Beyond the tip of the iceberg: Adolescent weight development of women and men with features of binge eating disorder

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ABSTRACT

Objective: Binge eating disorder (BED) is a clinical eating disorder that is strongly and bidirectionally related to overweight and obesity. Little is known about how subclinical features of BED relate to weight development in adolescence and young adulthood.
Method: Women (n = 2825) and men (n = 2423) from the community-based longitudinal FinnTwin16 cohort participated. Seven eating-related cognitions and behaviors similar to the defining features of BED were extracted from the Eating Disorder Inventory-2 and were assessed at a mean age of 24. We used linear mixed models to assess the association of features of BED with BMI trajectories across four waves of data collection (mean ages 16, 17, 18, and 24).
Results: The number of features of BED at wave 4 (age 24) was significantly associated with BMI from age 16 years onwards. Those reporting more features of BED had gained more weight throughout adolescence and into their twenties.
Conclusions: Features of BED in young adulthood were preceded by steeper BMI trajectories in adolescence. A higher number of features were consistently associated with higher BMI and more weight gain.

1. Introduction

Binge eating disorder (BED) is an eating disorder characterized by recurrent binge eating episodes that are not associated with inappropriate compensatory behaviors (such as purging). The binge eating causes psychological distress and is often associated with strong feelings of embarrassment, depression, and guilt (American Psychiatric Association, 2013). With a population prevalence of < 1%–3.5% (Hudson, Hiripi, Pope Jr., & Kessler, 2007; Kessler et al., 2013; Mustelin, Raevuori, Hoek, Kaprio, & Keski-Rahkonen, 2015; Preti et al., 2009; Smink, van Hoeken, Oldehinkel, & Hoek, 2014) BED represents the tip of the iceberg of disinhibited eating, i.e. eating behaviors that involve a lack of restraint over food intake. The excess calories consumed during binge eating episodes are likely to lead to weight gain and BED is indeed most common among individuals with obesity (de Zwaan, 2001). Clinical BED is often also preceded by weight gain (Mustelin et al., 2015), indicating a bidirectional association between binge eating and weight gain. While clinical BED is relatively rare, features of BED, such as overeating, loss of control eating, emotional eating, and feelings of shame and guilt related to eating, are widespread and often longstanding problems in the population (Ackard, Neumark-

Sztainer, Story, & Perry, 2003; Goldschmidt, Wall, Loth, Bucchianeri, & Neumark-Sztainer, 2014; Mustelin, Bulik, Kaprio, & Keski-Rahkonen, 2017; Neumark-Sztainer, Wall, Larson, Eisenberg, & Loth, 2011; Solmi, Hatch, Hotopf, Treasure, & Micali, 2014). Yet, such features are often overlooked because their clinical significance remains unclear.

A number of studies have examined binge eating and loss of control eating among children and adolescents. In prospective studies, these behavioral features of BED have been found to be associated with weight development and predict excess weight gain both among children at increased risk for obesity and in a community-based cohort of adolescents (Sonneville et al., 2013; Tanofsky-Kraff et al., 2006; Tanofsky-Kraff et al., 2009). To date, no large-scale community-based studies have examined the relationship between weight development in adolescence and features of BED in early adulthood. Further, previous research has mainly focused on binge eating or loss of control eating as individual behaviors. Therefore, little is known about how the number of BED features in young adults relates to their weight development in adolescence.

We have previously reported in a sample of Finnish twins that more than half of young adults report at least one feature of BED (prevalence of the individual features ranged from 7.4% to 44.7% among women

Table 1

BMI and proportion of participants with overweight and obesity at age 16 according to total number of BED features at age 24.

	N (%)	Mean BMI	95% confidence interval	Linear regression	Overweight or obesity (%)	Obesity (%)
Women (N = 2550[a])						
0	835 (33)	19.8	19.6, 19.9		3.1	0.4
1	672 (26)	20.0	19.8, 20.2		2.0	0.4
2	445 (17)	20.4	20.2, 20.7		3.6	0.7
3	266 (10)	20.9	20.5, 21.2		5.6	0.8
4	150 (5.9)	20.9	20.4, 21.3		6.0	0.7
5	90 (3.5)	21.2	20.6, 21.8		11	0.0
6–7	92 (3.6)	21.9	21.3, 22.6		15	4.3
				$\beta = 0.33, p < 0.001$		
Men (N = 2105[a])						
0	920 (44)	20.3	20.1, 20.4		3.2	0.3
1	847 (40)	20.4	20.2, 20.5		3.4	0.2
2	214 (10)	20.7	20.3, 21.0		5.1	0.5
3	73 (3.5)	20.8	20.2, 21.3		5.5	0.0
4	28 (1.3)	20.7	20.1, 21.3		0.0	0.0
5	17 (0.81)	21.8	20.6, 23.0		12	0.0
6–7	6 (0.29)	21.7	17.6, 25.9		33	0.0
				$\beta = 0.19, p = 0.002$		

[a] Number of participants with data available both for features of BED at age 24 and BMI at age 16. Abbreviations: BMI, body mass index; BED, binge eating disorder.

and from 2.5% to 48.9% among men) and that these features of BED are associated with BMI both cross-sectionally and prospectively in adults (Mustelin et al., 2017). In adults, the individual features had modest effects, whereas the number of features was a strong determinant of BMI. In the present study our aim was to explore whether these features, as measured in early adulthood, were associated with weight development already in adolescence. We studied both behavioral features, such as binge eating and eating in secrecy, and cognitive and emotional features, such as thinking about binge eating and feeling guilty after overeating. Specifically, we compared BMI trajectories from adolescence to early adulthood between participants reporting different numbers of features of BED as young adults. We hypothesized that those reporting more features of BED as young adults would experience excess weight gain already in adolescence.

2. Participants and methods

2.1. FinnTwin16 birth cohorts

This nationwide longitudinal cohort study of health behaviors in twins and their families identified twin births in 1975–79 from the central population register of Finland (Kaprio, Pulkkinen, & Rose, 2002). Data collection and analysis were approved by the ethics committee of the Department of Public Health of University of Helsinki and the IRB of Indiana University.

The twins and their parents were sent baseline self-report questionnaires when the twins were 16 y (wave 1). Follow-up questionnaires were mailed to the twins when they were 17 y (wave 2), 18 y (wave 3), and 22–27 y (mean 24 y, wave 4). The cohort and waves of data collection have been previously described in detail (Kaprio, 2006; Kaprio, 2013). The analyses in the present study were restricted to individuals who participated in wave 4 (2825 women and 2423 men), when features of BED were assessed. Of them 94% had at least one valid measure of BMI in adolescence. We found no evidence of selective attrition in respect to BMI between Waves 1 and 4 (full attrition analysis available from the authors).

2.2. Assessment of BMI and features of BED

We calculated BMI from self-reported height and weight at each wave: age 16 through 24 y. Self-reported BMI correlated closely with measured BMI in a subsample of this cohort (Mustelin, Silventoinen, Pietilainen, Rissanen, & Kaprio, 2009). The wave 4 questionnaire included three subscales of the Eating Disorder Inventory-2 (EDI): Bulimia, Drive for Thinness, and Body Dissatisfaction. From the questionnaire, we elicited seven items similar to the defining features of BED: six items from the Bulimia subscale: 'I eat when I'm upset', 'I stuff myself with food', 'I have gone on eating binges where I have felt that I could not stop', 'I think about bingeing (overeating)', 'I eat moderately in front of others and stuff myself when they're gone', 'I eat or drink in secrecy' and one item from the Drive for Thinness subscale: 'I feel extremely guilty after overeating'. How each feature relates to the diagnostic criteria for BED is described in the Online Supplement.

Participants were defined as positive for each item if they reported it sometimes, often, usually, or always, and negative if their answer was 'rarely' or 'never'. Finally, participants were grouped according to how many features they reported. The resulting sum score had seven categories ranging from 'no features' to 'six or seven features' (Mustelin et al., 2017).

2.3. Statistical analyses

We used a multilevel growth curve modeling approach to estimate how the number of BED features at age 24 (independent variable) was associated with BMI trajectories (dependent variable) over all four waves: age 16 (wave 1) through 24 years (wave 4). Specifically, we used mixed-effects linear regression fit by maximum likelihood estimation, with random intercepts and an unstructured covariance structure. The data were treated as irregularly spaced, accounting for the participants' actual age at each wave. The model included interaction of the number of BED features with age, allowing us to assess whether the trajectories differed in steepness. To account for correlation within twin pairs, we used robust variance estimation for clustered data Williams (2000). Very few participants (< 1%–3%), were missing data for the used variables; we therefore performed a complete-case analysis (Langkamp, Lehman, & Lemeshow, 2010). We conducted all analyses separately for women and men using Stata 13.1.

3. Results

3.1. BMI at age 16

BMI and proportion of participants with overweight or obesity at age 16 according to total number of BED features at age 24 is shown in Table 1. The number of features of BED reported at age 24 was significantly associated with BMI at baseline (age 16) in both sexes. The