The correlation between anxiety and depression levels with bulimic symptomatology and body mass index during COVID-19 quarantine measures: A 2-month follow-up study

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ABSTRACT

Objectives: This study aims to investigate the relationship between anxiety and depression levels with bulimia symptoms and body mass index (BMI) during the quarantine measures.
Methods: Voluntary individuals were included, and individuals were evaluated before and after 2-month quarantine period, and self-report questionnaires were administered. In addition to the sociodemographic data form, Hospital Anxiety and Depression Scale (HADS) and Bulimic Investigatory Test, Edinburgh (BITE) were applied twice to the participants and their BMI were recorded.
Results: An increase in HADS-A scores was observed after quarantine (z=-6.456, P<0.001). Upon comparing the scale scores, and BMI values recorded at the onset of the quarantine period and two months later, a negative correlation was observed between the BITE-2 (after 2-month follow-up) score and both the BMI-2 value and the HADS-A1 (baseline measurement) score, with correlation coefficients of r =-0.493, P<0.001, and r =-0.267, P=0.041, respectively. Additionally, BMI-1 values were positively correlated with HADS-D1 (r=0.186, P=0.028) and negatively correlated with BITE-1 score (r=-0.323, P<0.001).
Conclusions: The finding of higher BMI in individuals with high depressive symptom severity, the negative correlation of bulimic symptoms with BMI, and higher anxiety levels after quarantine period reveal the impact of mental health on eating behavior and effect of pandemic on psychiatric symptoms. Our study can provide a unique perspective on eating behaviors and psychiatric symptomatology due to quarantine measures.
Keywords: Eating disorder, anxiety, depression, COVID-19, bulimia nervosa

*T*he novel human coronavirus disease has been defined as a life-threatening global pandemic, starting in late 2019 and known to affect millions of individuals worldwide [1]. Originating from China, COVID-19 quickly spread to Asia, Europe, and America, becoming a prevalent issue globally [1]. As scientists have endeavored to tackle the COVID-19 outbreak, they have also attempted to address its various dimensions, discovering that this global epidemic has led to significant changes in

human life. Among these changes are the quarantine process and secondary psychiatric problems resulting from the quarantine measures [2]. It has been supported by numerous studies that the pandemic and quarantine measures lead to no change in some individuals, while causing anxiety, depressive symptoms, and sleep problems in others [3-5]. Although it is generally accepted that quarantine and the pandemic process act as predisposing factors for psychiatric conditions, the impact on eating attitudes remains unclear due to the cross-sectional nature of clinical studies and conflicting findings [6].

Eating behaviors can be characterized as the choices individuals make regarding their food consumption, influenced by trends, personal preferences, specific diets, and calorie monitoring [7]. Clinical research to date supports that individuals' eating behaviors are influenced by sociocultural factors, economic factors, nutritional awareness, physiological needs, general health status, and psychological factors [7]. Psychological factors such as stress, emotional states, depression, etc., are among the primary influences on eating behaviors. For instance, while some people may eat more under stress, others might lose their appetite [8]. In some cases, exposure to environmental and psychological stressors can lead to the diagnosis of eating disorders [8]. Eating disorders are known as psychopathologies involving abnormal behaviors and thoughts regarding food intake, which can impair an individual's physical health, emotional well-being, and social functioning [9]. The most common disorders among eating disorders include anorexia nervosa, characterized by excessive weight loss and low body weight aimed at controlling and limiting body weight; bulimia nervosa, characterized by compensatory behaviors after bouts of uncontrolled eating; binge eating disorder, involving individuals regularly consuming excessive amounts of food and experiencing a loss of control over this issue; and avoidant/restrictive food intake disorder, characterized by a limitation/excessive selectivity in food intake [9].

The social isolation caused by COVID-19 pandemic, changes in daily routines, decreased appetite due to loss of taste and smell, and emotional eating behaviors due to stress appear to be the main reasons underlying the pandemic's triggering effect on eating disorders [10]. However, the lack of clinical research and inconsistent evidence on this subject makes it challenging for mental health professionals to provide clear evidence. This research aims to reveal the effect of COVID-19 quarantine measures on psychiatric symptoms and eating behaviors.

METHODS

Study Design and Sample Selection
This research was designed as a prospective clinical study, including a sample of 140 volunteers aged between 18-65 from Sakarya/Türkiye. Volunteers who were literate, without an active mental/cognitive illness diagnosis, and consented to participate were included in the study. Under COVID-19 measures, local quarantine protocols were enacted, and volunteers were evaluated twice: at the start and at the end of the 2-month quarantine period. During the initial assessment, volunteers' comorbid diseases, medical history, body mass indexes (BMI), and sociodemographic data were recorded. Scores from the Hospital Anxiety and Depression Scale (HADS) and the Bulimic Investigatory Test Edinburgh (BITE) were documented at both the beginning and 2 months following the start of the local quarantine.

Ethics committee approval was received from Sakarya University Faculty of Medicine non-invasive research ethics committee with date and decision number 2020/316. The study was conducted in compliance with the Declaration of Helsinki.

Sociodemographic Data Form
The gender, age, marital status, place of residence, educational status, monthly income, active employment status, and occupation of the volunteers included in the study were recorded with the sociodemographic data form and the data of the participants were obtained.

Hospital Anxiety and Depression Scale (HADS)
The Hospital Anxiety and Depression Scale (HADS) comprises two subscales: Anxiety (HADS-A) and Depression (HADS-D), each with seven items scored from 0-3 based on the individual's feelings over the past week. Cut-off scores categorize cases as mild (8-10), moderate (11-15), or severe (16+). The Turkish form's validity and reliability were first assessed by Ömer Aydemir *et al*. in 1997 [11].

Bulimic Investigatory Test, Edinburgh (BITE)

The Bulimic Investigatory Test, Edinburgh (BITE) is a diagnostic tool conducted by Kiran SG. *et al.* [12] in 2000, the Turkish validity and reliability study of the BITE scale measures eating habits and concerns related to eating, shape, and weight. The symptom subscale scores are categorized into low (0-9), medium (10-20), and high (20-30) levels of symptomatology.

Statistical Analysis

The obtained results were analyzed using the IBM SPSS (Statistical Package for the Social Sciences) Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY), utilizing descriptive statistics, the Kolmogorov-Smirnov test for normal distribution, Student's T-test, Wilcoxon test, Mann-Whitney U test, ANOVA, Kruskal-Wallis test, one-way analysis of variance, Levene's test, Tukey's HSD, and Spearman's correlation analysis. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 140 individuals aged between 18-65 participated in the research. 59.3% of the participants were female (n=83) and 40.7% were male. The ages of the participants ranged from a minimum of 18 to a maximum of 65 years, with a mean age of 29.84±9.30 years. Detailed information on sociodemographic characteristics of participants is presented in Table 1. The body mass indexes (BMIs) of the participants were evaluated. The smallest BMI was 17.16, and the largest BMI was 39.06. The mean BMI of all participants was 23.64 ± 3.91 kg/m2.

Psychiatric History of Participants

Ten (7.1%) participants reported that they had at least one psychiatric diagnosis during childhood and/or adolescence and received treatment for this reason. When the participants were asked whether they had been diagnosed with bulimia nervosa at any time,

Table 1. Sociodemographic characteristics of participants

	n	%		n	%
Gender			**Place of Residence**		
Female	83	59.3	Rural	13	9.3
Men	57	40.7	Urban	127	90.7
Marital status			**Income Level**		
Married	47	33.6	TRY 0-2000	40	28.6
Single	91	65	TRY 2001-5000	38	27.1
Divorced	2	1.4	TRY 5001-10.000	54	38.6
Education level			TRY 10.001 and above	8	5.7
Primary school	-	-	**Occupation**		
Middle School	1	0.7	Student	48	34.3
High school	14	10	Public officer	55	39.3
University	96	68.6	Worker	8	5.7
Master's Degree and above	29	20.7	Shopkeeper	5	3.6
Comorbidity			Self-employed	1	0.7
Yes	26	18.6	Other	23	16.4
No	114	81.4	**Working Status**		
			Regular employee	79	56.4
			Working irregularly	10	7.1
			Unemployed	51	36.4
Total	140	100%	**Total**	140	100%

it was found that none of them had been diagnosed with bulimia nervosa. When asked whether they had been diagnosed with anorexia nervosa at any time, 0.7% (n=1) reported that they had been diagnosed with anorexia nervosa.

One (0.7%) participant reported that their family members had been diagnosed with anorexia nervosa or bulimia nervosa.

The rate of those who reported receiving any psychiatric diagnosis in adulthood was 19.3% (n=27), and the rate of those who reported receiving psychiatric treatment for any reason in adulthood was 17.9% (n=25).

Non-Psychiatric Comorbidities

Twenty-six (18.6%) participants reported that they had at least one chronic disease, while others reported that they did not have any chronic disease. Comorbid conditions are shown in Table 2.

When participants were asked whether they had a positive or suspected COVID infection detected by tests and/or imaging examinations, 5.7% (n=8) re-

ported having a positive or suspected COVID infection, while the remaining participants reported not having such a condition.

Comparison of Participants' Scale Scores at the Beginning of the Quarantine Period

The comparison of sociodemographic data, BITE-1, HADS-A-1 and HADS-D-1 scores and BMI-1 values are shown in Table 3. Based on the statistical data in Table 3, it was determined that the mean values of HADS-A-1 [U=1822,0; z=-2,329; P=0.020] and BMI-1 [U=1368,0; z=-4,231; P<0.001] showed significant differentiation according to the gender variable. Accordingly, the mean value of HADS-A1 was higher in female individuals (X=9.002; SD=2.42) than in male individuals (X=8.09; SD=2.03).

According to Table 4, when the participants were evaluated in terms of HADS-A-1, HADS-D-1 and BITE-1 scores, it was determined that there was a statistically significant correlation between the scale scores. BITE-1 score was negatively correlated with BMI-1, HADS-A-1, HADS-D-1 scores (P<0.001;

Table 2. Non-Psychiatric Comorbidities of Participants

Comorbid Conditions	Percentage of Responses	
	n	%
Allergy	2	6.90%
Asthma	5	17.20%
Chronic bronchitis	2	6.90%
Diabetus mellitus	3	10.30%
Familial Mediterranean fever	2	6.90%
Hypothyroidism	4	13.80%
HIV	1	3.40%
Hepatitis B	1	3.40%
Migraine	1	3.40%
Meniere's disease	1	3.40%
Peptic ulcer	4	13.80%
Osteoarthritis	1	3.40%
Irritable bowel syndrome:	1	3.40%
Hypertension	1	3.40%
Total	**29***	**100.00%**

HIV=Human immunodeficiency virus

*Due to the presence of multiple comorbid conditions, n is calculated as 29 instead of 26

Table 3. Comparison of sociodemographic characteristics and HADS-A-1, HADS-D-1, BITE-1, and BMI-1 scores at the Initial Assessment

	HADS-A-1	HADS-D-1	BITE-1	BMI-1
Gender	U=1822.0	U=2241.0	U=2320.0	U=1368,0
	z=-2.329	z=-.531	z=-.193	z=-4.231
	P=0.020	P=0,595	P=0.847	**P<0.001**
Marital status[a]	U=1873.5	U=2153.5	U=1598.5	F=4.662
	z=-1.391	z=-1.142	z=-2.595	t=3.797
	P=0.164	P=0.887	**P=0.009**	**P<0.001**
Psychiatric diagnosis	U=913.00	U=1477.0	U=1468.5	F=.099
	z=-3.268	z=-.258	z=-.302	t=-.937
	P=0.001	P=0.797	P=0.763	P=0.350
Weight status[c]	U=2049.5	U=1586.0	U=1437.0	U=.000
	z=-.164	z=-2.270	z=-2.935	z=-9.421
	P=0.869	**P=0.023**	**P=0.003**	**P<0.001**
Income level[b]	U=1809.0	U=1832.0	U=2226.0	U=2184.5
	z=-2.581	z=-2.473	z=-.807	z=-.980
	P=0.001	**P=0.013**	P=0.420	P=0.327
Comorbidity	U=1410,5	U=1440.5	U=1479.0	U=1401,5
	z=-.387	z=-.224	z=-.016	z=-.431
	P=0.699	P=0.823	P=0.987	P=0.666
Employment status	x^2=12.561	x^2=7.879	x^2=5.298	F=.832
	P=0.002	**P=0.019**	P=0.071	P=0.437
Education level	x^2=3.810	x^2=1.300	x^2=0.666	F=2.899
	P=0.149	P=0.522	P=0.717	P=0.058

HADS=Hospital Anxiety and Depression Scale, HADS-A=Anxiety, HADS-D=Depression, BITE=Bulimic Investigatory Test, Edinburgh, BMI=Body Mass Index

Mann Whitney U, Kruskall Wallis, Student's T Test, ANOVA Tests were applied.

[a]Marital status; Married single

[b]Income Level; TRY 5000 and below – TRY 5000 and above

[c]Weight Status: Normal or Underweight - Recategorized as Overweight or Obese.

P=0.024 and P=0.007, respectively) and positively correlated with age (P=0.009). There was a statistically significant positive correlation between HADS-A-1 and HADS-D-1 scores (P<0.001).

Assessment of Participants Accessible Two Months Later

At the end of two months, 42.1% (n=59) of the participants could be reached. 66.1% (n=39) of the patients who could be reached were female and the others were male.

Since the p values of BITE, HADS-D and BMI were P<0.005 according to the Kolmogorov-Smirnov test, it was determined that they did not show a normal distribution and non-parametric tests were applied. No statistically significant difference was detected between the HADS-D, BITE scores and BMI values of the participants who could be reached two months later, before and after quarantine. (z=-1.011, P=0.312; z=-1.314, P=0.189; z=-.111, P=0.912, respectively). There was a statistically significant difference between the HADS-A scores of participants who could be

Table 4. HADS-A1, HADS-D1, BITE-1, age and BMI evaluation at the initial assessment

n=140		BITE-1 score	HADS-D-1	HADS-A-1	BMI-1	Age
BITE-1	r	1				
	Pvalue	.				
HADS-D-1	r	-.226	1			
	Pvalue	**0.007**	.			
HADS-A-1	r	-.190	.386	1		
	Pvalue	**0.024**	**0.001**	.		
BMI-1	r	-.323	.186	-0.075	1	
	Pvalue	**0.001**	**0.028**	0.378	.	
Age	r	.247	-0.032	-.230	.368	1
	Pvalue	**0.003**	0.708	**0.006**	**0.001**	.

HADS=Hospital Anxiety and Depression Scale, HADS-A=Anxiety, HADS-D=Depression, BITE=Bulimic Investigatory Test, Edinburgh, BMI=Body Mass Index
Spearman Correlation Analysis was applied

reached two months later, before and after quarantine (z=-6.456, P<0.001). Accordingly, HADS-A scores increased significantly after quarantine.

HADS-A, HADS-D, BITE scale scores applied at the beginning and after the quarantine period and BMI values of the participants who could be reached after two months were compared, it was found that the BITE-2 score was negatively correlated with BMI-2 value and HADS-A1 score (r=-.493, P<0.001 and r=-.267, P=0.041, respectively).

In this sample, BMI-1 values were positively correlated with HADS-D1 (r=.186, P=0.028) and negatively correlated with BITE-1 score (r=-.323, P<0.001).

DISCUSSION

The COVID-19 pandemic is a global event that seriously affects public health and social life around the world [13]. It has been understood that this pandemic affects human health through many different mechanisms and triggers mental/physical pathologies [13]. In the post-pandemic period, the long-term effects of the virus are still being discussed. This study tried to draw attention to the effects of the quarantine period during the pandemic on the psychological health of individuals between the ages of 18-65 and some related eating behaviors. The study is noteworthy in that it provides a comprehensive analysis by taking into account various factors such as sociodemographic characteristics, BMI, psychiatric background, comorbid conditions and traumatic experiences of the participants. The participants included in our study were distributed across a wide age range (18-65), genders (59.3% female, 40.7% male) and socioeconomic groups. The average age is 29.84 years and they generally live in urban areas. Socioeconomic profiles varied; working people, university graduates and individuals from different income levels were included in the study. Similarly, individuals' Body mass indexes have a wide distribution (average 23.64±3.91 kg/m2). When the psychiatric background of the participants was analyzed, the rate of psychiatric diagnosis in childhood was 7.1%. This rate was particularly low for bulimia nervosa and anorexia nervosa. Additionally, 28.6% of the participants experienced a traumatic event in their childhood. Participants' anxiety and depression levels were evaluated with HADS scores during the quarantine period. The findings showed that women, married individuals, those with low income groups and those who had previously received a psychiatric diagnosis had higher anxiety levels. In the evaluation made after the two-month quarantine period, the anxiety, depression and bulimic symptomatology scores of the participants were examined regarding their psychological states. A significant increase was detected in anxiety levels, but no significant

change was detected in depression and bulimia scores.

The participant profile of the study is examined sociodemographically, it is seen that it was conducted on a population aged 29.84±9.30. It is important to evaluate this demographic structure in terms of responses to pandemic conditions and stress because this age range covers a period when both working life and family life continue actively. This is important in terms of the individual's coping mechanisms and the potential to be affected by the isolation experienced during the pandemic. Participants included in similar studies focusing on the relationship between the pandemic and eating disorders were found to consist mainly of young individuals [14, 15].

In terms of psychiatric background and comorbidity, it is noteworthy that the study participants had psychiatric diagnosis and treatment both in childhood and adolescence and in adulthood. These findings suggest that during the pandemic, psychologically more vulnerable groups may be more affected. Gender differences have also been an important parameter in terms of psychological effects during the pandemic period. The fact that HADS-A scores in female participants were significantly higher than in males may indicate that women may be more affected by the pandemic. This differentiation may be attributed to the additional stress that women often face due to societal role expectations and the responsibility of managing multiple tasks within the household. Also, the finding of a significant difference in BMI values by gender indicates that there are differences between genders in healthy nutrition and body weight management during the pandemic. A similar study has found that women were at a higher risk for eating disorders and vulnerable for psychiatric symptoms during the pandemic period [16].

Findings regarding marital status and place of residence indicate that higher BMI and BITE scores are encountered, especially in married individuals and those living in urban areas. These findings suggest that married individuals and people in densely populated cities may have to struggle more with the psychological and physiological pressures that may occur during the pandemic, suggesting that these may be related to the complexity of urban life and the stresses of home life. These risk factors, which caused changes in eating behavior, have similarly been emphasized in previous research [6, 17, 18].

Although no significant correlation was found between the presence of comorbid diseases and psychological stress, this may create a significant health management burden during the pandemic and indirectly affect quality of life, mental health and general well-being. Individuals with chronic diseases may need to apply to healthcare systems more frequently, which may lead to increased risk perception and health concerns during the pandemic. In a similar follow-up study on eating disorders and the pandemic, it was observed that individuals with early trauma or insecure attachment were particularly vulnerable [19].

In the follow-up evaluation two months later, it was observed that HADS-Anxiety scores increased significantly compared to the early stages of the pandemic, but there was no significant change in HADS-Depression, BITE scores and BMI values. This supports the hypothesis that prolonged quarantine and pandemic conditions continue to affect people's anxiety levels, but that symptoms of depression and eating habits may stabilize over time. This may suggest that in the later stages of the pandemic, people are to some extent able to adapt to uncertain environments and ever-changing conditions, or that the associated emotional responses may change over time. However, these findings are important in that the increase in anxiety levels over time indicates the persistence of economic, social and health-related concerns that the pandemic is likely to bring. The literature on research conducted on the pandemic and eating disorders shows variable evidence regarding the association with symptoms of depression and anxiety [20-22].

The pandemic and quarantine measures have had multidimensional and complex effects on human psychology [18]. Although this study reflects the effects over a specific time period, the long-term psychosocial consequences of the pandemic are not yet fully known. It highlights the need to design interventions and support services that aim to promote well-being during and after the pandemic, with a focus on groups at risk for mental health. Also, how health habits and lifestyle choices will be affected under pandemic conditions and their impact on overall health should be carefully monitored.

The generalizability of the findings should be evaluated depending on the methodological limitations of the study and the participant profile. However,

this study can be seen as a first step based on important data that contributes to the understanding of the psychosocial effects associated with the pandemic. In future studies, it is important to further deepen these findings, to examine their relationship with various individual and social variables in more detail and to understand their long-term effects. The data presented in this study provide reference points that can be used to make sense of the impact of the pandemic on human behavior and mental health.

Strengthening psychosocial support systems is vital for the development of strategies and services to help individuals cope with the challenges they face during and after global crises such as the pandemic. Such research also provides valuable information to improve the effectiveness of public health policies and intervention programs.

Limitations

As for study limitations, the limited sample size and demographic diversity require caution regarding the adaptability of the findings to the general population. Additionally, due to the cross-sectional design of the study, definitive conclusions cannot be drawn about cause-effect relationships. Also, the fact that mental symptoms were assessed with self-report scales and that other factors that may affect mental status, such as genetic factors or family environment, were not addressed can be considered as other main limitations. However, comprehensive and long-term prospective studies are needed to understand the effects of the pandemic on the psychosocial status of individuals.

CONCLUSION

The findings of this study show that COVID-19 quarantine measures have profound effects on people's psychology and eating habits. In particular, the observed correlation between increased depressive symptoms and anxiety levels and disruptions in eating patterns highlights the need to assess the pandemic in terms of psychological stressors and their possible long-term effects on behavior. Such information can be vital in developing strategies to respond to future health crises and strengthen mental health support systems.

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