

Eating disorders in patients with Type 1 diabetes: A meta-analysis

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ABSTRACT. A meta-analysis of controlled studies on prevalence of eating disorders in Type 1 diabetes was performed in order to assess differences between diabetic and non-diabetic female subjects. All controlled studies using the *Diagnostic and Statistical Manual of Mental Disorders Third Edition Revised (DSM III-R)* or the *DSM Fourth Edition (DSM IV)* criteria for interview-based diagnosis were included in the analysis. The total sample was composed of 748 and 1587 female subjects with and without dia-

betes, respectively. The prevalence of anorexia nervosa (AN) in Type 1 diabetic subjects was not significantly different from that of controls (0.27 vs 0.06%), while that of bulimia nervosa and of the two conditions combined was significantly higher in diabetic patients (1.73 vs 0.69%, and 2.00 vs 0.75%, respectively; both $p < 0.05$). Type 1 diabetes is associated with a higher prevalence of bulimia nervosa in females.

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INTRODUCTION

A high prevalence of eating disorders has been reported in patients with Type 1 diabetes, suggesting a possible association of the two conditions (1, 2). However, more recent studies, using the *Diagnostic and Statistical Manual of Mental Disorders Third Edition Revised (DSM III-R)* (3) or the *DSM Fourth Edition (DSM IV)* (4) criteria, rather than the older and less stringent *DSM III* (5) criteria, provided remarkably lower estimates of prevalence (6). Furthermore, when formal diagnoses of eating disorders were assessed with interviews, rather than through self-reported questionnaires (6), no difference in the prevalence of anorexia nervosa (AN) or bulimia nervosa (BN) was ever reported between Type 1 diabetic patients and control subjects, although most of the studies showed a trend toward a higher prevalence in diabetic patients (6-10). It should be observed that AN and BN have a relatively low prevalence in the general population; for this reason, the detection of small differences in prevalence between diabetic and non-diabetic

individuals would require studies on very large samples (6), which are virtually unfeasible. A meta-analysis of controlled studies with adequate methodology could therefore add relevant information.

MATERIALS AND METHODS

An extensive search of MEDLINE was made for all articles concerning Type 1 (or insulin-dependent) diabetes mellitus and eating behavior and/or eating disorders (and/or AN, BN, binge eating) published between 1987 and 2003. References in those articles were manually searched for other relevant papers. No attempt was made to identify unpublished studies or presentations at Congresses. Case-controlled studies, comparing patients with Type 1 diabetes mellitus with matched non-diabetic control subjects, assessing the prevalence of AN and BN according to *DSM-III-R* (4) or *DSM IV* (5) criteria, using structured or non-structured clinical interviews, were included in the analysis. Only data on female subjects were considered, as the prevalence of eating disorders among males is extremely low (11). The results of different studies were combined; mean and SD of age and body mass index (BMI) were calculated (12) in diabetic patients and non-diabetic control subjects, and compared using Student's unpaired *t*-tests. Only diagnoses of AN and BN were considered; the "eating disorders not otherwise specified" category was excluded from the analysis because of its uncertain definition, while "binge eating disorder" was excluded because the diagnostic criteria were clarified only in 1994 (5), and therefore this category was not considered in most studies. Differences in current prevalence of eating disorders were assessed using the chi-square test. The variance in the prevalence of eating disorders in Type 1 diabetic patients and control subjects was calculated, as well as the sampling error variance, in order to exclude statistical artifacts (13).

Key-words: Type 1 diabetes, anorexia nervosa, bulimia nervosa, eating behavior, meta-analysis.

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RESULTS

Eight studies were included in the analysis (6-10, 14-16); only two studies included samples of male diabetic patients and control subjects (7, 10). The total number of diabetic patients was 847 (99 males, 748 females), while control non-diabetic subjects were 1745 (158 males, 1587 females). Male subjects were excluded from the analysis, because of insufficient sample size. Among females, no differences between diabetic patients and control subjects were observed for age (16.4 ± 1.8 vs 15.8 ± 1.8 yr) and BMI (20.3 ± 3.4 vs 20.9 ± 3.2 kg/m²).

Current diagnoses reported in females by each study are summarized in Table 1. Mean prevalence of AN in diabetic females and control subjects was 0.27 and 0.06%, respectively, with an observed variance of 0.04 and 0.004, and an observed sampling error variance of 0.04, and 0.004, respectively. Prevalence of BN in diabetic and non-diabetic females was 1.73 and 0.69%, respectively, with observed variance of 0.30 and 0.06, and observed sampling error variance of 0.21 and 0.04, respectively. For the two conditions combined, the observed prevalence was 2.00 and 0.75%, with observed variance of 0.35 and 0.08, and sampling error variance of 0.25 and 0.05, in diabetic patients and control female subjects, respectively. The combined prevalence of AN and BN was significantly higher in Type 1 diabetic patients than in control subjects ($\chi^2=5.89$, $p<0.02$). The prevalence of AN was not significantly different in females with or without diabetes, while the prevalence of BN was significantly higher in diabetic patients ($\chi^2=4.48$, $p<0.05$).

DISCUSSION

The present analysis shows that the prevalence of BN is increased in adolescent and adult female patients

with Type 1 diabetes. Such a difference could not be detected by individual studies because of insufficient sample size. A similarly higher prevalence in Type 1 diabetic patients was reported by one study for the ill-defined category of eating disorder not otherwise specified (16).

It has been suggested that dietary prescription could facilitate the onset of eating disturbances in Type 1 diabetic women. In fact, several studies have shown an increased restraint over eating in diabetic patients (6, 7), although the validity of the psychometric measures of restraint in patients with diabetes has been questioned (14). It has also been proposed that fluctuations in body weight immediately preceding and following the diagnosis of Type 1 diabetes could focus the attention of susceptible individuals on body shape and weight, precipitating abnormalities of eating behavior (17). Furthermore, mood depression associated with diabetes (18) could also facilitate the onset of binge eating (19).

Some limitation of the present study should be recognized. First of all, only data concerning females were considered; although the prevalence of AN and BN among males in the general population is extremely low, further data are needed for male patients with Type 1 diabetes. More importantly, binge eating disorder and eating disorders not otherwise specified, which could have a higher prevalence than AN and BN, were not considered in the present meta-analysis, because of the inconsistency of diagnostic criteria throughout different studies. Although Type 1 diabetes is likely to be associated with a higher prevalence of eating disorders not otherwise specified in a similar manner as AN and BN, as described in one study (16), further investigations are needed to clarify this point.

Table 1 - Prevalence of eating disorders in female diabetic patients and control subjects in individual studies.

Individual studies (ref.)	Diabetic patients			Control subjects		
	no.	A no.	B no.	no.	A no.	B no.
Robertson et al., 1990 (14)	56	1 (1.8)	1 (1.8)	60	0 (0.0)	1 (1.7)
Fairburn et al., 1991 (6)	54	0 (0.0)	3 (5.5)	67	0 (0.0)	2 (3.0)
Peveler et al., 1992 (7)	33	0 (0.0)	0 (0.0)	33	0 (0.0)	0 (0.0)
Striegel-Moore et al., 1992 (8)	46	0 (0.0)	0 (0.0)	46	0 (0.0)	0 (0.0)
Mannucci et al., 1995 (10)	62	1 (1.6)	1 (1.6)	148	1 (0.6)	3 (2.0)
Vila et al., 1995 (9)	52	0 (0.0)	3 (5.8)	46	0 (0.0)	0 (0.0)
Engstrom et al., 1999 (15)	89	0 (0.0)	0 (0.0)	89	0 (0.0)	0 (0.0)
Jones et al., 2000 (16)	356	0 (0.0)	5 (1.4)	1098	0 (0.0)	5 (0.4)

No.: total number of subjects enrolled; A no.: number of subjects with anorexia nervosa (AN); B no.: number of subjects with bulimia nervosa (BN). Data are expressed as absolute number (% of no.).

Several studies have shown that eating disorders are associated with impaired metabolic control in patients with Type 1 diabetes (9, 10, 14, 15). For this reason, although underlying pathogenetic relationships remain unclear, the association of Type 1 diabetes and eating disorders suggests the clinical usefulness of an accurate screening for eating disturbances in all patients with inadequate metabolic control.

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