VIA MEDICA
RESEARCH PAPER
ISSN 2450–7458
E-ISSN 2450–8187

Verónica Vázquez-Velázquez[1], José J. Pizarro[2], Sofía Sánchez Román[3], Valeria Soto Fuentes[1], Denise Arcila Martínez[4], Héctor Velázquez Jurado[4]

[1]Obesity and Eating Disorders Clinic, Department of Endocrinology and Metabolism, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Mexico City, Mexico

[2]University of the Basque Country, Basque Country, Spain

[3]Department of Neurology and Psychiatry, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Mexico City, Mexico

[4]Comprehensive Diabetes Patient Care Center (CAIPADI), Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Mexico City, Mexico

Psychological Impact of COVID-19 Lockdown on Well-being: Comparisons between People with Obesity, with Diabetes and without Diseases

ABSTRACT

Introduction: Obesity and type 2 diabetes mellitus are two chronic diseases most associated with hospitalizations and deaths from COVID-19.

Background: This study compared psychological impact of COVID-19 lockdown in people with obesity, people with type 2 diabetes (T2D) and people without diseases, and determined the factors associated with well-being.

Materials and methods: An online survey on negative affect, attitudes, social support and sharing, coping, well-being, and eating behavior was conducted in 157 people with obesity, 92 with type 2 diabetes and 288 without diseases.

Results: People with obesity were the most worried of getting infected (70%) or dying (64%) and had the highest levels of emotional eating. People with T2D showed better coping strategies and higher well-being. Negative affect, worries about COVID-19 consequences and uncontrolled eating had negative impact, but social support, social sharing, and coping contributed positively ($p < 0.001$) to well-being. A 48.7% of people with obesity experienced more difficulties to adhere to treatment compared to only 11.1% of people with T2D.

Conclusions: People with obesity had less well-being and more COVID-19 worries and emotional eating than people with T2D and without diseases. Well-being depends on negative affect, worries and eating behavior. Future research about the impact in long-term on weight and health status in patients with chronic diseases is needed. (Clin Diabetol 2022, 11; 3: 183–191)

Keywords: SARS COV-2, metabolic diseases, well-being, mental health, eating behavior

Introduction

The disease known as COVID-19, caused by the SARS-CoV-2 coronavirus, is a pandemic that poses a major public health threat in our current global community [1]. The effects of the pandemic are experienced at the individual (e.g., insecurity and emotional isolation) and community (e.g., economic losses, school closures) levels, and these effects translate into mental health consequences, such as anxiety and worry [2].

Regarding this, it has been studied how this experience influences emotional well-being, and it has been

Address for correspondence:
Héctor Velázquez-Jurado
Vasco de Quiroga 15
Col. Belisario Domínguez Sección XVI
Tlalpan, CP 14080, Mexico City, Mexico
phone: +5255737378
e-mail: hector.velazquezj@incmnsz.mx
Clinical Diabetology 2022, 11; 3: 183–191
DOI: 10.5603/DK.a2022.0020
Received: 30.11.2021 Accepted: 4.05.2022

This article is available in open access under Creative Common Attribution-Non-Commercial-No Derivatives 4.0 International (CC BY-NC-ND 4.0) license, allowing to download articles and share them with others as long as they credit the authors and the publisher, but without permission to change them in any way or use them commercially.

found that both the disease and the confinement are experienced as unpleasant, unprecedented, which have a psychological impact, causing anxiety, acute stress, depression, irritability, insomnia, or post-traumatic stress disorder [3, 4].

In a review of studies evaluating psychological responses and coping methods used by different populations in past outbreaks of infectious disease [severe acute respiratory syndrome (SARS), Ebola, H1N1 influenza], it was concluded that there are negative responses to outbreaks (anxiety, fears, depression, anger, guilt, grief and loss, post-traumatic stress, and stigmatization), but also a greater sense of empowerment and compassion towards others. Regarding coping strategies, the most used was the search for social support. Problem solving attempts resulted in a decrease in sadness in older adults, thus evaluating the situation as controllable, more than younger ones [5].

Two of the most vulnerable populations to the COVID-19 disease with one of the highest number of deaths in Mexico are people with diabetes (37%) and with obesity (22%) [6].

In people with obesity, it is known that perception of stress and emotional overload can lead to maladaptive coping strategies, for example, eating to suppress negative emotions or addictions, and to a lower quality of life. These ways of coping can also favor weight gain or difficulty reducing it [7–9].

In the case of patients with type 2 diabetes mellitus (DM), the diagnosis and the demands that the disease implies, in themselves have altered people's lives, which can play a role of mediators that influence the way of coping with stress [10–13]. Increased social support and a problem-centered positive coping style were related to social well-being, physical and psychological health (increased self-care, metabolic control), while avoidance was associated with a poorer quality of life, an increase in depressive and anxiety-related symptoms related to diabetes, poorer metabolic control, lower well-being and changes in eating behavior [14–16]. In people with diabetes, the use of positive strategies focused on emotion, such as humor or looking for the positive side of things, helps to calm stress, without compromising the disease, helping to reduce the frustration that can affect the self-care [16].

In this moment of special stress for all and in which patients with obesity and type 2 diabetes mellitus are not receiving their usual medical attention due to confinement, it is important to identify psychological variables that may later be impacted. There are few studies that determine if the pandemic outbreak is impacting differently on emotional well-being to these clinical groups.

Therefore, the aims of this study are: 1) to compare well-being, attitudes towards COVID-19, social support, coping strategies, and eating behavior during lockdown in patients with obesity, patients with type 2 diabetes mellitus and people without diseases; and 2) to determine the factors associated with their well-being.

Materials and methods

Subjects

The sample consisted of 673 people from Mexico (67.1% women), aged between 17 and 80 (M = 44.3, SD = 13.5), who were invited to participate through the snowball mechanism.

Patients with obesity or patients with type 2 diabetes

Eligible participants were 18 years or older and we selected for this study only those who have a file at the INCMNSZ, with diagnosis of obesity [body mass index (BMI) > 30, from the Obesity and Eating Disorders Clinic] or type 2 diabetes mellitus (by oral glucose tolerance test or glycated hemoglobin, from the Comprehensive Diabetes Patient Care Center CAIPADI) to make certain the diagnosis. We excluded patients with heart failure, complications of type 2 diabetes mellitus, schizophrenia, severe psychotic depression or with suicidal ideas, bipolar disorder, obsessive compulsive disorder, addictions, dementia, moderate or profound intellectual disability, previously obtained in the file. The group of patients who had both obesity and type 2 diabetes (n = 85) was excluded to have more homogeneous groups.

People without diseases

Eligible participants were 18 years or older. The selection of this group was made through the question: "Indicate if a doctor has diagnosed you with any of the following diseases. Please check all the options you require: type 2 diabetes, obesity, high blood pressure, cancer, Obstructive Sleep Apnea Syndrome, depression, anxiety, binge eating disorder or none of the above." Only people who answered "none of the above" were included. Also, we did not include participants with current obesity, determined from their self-reported height and weight.

From the 673 participants who initially answered, 537 were included forming the following groups, according to their condition: people with obesity (n = 157), people with T2D (n = 92), and people without diseases (n = 288) (Fig. 1).

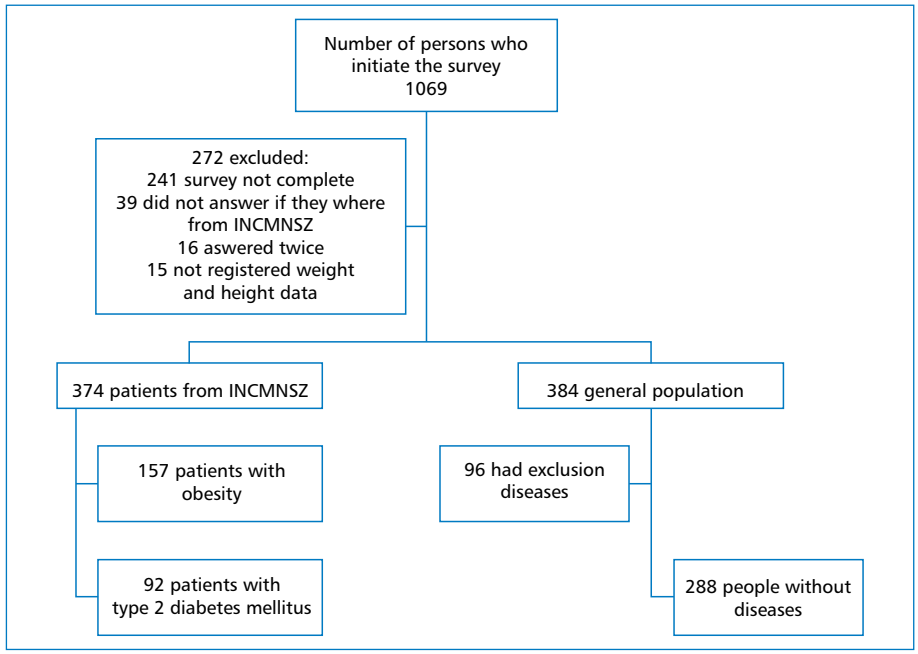

Figure 1. Algorithm Showing Participants' Recruitment in the Survey and the Inclusion in the Comparing Groups

Procedure and participants

This study was a cross-sectional, non-interventional, descriptive study. The participation was encouraged through the authors' networks as well as by email to the database of patients from the Obesity and Eating Disorder Clinic and from the Comprehensive Diabetes Patient Care Center — CAIPADI — of the National Institute of Medical Sciences and Nutrition Salvador Zubirán (INCMNSZ). Ethics approval was obtained from the INCMNSZ and all respondents provided electronic informed consent prior to initiation of the survey. Data gathering was conducted between April 26 and July 19, 2020.

Instruments

Participants were sent a link to open the survey and answer it through a computer or on their smartphone with internet access.

The survey was completed entirely in Spanish through the Qualtrics platform, and the average duration was 20–30 minutes. The answers given by the people created automatic calculations based on the answers of each participant, which allowed them to know their scores and receive feedback and advice on four aspects at the end: 1. Social connections with others, 2. Obsession for COVID-19 information, 3. Healthy habits and, 4. Anxiety and distress related to COVID-19. This feedback was accompanied by international recommendations (NIH, CDC, etc., aimed at the Spanish-speaking population) for a better management of information, stress, emotions, and coping strategies in the face of the pandemic.

1. **Survey "The Pandemic Project": The study of people during COVID-19**. This online survey was conducted at the University of Texas by Pennebaker, Ashokkumar, Vergani, Pizarro, and cols [17]. This project was approved by the University of Texas Research and Ethics Committee (University of Texas, Austin: IRB # 2016-11-0136). The Spanish version was reviewed for use by the University of Texas team and a logical or apparent validation was carried out by the researchers of the present study. For this study, we use the following items integrated in the next categories or end points:
   a) **Personal data.** Age, sex, educational level, job status, self-reported weight, and height.
   b) **Negative affect**. Generalized negative emotions because of the pandemic. Responses include a 5-point scale: not at all, a little, a moderate amount, a lot, a great deal (ω = 0.85)
   a) **Attitudes towards COVID-19 (worries and consequences).** To what degree they were worried about getting or dying from COVID-19 (Contagion ω = 0.89). To what degree they were worried about consequences of COVID-19 (affording rent/utilities/food, medical bills, childcare, losing their job) (ω = 0.77). Responses include a 5-point scale: not at all, a little, a moderate amount, a lot, a great deal. Finally, "If the COVID-19 pandemic has negatively im-

pacted you to follow your doctor's treatment instructions."

b) **Social support/connection**. Participants indicated to what degree has the COVID-19 outbreak influenced their social connections (ω = 0.81). Responses were: much less connected, a little less connected, about the same, a little more connected, much more connected.

c) **Social sharing**. Participants were asked, "In the last 3 days, how many people have you spoken to face to face or by phone text or online." Responses were: zero, 1–2 persons, 3–4 persons, 5–9 persons or over 10 persons (ω = 0.65).

d) **Coping**. We asked participants, "In the last week, on how many days did you engage in the following: prayer or spiritual meditation, yoga, or other relaxation exercise (ω = 0.63). Responses were: 0 days, 1 day, 2–3 days, 4–5 days, or 6–7 days.

e) **Well-being**. Participants indicated their self-reported well-being, which focused on an eudaimonic (e.g., "have a meaningful life", "have a close group of friends and family", "have a deeply religious and spiritual life") and a hedonic dimension ("feel hopeless and depressed", "are afraid and anxious", reversely coded) (ω = 0.81). Responses include a 5-point scale: not at all, a little, a moderate amount, a lot, a great deal.

3. **Eating behavior.** We used the Three Factor Eating Questionnaire-R18 (TFEQ-R18). It is a self-administered questionnaire developed to measure 3 factors of eating behavior: cognitive restraint [CR] (e.g., "I intentionally take small portions for weight control"), uncontrolled eating [UE] (e.g., "When I smell or see a tasty dish, I find it hard to stop eating it, even when I have just eaten") and emotional eating [EE] (e.g., "When I feel anxious, I find myself eating"). It consists of 18 items with 4-point scale (totally true, moderately true, moderately false, totally false) [18]. The Spanish version showed adequate internal consistency (ω = 0.85) (internal data).

Statistical analyses

First, we performed a series of exploratory and confirmatory factor analyses to evaluate the psychometric properties of the scales (i.e., EFAs and CFAs), with their respective reliability tests (i.e., McDonald's Omega). Subsequently, we performed correlation analyses and linear regressions to predict the participants' well-being and eating behavior. Finally, in the case of analysis only with the sample of patients, we performed a series of hierarchical regressions.

All analyses were conducted both in R (R Core Team, 2014) and RStudio (RStudioTeam, 2015).

Descriptive statistics were used to analyze sociodemographic characteristics, health considerations, attitudes, behaviors, and coping strategies. Weight, height, scores on the TFEQ-R18 questionnaire, the number of hours spent on various activities are expressed as means and standard deviation. Comparisons were made between the three groups using the Kruskal-Wallis test (categorical variables) or an ANOVA (continuous variables). Linear correlations and regressions were carried out to calculate the univariate associations between the diagnosis of the diseases and the rest of the variables. All tests were done with two tails, with a significance level of $p < 0.05$.

Results

Table 1 shows the sociodemographic characteristics of the sample, divided into the three groups analyzed. It was observed that people with T2D were the oldest (57.19 ± 9.74). The highest proportion of women was found in the group of people without diseases (75.44%). Regarding the educational level, about 40% in each group reported university studies. The predominant job status was full-time employed, followed by self-employment which was reported by at least 20% in each group. The highest percentage of unemployment was observed in people with obesity (16.8%). Regarding self-perceived health status, 29.9% of people with obesity perceived their health as good or excellent, compared to 53.2% of T2D people and 66.8% of people without diseases.

Table 2 shows the comparisons of end points according to each group. People with obesity reported higher worries about COVID contagion (4.09 ± 0.96). Regarding worries about the consequences of the disease, people with obesity showed greater concern (3.08 ± 0.95) than people with T2D (2.45 ± 1.03) and people without diseases (2.76 ± 0.98) who in turn were more concerned than people with T2D. For the positive coping, people with T2D showed better strategies (2.81 ± 0.94). Regarding well-being, people with T2D reported higher levels (3.88 ± 0.69) than people with obesity (3.46 ± 0.80) and people without diseases (3.47 ± 0.72). Regarding the eating behavior variables, it was observed that people without diseases had a greater cognitive restraint (7.53 ± 2.65) than people with T2D (6.65 ± 2.44) and people with obesity (7.07 ± ± 2.35). People without diseases reported similar levels of uncontrolled eating (18.50 ± 3.98) to people with obesity (19.10 ± 4.81), and in both these groups it was higher than in people with T2D who reported the lowest levels (16.30 ± 3.42). Regarding emotional eating,

Table 1. Participants' General Characteristics (n = 537)

	Patients with obesity (n = 157)	Patients with type 2 diabetes mellitus (n = 92)	People without diseases (n = 288)	P
Age, mean ± SD	45.5 ± 11.7	57.2 ± 9.7	38.2 ± 12.9	< 0.001
Sex, n (%)				
Female	108 (68.8)	47 (51.1)	215 (75.4)	< 0.001
Male	49 (31.2)	45 (48.9)	70 (24.6)	
Educational level, n (%)				
Elementary school and below	1 (0.6)	4 (4.4)	0	< 0.001
Secondary graduated	17 (11.0)	15 (16.5)	4 (1.4)	
High school or university undergraduate	52 (33.8)	15 (16.5)	70 (24.6)	
University graduated	63 (40.9)	39 (42.9)	124 (43.7)	
Postgraduate	21 (13.6)	18 (19.8)	86 (30.3)	
Job status, n (%)				
Student	8 (5.1)	3 (3.3)	63 (22.5)	< 0.001
Full-time employed	39 (25.2)	26 (29.5)	80 (28.5)	
Part-time employed	19 (12.3)	4 (4.5)	19 (6.8)	
Self-employed	32 (20.6)	23 (26.1)	62 (22.1)	
Work at home	17 (11.0)	9 (10.2)	22 (7.8)	
Unemployed, seeking job	26 (16.8)	4 (4.5)	16 (5.7)	
Unemployed, not seeking job	9 (5.8)	4 (4.5)	10 (3.6)	
Retired	5 (3.2)	15 (17)	9 (3.2)	
People at home, mean ± SD	2.8 ± 1.9	2.3 ± 1.7	2.7 ± 1.6	0.096
BMI, mean ± SD	39.1 ± 6.6	26.2 ± 2.6	23.7 ± 2.8	< 0.001
How would you rate your health, n (%)				
Poor	9 (5.7)	2 (2.2)	1 (0.3)	< 0.001
Below average	40 (25.5)	6 (6.5)	11 (3.8)	
Average	61 (38.8)	35 (38.0)	83 (28.9)	
Good	42 (26.7)	43 (46.7)	131 (45.6)	
Excellent	5 (3.2)	6 (6.5)	61 (21.2)	

Values are mean ± SD or %
Missing cases in sex, educational level, job status, rate of health

it was observed that people with obesity (6.82 ± 3.07) had higher levels than people without diseases (5.88 ± ± 2.58) and people with T2D respectively (4.30 ± 2.26).

The hierarchical multiple regression (Tab. 3) revealed that at step one, age contributed significantly to the regression model, [b = 0.02, (95% CI: 0.01, 0.02), p < 0.001], and accounted for 8.4% of the variation of well-being. Introducing chronic condition, does not explain people's self-reported well-being; however, negative affect [b = –0.28, (95% CI: –0.34, –0.22), p < 0.001] and worries about COVID-19 consequences [b = –0.11, (95% CI: –0.17, –0.05), p < 0.001] contributed significantly. This model explained an additional 19.0% of variation in well-being; this change in R^2 was significant, p < 0.001. In a third step, Social support [b = –0.17, (95% CI: 0.11, –0.24), p < 0.001], Social sharing [b = 0.14, (95% CI: 0.05, 0.23), p < 0.001], and Coping [b = 0.22, (95% CI: 0.17, 0.28], p < 0.001) contributed significantly. also this model explained an additional 13.4% of variation in Well-being, this change in R^2 was significant, p < 0.001. In a final step, Negative affect [b = –0.22, (95% CI: –0.27, –0.16), p < 0.001], COVID Consequences [b = –0.12, (95% CI: –0.18, –0.07), p < 0.001], Social Support [b = 0.17, (95% CI: 0.11, 0.23), p < 0.001], Social sharing [b = 0.17, (95% CI: 0.08, 0.25), p < 0.001), Coping [b = 0.20, (95% CI: 0.14, 0.26), p < 0.001] and Uncontrolled eating [b = –0.18, (95% CI: –0.33, –0.04), p < 0.001] contributed significantly to the regression model, and accounted for a total 43.5% of the variation of well-being.

Finally, 25.6% of people with obesity had no impact on their treatment and continued with their medical recommendations, 6.4% reported no change in their treatment but they admitted not having been following

Table 2. Comparisons of Means between Patients with Obesity, Patients with Diabetes and People without Diseases (n= 537)

Dependent variable	Patients with obesity (n = 157)	Patients with type 2 diabetes mellitus (n = 92)	People without diseases (n = 288)	$F_{(2, 534)}$	P	$_{partial}\eta^2$	95% CI
[LL, UL]							
Negative affect	2.93 (1.14)	2.61 (1.06)	2.84 (1.06)	2.67	0.070	0.01	[0.00, 0.03]
COVID worries	4.09^{c} (0.96)	3.92^{b} (0.94)	3.77^{a} (0.93)	5.81	0.003	0.02	[0.00, 0.04]
COVID consequences	3.08^{c} (0.95)	2.45^{a} (1.03)	2.76^{b} (0.98)	12.62	0.000	0.05	[0.02, 0.08]
Social support	2.75 (0.92)	2.86 (0.93)	2.76 (0.72)	0.61	0.542	0.00	[0.00, 0.01]
Social sharing	2.29 (0.62)	2.37 (0.69)	2.31 (0.53)	0.66	0.516	0.00	[0.00, 0.01]
Coping	2.25^{a} (0.95)	2.81^{b} (0.94)	2.39^{a} (0.88)	11.18	0.000	0.04	[0.02, 0.07]
Well-being	3.46^{a} (0.80)	3.88^{b} (0.69)	3.47^{a} (0.72)	11.63	0.000	0.04	[0.02, 0.07]
EB cognitive restraint	7.07^{ab} (2.35)	6.65^{a} (2.44)	7.53^{b} (2.65)	4.74	0.009	0.02	[0.00, 0.04]
EB uncontrolled eating	19.10^{b} (4.81)	16.30^{a} (3.42)	18.50^{b} (3.98)	13.38	0.000	0.05	[0.02, 0.08]
EB emotional eating	6.82^{c} (3.07)	4.30^{a} (2.26)	5.88^{b} (2.58)	25.46	0.000	0.09	[0.05, 0.12]

LL and UL represent the lower-limit and upper-limit of the partial η^2 confident interval. Post-hoc analyses were conducted with Tukey HSD, whenever ANOVAs were significant. Different super indexes indicate mean differences of $p < 0.05$
EB — eating behavior

medical recommendations, 19.2% had a negative effect on their treatment; therefore, they had to implement actions to improve their self-management, and 48.7% perceived an effect on their treatment, making adherence to treatment more complicated.

Of T2D people, 54.4% did not have an impact on their treatment and followed it regularly, 1.1% had no change, although they also admitted that they did not follow it correctly, 33.3% had an impact on their treatment so they had to improve self-management and 11.1% had a negative effect, which further complicated their self-management.

Discussion

This study investigated the psychological impact of COVID-19 pandemic in well-being on two clinical groups, people with obesity or T2D, compared with people without diseases, and explored the variables associated with well-being. Most investigations with this clinical group have centered in the study of the condition as a risk factor for poor outcomes in COVID-19 infection [19, 20]. However, there are few studies that assess the impact of COVID-19 lockdown for this specific group.

In this study, people with obesity were the group with the highest emotional eating, but similar cognitive restraint and uncontrolled eating compared with people without diseases. This suggests that people with obesity are struggling with the same problems as those people without diseases when trying to control their weight through cognitive restraint. Uncontrolled eating may function as a non-adaptive way to cope with negative emotions, and people with obesity have the same difficulty as people without diseases in controlling what they eat, but being the group with more worries about COVID-19, surely because it is known that excess weight leads to increased risk of hospital admissions, needing respiratory support and mortality [21]. Given this increased risk, people with obesity may face additional stress, which turns out to be a trigger for emotional eating and creates more challenges in managing weight, along with the fact that it is known that elevated levels of stress are regularly associated with obesity [7–10]. Accordingly, Brown et al. found that COVID-19 lockdown negatively impacted on diet, physical activity, sleep, mental health, and access to weight management services, particularly in those with severe and complex obesity; and that higher depression and lower well-being were predictors of adverse changes in health-related behaviors during the COVID-19 lockdown [12].

Also, people with obesity perceived a consequence of the pandemic on their treatment, making adherence to treatment more complicated, supporting the results from Imbriano et al. who mention that self-reported worry was not associated with increased engagement in health behaviors [2]. In a similar way, Athanasiadis at al. found an increase in depressed mood, anxiety/worry, and loneliness. Unhealthy eating habits, such as snacking, binge eating, and loss of control while eating, increased too [22, 23].

On the other hand, people with T2D showed more mindfulness-based coping strategies, such as praying, meditation, relaxation techniques, time planning, and practice of gratitude. This group of patients

Table 3. Hierarchical Regression Models Predicting Well-being

Predictor	*b*	95% CI [LL, UL]	Fit	Difference
(Intercept)	2.84**	[2.64, 3.05]	R^2 = .084**	
Age	0.02**	[0.01, 0.02]	95% CI [0.04, 0.13]	
Gender[1]	0.08	[–0.06, 0.21]		
(Intercept)	4.08**	[3.75, 4.41]	R^2 = 0.274**	ΔR^2 = .190**
Age	0.01**	[0.00, 0.01]	95% CI [0.20, 0.33]	95% CI [0.13, 0.25]
Gender[1]	0.01	[–0.11, 0.14]		
Obesity[2]	–0.03	[–0.17, 0.10]		
Diabetes[2]	0.12	[–0.06, 0.30]		
Neg. Affect	–0.28**	[–0.34, –0.22]		
COVID worries	0.05	[–0.02, 0.12]		
COVID consequences	–0.11**	[–0.17, –0.05]		
(Intercept)	2.78**	[2.39, 3.18]	R^2 = 0.406**	ΔR^2 = 0.132**
Age	0.00*	[0.00, 0.01]	95% CI [0.33, 0.45]	95% CI [0.09, 0.18]
Gender[1]	0.07	[–0.04, 0.18]		
Obesity[2]	0.03	[–0.09, 0.15]		
Diabetes[2]	0.05	[–0.11, 0.22]		
Negative affect	–0.23**	[–0.29, –0.18]		
COVID worries	0.04	[–0.02, 0.10]		
COVID consequences	–0.13**	[–0.18, –0.07]		
Social support	0.17**	[0.11, 0.24]		
Social sharing	0.14**	[0.05, 0.23]		
Coping	0.22**	[0.17, 0.28]		
(Intercept)	3.40**	[2.91, 3.89]	R^2 = 0.435**	ΔR^2 = 0.028**
Age	0.00	[–0.00, 0.01]	95% CI [0.36, 0.48]	95% CI [0.01, 0.05]
Gender[1]	0.01	[–0.10, 0.13]		
Obesity[2]	0.06	[–0.06, 0.18]		
Diabetes[2]	0.01	[–0.15, 0.18]		
Negative affect	–0.22**	[–0.27, –0.16]		
COVID worries	0.04	[–0.02, 0.10]		
COVID consequences	–0.12**	[–0.18, –0.07]		
Social support	0.17**	[0.11, 0.23]		
Social sharing	0.17**	[0.08, 0.25]		
Coping	0.20**	[0.14, 0.26]		
EB restrictive control	–0.03	[–0.09, 0.03]		
EB uncontrolled eating	–0.18*	[–0.33, –0.04]		
EB emotional eating	–0.07	[–0.15, 0.01]		

LL and UL indicate the lower and upper limits of a confidence interval, respectively.
[1]Gender is a dummy coded variable (0 = female; 1 = male); [2]Obesity and Diabetes are dummy coded variables (0 = healthy; 1 = with the chronic condition)
* indicates $p < 0.05$; ** indicates $p < 0.01$
CI — confident interval; EB — eating behavior

also showed more well-being. These results are like those from an online survey in patients with diabetes conducted in India. The authors of this study reported that patients were able to keep them physically active and were able to maintain good dietary compliance probably since they had more time to do that [24]. It is possible that the positive coping strategies found in our sample of people with T2D are related with the close follow-up of patients through remote consultations from the multidisciplinary team of the Diabetes Center from our Institution. As part of this follow-up, they have received online information about strategies to cope with diabetes through this pandemic. Also, it is noteworthy that this group was older (mean 57 years old) than the participants from the other two groups, and age is an important factor in the stress and coping process [7].

We found most people with T2D perceived no impact or a positive impact on the adherence to their treatments. However, almost half of people with obesity perceived that COVID-19 has imposed an impact in their ability to adhere to their treatments. It is important to consider that proactive development of strategies that can help people with obesity to cope with this phenomenon must be stressed. Future research in our group of patients about the impact in long-term on weight and health status is needed.

This study has some limitations. Firstly, due to the COVID-19 pandemic, the data was collected online, which could represent a barrier for those who do not have access to electronic media. On the other hand, the sample is made up mostly of women with obesity and without metabolic diseases. Therefore, it is important to limit the findings of the present investigation to this population. In the same way, we found the oldest age group in people with T2D, which could partly explain the results, being a population with more experience in self-management, due to the years lived with the disease, so they have developed better coping strategies.

The main strength of the study was the timely and unique opportunity to examine the effect of a common stressor (COVID-19) in patients with two of the chronic diseases most associated with hospitalizations and deaths from COVID-19 and compare with people from the general population without chronic and mental diseases.

We can conclude that there is a clear difference in the impact of COVID-19 pandemic on well-being and self-management among the participants with obesity and T2D. But our findings suggest that pandemic outbreak may have negative effect on people with or without diseases, especially in how they cope with it.

Acknowledgements

We thank James W. Pennebaker and Ashwini Ashokkumar from the University of Texas at Austin, Austin, Texas, United States of America for their consent to use and translate into Spanish the survey "The Pandemic Project".

Conflict of interest

VVV reports personal fees from Novo Nordisk, outside the submitted work. Other authors report no conflicts of interests.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

REFERENCES

1. Quarantine and isolation. Centers for Disease Control and Prevention. Published March 21, 2017. Updated September 29, 2017. https://www.cdc.gov/quarantine/index.html (13.04.2021).
2. Imbriano G, Larsen EM, Mackin DM, et al. Online Survey of the Impact of COVID-19 Risk and Cost Estimates on Worry and Health Behavior Compliance in Young Adults. Front Public Health. 2021; 9: 612725, doi: 10.3389/fpubh.2021.612725, indexed in Pubmed: 33855007.
3. Brooks SK, Webster RK, Smith LE, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet. 2020; 395(10227): 912–920, doi: 10.1016/S0140-6736(20)30460-8, indexed in Pubmed: 32112714.
4. Yang H, Ma J, Yang H, et al. How an Epidemic Outbreak Impacts Happiness: Factors that Worsen (vs. Protect) Emotional Well-being during the Coronavirus Pandemic. Psychiatry Res. 2020; 289: 113045, doi: 10.1016/j.psychres.2020.113045, indexed in Pubmed: 32388418.
5. Chew QH, Wei KC, Vasoo S, et al. Narrative synthesis of psychological and coping responses towards emerging infectious disease outbreaks in the general population: practical considerations for the COVID-19 pandemic. Singapore Med J. 2020; 61(7): 350–356, doi: 10.11622/smedj.2020046, indexed in Pubmed: 32241071.
6. Informe diario sobre coronavirus COVID-19 en México. Gobierno de México. CONACYT. https://datos.covid-19.conacyt.mx/ (24.07.2021).
7. Wang J, Sereika SM, Styn MA, et al. Factors associated with health-related quality of life among overweight or obese adults. J Clin Nurs. 2013; 22(15-16): 2172–2182, doi: 10.1111/jocn.12280, indexed in Pubmed: 23829404.
8. Hemmingsson E. A new model of the role of psychological and emotional distress in promoting obesity: conceptual review with implications for treatment and prevention. Obes Rev. 2014; 15(9): 769–779, doi: 10.1111/obr.12197, indexed in Pubmed: 24931366.
9. Greeno CG, Wing RR. Stress-induced eating. Psychol Bull. 1994; 115(3): 444–464, doi: 10.1037/0033-2909.115.3.444, indexed in Pubmed: 8016287.
10. Skinner TC, Joensen L, Parkin T. Twenty-five years of diabetes distress research. Diabet Med. 2020; 37(3): 393–400, doi: 10.1111/dme.14157, indexed in Pubmed: 31638279.
11. Nicolucci A, Kovacs K, Holt R, et al. Diabetes Attitudes, Wishes and Needs second study (DAWN2™): cross-national benchmarking of diabetes-related psychosocial outcomes for people with diabetes. Diabet Med. 2013; 7: 767–777, doi: 10.1111/dme.12245, indexed in Pubmed: 23711019.
12. Brown A, Flint SW, Kalea AZ, et al. Negative impact of the first COVID-19 lockdown upon health-related behaviours and psychological wellbeing in people living with severe and complex obesity in the UK. EClinicalMedicine. 2021; 34: 100796, doi: 10.1016/j.eclinm.2021.100796, indexed in Pubmed: 33754138.
13. Burns RJ, Deschênes SS, Schmitz N. Associations between coping strategies and mental health in individuals with type 2 diabetes: Prospective analyses. Health Psychol. 2016; 35(1): 78–86, doi: 10.1037/hea0000250, indexed in Pubmed: 26192382.
14. Shah BM, Gupchup GV, Borrego ME, et al. Depressive symptoms in patients with type 2 diabetes mellitus: do stress and coping matter? Stress Health. 2012; 28(2): 111–122, doi: 10.1002/smi.1410, indexed in Pubmed: 22282035.
15. Gagnon C, Aimé A, Bélanger C. Predictors of comorbid eating disorders and diabetes in people with type 1 and type 2 diabetes. Can J Diabetes. 2017; 41(1): 52–57, doi: 10.1016/j.jcjd.2016.06.005, indexed in Pubmed: 27614805.
16. McCoy MA, Theeke LA. A systematic review of the relationships among psychosocial factors and coping in adults with type 2 diabetes mellitus. Int J Nurs Sci. 2019; 6(4): 468–477, doi: 10.1016/j.ijnss.2019.09.003, indexed in Pubmed: 31728402.
17. Pennebaker JW, Ashokkumar A, Vergani L, Pizarro JJ, et al. The pandemic project: The study of people during COVID-19. https://utpsyc.org/covid19/. (16.04.2020).
18. de Lauzon B, Romon M, Deschamps V, et al. Fleurbaix Laventie Ville Sante Study Group. The Three-Factor Eating Questionnaire-R18

is able to distinguish among different eating patterns in a general population. J Nutr. 2004; 134(9): 2372–2380, doi: 10.1093/jn/134.9.2372, indexed in Pubmed: 15333731.
19. Zakka K, Chidambaram S, Mansour S, et al. PanSurg Collaborative. SARS-CoV-2 and obesity: "covesity"-a pandemic within a pandemic. Obes Surg. 2021; 31(4): 1745–1754, doi: 10.1007/s11695-020-04919-0, indexed in Pubmed: 33479921.
20. Gao F, Zheng KI, Wang XB, et al. Obesity is a risk factor for greater COVID-19 severity. Diabetes Care. 2020; 43(7): e72–e74, doi: 10.2337/dc20-0682, indexed in Pubmed: 32409499.
21. Raeisi T, Mozaffari H, Sepehri N, et al. The negative impact of obesity on the occurrence and prognosis of the 2019 novel coronavirus (COVID-19) disease: a systematic review and meta-analysis. Eat Weight Disord. 2022; 27(3): 893–911, doi: 10.1007/s40519-021-01269-3, indexed in Pubmed: 34247342.
22. Athanasiadis DI, Hernandez E, Hilgendorf W, et al. How are bariatric patients coping during the coronavirus disease 2019 (COVID-19) pandemic? Analysis of factors known to cause weight regain among postoperative bariatric patients. Surg Obes Relat Dis. 2021; 17(4): 756–764, doi: 10.1016/j.soard.2020.11.021, indexed in Pubmed: 33390351.
23. Nather K, Bolger F, DiModica L, et al. The impact of COVID-19 on obesity services across Europe: A physician survey. Clin Obes. 2021; 11(5): e12474, doi: 10.1111/cob.12474, indexed in Pubmed: 34254445.
24. Nachimuthu S, Vijayalakshmi R, Sudha M, et al. Coping with diabetes during the COVID - 19 lockdown in India: Results of an online pilot survey. Diabetes Metab Syndr. 2020; 14(4): 579–582, doi: 10.1016/j.dsx.2020.04.053, indexed in Pubmed: 32416527.