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Pokrajac-Bulian, Alessandra; Kukić, Miljana; Klobučar Majanović, Sanja; Tkalčić, Mladenka

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Body Weight and Psychological Functioning in Type 2 Diabetes Mellitus Patients: A Preliminary Study

Alessandra Pokrajac-Bulian and Miljana Kukić

University of Rijeka, Faculty of Humanities and Social Sciences,
Department of Psychology, Croatia

Sanja Klobučar Majanović

University of Rijeka, Clinical Medical Centre Rijeka, Faculty of Medicine, Croatia

Mladenka Tkalčić

University of Rijeka, Faculty of Humanities and Social Sciences,
Department of Psychology, Croatia

Abstract

The aim of this study was to assess the relationship between beliefs about the causes of illness, glycaemic control, and affective status of overweight and obese women and men with type 2 diabetes. The clinical sample included 88 patients (46 males), aged from 31 to 79 years. Patients were examined in the Outpatient Clinic for Endocrinology, Diabetes and Metabolic Diseases in the Clinical Medical Centre Rijeka. Psychological measurements included the Revised Illness Perception Questionnaire and the Hospital Anxiety and Depression Scale. Patients' body weight, height and glycaemic control (HbA1c) were also obtained.The results show that body mass index (BMI) is not significantly correlated with the level of HbA1c, nor with measured psychological variables (psychological attributions of illness, anxiety and depressive symptoms). A stronger belief that illness was caused by psychological factors is correlated with more symptoms of anxiety and depression in patients. There was a significant main effect of patients' sex on psychological attributions and anxiety symptoms. Women reported stronger beliefs that psychological factors might have been the cause of their illness and showed higher levels of anxiety symptoms than men. There was no significant main effect of glycaemic control on measured psychological variables. The results suggest that in working with T2DM patients it is important to pay attention to psychological aspects of illness, taking into account the patient's sex. Inquiring about diabetes causation beliefs and emotional status may be a way of recognizing possible barriers towards providing care.

Keywords: obesity, diabetes, glycaemic control, illness causation beliefs, anxiety, depression

✉ Alessandra Pokrajac-Bulian, University of Rijeka, Faculty of Humanities and Social Sciences, Department of Psychology, 51000 Rijeka, Croatia. E-mail: *pokrajac@ffri.hr*

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Introduction

Obesity and type 2 diabetes are metabolic diseases that are becoming worldwide epidemics (Everard & Cani, 2013; Lau, Carvalho, Pina-Vaz, Barbosa, & Freitas, 2015). Obesity is accompanied by numerous, potentially life-threatening, comorbid disorders, huge economic costs, and its prevalence is increasing in almost all continents and in almost all developed countries (López-Jiménez & Cortés-Bergoderi, 2011). According to the World Health Organization (2015) more than 1.9 billion adults are overweight, among whom more than 650 million are obese. In Europe over 40% of adults have excessive body weight, and about 20% are obese (Berghoefer et al., 2008). A similar situation can be found in Croatia, where more than 20.4% of the adult population is obese (Musić Milanović, 2010). Among the many health problems that arise as a result of obesity, diabetes is one of the most serious, so in the 21st century it is essential to understand the pathological processes underlying obesity and metabolic co-morbidities, especially type 2 diabetes.

Diabetes, as one of the most frequent consequences of obesity, is a complex, chronic disease that presents a huge challenge for the healthcare system due to its increasing prevalence and devastating complications (Zimmet, Magliano, Herman, & Shaw, 2014). Type 2 diabetes mellitus (T2DM) is the most common form of diabetes, accounting for 90% of cases globally. Unhealthy dietary habits and sedentary behaviour that lead to obesity are the major drivers of this global pandemic (Zimmet, 2017). According to the overall reported data, in 2016 Croatia registered almost 300 000 patients diagnosed with diabetes (Croatian Institute of Public Health, 2016). Of people with T2DM, 79% of men and 84% of women are overweight or obese (Musić Milanović, 2010).

People with diabetes are at risk of developing a variety of complications that negatively affect their quality of life and cause substantial premature mortality. Furthermore, diabetes-related complications account for a major part of healthcare costs associated with diabetes (Zhang et al., 2010). While microvascular complications, including retinopathy, nephropathy and neuropathy, tend to develop after the onset of diabetes, the risk of macrovascular complications, such as coronary heart disease, stroke and peripheral vascular disease, might be present even before the diagnosis of diabetes, partly driven by underlying insulin resistance and coexisting cardiometabolic risk factors (van Dieren, Beulens, van der Schouw, Grobbee, & Neal, 2010). In addition to vascular complications, diabetes is also associated with other co-morbidities, including increased risk of different malignancies, reproductive disorders, osteoporosis and sleep apnoea (Dede, Tournis, Dontas, & Trovas, 2014; Giovannucci et al., 2010). Good glycaemic control is essential in preventing diabetic complications. The level of glycosylated haemoglobin (HbA1c) provides a measure of glycaemic control during 8-12 weeks prior to testing (Jeffcoate, 2004). Target HbA1c goal of < 7% may be recommended for patients with short disease duration, long life expectancy, and no significant

cardiovascular disease. However, less stringent HbA1c goals may be considered appropriate for patients with advanced complications, limited life expectancy, a history of severe hypoglycaemia and extensive comorbid conditions (American Diabetes Association, 2018). A systematic review and meta-analysis showed that psychosocial interventions modestly but significantly improved HbA1c and mental health outcomes (Harkness et al., 2010). A complex interaction between genetic predisposition, environmental and behaviour/psychological factors drives disease aetiologies – the same is true for obesity and diabetes.

Diabetes is often accompanied by psychological factors, especially depression, anxiety and other mood disorders, since people with diabetes face the threat of blindness, amputation, end-stage kidney disease, hypoglycaemia and premature death (Piette, Richardson, & Valenstein, 2004). Compared with the general population, diabetic patients are twice as likely to experience anxiety and depression disorders (Anderson, Freedland, Clouse, & Lustman, 2001; Egede, Zheng, & Simpson, 2002). Collins, Corcoran, and Perry (2009) suggest that the prevalence of depressive symptoms in patients with diabetes is between 10.4 and 11.2%, while 22.4% of them show mild to severe depression. An international study concerning patients with diabetes, which was carried out in 17 countries, showed that major depression was 40% more frequent in patients with diabetes compared to the control group (Lin et al., 2008). Depression is consistently associated with hyperglycaemia, it increases the likelihood and risk of diabetes-related complications and nonadherence with prescribed therapy (de Groot, Anderson, Freedland, Clouse, & Lustman, 2001; Gonzalez et al., 2008; Lustman et al., 2000). Research findings show that subclinical symptoms of depression are common and persistent in patients with diabetes, are more often associated with poor regulation of diabetes than with mood disorders per se, as well as with nonadherence to treatment, increasing the risk of complications and mortality (Gonzalez, Esbitt, Schneider, Osborne, & Kupperman, 2011; Zhang et al., 2005). Diabetes and depression seem to be inter-related, even though depression frequently precedes the development of T2DM (Gonzalez et al., 2011; Mezuk, Eaton, Albrecht, & Golden, 2008). One possible explanation of this relationship is that biological factors underlying depression act as mediators between depression and disease outcome, but on the other hand it is also reasonable to take into account negative health behaviours related to depression as possible mediators, such as inactivity, poor eating habits, smoking, and failure to comply with recommendations during treatment (Gonzalez et al., 2011).

The prevalence of symptoms of mild to severe anxiety (32%) in patients with diabetes is considerably higher than in the general population (15%) (Collins et al., 2009; Lloyd, Dyer, & Barnett, 2000). The likelihood of developing anxiety disorder is about 20% higher in patients with diabetes compared to non-diabetic individuals (Lin et al., 2008). It is quite difficult to determine to what extent some of the anxiety disorders or the subclinical level of anxiety occur in people with diabetes. In mixed sample studies with patents with T2DM and T1DM the presence of anxiety

symptoms ranges between 40-42% (Grigsby, Anderson, Freedland, Clouse, & Lustman, 2002; Mitsonis, Dimopoulous, & Psarra, 2009). Anxiety is often associated with the phobia and/or with a significant fear of self-injecting or self-testing in about 9 to 28% of patients, which could become a major problem in treatment adherence (Mollema, Snoek, Heine, & van der Ploeg, 2001). Among patients who take insulin, the fear of hypoglycaemia or low blood sugar levels may be present (Gonzalez et al., 2011; Weinger & Lee, 2006). Hypoglycaemia often causes irritability, cognitive dysfunction, tremors and excessive sweating. If glucose drops to a critically low level, a loss of consciousness occurs, and in some cases even death. To avoid the risks related to low blood glucose levels, patients prefer to keep higher blood sugar levels (Weinger & Lee, 2006). Other research shows that anxiety is associated with problems of facing diabetes, poor clinical outcomes, and finally it decreases a person's functionality and quality of life, even at the sub-clinical level (Gonzalez et al., 2011).

Depressive and anxious individuals with diabetes are less willing to follow self-care and dietary recommendations, are less physically active, and are less likely to take prescribed medications (Ciechanowski, Kanton, & Russo, 2000; Collins et al., 2009). Therefore, the reduction of depressive and anxious symptoms in diabetic patients could be very useful in controlling glycaemia (Collins et al., 2009). Patients are likely to show psychological vulnerability after the diagnosis of diabetes, when their medical condition changes, when the need for intensified treatment is apparent (e.g., insulin initiation), especially after the onset of diabetes-related complications. Research findings suggest that patients' behaviours are focused on self-care, including maintaining glycaemic control in T2DM, as a result of beliefs about or perception of the disease (Harvey & Lawson, 2009).

A person's belief that diabetes is a disease that can be controlled will trigger other forms of behaviour compared to beliefs that the disease is somewhat out of their control. Intense emotional reactions that accompany the disease are also a consequence of beliefs about the illness (Mc Sharry, Moss-Morris, & Kendrick, 2012). The Common-Sense Model (CSM) of illness, as postulated by Leventhal and colleagues (Leventhal, Meyer, & Nerenz, 1980; Leventhal, Nerenz, & Steele, 1984), provides a theoretical perspective of the process used by persons to make sense of a disease threat, and for understanding the factors affecting the perception of disease as well as its influence on future behaviour, health outcomes and regulatory behaviours. Illness representations reflect a person's implicit 'common sense' beliefs of an illness derived from both lay and expert sources as well as personal and vicarious experiences with a particular disease (Henderson, Orbell, & Hagger, 2009), activated in response to somatic and functional changes (Leventhal, Philips, & Burns, 2016). Leventhal et al. (1984) proposed that an illness or symptoms can generate both cognitive and emotional representations. Perceptual domains include cognitive representations of illness in five core domains: identity, consequences, cause, timeline and control/cure, while the emotional aspects include negative reactions

such as fear, anger and distress, anxiety or depression (Broadbent, Petrie, Main, & Weinman, 2006; Leventhal et al., 1980, 1984, 2016).

Psychological attributions refer to the possible causes or impacts associated with the development of diabetes. There are internal and external factors that interact and may trigger the disease. The interaction of factors, such as eating habits, lack of rest, exposure to life stressors or bacteria/viruses, increase the sensitivity of a person to disease (Santos, Hurtado-Ortiz, Lewis, & Ramirez-Garcia, 2015). Although some of the causes of disease are external, like viruses or stress, they are simultaneously experienced as an internal state, depending on how the person experiences and interprets them (Lau, Bernard, & Hartman, 1989). Understanding the possible causes of a disease is, according to the CMS model, one of the basic components that characterise the representation of illness (Leventhal et al., 2016).

In this paper we will focus on psychological factors and metabolic outcomes in overweight and obese women and men with type 2 diabetes. Specifically, the aim of this study is to assess the relationship between beliefs about the causes of disease, glycaemic control, and affective status (anxiety and depression) of overweight and obese persons with type 2 diabetes. In line with the review of research findings related to type 2 diabetes and obesity, we expect that the level of anxiety and depression in women with diabetes will depend more on successfulness of glycaemic control and body weight than in men with diabetes. Furthermore, we expect that women with diabetes will attribute disease causes to psychological factors significantly more than men with diabetes.

Method

Participants

The sample consisted of 88 patients (46 males) with type 2 diabetes (T2DM) who were treated in the Outpatient Clinic for Endocrinology, Diabetes and Metabolic Diseases in the Clinical Medical Centre Rijeka. Patients' body mass index (BMI) ranged from 22.77 to 50.30 kg/m^2 (M = 31.38; SD = 5.57). Among them, 6.8% had normal weight, 44.3% were overweight, and 48.9% were obese. In accordance with the aim of this study, only overweight and obese patients (N = 82) were included in further data analyses. In this subsample, the patients' age ranged from 31 to 79 years (M = 60.12; SD = 9.81). The average duration of T2DM was 10.67 years (51.9% of subjects have had T2DM for up to 10 years, 18.5% of subjects have had T2DM for up to 15 years, while 11.1% of subjects have been suffering from T2DM for more than 20 years). Regarding successfulness in glycaemic control, 53.7% patients had poor (HbA1c > 7.5%), and 46.3% patients had good glycaemic control (HbA1c < 7.5%).

Measures

Glycaemic Control (HbA1c)

The level of glycosylated haemoglobin (HbA1c) was used as an indicator of the patients' glycaemic control. The HbA1c test measures the percentage of glucose in the blood joined with the haemoglobin molecule. The values of glycosylated haemoglobin below 7.5% indicate good regulation of glycaemia, while values above 7.5% indicate poor regulation (Berg, 2013).

Body Mass Index (BMI)

Body mass index was used as an indicator of (un)healthy body weight. BMI was calculated by dividing the patient's body weight (in kilograms) by the square of his/her body height (in meters).

Self-Assessment Questionnaires

The patient's perceptions of the causes of illness were evaluated using a subscale "Causes" from the *Revised Illness Perception Questionnaire* (IPQ-R; Moss-Morris et al., 2002), an instrument that evaluates different components of the representation of illness based on Leventhal's Self-Regulatory Model. The subscale "Causes" consists of a list of 18 possible causes of illness. The participants had to indicate what they considered to be the cause(s) of their illness. All items were rated on a 5-point Likert-type scale (from 1 = *strongly disagree* to 5 = *strongly agree*). Following a factor analysis, the authors of the questionnaire suggested that the causes might be divided into four factors: Psychological attributions (6 items; e.g., "Family problems or worries" and "My emotional state"), Risk factors (7 items; e.g., "Alcohol" and "Hereditary"), Immune system factors (3 items; e.g., "A germ or virus" and "Altered immunity") and Accident or chance factors (2 items; "Chance or bad luck" and "Accident or injury") (Moss-Morris et al., 2002). Higher scores on each subscale represent stronger beliefs in a particular type of illness causes. In the present study, Cronbach's alpha coefficients for Psychological attributions, Risk factors, Immune system factors and Accident or chance factors were .73, .41, .44, and .62, respectively. In subsequent data analysis, only the score obtained from the subscale Psychological attributions was used, due to the fact that the reliability coefficient for that subscale was the only satisfactory one.

Symptoms of anxiety and depression were measured by the *Hospital Anxiety and Depression Scale* (HADS; Zigmond & Snaith, 1983). The HADS is a 14-item self-report screening scale. It has two subscales, each consisting of 7 items aimed to assess either symptoms relevant to anxiety (HADS-A) or symptoms relevant to depression (HADS-D) over the period of the past 2 weeks. Participants have rated the items on a 4-point scale (0 through 3). A total score for each subscale is obtained

by summing the 7 items, with a possible range from 0 to 21. Higher scores represent more symptoms related to anxiety and depression. Generally, a score of 7 or less is considered to be within the normal range, between 8 and 10 is considered as "a possible case", and a score of 11 or more is considered as "a probable case" of anxiety or depression. In this sample, the Cronbach's alpha coefficients for the HADS-A and HADS-D were .84 and .71, respectively.

Questionnaires were translated into Croatian language (two forward and one back translation with adjustment for Croatian population).

Procedure

The data were collected during the patients' visit to the Outpatient Clinic for a medical check-up. The psychologists had them complete the self-assessment questionnaires, and the medical team obtained the height and weight of each participant, as well as the level of glycosylated haemoglobin (HbA1c). The hospital's ethics committee approved the study and a written informed consent was obtained from each participant included in the study.

Results

Statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., 2011).

Means, standard deviations and ranges for psychological measures are presented in Table 1.

Table 1

Means, Standard Deviations and Ranges for all Psychological Measures

Scale name	*N* of items	*M*	*SD*	Range
IPQ-R				
Psychological attributions	6	17.18	4.02	9-26
HADS				
Anxiety	7	5.44	3.57	0-14
Depression	7	4.84	3.30	0-13

Note. IPQ-R - Revised Illness Perception Questionnaire; HADS - Hospital Anxiety and Depression Scale

Regarding the level of anxiety, 76.3% of patients were not anxious, 11.2% showed signs of possible anxiety, and 12.5% of patients had symptoms suggesting probable anxiety. In terms of depressive symptoms, 73.8% of the patients were not depressed, 20.0% had symptoms suggesting possible depression, and 6.2% of the patients had symptoms suggesting probable depression.

To examine the relationship among BMI, HbA1c, psychological attributions, anxiety and depressive symptoms, a correlation analysis was conducted. Pearson correlation coefficients between all variables are presented in Table 2.

Table 2

Correlations between Measured Variables

Variables	HbA1c	Psychological attributions	Anxiety	Depression
BMI	.11	.09	.08	.21
HbA1c	-	.07	.24*	.15
Psychological attributions		-	.58**	.44**
Anxiety			-	.63**

*$p < .05$; **$p < .01$.

As can be seen in Table 2, no significant correlation between body mass index of patients suffering from T2DM and their level of HbA1c (a measure of glycaemic control) was found. In addition, BMI was not significantly correlated with psychological attributions of illness, anxiety and depressive symptoms. The level of HbA1c was significantly correlated only with anxiety symptoms, but that correlation was weak. Correlation analyses showed that a stronger belief that illness was caused by psychological factors was correlated with more symptoms of anxiety and depression in patients.

Because there were no significant differences ($p > .05$) between overweight and obese patients in the level of HbA1c and psychological variables, they were treated as a single group in further analyses.

To examine the effects of glycaemic control (measured by the level of HbA1c) and patient's sex on causal attributions for diabetes, as well as on anxiety and depressive symptoms, separate two-way between-subjects ANOVAs were run for each of the dependent measures. In all of these analyses a 2 (glycaemic control: good versus poor) x 2 (sex: male versus female) between-subjects ANOVA design was used.

In the first ANOVA, psychological attributions were set as the dependent variable. Results revealed that there was a significant main effect of patient's sex on psychological attributions ($F_{(1,78)} = 4.161$, $p < .05$). Women reported stronger beliefs that psychological factors might have been the cause of their illness than men ($M_{\text{women}} = 18.15$, $M_{\text{men}} = 16.30$). The Partial eta^2 value of 0.051 indicates that 5.1% of the between subjects variance is accounted for by the patient's sex. There was no significant main effect of glycaemic control on psychological attributions, as well as no significant interaction between glycaemic control and sex. The effects of glycaemic control and patients' sex on psychological attributions are shown in Figure 1.

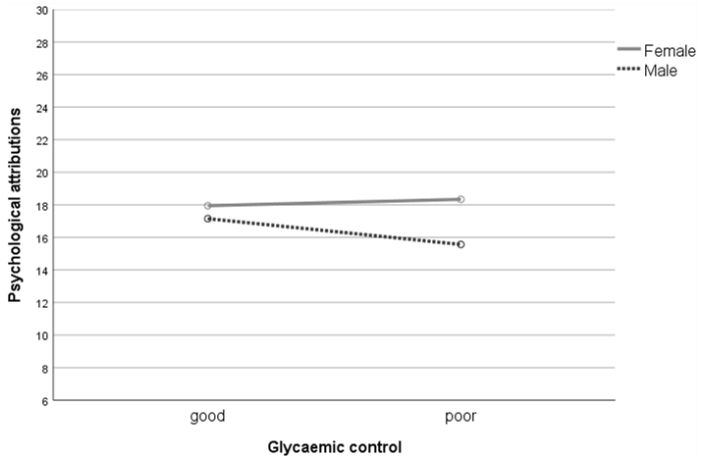

Figure 1. Differences in psychological attributions between female and male patients with poor and good glycaemic control.

In the second ANOVA, in which the level of anxiety symptoms was set as the dependent variable, the main effect of patients' sex was again significant ($F_{(1,76)}$ = 7.523, $p < .01$). Women reported higher levels of anxiety symptoms than men did (M_{women} = 6.60, M_{men} = 4.38). The Partial eta^2 value of 0.090 indicates that 9% of the between subjects variance is accounted for by the patient's sex. The main effect of glycaemic control was not significant, as well as the interaction between glycaemic control and sex. The effects of glycaemic control and patient's sex on the level of anxiety symptoms are shown in Figure 2.

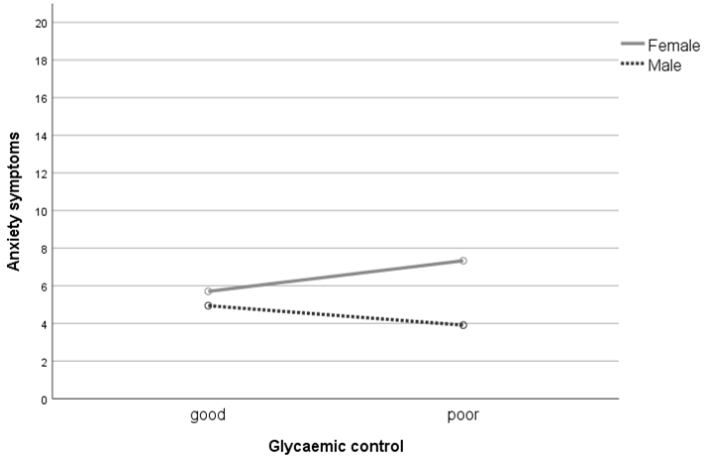

Figure 2. Differences in anxiety symptoms between female and male patients with poor and good glycaemic control.

In the third ANOVA, in which the level of depressive symptoms was set as the dependent variable, there were no significant main effects of glycaemic control and sex, as well as no significant interaction between glycaemic control and sex, which, however, approached significance ($F_{(1,76)} = 3.319$, $p = .072$). The Partial eta^2 value of 0.042 indicates that 4.2% of the between subjects variance is accounted for by glycaemic control x sex interaction.

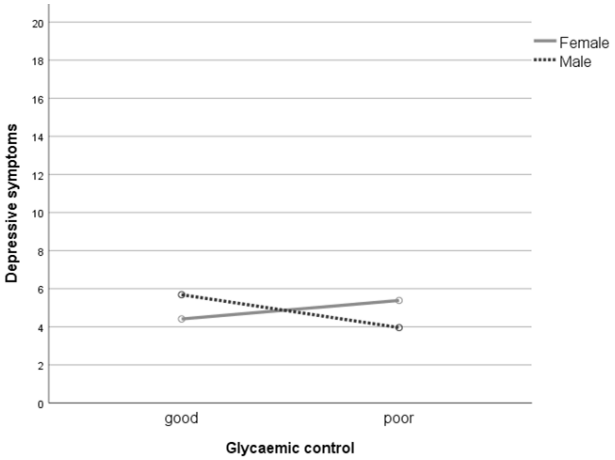

Figure 3. Differences in depressive symptoms between female and male patients with poor and good glycaemic control.

Discussion

The aim of this study was to explore the relationship between beliefs about the causes of disease, glycaemic control and affective status in overweight and obese persons with type 2 diabetes. The results show that anxiety is associated with poorer disease control and psychological attributions related to the cause of the illness. We assume that the presence of anxiety in patients with T2DM could lead to difficulties in dealing with diabetes, worse clinical outcomes, reduced functionality and diminished overall quality of life (Gonzalez et al., 2011). The main findings of this study are in line with other research results confirming that the reduction of anxiety symptoms could be very useful in glycaemia regulation (Collins et al., 2009). In our sample, almost one quarter of patients show possible or probable anxiety, which is greater than in the general population but somewhat lower than found in other studies (Collins et al., 2009; Lloyd et al., 2000). Interestingly, in the context of the association of anxiety symptoms with psychological attributions, more anxiety symptoms are present in those patients who attribute the cause of their illness to negative thoughts about the illness, family problems or problems caused by the

disease, their emotional state, personality, and perception of the stressfulness of certain situations. The lack of a person's capacity to use coping strategies directed to problem solving generates fear, loneliness, and increases anxiety. Furthermore, negative thoughts that cause unpleasant emotions boost the anxiety even more. The more anxious a person is his/her coping with the disease worsens and he/she enters into a vicious cycle of anxiety maintenance, which makes it difficult to regulate glycaemia. The results of this study have also shown that the use of psychological attributions in understanding diabetes was associated with a more frequent experience of depressive symptoms. Depression is primarily associated with psychological attributions related to beliefs that bad and negative things will happen in a person's life or that the disease is caused by family problems and concerns, as well as mood states such as feeling down, lonely and anxious. This negative mental attitude is associated with a sense of helplessness, which is consistently related to increased risk of complications in diabetes and nonadherence to prescribed therapy, as frequently shown in various studies (de Groot et al., 2001; Gonzalez et al., 2008; Lustman et al., 2000). In our sample, 20% of patients reported possible symptoms and 6% probable symptoms of depression, which is significantly more than in other studies (Collins et al., 2009). Van Dooren et al. (2016) believe that a person's own awareness of diabetes can contribute to higher levels of depressive symptoms, and therefore one must deal with chronic illness or its complications. Type 2 diabetes self-management represents a burden for the patients; it requires discipline and perseverance in everyday activities, such as maintaining a particular diet, regular exercise, enough rest, taking prescribed medication and monitoring glucose levels. Insulin therapy is particularly demanding and is associated with elevated psychological distress (Delahanty et al., 2007). Additionally, complications caused by diabetes may also cause functional impairments such as reduced mobility, visual impairment, fatigue, and pain, further disturbing/reducing patients' quality of life (van Dooren et al., 2016).

In explaining psychological distress, particularly depression in diabetic patients, it is important to emphasize the possible biological mechanisms as well. Cerebrovascular disease may be a causal or vulnerability factor in the onset of depression in diabetic persons. The hypothesis of "vascular depression" refers to the possibility that brain damage, especially frontal lobe damage caused by small vessel disease, could be related to the presence of depressive symptoms (Alexopoulos et al., 1997; Krishnan, Hays, & Blazer, 1997). Also, a higher level of arterial stiffening, which is an early phenomenon in the development of cardiovascular disease, rapidly develops in T2DM, but more often in depressed individuals. Another hypothesis emphasizes the importance of the systemic low-grade inflammation as a key factor in the development of cardiovascular disorders, which is very common in T2DM, but also plays a significant role in the aetiology of depression and obesity (Taylor, Aizenstein, & Alexopoulos, 2013). Bot et al. (2013) assume that the blood glucose level itself may be a compelling regulator for mood states as well. Prolonged hyperglycaemia or hypoglycaemia are able to induce negative emotional states in

T2DM. Furthermore, recent findings stress the important role of brain-gut communication, or more precisely the brain-gut-islet connection, in pathogenesis of obesity and type 2 diabetes (Woods, Benoit, & Clegg, 2006). A new perspective for developing efficient and precise therapeutics for metabolic diseases has arisen from this fact (Clemmensen et al., 2017). It includes not only pharmacotherapeutics, but also psychological and cognitive interventions aimed at intervening between the affective-cognitive system of the brain and the gut/islet miscommunication.

Sex Differences in Psychological Attribution, Anxiety, Depression and Glycaemic Control

As expected, women in this study in a larger degree believe that psychological factors have led to the development of their diabetes than men, regardless of whether their glycaemic control is good or bad. Women choose more often psychological causes (e.g., stress/worry, emotional state, family problems) as the main contributors to the development of their T2DM. Concha, Mayer, Mezuk, and Avula (2016) found that, accompanied by hereditary causes and an unhealthy lifestyle, the concept of stress or negative emotions emerged as a significant direct and indirect link to the onset of diabetes in the Hispanic/Latino patients. The authors used a qualitative research design and have conducted interviews with patients in order to understand the cause of T2DM. Content analyses revealed the role of emotional distress in disengagement or as an obstacle to self-care activities in diabetes. Although we have not conducted interviews with our patients, the results of this study support the idea that discussing about the psychological causes of their illness may be a useful technique for women with diabetes and help them achieve greater adherence to treatment, increasing the likelihood of maintaining self-care activity and consequently achieving better regulation of glycaemia, and better quality of life.

Women are also significantly more anxious than men, regardless of glycaemic control. The explanation can be found in the fact that we have included in the study exclusively overweight and obese patients. A sedentary lifestyle that leads to obesity has negative effects on psychological well-being. Obese and overweight people often avoid physical activity, partly because it is harder for them to do exercise, and partly because of the shame associated with their body. Dunn, Trivedi, Kampert, Clark, and Chambliss (2005) found that physical activity alleviates anxiety through shifting attention from negative thoughts and worries, increasing the possibilities of social contacts, and changing the biochemistry of the brain and, consequently, favourably affecting mood. This finding helps to understand the relationship between anxiety and sedentary lifestyle, which leads to obesity. The relationship can also be observed inversely, since psychological disturbances can also lead to weight gain. For example, research has shown that anxious people exaggerate intake of food, especially socially anxious individuals, which in some of them may result in obesity (Dunn et al., 2005). We can suppose that the negative consequences of being

overweight are greater for women because body dissatisfaction and overweightness can increase anxiety, especially in women who constantly worry about their own health.

Interestingly, there were no significant differences in depressive symptoms between patients with good and bad glycaemic control. However, it is important to stress the unexpected finding of this study related to the marginally significant interaction effect of sex and glycaemic control ($p < .073$; Partial $eta^2 = 0.042$). It means that men with good glycaemic control express more depressive symptoms compared to women with good glycaemic control and men with bad glycaemic control. Of course, the clinical relevance of this result should be interpreted with caution. However, this result emphasises the need for a different and individualised approach to male and female patients with T2DM. Men with good glycaemic control are at a greater risk of developing depressive symptoms (probably due to emotional engagement in disease control that can trigger the feeling of helplessness and unhappiness, as stated in the following item: *Because of illness I cannot enjoy the things I have previously enjoyed or have to give up on a common lifestyle or I can no longer enjoy my favourite food*). Therefore, more attention should be paid to accompanying negative mood in men with good glycaemic control and women in general, regardless of the successfulness of their glycaemic control.

Limitations and Contribution of this Study

Of course, the results of this preliminary study should be interpreted with caution. A relatively small sample size is the most significant limitation of the study, making generalizations difficult and affecting external validity. No causal conclusions can be made, as the study is correlational in nature. But there are some advantages of the study. First, our sample consists of an equal number of men and women, allowing us to explore gender differences in psychological and biological variables. Second, our sample consists of overweight and obese patients with diabetes, which is the most common co-morbidity, nowadays gaining epidemic proportions. And third, although a great number of studies from different countries investigate the Leventhal CSM model with patients with various diseases, similar studies in Croatia are very rare, especially with obese patients with diabetes. This study links obesity and type 2 diabetes and explores some of the variables related to both conditions because the precise mechanisms linking the two conditions still remain unclear.

The presented results provide support to an individualised approach to overweight and obese women and men with diabetes, which could improve patients' care and enhance health outcomes. One of the most important aspects of communication with this group of patients is to understand patients' beliefs about the causes of their disease as well as accompanying emotional states. This would be of significant value in understanding patients' strengths and obstacles for using self-

management strategies in glycaemic and weight control. To summarise, this preliminary study contributes to the understanding of possible effective interventions including an approach more tailored to women and men with both conditions.

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Peso corporal y funcionamiento psicológico en los pacientes con diabetes mellitus tipo 2: Estudio preliminar

Resumen

El objetivo de este estudio fue evaluar la relación entre las convicciones sobre las causas de enfermedad, control glucémico y estado afectivo de mujeres y hombres con sobrepeso y obesos que sufren de diabetes tipo 2. La muestra clínica incluyó 88 pacientes (46 hombres), a la edad de entre 31 y 79 años. Los pacientes fueron examinados en la Clínica de consulta externa de endocrinología, diabetes y enfermedades metabólicas del Centro hospitalario clínico de Rijeka. Mediciones psicológicas incluían el Cuestionario Revisado de Percepción de Enfermedad y la Escala de Ansiedad y Depresión Hospitalarias. También se obtuvieron el peso corporal, altura y control glucémico de los pacientes. Los resultados demuestran que el índice de masa corporal (IMC) no fue significativamente correlacionado con el nivel de HbA1c, ni con las variables psicológicas mesuradas (atribuciones psicológicas de la enfermedad, ansiedad y síntomas de depresión). Convicción más fuerte que la enfermedad fue causada por los factores psicológicos fue correlacionada con más síntomas de ansiedad y depresión en los pacientes. Hubo un efecto principal significativo del género de paciente en las atribuciones psicológicas y síntomas de ansiedad. Las mujeres mostraron convicciones más fuertes que los factores psicológicos podrían causar su enfermedad y mostraron también niveles más altos de síntomas de ansiedad que los hombres. No hubo un efecto principal más significativo del control glucémico en las variables psicológicas. Los resultados sugieren que trabajando con los pacientes con la DMT2 es importante prestar atención a los aspectos psicológicos de enfermedad, teniendo en cuenta el género de paciente. Examinar las convicciones sobre las causas de diabetes y el estado emocional podría posibilitarnos reconocer posibles obstáculos en proporcionar cuidados.

Palabras clave: obesidad, diabetes, control glucémico, convicciones sobre las causas de enfermedad, ansiedad, depresión

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