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Research report

# Overeating phenotypes in overweight and obese children ☆

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ABSTRACT

The purpose of this study was to identify overeating phenotypes and their correlates in overweight and obese children. One hundred and seventeen treatment-seeking overweight and obese 8–12 year-old children and their parents completed the study. Children completed an eating in the absence of hunger (EAH) paradigm, the Eating Disorder Examination interview, and measurements of height and weight. Parents and children completed questionnaires that evaluated satiety responsiveness, food responsiveness, negative affect eating, external eating and eating in the absence of hunger. Latent profile analysis was used to identify heterogeneity in overeating phenotypes in the child participants. Latent classes were then compared on measures of demographics, obesity status and nutritional intake. Three latent classes of overweight and obese children were identified: High Satiety Responsive, High Food Responsive, and Moderate Satiety and Food Responsive. Results indicated that the High Food Responsive group had higher BMI and BMI-Z scores compared to the High Satiety Responsive group. No differences were found among classes in demographics or nutritional intake. This study identified three overeating phenotypes, supporting the heterogeneity of eating patterns associated with overweight and obesity in treatment-seeking children. These finding suggest that these phenotypes can potentially be used to identify high risk groups, inform prevention and intervention targets, and develop specific treatments for these behavioral phenotypes.



## Introduction

Rates of childhood obesity have grown substantially over the past few decades (Ebbeling, Pawlak, & Ludwig, 2002), reaching epidemic proportions. Currently, 31% of children and adolescents in the United States are overweight or obese (Ogden, Carroll, Kit, & Flegal, 2012). Childhood obesity is associated with a number of negative health sequelae including orthopedic and endocrine conditions, cardiovascular disease, cancer, and all-cause mortality (Dietz, 1998; Key et al., 2004; Micic, 2001). Because obesity is potentially a preventable cause of disease risk, a greater understanding of etiological factors could significantly improve child and adult psychological and health outcomes.

Childhood obesity is a complex and heterogeneous condition, and the majority of research studies have examined the relationship between independent variables and weight status (Diamond & Siqueland, 2001; Dunton, Kaplan, Wolch, Jerrett, & Reynolds, 2009; Rosenkranz & Dzewaltowski, 2008). Overeating, or eating past nutritional needs, is considered a significant contributor to the childhood obesity epidemic. There is increasing evidence supporting the influence of appetitive traits such as reward sensitivity, hunger and satiety mechanisms, and food cue responsiveness on obesity risk (Berridge, Ho, Richard, & DiFeliceantonio, 2010; Jansen et al., 2003; Volkow, Wang, & Baler, 2011). These appetitive traits along with an abundance of food (such as in the current food environment) may contribute to differential caloric consumption and increased weight gain in vulnerable children.

Research suggests that there are a number of measures of appetitive traits that are associated with adiposity in children, including external eating, satiety sensitivity, eating in the absence of hunger, loss of control eating, and emotional eating (Barkeling, Ekman, &

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Rossner, 1992; Braet & Van Strien, 1997; Jansen et al., 2003). Compared to healthy weight children, obese children have increased consumption and less reduction of eating rate toward the end of a meal (Barkeling et al., 1992). Studies suggest that overweight children have increased responsivity to food cues (Bruce et al., 2010; Jansen et al., 2003) and that food responsiveness, satiety responsiveness, and emotional eating can differentiate children of different weight status (Croker, Cooke, & Wardle, 2011; Jansen et al., 2003; Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009). Eating related cognitions, such as loss of control eating, have also been associated with increased weight in youth (Tanofsky-Kraff, Marcus, Yanovski, & Yanovski, 2008; Tanofsky-Kraff et al., 2009, 2011). Finally, eating in the absence of hunger is associated with increased adiposity (Faith et al., 2006; Fisher & Birch, 2002; Fisher et al., 2007; Hill et al., 2008; Jansen et al., 2003). Although research to date has carefully controlled for the influence of individual factors associated with childhood obesity, these strategies cannot address multiple factors acting in concert. Additional understanding of the complexity contributing to the heterogeneity among obese children could lead to the identification of high-risk subgroups, facilitate development of targeted treatments, and serve as an index to evaluate responsiveness to those treatments.

In this study we employed latent profile analysis to examine a range of behavioral and psychological variables based on interview-based assessments, laboratory paradigms, and parent and child self-report. Latent structures were identified using child eating in the absence of hunger, child report of loss of control eating, parent report of child food responsiveness, parent report of child food satiety responsiveness, child report of negative affect eating, and child report of external eating. Latent profiles were then compared on standardized BMI, BMI percentile, and dietary intake.

## Methods

### Participants

One hundred and seventeen overweight or obese (>85 BMI-percentile) children aged 8–12 years and their parents were recruited through media announcements, advertisements, direct mailing and physician referrals in Minneapolis for two treatment studies focused on reducing overeating. Exclusion criteria included parent or child involvement in another weight loss treatment, medications that affect weight or appetite, and psychiatric and physical conditions (e.g., eating disorder, psychosis) that could interfere with participation. Participants provided written informed consent (participating parent) and assent (child). This study obtained approval through the Internal Review Board of the University of Minnesota. All participants who completed the baseline evaluation were included in this analysis. Demographics of the sample are provided in Table 1.

**Table 1**
Demographic characteristics of children and parents.

| | *N* = 117 pairs |
|---|---|
| *Child* | |
| Sex (% female) | 53% |
| Mean age (SD) | 10.42 (1.35) |
| Race | |
| Caucasian | 54% |
| African American | 14% |
| Multi-Race | 20% |
| Other | 12% |
| BMI | 27.22 (4.56) |
| BMI-Z | 2.06 (.39) |
| EAH (percent of daily caloric needs) | *M* = 15.22 (SD = 11.60)<br>Range = .24–96.25 |
| *Parent* | |
| Gender (% female) | 91% |
| Marital status (% currently married) | 68% |
| Education (% college graduates) | 57% |
| Race | |
| Caucasian | 70% |
| African American | 14% |
| Multi-Race | 8% |
| Other | 8% |
| BMI | 31.53 (7.09) |

*Note:* Values in parentheses are standard deviation.

### Measures

#### Indicator variables

*Child eating in the absence of hunger (EAH).* The EAH paradigm was initially described by Birch and colleagues (Birch & Fisher, 2000; Fisher & Birch, 2002). Each child in this study participated in a standard ad libitum pizza dinner with their parents. Self-reported post-meal satiety was assessed with a cartoon representation of three levels of fullness (Faith et al., 2006) and two questions; children rated their level of hunger and fullness via a 1–5 scale with 1 being "not at all hungry/full" and 5 being "extremely hungry/full." Endorsement of a 4 or 5 in fullness was required to move onto the next task. If the child was not full at a 4 or 5 level, they were encouraged to return to the meal until they were full. Ten minutes following the completion of the meal, each child tasted and rated the palatability of small samples of 11 sweet and savory snack foods (popcorn, Cheez-its, Cheetos, potato chips, pretzels, Skittles, Hershey bars, chocolate chip cookies, Fig Newtons, jelly beans, M&M's) using cartoon illustrations of faces depicting "yummy," "just ok," and "yucky" (Faith et al., 2006). Following the rating of foods, the child was left alone in a room with containers holding generous pre-weighed portions of the same snack foods as well as toys and games. The child was told that s/he could play with the toys or eat any of the foods while the coordinator worked in the adjacent room. After 10 min, the coordinator returned to the room and ended the free access session. The amounts of remaining food items were measured. The total snack food calories consumed by each child was calculated from the amount consumed, and this total was divided by child's estimated daily caloric needs to derive the percent of caloric needs consumed during the free access period. Daily caloric needs were estimated using age-specific formulas for calculating estimates of energy requirements according to weight, age, height, and physical activity level (EAH%). To be conservative, a physical activity level of "low active" was used for all children in this study (National Academy of Sciences, Institute of Medicine, Food and Nutrition Board, 2005).

*Child loss of control eating (LOC).* The presence or absence of LOC eating in the past month was assessed using the Eating Disorder Examination (EDE) (Fairburn & Cooper, 1993), adapted for children (ChEDE) (Bryant-Waugh, Cooper, Taylor, & Lask, 1996). All interviewers attend a two-day training prior to administration. The ChEDE has strong inter-rater reliability and discriminant validity for eating episodes when administered in youth (Bryant-Waugh et al., 1996; Glasofer et al., 2007; Tanofsky-Kraff et al., 2004; Watkins, Frampton, Lask, & Bryant-Waugh, 2005). Children who reported either objective or subjective bulimic episodes were categorized as engaging in LOC eating, whereas children who only reported objective overeating or no episodes of overeating or LOC were classified as not endorsing LOC eating.

*Negative Affect Eating (EAH NAE).* Negative affect eating was assessed using the negative affect scale from the Eating in the Absence of Hunger Questionnaire for Parents. The Eating in the Absence of Hunger Questionnaire for Parents is a 14-item questionnaire completed by parents about their child's eating which