMI at age 7. The secondary aim of this study was to examine factors that moderated risk of later binge eating among those with high-EAH at age 7. A median split was used to create low- and high-EAH groups (median = 153.1 kcal), and a series of logistic regressions were conducted among those with high-EAH, looking at whether or not the risk factors were predictive of binge eating.

3. Results

EAH and binge eating descriptives are shown for those who with low- and high-EAH, those with and without binge eating, and for the total sample in Table 1.

3.1 EAH in childhood predicting binge eating in adolescence

Girls' EAH intake at age 7 predicted both continuous scores on the BES and the presence of binge eating at age 15. After adjusting for girls' BMI at 7, calories consumed during EAH protocol at 7 positively predicted BES scores at 15 (parameter estimate: 1.41, SE: 0.50, $p < .01$). After adjusting for girls' BMI at 7, for every 100 kcal that a girl consumed during the EAH protocol, she was 1.72 (95% CI: 1.16, 2.56) times more likely to report binge eating at age 15 ($p < .01$).

3.2 Risk factors for developing binge eating among those with high-EAH in childhood

As shown in Table 2, several risk factors for binge eating were identified for those with high-EAH in childhood; BMI, anxiety, depression, dietary restraint, emotional disinhibition, and body dissatisfaction were all significant predictors of binge eating at age 15. External disinhibition was not a significant predictor of reported binge eating among those with high EAH.

4. Discussion

The findings of the present research are the first to show that EAH, a behavioral measure of disinhibited eating behavior during childhood, predicts self-reported binge eating during adolescence. These findings are significant after adjusting for weight status in childhood, indicating that EAH contributes additional risk for binge eating above and beyond weight status, which is a significant risk factor for binge eating (21). While this is the first study to show that EAH predicts later binge eating, these findings are consistent with work from Tanofsky-Kraff and colleagues that has shown that children who self-reported higher EAH also endorsed loss of control eating (22), which shares related pathology to binge eating. These findings suggest that high EAH in childhood may be useful as a clinical indicator for later binge eating.

While EAH in childhood predicted reports of binge eating during adolescence, not all girls with high energy intake in the EAH protocol had high scores on the Binge Eating Scale (12) measure, indicating that high-EAH alone is not sufficient for the development of binge eating. Analyses among those with high-EAH identified critical psychological and weight-related factors that contribute to binge eating risk, namely anxiety, depressive symptoms, dietary restraint, emotional disinhibition, elevated BMI, and body dissatisfaction. These findings are consistent with results from prospective studies in an adolescent population in which body dissatisfaction, emotional eating, body mass, depressive symptoms, restraint, and low self-esteem were all risk factors for binge eating (8, 9), and extends the literature by confirming that many of these risk factors are present in girls before adolescence, as early as age 7, highlighting the need for early prevention and intervention.

The current study is not without limitations. The current sample was homogenous—white females from primarily well-educated, middle-class families, and thus the results may not generalize to other populations (e.g., males, minorities). The current study assessed only self-reported binge eating and thus findings should be confirmed using a clinical interview. Given that the sample was recruited at age 5 and was not recruited based on weight or eating behaviors, only a small number of self-reported binge eaters ($n=25$) were identified which may have limited the ability to detect group differences. Thus, future work should confirm the findings using a larger sample. Additionally, given that EAH is a laboratory eating task, it is unclear if results would be similar in a naturalistic setting. However, given that previous work has shown that EAH predicts overweight across time (2, 3), it seems likely that high-EAH in the laboratory mirrors aspects of eating behavior occurring in everyday environments.

The current study has provided evidence that elevated EAH during childhood predicts reports of later binge eating. Given that the current study assessed only self-reported binge eating, more research is needed to investigate EAH during childhood as a prospective risk factor for Binge Eating Disorder, corroborating reports on the BES with a clinical interview to assess for eating disorders characterized by binge eating (e.g., Binge Eating Disorder, Bulimia Nervosa). Taken together, the current study has implications for future prevention studies, suggesting that eating disorder prevention programs would be beneficial during

middle childhood, with EAH as a potential target, particularly among girls with other known risk factors.

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Highlights

- Calories consumed during the Eating in the Absence of Hunger (EAH) protocol at age 15 predict continuous scores on the Binge Eating Scale (BES) at age 15
- Calories consumed during the Eating in the Absence of Hunger (EAH) protocol at age 15 predict presence of binge eating at age 15
- Among girls with high-EAH at age 7, girls with elevated BMI, negative affect, and maladaptive eating- and weight-related cognitions were at increased risk

Table 1

Eating in the Absence of Hunger (EAH), BMI, and binge eating characteristics for those with low- and high-EAH and no binge eating and binge eating

	Low-EAH (n=79)	High-EAH (n=79)	Total Sample (N=158)
EAH (kcal), age 7	73.4 ± 45.8	265.7 ± 104.1	169.5 ± 125.4
BMI percentile [/] , age 7	55.5 ± 27.1	62.6 ± 30.0	58.9 ± 27.7
BMI percentile, age 15	59.5 ± 24.3	63.7 ± 25.8	61.5 ± 25.0
# with binge eating (%), age 15	5 (5.7%)	20 (22.0%)	25 (15.8%)

	No binge eating (n=133)	Binge eating (n=25)	Total sample (N=158)
EAH (kcal), age 7	153.1 ± 108.4	256.7 ± 169.8	169.5 ± 125.4
BMI percentile [/] , age 7	56.7 ± 27.7	70.9 ± 25.5	58.9 ± 27.7
BMI percentile, age 15	59.1 ± 24.5	76.3 ± 23.8	61.5 ± 25.0
Scores on the BES, age 15	6.7 ± 4.4	23.7 ± 6.1	9.2 ± 7.7

Binge eating defined as scores on the BES

[/] All models adjusted for BMI; however, BMI percentile presented here to aid in interpretation.

Table 2

Risk factors predicting the presence of binge eating in adolescence among those with high-EAH during childhood, adjusting for BMI at age 7

	Odds of reporting binge eating
BMI ^I	1.28 (1.08, 1.51) **
Anxiety	1.18 (1.08, 1.30) ***
Depression	1.10 (1.002, 1.21) *
Dietary restraint	4.68 (1.59, 13.73) **
Emotional disinhibition	3.54 (1.16, 10.82) *
External disinhibition	1.57 (0.48, 5.11)
Body dissatisfaction	1.62 (1.21, 2.22) **

^I All models included BMI as an additional covariate; model looking at influence of BMI included BMI as a single variable

Odds ratios are bolded to convey significance

Data presented as odds ratios with 95% confidence interval in parentheses.

* $p < .05$,

** $p < .01$,

*** $p < .001$