

5-Year Prevalence and Persistence of Disturbed Eating Behavior and Eating Disorders in  
Girls with Type 1 Diabetes

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**Running Title:** Eating Disorders in Girls with Type 1 Diabetes

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Disturbed eating behavior (DEB), which includes subthreshold and full-syndrome eating disorders (ED) as well as milder eating disturbances, is more common in girls and women with type 1 diabetes than in their non-diabetic peers (1,2). DEB is associated with poorer metabolic control (1,3), and increased hospitalizations and diabetes-related medical complications (4-7). At baseline of the present study, there were higher rates of DEB in girls with type 1 diabetes 9-13 years of age than in a non-diabetic control group (8% versus 1%; 8), and baseline DEB persisted in half of individuals one year later (9). The current paper summarizes data from baseline to 5-year follow-up.

## **RESEARCH DESIGN AND METHODS**

See Colton et al. (8) for a description of methodology. Participants were classified as normal weight, overweight or obese using the International Obesity Task Force cutoffs for children and adolescents (10), which extrapolate BMI values of 25 and 30 into the pediatric age range. Rates DEB and ED were organized by age in years at the time of each assessment (Table 1). Point prevalence was calculated as all 'cases' of DEB in participants of a particular age / total number assessed at that age. Similar calculations were carried out for point prevalence of ED. Cumulative prevalence includes current and/or past DEB or ED.

## **RESULTS**

126 girls participated at baseline (71.2% participation), 106 at 1 year (84.1%), 88 at 2 years (83.0%), 76 at 3 years (86.4%), and 98 at 5 years (77.8%). Girls who dropped out at 5 years were not more likely to have DEB at baseline than were those who stayed in the study ( $\chi^2 = 0.18$ ,

$df = 1$ ;  $p = 0.9$ ). Mean age was  $11.8 \pm 1.5$  years at baseline, and  $16.5 \pm 1.6$  at 5 years. Mean BMI was  $20.1 \pm 3.2 \text{ kg/m}^2$  at baseline, and  $24.8 \pm 4.2$  at 5 years. Mean A1c was  $8.3 \pm 1.1\%$  at baseline, and  $8.5 \pm 1.1\%$  at 5 years. At 5 years, 55.1% (54/98) of girls were classified as normal weight, 34.7% (34/98) as overweight and 10.2% (10/98) as obese (17).

At 5 years, 49.0% (48/98) of participants reported current DEB; 43.9% (43/98) active dietary restraint, 6.1% (6/98) binge-eating episodes, 3.1% (3/98) self-induced vomiting, 3.1% (3/98) insulin omission, and 25.5% (25/98) intense, excessive exercise for weight control. Thirteen participants (13.3%) met criteria for an ED; 3 girls had bulimia nervosa, 3 had eating disorder not otherwise specified, and 7 had a subthreshold ED. A1c was not higher in girls with disturbed EB (8.7% versus 8.4%;  $t = 1.60$ ,  $df = 91$ ;  $p = 0.11$ ), though there was a trend for higher A1c in those with an ED (9.1% versus 8.5%;  $t = -1.75$ ,  $df = 91$ ;  $p = 0.08$ ). BMI was higher in those with DEB ( $26.1$  versus  $23.5 \text{ kg/m}^2$ ;  $t = -3.28$ ,  $df = 96$ ;  $p = 0.001$ ).

64/126 baseline participants (50.8%) reported DEB at one or more assessments. At least two assessments are available for 116 of the 126 at baseline (92.1%). Of these 116 girls, 26 (22.4%) had early DEB at baseline and/or at 1-year follow-up, and 90 (77.6%) did not. 24/26 girls (92.3%) with early DEB also reported DEB at later stages of the study. Of the 90 girls with no early DEB, 35 (38.9%) had DEB at a later assessment, and 55 girls (61.1%) had no DEB detected at any time. DEB was highly persistent over time ( $\chi^2 = 23.0$ ;  $df = 1$ ;  $p < 0.001$ ).

## **CONCLUSIONS**

Using a validated diagnostic interview, half of girls reported DEB at some point during this longitudinal study, and early DEB almost universally persisted. The expected relationship between DEB and poorer metabolic control was not evident at 5 years, though there was a trend for higher A1c in individuals with an ED. This offers hope that early intervention might prevent the worsening metabolic control that is often associated with DEB. Low rates of binge-eating and deliberate insulin omission may account for this weaker-than-expected association.

Higher BMI and DEB were strongly associated. Higher BMI is associated with dieting in the general population (11,12), and girls and women with type 1 diabetes are, on average, heavier than their peers (13). Although this study did not include a general population comparison group, 44.9% of participants were overweight or obese at Time 5, approximately twice the rate in the Canadian Community Health Survey (14). This is likely one pathway for increased risk of DEB in individuals with type 1 diabetes.

The relationship between higher weight and DEB presents a management dilemma for clinicians, since both dietary restraint and higher weight are clear risk factors for the development of ED and their negative health consequences. Efforts focused on maintaining weight below the overweight range may increase food and weight preoccupation in vulnerable individuals, and may lead paradoxically to reactive overeating and binge-eating. On the other hand, inattention to body weight may fail to reduce the risk that is associated with an elevated BMI in this population. Screening should start early and occur annually. Clinical approaches should focus on normalizing eating behavior and enhancing self esteem based on personal attributes unrelated to weight and eating, with a low threshold for referral for specialized eating disorder services.

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**Table 1.**  
**Point Prevalence and Cumulative Prevalence of Disturbed Eating Behavior (DEB)**  
**and Subthreshold/Full Syndrome Eating Disorders (ED) by Age**

Age (years)	DEB Point Prevalence	DEB Cumulative Prevalence	ED Point Prevalence	ED Cumulative Prevalence
9	1/19 (5.3%)	1/19 (5.3%)	0/19 (0%)	0/19 (0%)
10	5/36 (13.9%)	5/36 (13.9%)	1/36 (2.8%)	1/36 (2.8%)
11	6/54 (11.1%)	7/54 (13.0%)	2/54 (3.7%)	3/54 (5.6%)
12	8/73 (11.0%)	10/73 (13.7%)	2/73 (2.7%)	4/73 (5.5%)
13	23/75 (30.7%)	26/75 (34.7%)	8/75 (10.7%)	11/75 (14.7%)
14	17/75 (22.7%)	30/75 (40.0%)	1/75 (1.3%)	9/75 (12.0%)
15	17/57 (29.8%)	23/57 (40.4%)	5/57 (8.8%)	8/57 (14.0%)
16	15/47 (31.9%)	24/47 (51.1%)	2/47 (4.3%)	8/47 (17.0%)
17	10/25 (40.0%)	13/25 (52.0%)	3/25 (12.0%)	4/25 (16.0%)
18	12/19 (63.2%)	14/19 (73.7%)	1/19 (5.3%)	2/19 (10.5%)
19	7/12 (58.3%)	8/12 (66.7%)	4/12 (33.3%)	6/12 (50.0%)