



# The Association of Eating Attitudes between Metabolic Control and Quality of Life in Patients with Type 1 and Type 2 Diabetes Mellitus

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## Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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## ABSTRACT

**Aims:** The combination of an eating disorder and diabetes mellitus (DM) puts patients at high risk of mortality and morbidity. The purpose of this study was to determine the association of eating attitudes between metabolic control and quality of life in patients with type 1 DM (T1DM) and type 2 DM (T2DM) and with regard to different type of medical treatments.

**Study Design:** A descriptive cross-sectional study.

**Place and Duration of the Study:** Ege University Hospital Endocrine Polyclinic, December, 2013 – April, 2014. Izmir, Turkey.

**Methodology:** One hundred and fifty adults with T1DM (n=52) and T2DM (n=98) were evaluated using general information questionnaire, Eating Attitude Test (EAT-40 Turkish version), SF-36 quality of life questionnaire. Biochemical data were collected from the hospital records retrospectively. Data were analyzed with SPSS version 15.0 programme.

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**Results:** The prevalence of disorders of eating attitudes in patients was found to be 39.3%. Metabolic control and quality of life were not related with eating attitudes in patients with DM. No significant correlation was found between the types of DM in terms of eating attitudes and medical treatments.

**Conclusion:** DM is considered to be a risk factor for the development of eating disorders. In this area further studies are needed to develop diabetes specific eating behavior rating scales.

*Keywords: Diabetes mellitus; eating disorder; metabolic control; quality of life.*

## 1. INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of DM is associated with long-term damage, dysfunction, and failure of various organs [1].

DM care is complicated and it requires multifactorial risk reduction strategies to ensure glycemic control. The main aim of the treatment of DM is to provide metabolic control for prevention of both acute and chronic complications [2]. A healthful eating pattern, regular physical activity, and often pharmacotherapy are key components of DM management [3].

Eating disorders includes a wide spectrum of unhealthy and potentially dangerous attitudes and behaviors, the boundaries of which are often difficult to define with precision. The disorders such as anorexia nervosa (AN), bulimia nervosa (BN), binge eating and night eating syndrome have increased rapidly for the last 25 years in all countries [4].

Individuals, particularly women, experience significant undesirable weight gain with exogenous insulin treatment prescribed at the time of diagnosis, which may promote body dissatisfaction [5]. Individuals with DM constitute risk groups regarding eating disorders because of insulin-dependent weight gain, food restrictions, concerns about body image, and psychological factors. DM is considered as a risk factor for the development of eating disorders. In particular, insulin under-use to control body weight is common. Thus, most studies tend to focus on young women with type 1 DM (T1DM); however, recent studies have included patients with type 2 (T2DM) [6,7].

Individuals with both T1DM and T2DM may intentionally omit prescriptions of insulin for the purpose of weight control, and the current

diagnostic manuals specify that omitting and/or reducing insulin as a potential purging method in criteria for AN and/or BN individuals with T1DM. Individuals with T2D have been reported to intentionally cut down oral diabetes medications for the same reason [8].

Disorders of eating attitudes have been reported to be associated with poor metabolic control, weight gain, a tendency to omit prescribed doses of insulin, and an increased prevalence of microvascular complications [9]. Individuals with DM and co-occurring eating disorders are at increased risk for life-threatening complications of DM, including diabetic ketoacidosis (DKA), kidney failure, diabetic retinopathy, neuropathy, cardiovascular disease, stroke, and coma [10]. So, the combination of an eating disorder and DM puts patients at high risk of mortality and morbidity [11].

DM is a chronic illness that can influence quality of life, work life, interpersonal relationships, social activities, physical and mental well-being as the treatments are burdensome, and the complications can be debilitating and life threatening. Therefore, evaluation of the quality of life in patients with DM has become important. [12]

The purpose of this study was to investigate the frequency of disorders of eating attitudes, the association of eating attitudes between metabolic control and quality of life in patients with T1DM and T2DM. It was also figured out whether eating attitudes differ depending on types of medical treatments. It is hypothesized that;

Hypothesis 1; Disorders of eating attitude are associated with poor glycemic control and bad quality of life in patients with DM.

Hypothesis 2; Different type of medical treatment, especially taking insulin increases the rate of disorders of eating attitudes.

## 2. METHODS

### 2.1 Design

The cross-sectional study design was used for the evaluation of disorders of eating attitudes. All participants who met the inclusion criteria were recruited for the study. It was conducted according to the principals of the Declaration of Helsinki and was approved by Ege University Ethics Committee in İzmir, Turkey (1311.1/11). Participants gave written informed consent prior to the study.

### 2.2 Sample

The sample in this study was 150 patients with T1DM and T2DM, who were recruited in Ege University Hospital Endocrine Polyclinic in Turkey between December 2013 - April 2014. The inclusion criteria were as follows; (1) diagnosed with T1DM or T2DM treated with oral antidiabetic drugs (OAD), insulin therapy or insulin pump, (2) above 18 years of age, (3) duration of DM for at least 1 year, (4) non-pregnant, (5) any medication except hypertension and dyslipidemia, (6) any complication, (7) without communication problems.

### 2.3 Measures and Procedures

Disorders of eating attitudes were assessed by using Eating Attitudes Test-40 (EAT) (Turkish version), SF-36 scale was used for assessed quality of life. Blood glucose value [fasting and postprandial blood glucose (FBG and PBG) ], glycosylated hemoglobin (A1C), triglycerides (TG), total cholesterol (TC), high density lipoprotein (HDL) and low density lipoprotein (LDL) were collected from the hospital records as the metabolic control parameters. The following questionnaires and forms were applied to all participants face to face by the researcher.

### 2.4 General Information Questionnaire

This questionnaire had 29 questions which were performed with literature review information by the researcher. This questionnaire had 7 questions about socio demographic information (age, gender, education, job, marital status, average income, and the number of people lived with in the same house), 7 questions about diseases (type of diabetes, age of diabetes, medical treatment, duration of medical treatment,

insulin omission, frequency of insulin omission, presence of hypertension and/or dyslipidemia), 3 questions about family history (presence of anyone in the family with DM, psychological disease, and eating disorders), 12 questions about habits of participants (whether they have any nutrition therapy, who offered this therapy, whether there is a presence of skipping meal, if yes, which meal it is and what the cause is, what kind of habits they have about eating snacks and what the frequency is, whether they experienced any hypoglycemia episodes and what the frequency is, what the amount of food consumed during the treatment of hypoglycemia is and whether they consume alcohol or smoke any cigarettes).

### 2.5 Eating Attitudes Test-40 (Turkish Version)

The original questionnaire was developed by Garner and Garfinkel in 1979 [13]. Its validity and reliability was conducted by a study in Turkey by Savasir and Erol in 1989. Cronbach alpha credibility coefficient of the scale has been found as 0.70 [14]. The EAT is a 40 item questionnaire designed to measure abnormal eating attitudes and behaviors in particular those of a restrictive type that are typical of anorexia nervosa. It consisted of 6-point Likert-type response form: "always", "very often", "often", "sometimes", "rarely" and "never" options (grouped in accordance with response frequency of violence or grouped by the question type) and participants filled the forms by themselves. Cut-off score of 30 points was considered and, more than or equal to 30 points showed that there were disorders of eating attitudes [13,14].

### 2.6 SF-36 Quality of Life Questionnaire

The original questionnaire was developed by Ware and Sherbone [15] and its validity and reliability were conducted by a study in Turkey by Rukiye Pınarın 1995 [16]. This scale which was a generic scale with wide-spectrum measurements composed of 36 items which provided assessment in eight subscale; physical functioning, social functioning, role limitations due to physical problems, role limitations, emotional problems, mental health, energy / vitality, pain, and the general health perception [15]. In addition, each item was scored on a 0 to 100 range, so 0 means poor health status, and 100 means good health status, and each subscale score can be obtained separately [16].

## 2.7 Biochemical Data and Anthropometric Measurements Form

Routine biochemical data about DM which were blood glucose values, A1C, TG, TC, HDL, LDL collected from the hospital records. All participants' blood pressure levels (with electronic sphygmomanometer), height (with tape measure), weight (with electronic weight), body mass index (BMI), waist circumference (with tape measure), hip circumference (with tape measure) and waist-hip ratio were measured the same way, and also recorded by the same researcher. Metabolic control evaluation criteria were based on the guidelines of American Diabetes Association [2] (ADA); A1C; normal  $\leq 6.5\%$  ( $\leq 48$  mmol/mol), "ideal" 6.5-7% n (48-53 mmol/mol), "good"  $\geq 7\%$  ( $\geq 53$  mmol/mol) and "poor"  $8\% \geq 53$  mmol/mol), fasting blood glucose (FBG); normal  $<70$  mg/d ( $< 3.88$  mmol/L) ,"low" 70-130 mg/dl (3.88-7.22 mmol/L) "poor"  $>130$  mg/dl ( $>7.22$  mmol/L), postprandial blood glucose (PBG); normal  $<140$  mg/dl ( $<7.7$  mmol/L), "low" 140-180 mg/dl (7.7-10 mmol/L) and "poor"  $>180$  mg/dl ( $>10$  mmol/L).

## 2.8 Statistical Analyses

All analyses were carried out using computer software SPSS 15.0 (SPSS version 15.0, SPSS Inc. Chicago, IL, USA). The significance level was two-tailed values of  $p < 0.05$ . Compliance with the theoretical distribution of quantitative data was tested with the Kolmogorov-Smirnov Test. The chi-square test was used for the evaluation of nominal and ordinal data and unpaired t test or Mann-Whitney U test was used for the quantitative data. Kruskal Wallis test was applied for the evaluation of more than two variables. Relationships between eating attitudes and metabolic control or quality of life were analyzed with Spearman correlation analysis. Pearson correlation analysis was used to investigate the relationship between disordered eating attitudes and different type of treatments.

## 3. RESULTS

The study included 150 patients (70,7% women, 29,3% men) with 52 T1DM (25 using insulin pump and 27 taking insulin) and 98 T2DM (50 taking OAD and 48 taking insulin). Mean values of participants' demographic characteristics were; age 44.9 years ,duration of disease 10.6 years, weight 80.4 kg, height 163.7cm, BMI 30.2

kg / m<sup>2</sup>, waist circumference 96.7 cm, hip circumference 109.5 cm and waist-hip ratio 0.9.

**Table 1. Characteristics of the participants**

	Mean±SD	Range (min.-max.)
Age (years)	44.9±13.1	18-68
Duration of disease (years)	10.6±7.0	1-32
Weight (kg)	80.4±17.2	46-141
BMI (kg / m <sup>2</sup> )	30.2±7.1	18-51
Waist circumference (cm)	96.7±14.6	65-145
Hip circumference (cm)	109.5±12.7	85-156

*BMI: Body Mass Index*

Mean scores on the participants eating attitudes, quality of life and metabolic control had been stated as follows; eating attitudes test 26.2 points, functional status 67.6 points, well-being 63.7 points, overall understanding of health 51.7 points, A1C 8.8% (73 mmol/mol), FPG 180.9 mg/dl, PMG 213.1 mg/dl, TG 158.1 mg/dl, TC 203.1 mg/dl, HDL 49.0 mg/dl and LDL 126.3 mg/dl. Most of participants had hypoglycemia (78.7%) which was shown 5.1% had every day and 24.6% had less than 1 month indicating eating too much during episodes for treatment of hypoglycemia. The rate of insulin omission was 38% and the rate of insulin therapy was 31.6 % once a day at least. The prevalence of disorders of eating attitudes in patients with DM was found to be 39.3% (59 participants). Patients who had disordered eating attitudes, which had shown 33.9% patients with T1DM (20 patients) and 39.3% patients with T2DM (39 patients). There was not found any statistically significant difference between types of DM and its treatment ( $P = .663$ ) (Table 2).

Pearson chi-square test was used to compare the patients with and without eating disorder with type of DM and treatments.

Generally the answers of life quality questionnaire were over 50 points except the answer of changes in health during the past year. The group with disorders of eating attitudes had significantly lower scores in role limitations due to physical function subscale. ( $P = .05$ ) (Table 3).

There is no significant difference between disorders of eating attitudes and metabolic control (A1C, FBG and PBG).

**Table 2. Relationship between disorders of eating attitudes, and types of diabetes mellitus and the medical treatment**

Types of diabetes and treatments	Disorders of eating attitudes			p value
	-	+	Total	
<b>T1DM</b>				
Insulin therapy	16	11	27	
Group (%)	59.3	40.7	100	
Total (%)	17.6	18.6	18	
Insulin pump therapy	16	9	25	
Group (%)	64.0	36.0	100.0	
Total (%)	17.6	15.3	16.7	
<b>T2DM</b>				
Insulin therapy	26	22	48	0.663
Group (%)	%54.2	%45.8	%100.0	
Total (%)	%28.6	%37.3	%32.0	
OAD	33	17	50	
Group (%)	%66.0	%34.0	%100.0	
Total (%)	%36.3	%28.8	%33.3	
Total (T1DM and T2DM)	91	59	150	
Group (%)	%60.7	%39.3	%100.0	
Total (%)	%100.0	%100.0	%100.0	

+ : The presence of disorders of eating attitudes, - : The absence of disorders of eating attitudes.  
T1DM: type 1 diabetes mellitus, T2DM: type 2 diabetes mellitus, OAD: Oral antidiabetic drugs

**Table 3. Relationship between in patients with and without disorders of eating attitudes and quality of life**

	Disorders of eating attitudes	n	Mean score	p value
Physical functioning	-	91	79.49	0.160
	+	59	69.34	
Social functioning	-	91	75.62	0.965
	+	59	75.31	
Role limitations due to physical function	-	91	80.81	0.041
	+	59	67.31	
Role limitations due to emotional problems	-	91	78.07	0.336
	+	59	71.53	
Mental health	-	91	74.64	0.762
	+	59	76.83	
Energy / vitality	-	91	79.15	0.201
	+	59	69.87	
Pain	-	91	78.17	0.340
	+	59	71.38	
General health perception	-	91	80.10	0.091
	+	59	68.40	

+ : The presence of disorders of eating attitudes, - : The absence of disorders of eating attitudes

#### 4. DISCUSSION

Intensive research on the comorbidity of eating disorders and DM has been carried out in the past 25 years [17]. This study was performed in adult patients with T1DM and T2DM because of the necessary focus on foods in the management of both types of DM. It may lead to a rigid and perfectionist attitude toward eating which in turn may increase the risk of developing an eating disorder through excessive preoccupation with weight and diet, binge eating, and dysfunctional weight control behaviors [6]. Disordered eating behaviors such as binge eating, excessive

dieting, and insulin omission for weight control or loss are common among with T1DM (especially in adolescents) [18]. Some significant risk factors such as <60 years of age, being African - Americans ethnic origin, high BMI and high A1C are associated with binge eating disorders and T2DM [19]. But, these risk factors could not be found in this study. Some studies found equivalent or low rates of diagnosable eating disorders, but high rates of disorders of eating attitudes. The prevalence of comorbid T2DM and eating disorders suggests that 2,5% to 40% of individuals with T2DM have an eating disorder. There was a presence of an eating disorder in

T1DM between 11,5% and 27,5% [6,7,17,20]. As a result of this research; disorders of eating attitudes were found to be at a high proportion (39.3%) in patients with DM. According to EAT-40, 28% of the participants indicated 'often' for the statement of 'Have gone on eating binges where I feel that I may not be able to stop', and 41.3% of the participants stated that they 'feel that food controls their life', and 22.1% of them indicated that they 'feel that others pressure me to eat' in this study. We thought that perhaps spending a lot of time to think about the foods and excessive compliance or noncompliance with the protocol of diabetic diet may be caused by these high prevalence of disorders of eating attitudes. The patients with T2DM in insulin therapy had high prevalence of disorders of eating attitudes. However, significant differences were not found between eating attitudes and type of medical treatments. High rates of disorders of eating attitudes are seen in other treatments as much as it is seen in the insulin therapy. As glycemic control improves, weight gain is a common side effect of successful treatment with insulin. Weight concerns may develop when intensive treatment results in weight gain as well as improved metabolic control. The omission of insulin can be used to induce glycosuria, allowing excess calorie intake without resultant weight gain. The presence of diagnosable eating disorders and behavior categorized as subclinical disorders of eating attitudes has been associated with increases in retinopathy, neuropathy, poor short term metabolic control [7]. More recent cross-sectional studies have demonstrated a positive association between elevated A1C and diagnosable eating disorders [7,21]. With regard to long-term metabolic control and eating disorders, studies have yielded mixed results. In a prospective five-year study in women patients with T1DM, significant correlation was not found between eating disorders and a poor glycemic control [22]. According to our study; although prevalence of disorders of eating attitudes were found to be at a high proportion (39.3%) in patients with DM, significant differences were not found between metabolic control and disorders of eating attitudes. 64% of the patients had high FPG, 30% above normal PPG and 72.6% above 7% (53 mmol/mol) A1C. Most of the people with DM focused on only losing weight. Metabolic control part was generally ignored. Therefore, they could have had bad metabolic control. A1C values in patients with insulin omission that were significantly higher than those without insulin omission (P =.05). During episodes of hypoglycemia in diabetics, excess food

consumption and the associated weight gain may occur. So the development of compensatory behavior (insulin omission) to avoid weight gain could lead to deterioration of metabolic control. But surprisingly, there is no statistical significant difference between hypoglycemia and insulin omission. Patients who have disorders of eating attitudes, have higher A1C values, but there is no statistical significant difference between A1C and disorders of eating attitudes (P > .05). Besides the social pressure on overweight and obese individuals in Western societies, patients with T2DM are urged to lose weight for medical reasons. It appears that constant dieting contributes to a casual fashion to the development of binge eating and subsequent weight gain [20-23]. In this study, interestingly there is no statistical significant difference between BMI and eating attitudes. Eating disorders lead to reduction of quality of life with deterioration of social functioning and physical activity in diabetic patients [24]. In this study significant differences were found only between disorders of eating attitudes and physical role of quality of life subscales (P = .05). According to this study, patients with T2DM were associated with significantly poor levels of health status than patients with T1DM, particularly in terms of physical and social well-being. In terms of treatment of DM who use insulin pump therapy, stated that they had significantly higher quality of life (P =0.05).

**Table 4. Relationship between the patients with and without disorders of eating attitudes and metabolic control**

	Disorders of eating attitudes (n)		p value
	-	+	
<b>FBG</b>			
Low	2	1	0.489
Normal	32	18	
High	56	40	
<b>PBG</b>			
Low	10	8	0.291
Normal	12	8	
High	31	14	
<b>A1C</b>			
< 6.5% (<48 mmol/mol)	15	6	0.337
≥ 6.5% (≥ 48 mmol/mol)	72	51	
< 7.0% (< 53 mmol/mol)	25	13	
≥ 7.0% (≥ 53 mmol/mol)	62	44	0.277

FBG: Concentration of fasting blood glucose,  
PBG: concentration of postprandial blood glucose and  
A1c: glycated hemoglobin A1c

## 5. CONCLUSION

Treatment approach should be maintained with a multidisciplinary team [6,18,25]. Eating habits, physical activity, and the concern of weight gain must be investigated for creating individual medical nutrition therapy programs in diabetic patients. It may be important in terms of psychological and medical complications that may arise. In this area, further studies are needed to develop DM-specific eating behavior rating scales with longer duration and in larger samples.

## 6. LIMITATION OF THIS STUDY

Most of the patients who applied to polyclinics had at least one complication of DM. So, these patients were excluded from the study, and only 150 patients were included into the study.

## COMPETING INTERESTS

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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