

Binge Eating, Mood, and Quality of Life in Youth With Type 2 Diabetes

Baseline data from the TODAY study

THE TODAY STUDY GROUP*

OBJECTIVE—The current study examines the prevalence of binge eating and its association with adiposity and psychosocial functioning in a large, diverse sample of youth with type 2 diabetes.

RESEARCH DESIGN AND METHODS—In the TODAY study, 678 (mean age 14.0 years; 64.9% girls) of the 704 youth randomized to the study completed a self-report measure of eating disorder symptoms and were categorized as nonovereaters, overeaters, subclinical binge eaters, or clinical binge eaters.

RESULTS—Youth with clinical (6%) and subclinical (20%) levels of binge eating had significantly higher levels and rates of extreme obesity, global eating disorder and depressive symptoms, and impaired quality of life.

CONCLUSIONS—These findings highlight the importance of evaluating youth with type 2 diabetes for the presence of binge eating. Future research is needed to determine the cumulative effects of disordered eating, obesity, and psychosocial distress on adherence to lifestyle change recommendations and longitudinal response to treatment.

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Binge eating and other eating disturbances occur more commonly in girls with type 1 diabetes than girls without diabetes (1–3). However, disturbed eating behaviors, such as binge eating, have not been well studied in youth with type 2 diabetes, despite risk due to age and weight status (4,5). This report summarizes binge eating and related psychosocial disturbances in a large sample of youth with type 2 diabetes in TODAY (Treatment Options for type 2 Diabetes in Adolescents and Youth).

RESEARCH DESIGN AND METHODS

TODAY is a multicenter randomized clinical trial funded by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) of the National Institutes of Health (NIH). The collaborative study includes 15 clinical

centers and a data coordinating center (see Supplementary Data). The study design and objectives have been described elsewhere (6). The protocol was approved by an External Evaluation Committee convened by the NIDDK and by Institutional Review Boards at each participating institution. All participants provided informed consent, and minor children confirmed assent according to local guidelines. Enrollment began May 2004 and ended February 2009 with a total of 704 participants. Eligibility requirements included 10–17 years of age, type 2 diabetes <2 years' duration, BMI \geq 85th percentile at diagnosis, and an adult caregiver willing to support study participation. All participants completed a run-in period to discontinue nonstudy diabetes treatments, achieve hemoglobin A_{1c} (HbA_{1c}) <8% on metformin only, and demonstrate adherence to the study protocol.

Demographic variables included age, sex, self-report race/ethnicity, and highest household educational level as a proxy for socioeconomic status. Baseline body composition measures included height, weight, waist circumference, and abdominal height. BMI percentile, BMI z score, and percent overweight were calculated. Other physical health measures included HbA_{1c}, blood lipids, and blood pressure.

Of 704 randomized youth, 678 completed the baseline Youth Eating Disorder Examination Questionnaire (YEDEQ), a self-report measure of eating disorder symptoms (7). Responses to “How many times [over the past 28 days] have you eaten what other people would think was a really big amount of food, given the situation?” (objective overeating episodes) and “On how many of these times did you feel like you had lost control while eating?” were used to derive eating categories. Positive responses to both questions were used to establish binge eating, i.e., reporting episodes of objective overeating with an associated loss of control. Nonovereaters reported zero for objective overeating episodes and loss of control questions; overeaters, \geq 1 objective overeating episodes, but zero loss of control episodes; subclinical binge eaters, \geq 1–<4 binge eating episodes; and clinical binge eaters, \geq 4 binge eating episodes. Responses to each of the four YEDEQ subscales (restraint, eating, weight, and shape concerns) were totaled and averaged to provide a global subscale score, a measure of overall distress related to eating, weight, and shape concerns.

Mood was evaluated by self-report questionnaires, the Beck Depression Inventory (BDI) (8), or the Child Depression Inventory (CDI) (9), depending upon participant age. The presence of clinically significant mood impairment was indicated by a BDI score \geq 14 and CDI \geq 13. Quality of life (QOL) was measured by total score on the Pediatric Quality of Life Inventory (PedsQL) (10). Clinically significant impairment in QOL was defined as a total score at least 1 SD below the mean score for the sample.

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Table 1—Comparisons by eater category

	Nonovereater	Overeater	BE		P value
			Subclinical BE	Clinical BE*	
N	337	164	135	42	
Mean (SD)					
BMI percentile	97.5 (3.2)	97.5 (4.2)	97.9 (2.9)	98.6 (2.1)	0.1583
BMI z score	2.17 (0.46) ^a	2.24 (0.50) ^b	2.26 (0.45)	2.40 (0.42) ^{a,b}	0.0077
% Overweight†	73.4 (35.8) ^{a,b}	80.6 (37.9) ^c	82.4 (37.9) ^a	94.2 (36.4) ^{b,c}	0.0012
Waist circumference (cm)	106.0 (16.5) ^{a,b,c}	109.9 (18.0) ^a	109.9 (19.2) ^b	112.8 (22.4) ^c	0.0171
Abdominal height (cm)††	23.9 (3.7) ^a	24.4 (4.0)	24.5 (3.7)	25.5 (3.4) ^a	0.0403
Global YEDEQ	1.1 (0.9) ^{a,b}	1.2 (0.9) ^{c,d}	1.8 (1.0) ^{a,c,e}	2.3 (1.0) ^{b,d,e}	<0.0001
BDI‡	5.1 (7.4) ^{a,b}	5.8 (6.0) ^c	8.4 (7.5) ^{a,d}	14.5 (12.9) ^{b,c,d}	0.0031
CDI‡	5.6 (5.2) ^{a,b,c}	7.5 (6.0) ^{a,d}	8.4 (7.1) ^{b,e}	11.1 (8.7) ^{c,d,e}	<0.0001
PEDSQL	82.5 (11.7) ^{a,b,c}	79.4 (11.3) ^{a,d}	78.2 (11.5) ^{b,e}	70.5 (12.9) ^{c,d,e}	0.0033
Percent					
Sex (% girls)	65.3	62.2	67.4	69.0	0.7488
BMI percentile ≥99	37.7 ^{a,b,c}	51.2 ^a	48.1 ^{b,d}	66.7 ^{c,d}	0.0004
Global YEDEQ ≥4.0	0.6 ^{a,b}	0.6 ^c	3.7 ^a	9.5 ^{b,c}	<0.0001
BDI ≥14 or CDI ≥13	10.1 ^{a,b}	16.3 ^c	20.3 ^a	30.0 ^{b,c}	<0.0001
PEDSQL <68.2§	11.6 ^{a,b}	17.2 ^c	19.1 ^{a,d}	41.5 ^{b,c,d}	<0.0001

Comparisons across eater categories were made by ANOVA for continuous variables and χ^2 test for categorical variables, followed by unadjusted pairwise comparisons to explore overall significance. BE, binge eater. *Although the definition of clinical binge eater used in this article is consistent with proposed definitions of binge eating disorder in the *Diagnostic and Statistical Manual of Mental Disorders, fifth edition* (DSM-V), published by the American Psychiatric Association, the current study focuses on a shorter time period for diagnosis than DSM-V (1 vs. 3 months). †Percentage above age- and sex-specific median BMI. ††Also referred to as sagittal abdominal diameter (SAD); measured laterally using a Holtain Kahn Abdominal Caliper with the patient supine. ‡BDI administered to youth age 16 years or older ($N = 84$ for nonovereaters; $N = 44$ for overeaters; $N = 31$ for subclinical binge eaters; $N = 8$ for clinical binge eaters); CDI to youth younger than 16 years ($N = 244$ for normal eaters; $N = 117$ for overeaters; $N = 102$ for subclinical binge eaters; $N = 32$ for clinical binge eaters). §Cutoff used is 1 SD below the sample mean. ^{a,b,c,d,e}Pairs of values in a row with the same letters are significantly different from each other ($P < 0.05$).

RESULTS—The mean age of the sample was 14.0 years (41.7% Hispanic, 32.0% black non-Hispanic, 20.1% white non-Hispanic, 6.2% American Indian), and 64.9% were girls. Of the households, 16.9% had a primary caregiver with a bachelor's degree or higher educational level, whereas more than half reported completing high school or less. The mean HbA_{1c} for the sample at baseline was 6.0 (SD = 0.7).

Fifty percent of the participants were classified as nonovereaters, 24% as overeaters, 20% as subclinical binge eaters, and 6% as clinical binge eaters. There were no significant differences among eater categories on sex, age, race/ethnicity, household education, or on physical health indexes such as HbA_{1c}, blood lipids, or blood pressure. However, participants classified as clinical binge eaters differed significantly from nonovereaters and overeaters in terms of levels and rates of obesity, as measured by BMI z scores and percent overweight, and from nonovereaters on waist circumference and abdominal height. Participants categorized as clinical binge eaters had significantly greater global eating and weight and shape concerns than nonovereaters or overeaters. Clinical binge eaters had more depressive

symptoms than participants in any of the other eater categories. Subclinical and clinical binge eaters had lower QOL than nonovereaters (see Table 1).

CONCLUSIONS—The current study found that 26% of the youth with type 2 diabetes in this large, diverse sample reported binge eating, with significant relationships between binge eating patterns, higher levels of obesity, psychosocial distress, and poorer QOL. The presence of binge eating in youth with type 2 diabetes is particularly troubling given the association of binge eating with accelerated weight gain in those who are already overweight (11). The significant differences in waist circumference and abdominal height between youth with clinical levels of binge eating compared with those without binge-eating patterns are cause for further concern. Waist circumference has been shown to be an independent risk factor for cardiovascular problems such as high blood pressure, and visceral fat deposits have been linked to heightened insulin resistance (12).

Because binge eating has been identified as a moderator and predictor of reduced treatment outcome in weight loss studies (13), the results of this article

have implications for youth with type 2 diabetes whose treatment prescription includes disease management through changes in eating habits and physical activity. Furthermore, evidence from the type 1 diabetes literature suggests that the effects of disordered eating on clinical outcomes are cumulative (14). The results reported here highlight the importance of early assessment for disturbed eating, weight and shape concerns, and mood problems, so that appropriate referral and/or specialized treatment can be initiated (15). Future research is required to assess the impact of binge eating and its associated features upon response to treatment and weight reduction for youth with type 2 diabetes.

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