Eating Disorders and Eating Problems Among Adolescents With Type 1 Diabetes: Exploring Relationships With Temperament and Character

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Objective  To determine temperament and character among adolescents with type 1 diabetes with and without disordered eating.  Method  A clinical sample of 199 adolescents from multiple centers with a mean age of 14.1 (SD, 2.5) years were screened and diagnosed for eating disorders. Assessed were temperament and character as conceptualized by Cloninger, glycemic control, and depression.  Results  Adolescent patients with clinical eating disorders or subthreshold eating problems had significantly higher mean scores in harm avoidance and lower mean scores in self-directedness. Harm avoidance remained significant even after controlling for depressive pathology.  Discussion  This study is the first to show evidence that among youths (in particular, girls) with type 1 diabetes, there is an association between low self-directedness, high harm avoidance, and the presence of eating, weight, and shape pathology. For these particular youths, important implications for clinical practice are outlined.

Key words  eating disorders; type 1 diabetes; temperament; character; adolescence.

Eating disorders like anorexia nervosa (AN) and bulimia nervosa (BN), as well as their partial syndromes (eating disorders not otherwise specified [ED-NOS]), are relatively common among young women in Western cultures and constitute the third most prevalent chronic health condition among adolescent females (Rosen, 2003). About 0.2–0.7% and 1.0–2.5% of adolescent and young adult women suffer from AN and BN, respectively (de Groot & Rodin, 1994; Karwautz & Treasure, 2000). In this context, overweight adolescents predominantly seem to be vulnerable, since a higher prevalence of unhealthy weight control behaviors could be evidenced in this group (Bouette, Neumark-Sztainer, Story, & Resnick, 2002). Adolescent girls and young women with type 1 diabetes have an increased risk for eating disorders as well as for milder, subthreshold eating problems (Affenito, 2001; Grylli, Karwautz, Hafferl-Gattermayer, & Schober, 2003; Nielsen, 2002; Striegel-Moore, Nicholson, & Tamborlane, 1992). Thus, diabetes in combination with an eating disorder places these young girls in a particularly difficult situation: First, having type 1 diabetes involves the necessary adaptation to a lifestyle that even though liberalized through medical advances still remains far from the “carefree” lifestyle of a person without this chronic disease; second, eating disorders are responsible for a number of disorder-specific disadvantages. As a result of both, patients with type 1 diabetes and an eating disorder are doubly disadvantaged (Ward, Troop, Cachia, Watkins, & Treasure, 1995).

In the largest controlled study of eating disorders in adolescent girls with type 1 diabetes to date (Jones, Lawson, Daneman, Olmsted, & Rodin, 2000), the prevalence of eating disorders meeting criteria of the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV), was 10%, and their subthreshold variants 14%, both being about twice as common in adolescent females. All correspondence should be sent to Andreas Karwautz, Eating Disorders Unit, University Clinic of Neuropsychiatry of Childhood and Adolescence, Medical University of Vienna, Waehringer Guertel 18-20, A-1090, Vienna, Austria. E-mail: Andreas.Karwautz@meduniwien.ac.at.
with type 1 diabetes as in peers without type 1 diabetes. Studies have also pointed to a deterioration of metabolic control in adolescent girls with type 1 diabetes combined with an eating disorder or subthreshold disordered eating behavior (Jones et al., 2000; Rydall, Rodin, Olmsted, Devenyi, & Daneman, 1997), but this topic is still controversial (e.g., Engstrom et al., 1999; Herpertz et al., 1998). Poor metabolic control is of crucial importance because it seems to be relevant during the onset, maintenance, and deterioration of short-term and long-term diabetes-related microvascular and macrovascular complications. Retinopathy, for example, a serious complication related to type 1 diabetes, is increased fivefold in this population (Nielsen, 2002).

Recent developments in the study of general and specific risk factors that favor the manifestation of eating disorders have focused on aspects that are both extrinsic (familial and sociocultural environments, the mother–daughter relationship, or the internalization of the thin ideal as a landmark of beauty in Western cultures) and intrinsic (genetic vulnerability, differential regulation of hormonal release, or function of proteins) (e.g., Fairburn, Cooper, Doll, & Welch, 1999; Karwautz et al., 2001). In this context, personality traits like temperament and character and their putative neurobiological correlates are prominent features in the cascade of predisposing and maintaining risk factors for an eating disorder (Fassino et al., 2002; Karwautz, Rabe-Hesketh, Collier, & Treasure, 2002; Kaye & Strober, 1999; Klump et al., 2000; Woodside et al., 2002).

One dimensional system describing normal personality traits is that developed by Cloninger (Cloninger, Przybeck, Srivakic, & Wetzel, 1994), according to which seven traits are modeled into two groups: (1) temperament, containing the traits of novelty seeking (response to novelty), harm avoidance (response to aversive stimuli), reward dependence (response to reward maintenance), and persistence (perseverance despite frustration); and (2) character, consisting of the traits of self-directedness (self-identification as an autonomous individual), cooperativeness (identification of the self as an integral part of the society), and self-transcendence (sense of a unity with all existing things). The first dimension, temperament, is assumed to be correlated with the activity of dopamine, serotonin, and noradrenalin in the brain, whereas the second, character, is based more on social goals and values. This dimensional approach to personality was used to deepen the knowledge about patients with eating disorders and to put forward neurobiological, therapeutic, and prognostic implications (Bulik, Sullivan, Joyce, Carter, & McIntosh, 1998; Cloninger & Srivakic, 1999; Fassino et al., 2002). In particular, temperamental traits as biologically rooted aspects of personality may aid early identification and early prevention of the development of psychiatric disorders and eating disorders.

Studies have consistently shown that patients with AN are characterized by high harm avoidance, high persistence, low novelty seeking, and low self-directedness (Brewerton, Hand, & Bishop, 1993; Bulik, Sullivan, Weltzin, & Kaye, 1995; Cloninger et al., 1994; Fassino et al., 2002; Karwautz et al., 2002; Karwautz, Troop, Rabe-Hesketh, Collier, & Treasure, 2003; Klump et al., 2000). Data on reward dependence are still controversial. Patients with bulimic behavior are characterized by high novelty seeking (Bulik et al., 1995), high harm avoidance (Mizushima, Ono, & Asai, 1998), high reward dependence (Brewerton et al., 1993), and low self-directedness (Fassino et al., 2002; Klump et al., 2000). The binge-purge cycle of bulimia can be understood as a particular expression of the approach-avoidance conflict of individuals who are high both in novelty seeking (leading to bingeing) and in harm avoidance (leading to purging) (Cloninger, 2002). Assumedly, high harm avoidance and low self-directedness are common basic traits in all patients with eating disorders (Fassino et al., 2002).

The relevance of assessing temperament in populations with diabetes has so far been seen by a few authors only. Three studies addressed this issue in children with type 1 diabetes using different measures of temperament (Garrison, Biggs, & Williams, 1990; Rovet & Ehrlich, 1988; Weissberg-Benchell & Glasgow, 1997). All three studies found that better metabolic control was related to negative mood and to higher behavioral activity levels, although the latter finding remained controversial. Weissberg-Benchell and Glasgow (1997) reported that fewer behavioral problems were associated with lower behavioral activity, greater flexibility, and less child responsibility for the diabetes regimen. Higher persistence and less distractibility were related to enhanced social competence. Despite the fact that these temperamental patterns could be in some apperceptive way analogically matched with Cloninger’s concept of temperament, the comparison with findings in the eating disorders as reported above would not be accurate.

The only study in type 1 and type 2 diabetes using the temperament construct developed by Cloninger observed that the presence of particularly problematic personality patterns (e.g., high harm avoidance and high reward dependence) was associated with poorer glucose regulation in adults (Lustman, Frank, & McGill, 1991).

Because of high clinical relevance of temperament and character traits for understanding the development of
psychiatric disorders in general and eating disorders in particular, we aimed to explore temperament and character traits in adolescents with type 1 diabetes and to use individual differences in temperament and character as statistical predictors of the occurrence of eating disorder symptoms.

**Methods**

**Participants**

Recruitment for this study was part of a larger project involving adolescent girls and boys with type 1 diabetes and their families, assessing psychological, familial, and biological factors affecting their eating behavior (Grylli, Hafferl-Gattermayer, Schober, & Karwautz, 2004). The study protocol was approved by the ethics committee of the Vienna University Hospital, where this research has been conducted. Eligible adolescents were identified from a list of current patients of the outpatient clinic for diabetes care as well as outpatient clinics in other general province hospitals in our country. Potential participants were sent a letter describing the study and/or they were contacted directly during their clinical visits or during their stay at a diabetes camp. Informed written consent was obtained from each participant (and also from a parent, for those less than 16 years of age). In a first step, 251 adolescents were approached for screening purposes, and 199 of them (96 girls and 103 boys) returned complete self-report measures. Thirty-five (17.6%) of these (30 girls, 5 boys) scored above the predetermined cutoff scores and were subsequently administered a semistructured interview in person.

Participants’ average body mass index (BMI) was 20.4 (SD, 3.3). The average duration of diagnosed diabetes was 5.6 years (SD, 3.4). They had been visiting their consultant pediatrician an average of 5.6 (SD, 3.7) times in the preceding year. Their mean glycosylated hemoglobin (HbA1c) blood level was 8.4% (SD, 1.8%).

All participants came from middle socioeconomic backgrounds (Kleining & Moore, 1968). Of the parents, 76.4% were married; 12.1% were separated; and 11.7% were divorced, were raising a child alone, or were living in a partnership without being married. Mothers were employees (60.4%), housewives or unemployed (25.2%), professionals (9.6%), or retired (0.8%). Fathers were employees (68.8%), professionals (16.4%), retired (2.4%), unemployed (0.8%), or students (0.4%).

**Classification of Eating Status**

Eating disorders were diagnosed according to the DSM-IV (American Psychiatric Association, 1994). Subthreshold eating and weight loss behaviors and shape concerns were diagnosed according to criteria based largely on the study conducted by Jones et al. (2000). On the basis of the adolescents’ responses, the patients were categorized into one of three “eating status” groups:

1. **Clinical eating disorders:** This category included patients who met DSM-IV criteria for AN (code 307.1), BN (code 307.51), or ED-NOS (code 307.50). ED-NOS were defined as eating disorders meeting all required criteria for AN or BN but one.

2. **Mild eating and shape problems (subthreshold):** This category included girls and boys who met one of the following criteria: (a) occasional binge eating (a minimum of three episodes), subsyndromal binge eating (i.e., almost all of the proposed research criteria of binge-eating disorder have been met except one), or purging over the past 3 months; (b) repeated chewing and spitting out of food to prevent weight gain (at least once a week over the preceding 3 months or twice a week over the past 4 weeks); (c) regular extreme dietary restraint (<2.1 megajoules [501.9 kcal] a day) or excessive exercising (more than 120 minutes, five times a week) for the purpose of weight loss over the past 4 weeks in absence of binge eating; or (d) problems with body image or eating attitudes, as indicated by a mean score of ≥2 on the weight-concern or shape-concern subscales of the Eating Disorders Examination (see the Measures section). Group 2 differed from ED-NOS patients because participants in this group did not completely fulfill any DSM-IV defined disorder.

3. **No eating problems:** This category included patients who reported no problems in eating attitudes and behaviors, as reflected by the absence of a clinical eating disorder and of subthreshold eating and shape problems.

**Measures**

For screening purposes in the first stage of the study, we used the Eating Attitudes Test–26 (EAT-26) (Garner, Olmsted, Bohr, & Garfinkel, 1982; Meermann & Vandereycken, 1987) and the Eating Disorder Inventory–2 (EDI-2) (Garner, 1991; Rathner & Waldherr, 1997). The EAT-26 is probably the most widely used standardized self-report measure of symptoms and concerns characteristic of an eating disorder (Garfinkel & Newman, 2001). The EAT-26 alone does not yield a
specific diagnosis of an eating disorder. However, studies have shown that it can be an efficient screening instrument as part of a two-stage screening process, in which those who score at or above a cutoff score are interviewed in person. The EDI-2 has three highly relevant subscales: drive for thinness, body dissatisfaction, and bulimia symptoms, which also serve as cutoff measures. For the diagnostic assessment in the second stage of the study, we used the Eating Disorders Examination, version 12.0 D (Fairburn & Cooper, 1993; Hilbert, Tuschen-Caffier, & Ohms, 2000), allowing for diagnosis of eating disorders according to the DSM-IV. This interview is considered to be the gold standard for the assessment of eating disorders and has good reliability and validity.

For assessment of personality traits, we used the Temperament and Character Inventory (TCI) (Cloninger et al., 1994), which has high internal consistency in all composite scales. The instrument has been used in many studies that included eating-disordered participants. Besides the 80-item junior version (Schmeck, Meyenburg, & Poustka, 1995), we used the standard TCI version 9, from 1994, which is suitable for participants aged 15 years and older. In order to make these two versions comparable, we calculated the T scores. These normative calculations were based on scores of 706 healthy non-referred adolescents (Schmeck & Poustka, 2001).

The Children’s Depression Inventory (CDI) (Stiensmeier-Pelster, Schürmann, & Duda, 2000) is a self-report measure that assesses the grade of depression in youths. This inventory comprises 27 items, which are statements not only of the typical symptoms of depressive disorders but also of side effects and consequences. The CDI is a valid and reliable instrument for both clinical and nonclinical samples. A score of ≥20 serves as cutoff for a depressive disorder.

Level of HbA1c is considered to be the gold standard for assessing the quality of metabolic control and represents the mean glucose concentration over the preceding 8 to 12 weeks. The non-diabetic range is 4.5–6.3%. For patients with diabetes, HbA1c below 8% is considered as acceptable metabolic control. High-pressure liquid chromatography (Menarini) was the assaying method used. The HbA1c level given here is the one closest to the study visit.

**Data Analytic Procedure**

Data analysis was conducted using SPSS, version 11.5 (Statistical Package for Social Sciences, 2003). Unpaired t tests were applied for comparisons of girls and boys on all seven scales of temperament and character. Kruskal-Wallis one-way analysis of variance by ranks with post-hoc Mann-Whitney tests was used to calculate differences on demographic, clinical, and temperament/character variables between adolescents in each eating status group. Even though the assumptions of normality for each level of eating status (clinical eating disorder, subthreshold eating problem, no eating problem) were not found to be violated (normal distribution and/or homogeneity of variances), because of the small sample size in the two groups having an eating disorder, F tests would be less robust and the assumption violations would be detected less reliably. Analysis of covariance was used in order to control for the effects of depression on the temperament dimension of harm avoidance. Unpaired t tests with multiple corrections and Bonferroni adjustments were applied in order to compare the standardized temperament and character scores among adolescents with type 1 diabetes and a clinical sample of adolescents with Axis I disorders (mood disorders, anxiety disorders) and one clinical sample of adolescents with Axis II disorders (personality disorders) derived from the literature (Schmeck & Poustka, 2001). Finally, binary logistic regression was used as a data reduction method to identify significant independent predictors of temperament and character for eating disturbances within the entire sample of adolescents with type 1 diabetes. Logistic regression is useful in statistically predicting the presence or absence of a characteristic based on values of a set of predictor variables. All p values reported are two-tailed.

**Results**

In total, 11.5% of the female and 0% of the male adolescents met DSM-IV criteria for eating disorders. Anorexia nervosa was absent in the sample. Patients had ED-NOS or bulimia nervosa. Subthreshold eating problems were present in 13.5% of the females and 1% of the males. Details on clinical presentations are given elsewhere (Grylli et al., 2004).

The three eating status diagnostic groups did not differ in age, duration of illness, number of consultations per year, or metabolic control (by means of HbA1c). However, the patients with clinical or subthreshold eating disorders had a significantly higher BMI than those without eating problems (Table I).

Adolescent boys and girls did not differ on HbA1c and BMI. They differed only on cooperativeness, t(190) = 2.68, p = .008. Although there were no males in the clinical eating disorders group and only one male in the subthreshold group, it was then decided not to omit adolescent boys from further analyses, in order to enable the comparison with the clinical control samples, which were of mixed sex.
Significant differences by eating status were found in two of the seven standardized dimensions of temperament and character: self-directedness and harm avoidance. Girls with type 1 diabetes and a clinical or a subthreshold eating problem scored significantly lower on the dimension of self-directedness and significantly higher on the dimension of harm avoidance (Table II). Harm avoidance remained significant even after controlling for depression ($F_{df=2} = 3.86, p = .02)$. 

**Binary Logistic Regression on Temperament and Character Variables**

Harm avoidance and self-directedness were entered independently and regressed on eating status. Because the clinical and subclinical groups were small, it would have been statistically incorrect to enrich the equations with more variables of interest. Harm avoidance ($\chi^2 = 5.63, \beta = -.07, p = .02, OR = 0.93, 95\% CI = .88–.99$) and self-directedness ($\chi^2 = 7.71, \beta = .08, p = .006, OR = 1.08, 95\% CI = 1.02–1.14$) were significant predictor variables in the adolescents with a clinical eating disorder versus those without an eating disorder. Harm avoidance ($\chi^2 = 9.29, \beta = –.08, p = .002, OR = 0.92, 95\% CI = .88–.97$) and self-directedness ($\chi^2 = 5.75, \beta = -.06, p = .017, OR = 1.06, 95\% CI = 1.01–1.11$) were significant predictor variables in the adolescents with a subthreshold eating problem vs. those without an eating disorder.

**Comparison of Temperament and Character Patterns With Psychiatric Samples**

Comparing our standardized data with standardized psychiatric Axis I and Axis II controls from the literature (Schmeck & Poustka, 2001), significant differences were ascertained between:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Clinical Eating Disorder ($n = 11$), mean (SD)</th>
<th>Subthreshold Eating &amp; Shape Problems ($n = 13$), mean (SD)</th>
<th>No Eating Disorder ($n = 175$), mean (SD)</th>
<th>$\chi^2 (df = 2)$</th>
<th>$p$</th>
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<tr>
<td>Novelty seeking</td>
<td>52.3 (11.7)</td>
<td>51.0 (7.7)</td>
<td>50.6 (9.9)</td>
<td>0.45</td>
<td>NS</td>
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<td>Harm avoidance</td>
<td>53.7 (8.9)</td>
<td>55.5 (12.8)</td>
<td>46.1 (9.4)</td>
<td>12.65$^{ab}$</td>
<td>.002</td>
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<td>Reward dependence</td>
<td>46.5 (12.3)</td>
<td>49.8 (10.8)</td>
<td>51.6 (9.5)</td>
<td>2.43</td>
<td>NS</td>
</tr>
<tr>
<td>Persistence</td>
<td>47.8 (13.0)</td>
<td>54.4 (8.2)</td>
<td>50.0 (10.0)</td>
<td>3.71</td>
<td>NS</td>
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<td>Self-directedness</td>
<td>40.3 (12.0)</td>
<td>43.3 (11.8)</td>
<td>51.5 (11.3)</td>
<td>11.68$^{ab}$</td>
<td>.003</td>
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<td>Cooperativeness</td>
<td>50.1 (12.2)</td>
<td>51.7 (13.0)</td>
<td>51.2 (9.6)</td>
<td>0.54</td>
<td>NS</td>
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<td>Self-transcendence</td>
<td>51.5 (13.4)</td>
<td>53.3 (9.6)</td>
<td>50.2 (10.8)</td>
<td>1.41</td>
<td>NS</td>
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**Table II. Standardized Temperament Score Variations by Eating Status and Two Literature Control Samples**

<table>
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<tr>
<th>Type 1 Diabetes with . . .</th>
<th>Psychiatric Samples (Schmeck et al., 2001)</th>
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<tr>
<td></td>
<td>Axis I Disorders ($n = 208$), $p^*$</td>
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<tr>
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<td>$p^*$</td>
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NS = not significant; $^*p < .001$ (Bonferroni adjustment).

$^a$Clinical eating disorder and no eating disorder differ.

$^b$Subthreshold eating & shape problems and no eating disorder differ.

$^c$No eating disorder and clinical control sample differ.

$^d$No eating disorders and personality disorder control sample differ.

$^e$Subthreshold eating disorder and personality disorder control sample differ.
(1) the sample with Axis I disorders and the adolescents with type 1 diabetes without an eating disorder on the dimension of harm avoidance, $t(381) = 5.83, p = .000$ (in these comparisons, the most conservative Bonferroni $p$ value was selected because the calculations were based on summary data) (see Table II); (2) the sample with Axis II disorders and the adolescents with type 1 diabetes without an eating disorder on the dimensions of harm avoidance, $t(200) = 7.67, p = .000$; reward dependence, $t(200) = 3.74, p = .000$; persistence, $t(200) = 3.04, p = 0.000$; and self-directedness, $t(200) = 7.67, p = .000$; and (3) the sample with Axis II disorders and the adolescents with type 1 diabetes with a subclinical eating disorder on the dimension of persistence, $t(38) = 3.62, p = .000$.

### Discussion

We addressed the question of how personality traits like temperament and character could differentiate adolescents with type 1 diabetes and disordered eating from those without disordered eating. Temperament and character dimensions attracted our interest because some of these traits have consistently been shown to be associated with eating disorders (Cloninger, 2002). Furthermore, this is the first study using the model of temperament and character developed by Cloninger in an adolescent population with type 1 diabetes, evaluating its clinical utility in order to inform the clinician about subpopulations that could be vulnerable to developing eating disorders and eating problems. Despite the fact that personality traits are enduring and heritable, they are valuable in that they shed more light on the intrapsychic and neurophysiologic dynamics underlying psychopathology—in the present case, the psychopathology of eating disorders. In this way diagnostic and therapeutic aspects can be individualized and modulated, achieving an optimal approach to patients and their needs.

We found that girls with type 1 diabetes and with a clinical or subthreshold eating disorder displayed higher harm avoidance and lower self-directedness than the girls with no eating pathology. These differences were corroborated by using regression analyses, showing statistical predictive power of these two dimensions for the clinical and subthreshold levels of eating disturbance, with the possibility of having an eating disorder in the presence of these variables ranging from 88 to 97% for harm avoidance and from 101 to 111% for self-directedness.

Conclusively, the presence of both could amplify eating disorders pathology in female adolescents with type 1 diabetes.

Additionally, we scanned our sample for depressive symptomatology. Many studies have shown that harm avoidance is significantly affected by depressive symptomatology (e.g., Brown, Svrakic, Przybeck, & Cloninger, 1992; Cloninger, Bayon, Svrakic, 1998; Hansenne et al., 1999; Kleifield, Sunday, Hurt, & Halmi, 1994; Richter, Eisemann, & Richter, 2000). After controlling for levels of depression, harm avoidance remained significant for differentiating adolescents with type 1 diabetes as a function of their eating status, although the level of significance was affected by state depression.

The patients in the three eating status diagnostic groups did not show substantial demographic and clinical differences except for BMI, which was higher in the eating disorder groups but still within a normal range. In general, marked elevation in body mass from adolescence to young adulthood in women with type 1 diabetes is a prevalent feature, which is often accompanied by increases in body shape concern, weight concern, and dietary restraint (Bryden et al., 1999). Beyond this, the association between HbA1c and eating status was not statistically significant, though this finding remains controversial (Engström et al., 1999; Jones et al., 2000). HbA1c control was suboptimal in adolescent populations with type 1 diabetes in general (Mortensen & Hougaard, 1997), and in our sample in particular.

Comparing our data with those from the literature on patients with various Axis I and II disorders, adolescents with type 1 diabetes but without an eating disorder had significantly lower harm avoidance than patients with psychiatric disorders. Lower harm avoidance seems therefore to be a protective factor for a psychiatric disturbance. Indeed, there exists a consistent body of studies in adult populations relating high harm avoidance with Axis I disorders (including anxiety, mood, eating, and substance-use disorders) and with personality disorders, which are frequently comorbid with one another (Battaglia, Przybeck, Bellodi, & Cloninger, 1996). In our sample, harm avoidance remained a significant associative factor as a function of the eating status of adolescents with type 1 diabetes, even after controlling for depressive symptomatology, thus supporting the notion of an enduring and heritable aspect of personality (Cloninger et al., 1994). This last finding remains speculative in nature, because clinical depression was not actually evaluated as part of this study.

Adolescents with type 1 diabetes without an eating disorder had higher self-directedness than adolescents
with an Axis I or II disorder, suggesting the possibility that higher self-directedness is a protective factor against psychiatric disturbance, and in particular against an eating disorder.

The present study had some limitations that may lead to further directions. Its cross-sectional nature does not permit conclusions about an etiological relationship between type 1 diabetes, temperament, character (controlling for depressive symptomatology but not clinical depression), and eating-disorder pathology. Longitudinal studies following the developmental transformations due to transactions of these factors could shed more light on the way in which these factors work together. In addition, we had only literature controls available for comparisons between the samples, and therefore the possibility of a statistical bias is high. Finally, future studies with larger samples designed to replicate and extend the findings of the present work are warranted.

The study has some clinical implications. Eating disorders in children and young adolescents with and without a chronic disease are very serious health problems that in most cases go undetected: Some clinicians do not recognize them (Bryant-Waugh, Lask, Shafran, & Fosson, 1992; Karwautz, deZwaan, Weber-Bingol, Weber, & Friedrich, 1997), or consider them as a passing phase, while others try to resolve them with nutritional education only. In order to avoid such significant delay in diagnosis, and despite the limitations of the present study, it is important that clinicians remain alert and thoroughly screen patients with type 1 diabetes for eating disorders (Rosen, 2003), referring also to personality measures. The available data support the need for routine assessment of temperament and character traits in adolescents with type 1 diabetes, with a special focus on adolescent girls.

Clinical studies have shown that all dimensions of the seven-factor model of personality can be measured in early childhood, in children as young as 2 years (Constantino, Cloninger, Clarke, Hashemi, & Przybeck, 2002). This compelling evidence suggests that children and adolescents with type 1 diabetes at risk for the development of an eating disorder might be identifiable early by maladaptive personality traits, like high harm avoidance and low self-directedness. Special interventions for youths with type 1 diabetes such as various psychoeducation programs (like the one developed recently by the Toronto research group; Olmsted, Daneman, Rydall, Lawson, & Rodin, 2002) and other interventions (Grego, Shroff-Pendley, McDonell, & Reeves, 2001; Plante, Lobato, & Engel, 2001) could be subsequently applied. Measures of depression should also be incorporated, since it has been shown that harm avoidance is significantly affected by depression, which is reduced by treatment of eating disorders (Kleifield et al., 1994). Besides clinical and psychological monitoring, in particular during the sensitive period of transition between childhood and adolescence, during which there is a high risk for the development of an eating disorder, personality measures could assist clinical evaluations of adolescents with type 1 diabetes in primary care (Goodwin, Hoven, & Spitzer, 2003).

Acknowledgments

This study was supported by a grant to A.K. from the Jubilaeumfonds of the National Bank of Austria (OENB grant number 9376). We thank the staff that helped us with data collection and all the families for their interest, time, and effort in our project. We also thank Dr. G. Heinze (Department of Clinical Biometrics, Medical University of Vienna) and Ms. K. Goth (Department of Child Psychiatry, University of Frankfurt) for their statistical and methodological advice, and Prof. Dr. Christian Woeber (Department of Neurology, Medical University of Vienna) for helping with the final version of the manuscript.

Received December 13, 2003; revisions received March 1, 2004, May 6, 2004, May 17, 2004, and June 11, 2004; accepted June 12, 2004

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