



# Nutritional behavior during the COVID-19 pandemic: the association of fear and sleep quality with emotional eating

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## Abstract

**Purpose** Even though it is known that fear and poor sleep quality trigger emotional eating, whether fear and poor sleep quality are associated with emotional eating during the COVID-19 pandemic is not clear. This study aimed to evaluate the association of fear of COVID-19, sleep quality, and some sociodemographic characteristics with emotional eating during the COVID-19 pandemic.

**Method** This cross-sectional descriptive study was completed with 495 participants in Turkey. The participants filled out a questionnaire that asked about sociodemographic characteristics, fear of COVID-19, nutritional behaviors, sleep quality, and self-reported weight and height through email or social media.

**Results** The fear of COVID-19 score ( $\beta$ : 0.090,  $p < 0.05$ ) and sleep quality score ( $\beta$ : 0.289,  $p < 0.001$ ) were associated with the emotional eating score at the rate of 0.8% and 8.3%, respectively. The association of fear of COVID-19 with emotional eating disappeared when combined with various factors. The collective association of all factors, fear of COVID-19 ( $\beta$ : 0.042,  $p > 0.05$ ), sleep quality ( $\beta$ : 0.246,  $p < 0.001$ ), BMI ( $\beta$ : 0.275,  $p < 0.001$ ), age ( $\beta$ :  $-0.259$ ,  $p < 0.001$ ) and gender ( $\beta$ :  $-0.169$ ,  $p < 0.001$ ) were associated with the emotional eating score at the rate of 18.3%.

**Conclusions** These findings suggest that fear of COVID-19, sleep quality, BMI, age, and gender were associated with emotional eating during the pandemic. We hope that this study will help in the development of guidelines and strategies through understanding the factors associated with nutritional behavior during the pandemic period.

**Level of evidence** Level V, cross-sectional descriptive study.

**Keywords** COVID-19 · Eating behaviors · Emotional eating · Sleep quality · Fear of COVID-19 · BMI

## Introduction

COVID-19 is a multisystemic disease caused by the new type of coronavirus (SARS-CoV-2), sometimes leading to severe symptoms such as Middle East Respiratory Syndrome and Severe Acute Respiratory Syndrome, which first appeared in December 2019 in Wuhan, China [1]. COVID-19 has led to deaths on a global scale with an increasing number of patients. The number of daily cases shared by the Ministry of Health in Turkey is 2.208.652 in total, and

14.380 on December 31, 2020 [2]. WHO emphasized that physical and social distance along with partial or complete quarantine are effective strategies in reducing the spread of the virus [3]. These strategies were implemented by most countries, including Turkey. The Government of Turkey has taken some measures to prevent the spread of the virus and reduce the number of patients, including closing crowded places such as schools, universities, cafes, gyms, mosques and requiring weekend quarantine for everyone and working from home [4].

The increase in time spent at home and socially distanced can cause psychological and behavioral alterations [5, 6]. Fear is known to be one of the most primitive feelings that come up in the face of a real or perceived threat. During the COVID-19 pandemic, limited information about the disease, high transmission and mortality rate of the disease, and excessive flow of information on social media created confusion and increased the level of fear in people. The occurrence

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of any infectious disease in a community is associated with psychological problems such as fear and anxiety [7]. These psychological problems can cause changes in lifestyle habits such as eating behavior, sleep quality, and physical activity [8, 9]. During a pandemic, some measures and restrictions to prevent the spread of the virus make it more difficult to deal with negative emotions and this fosters the development of maladaptive coping strategies, one of which is emotional eating [10, 11]. Emotional eating is described as an eating behavior that is hypothesized to occur as a response to emotions and not to physiological hunger [12, 13]. In stressful situations, people may consume more food than normal or, on the contrary, may limit food intake [14–18]. This shows that emotional states are associated with eating behavior. Pak et. al (2021) reported that there was no direct relationship between emotional eating and fear of COVID-19, and the depression has mediated the relationship between fear of COVID-19 and emotional eating during the COVID-19 pandemic in Turkey [19]. Studies among adults during COVID-19 have indicated that psychological factors and increased stress due to the pandemic may alter eating behaviors and trigger emotional eating [20–22]. Additionally, changes in eating behaviors have also been associated with quarantines and fear of catching the virus [23–26]. Studies have revealed that people gained weight during this period [20, 27] and have reported an increase in emotional eating and uncontrolled eating behaviors [25]. It is considered that psychological changes during the COVID-19 pandemic may lead to long-term eating behavior disorders. It is therefore worth investigating the association of the fear of COVID-19 with emotional eating during the pandemic.

Sleep habits [28] and sleep–wake rhythms [9, 29–32] changed during the COVID-19 pandemic. Casagrande et al. (2020) demonstrated that youth and women who had fear of COVID-19 had an increased risk of developing sleep disturbances, as well as higher levels of anxiety and distress [6]. Similarly, Cellini et al. (2020) showed that the increase in sleep difficulties was associated with a higher level of depression, anxiety, and stress in adults during the pandemic [33]. Stanton et al. (2020) evaluated 1491 adults and stated that negative changes in sleep were associated with higher depression, anxiety, and stress symptoms [34]. Studies on COVID-19 have reported that sleeping habits were also severely affected; quarantines have been considered to be a potential risk factor that negatively affects sleep quality [1, 35] and sleep quality was associated with negative affect and worry [36]. It is known that sleep pattern is a critical determinant of eating behavior in humans. Previous research showed that reduced sleep quality adversely affects both physiological and psychological health by causing poor eating habits [22, 37, 38]. In addition, studies showed that there was a negative relationship between emotional eating and sleep quality [39–41] and that poor sleep quality resulted

in increased food intake [41, 42]. During the pandemic, prolonged screen use, increased time spent at home due to quarantine and closures, and decreased physical activity may adversely affect the sleep quality of individuals. Therefore, it is thought that poor sleep quality may trigger emotional eating by causing difficulties in emotional regulation.

Body mass index (BMI) has been described as having a crucial role in the development of disordered eating behaviors [43, 44]. Emotional eating has been predominantly associated with overweight and obesity in the literature [12, 16, 45–47]. Additionally, it has been found that overweight individuals are more unsuccessful in coping with negative emotions and this situation leads them to emotionally eat [48]. Despite these findings, many individuals may have an optimal BMI even if they are emotional eaters [49]. Therefore, emotional eating can also be observed in normal-weight individuals [50]. With this information, it is important to explore the role of BMI in emotional eating during the pandemic, when fear increases and sleep patterns change.

The association of age and gender with emotional eating is well documented. Before the pandemic, it has been reported that the emotional eating levels of young individuals [51–53] and women [54–56] are higher by considering the demographic characteristics separately that may be associated with emotional eating. Studies conducted during the pandemic period also report similar results [26, 27]. However, when the fear experienced is evaluated together with the changing sleep quality and BMI, it is interesting to investigate whether age and gender factors are still predictors of emotional eating during the pandemic.

There are limited studies available, to the best of our knowledge, concerning what factors may be associated with emotional eating during the pandemic [10]. Therefore, it is clear that more research is needed on possible predictors of emotional eating. Our study aimed to provide an understanding of factors predicting emotional eating during COVID-19 in a sample of Turkish adults. In the present study, we examined the association of fear, sleep quality, BMI, age, and gender with emotional eating by hierarchical models. We focused primarily on the association between emotional eating and factors that were added to or changed in our lives during the pandemic period. Sociodemographic variables known to be associated with emotional eating were added to the model in later steps. In the first step, we hypothesized that fear experienced during the pandemic would be associated with emotional eating, regardless of sociodemographic variables. In the second step, we considered whether sleep quality is related to emotional eating due to the change in sleep–wake duration in the pandemic. In the third step, we evaluated the collective association of fear and sleep quality with emotional eating. Given that people stay awake longer due to restrictions, we considered that they might consume more food and increase their daily energy intake, resulting

in changes in BMI. Therefore, we evaluated the association of BMI in addition to fear and sleep at step four. In the fifth and final step, age and gender were added to the model and the collective association of all factors with emotional eating was revealed.

## Methods

### Design

This is a descriptive, correlational, and cross-sectional study.

### Participants

The population of the study consisted of individuals who resided in Turkey between November 2020 and January 2021. The sample size was calculated by G\* power analysis (based on 95% confidence and 80% power) based on data from the American Psychological Association Stress and Nutrition report indicating that 38% of adults develop stress-related binge eating or unhealthy eating behavior as previously described [20, 57]. Considering that this rate has increased in the pandemic (assuming 60%), it was determined that at least 282 people should be included in this study. The sample consisted of 495 individuals (post hoc analysis result: 0.95) who met the inclusion criteria, selected with the convenience sampling method. Individuals who were 18 years of age or older; who were able to speak, read, and comprehend Turkish; and who did not have any physical or cognitive health problems that would hinder filling out the form were included within the scope of the research.

The data were collected online using Google Forms. The study was advertised to university students in an online learning setting. First, the form and its link were shared with students who agreed to participate in the research. Then, the students were asked to share the link of the form via WhatsApp and email with their parents and relatives. Thus, Google Forms was shared with the participants residing in different places (large cities, provinces, districts, and villages) via WhatsApp and email in accordance with the principle of voluntary participation. In the email and WhatsApp, participants were informed about the purpose of the study, and those who marked the “I agree with participating in the survey” expression at the top of the Google Form were requested to fill out the form. Data collection and recording via Google Forms were managed by the researcher and limited to a one-time response by each participant. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Approval was obtained from

the Istanbul Medeniyet University Social and Human Sciences Ethics Committee (27102020/38) and the Scientific Research Platform of the Ministry of Health of Turkey (2020–10-22T19\_39\_16). Written informed consent was obtained from all subjects.

### Data collection forms

The research data were collected via the Participant Information Form that was prepared by the researchers in light of the relevant literature [5, 30, 58, 59], the Fear of COVID-19 Scale, the Pittsburgh Sleep Quality Index, and the Emotional Eating Scale.

### Participant information form

This form included socio-demographic questions about age, body weight, height, marital status, and education level of the participants. Bodyweight and height were based on self-report. The BMI was calculated by dividing self-reported weight by the height squared ( $\text{kg}/\text{m}^2$ ). Participants were asked whether they were married or single. To determine educational status, the highest number of years of schooling completed was asked and participants were divided into four categories i.e. primary or secondary school (8 years or less than 8), high school (9–12 years), undergraduate (13–16 years) and graduate school (17 years or more). Economic income has been categorized over the minimum wage determined by the Commission of Fixing the Minimum Wages of the Ministry of Family and Social Services (Turkey). The net minimum monthly wage for January 2021 was announced as 2825 Turkish liras [60]. Accordingly, those who earn 2825 Turkish liras or less were considered low, those who earn 2 times the minimum wage were considered medium (> 2825–5650 Turkish liras), and those who earn more than 2 times were considered high income (> 5650 Turkish liras).

### Fear of COVID-19 scale (FCV-19S)

This form was developed by Ahorsu et al. (2020) to measure COVID-19-induced fear levels. Designed as a five-point Likert-type scale (1 = strongly disagree to 5 = strongly agree), the FCV-19S includes seven items such as “I cannot sleep because I’m worrying about getting COVID-19” and “It makes me uncomfortable to think about Corona.” Total scores ranged between 7 and 35 points. A high score indicates that the respondent has high-level COVID-19 fear and the Cronbach’s alpha coefficient of the scale was reported to be 0.82 [61]. The Cronbach’s alpha coefficient in the Turkish validity and reliability study conducted by Ladikli et al. (2020) was 0.80 [62]. In this study, Cronbach’s alpha coefficient was 0.87.

### Pittsburgh sleep quality index (PSQI)

This scale was developed by Buysse et al. in 1989 [63]. The PSQI provides information about sleep quality during the previous month. In the PSQI that consists of 24 questions, 19 questions are answered by the participant while 5 questions are answered by the participant's bed partner. While the questions answered by the participant are included in the evaluations, the questions answered by the participant's bed partner are not taken into consideration. Each question in the PSQI is scored from 0 to 3 points. The total scores to be obtained from the seven components of the PSQI range from 0 to 21 points. A total PSQI score of 5 points or below indicates that the participant has "high sleep quality" whereas a total PSQI score above 5 points shows that the participant has "low sleep quality" [58, 64]. The Cronbach's alpha coefficient of the original scale was reported to be 0.83 [63]. The validity and reliability study for the PSQI was performed in Turkish by Ağargün et al. (1996), and Cronbach's alpha coefficient was ascertained as 0.80 [65]. In this study, Cronbach's alpha coefficient was found to be 0.71.

### Emotional eating scale (EES)

The EES, developed by Bilgen (2018) to identify individuals' emotional eating, consists of 30 items measuring the following subdimensions: "Eating When Nervous" (11 items), "Eating to Cope with Negative Emotions" (10 items), "Self-Control" (6 items), and "Control Against Stimuli" (3 items). This is a 5-point Likert-type scale with a minimum score of 30 and a maximum score of 150. As the score obtained from the EES increases, the emotional eating level goes up. A total EES score of 75 points and above indicates that the participant has emotional eating behavior. The Cronbach's alpha coefficient of the scale was reported as 0.96 (overall) [66]. In this study, Cronbach's alpha coefficient was calculated as 0.95.

### Data analysis

The data analysis was performed with SPSS 22.0 software. Descriptive statistics including numbers, percentages, means, standard deviations, and minimum and maximum values were calculated. Data were tested to investigate whether they were normally dispersed using visual (probability plots and histograms) and the Kolmogorov–Smirnov test. The Pearson's correlation coefficient was used to evaluate the hierarchical relationship between the continuous variables with a normal distribution. Values with a relationship in the correlation were included in the hierarchical regression. Five models were created to identify possible predictors of emotional eating. In Model 1, the FCV-19S was evaluated. In Model 2, the

PSQI was assessed. In Model 3, the FCV-19S and PSQI were examined. In Model 4, the FCV-19S, PSQI, and BMI were examined. In Model 5, the FCV-19S, PSQI, BMI, age, and gender were examined. Next, a hierarchical multiple regression analysis was performed to determine the factors associated with emotional eating. Statistical significance was defined as  $p$  value  $< 0.05$ .

### Results

Descriptive characteristics of the participants are presented in Table 1. The mean of participants' FCV-19S scores, PSQI scores, and EES scores was  $17.8 \pm 6.3$ ,  $6.0 \pm 2.3$ , and  $67.2 \pm 24.2$ , respectively. Fifty-six percent of the participants had poor sleep quality, while 33.7% had emotional eating behavior.

The FCV-19S score had significant positive correlations with the overall EES score ( $p < 0.05$ ). The PSQI score had statistically significant positive correlations with the overall EES score ( $p < 0.01$ ). There was no statistically significant correlation between the BMI and the overall EES score ( $p > 0.05$ ) but the BMI had a significant positive correlation with the self-control subscale score of EES ( $p < 0.05$ ). Significant negative correlations were found between the age and the overall EES score ( $p < 0.01$ ). Gender had significant positive correlations with the overall EES score ( $p < 0.01$ ) (Table 2).

All steps of the regression were significant (Table 3). The first step of the model indicated that high fear of COVID-19 was positively associated with emotional eating ( $\beta: 0.090$ ,  $p < 0.05$ ). Poor sleep quality was evaluated in the second step of the model and was associated with emotional eating ( $\beta: 0.289$ ,  $p < 0.001$ ). In the third step of the model, when fear of COVID-19 and sleep quality were evaluated together, the association of fear of COVID-19 with emotional eating disappeared ( $\beta: 0.060$ ,  $p > 0.05$ ) but poor sleep quality remained significant ( $\beta: 0.283$ ,  $p < 0.001$ ). In the fourth step, BMI was added. The association with the newly introduced factor (BMI) was positive ( $\beta: 0.092$ ,  $p < 0.05$ ). Fear of COVID-19 was not associated with emotional eating ( $\beta: 0.067$ ,  $p > 0.05$ ) but poor sleep quality remained significant ( $\beta: 0.284$ ,  $p < 0.001$ ). The all-factor model (Model 5) most accurately explained the variance of emotional eating when sociodemographic factors (age and gender) were added to the model. Younger age ( $\beta: -0.259$ ,  $p < 0.001$ ) and being female ( $\beta: -0.169$ ,  $p < 0.001$ ) were significantly associated with emotional eating. Poor sleep quality ( $\beta: 0.246$ ,  $p < 0.001$ ) and higher BMI ( $\beta: 0.275$ ,  $p < 0.001$ ) remained significant. Fear of COVID-19 ( $\beta: 0.042$ ,  $p > 0.05$ ) was not associated with emotional eating in model five.

**Table 1** Participants’ characteristics (N=495)

Variables	Mean ± SD	Min.-Max
Age (years)	32.3 ± 12.8	(18–73)
BMI (kg/m <sup>2</sup> )	23.7 ± 4.1	(16.1–38.1)
	N	%
<i>Gender</i>		
Male	153	30.9
Female	342	69.1
<i>Marital status</i>		
Married	232	46.9
Single	263	53.1
<i>Education level</i>		
Primary or secondary school	20	4.0
High school	192	38.8
Undergraduate school	178	36.0
Graduate school	105	21.2
<i>Economic situation</i>		
Low-level income	30	6.1
Medium-level income	332	67.1
High-level income	133	26.9
FCV-19S	17.8 ± 6.3	(7–35)
PSQI	6.0 ± 2.3	(2–14)
<i>Poor sleep quality (N=281, 56.8%)</i>		
EES	67.2 ± 24.2	(31–140)
Eating when nervous	22.8 ± 10.5	(11–55)
Eating to cope with negative emotions	20.4 ± 9.7	(10–50)
Self-control	15.8 ± 4.3	(6–28)
Control against stimuli	8.3 ± 2.9	(3–15)
Participants having emotional eating behavior (N=167, 33.7%)		

## Discussion

Fear is known as one of the most primitive feelings that come up in the face of a real or perceived threat. Fear is accompanied by anxiety when attempts to deal with a threat are unsuccessful [67]. At the beginning of the COVID-19 pandemic, the ambiguities about how the disease spread and how to be protected from it and, in the following period, the lack of an effective vaccine to protect from the disease led to an increase of fear in the individuals [68–70]. The mean FCV-19S score of the participants in this study was 17.8 ± 6.3 points. In studies conducted with university students, it was reported that the FCV-19S score was 14.3 ± 5.3 points [71] and 16.7 ± 5.3 points [72], respectively. In addition, in Turkey, Bakioglu et al. (2020) reported that the mean FCV-19S score of adults was 19.4 ± 6.0 points [73]. In this respect, it can be asserted that the individuals did not feel high-level fear. This situation might be in place as the research findings were obtained during the second wave of the pandemic when the individuals had more information about the ways of getting infected with COVID-19 and being protected from it and, above all, when the vaccine development efforts looked promising.

Studies on COVID-19 have reported that sleeping habits were severely affected and quarantines have been considered to be a potential risk factor that negatively affects sleep quality [6, 28, 33, 34]. In this study, the mean of participants’ PSQI scores was 6.0 ± 2.3 points and 56.8% of the individuals had low sleep quality. The findings herein presented seem to confirm the available data in the literature. In the COVID-19 pandemic, Targa et al. (2020) evaluated 71 individuals in Spain and reported that the mean PSQI score was 6.1 ± 3.0

**Table 2** Correlations between FCV-19S, PSQI, and EES scores

Variables		FCV-19S	PSQI	BMI	Age	Gender	Overall EES
FCV-19S	r	1					
	p						
PSQI	r	.106*	1				
	p	.019					
BMI	r	-.074	-.022	1			
	p	.101	.632				
Age	r	-.010	-.125**	.449**	1		
	p	.821	.005	.000			
Gender	r	.227**	.067	-.310**	–	1	
	p	.000	.139	.000	–		
Overall EES	r	.090*	.289**	.081	-.219**	.183**	1
	p	.046	.000	.073	.000	.000	

Pearson Correlation, \*p < 0.05. \*\*p < 0.01



**Table 3** Hierarchical multiple regression analysis for predictors of emotional eating

	EES				
	$R^2$	$\Delta R^2$	$\beta$	$p$	$F$ $p$
Model 1					
FCV-19S	0.008	0.006	0.090**	0.046	4.008 0.046
Model 2					
PSQI	0.083	0.082	0.289*	0.000	44.886 0.000
Model 3					
FCV-19S	0.087	0.083	0.060***	0.167	23.441
PSQI			0.283*	0.000	0.000
Model 4					
FCV-19S			0.067***	0.125	17.249
PSQI	0.095	0.090	0.284*	0.000	
BMI			0.092**	0.034	0.000
Model 5					
FCV-19S			0.042***	0.325	
PSQI			0.246*	0.000	21.966
BMI	0.183	0.175	0.275*	0.000	0.000
Age			-0.259*	0.000	
Gender			-0.169	0.000	

EES Emotional Eating Scale

\* $p=0.000$ . \*\* $p<0.05$ . \*\*\* $p>0.05$

0=Female, 1=Male

points [59]. Also, Eleftheriou et al. (2021) evaluated 559 students of medical schools and demonstrated that the mean PSQI score was  $6.6 \pm 3.2$  points [74]. Cheikh et al. (2020) showed that 60.8% of the participants had sleep disturbances during the COVID-19 pandemic in the United Arab Emirates [9]. In a study conducted in Greece, it was shown that more than half of the individuals (52.4%) had poor sleep quality during the COVID-19 pandemic [74]. As a result, it has been determined that the COVID-19 pandemic caused a worsening of sleep quality in more than half of the population. Therefore, interventions to increase the sleep quality of individuals should be planned.

In this current study, the mean of participants' EES scores was  $67.2 \pm 24.2$  points and one-third of the participants had emotional eating behavior. In another study in Norway, it was reported that emotional eating was observed in 54% of the adults during the COVID-19 pandemic [75]. Also, in a study conducted with Saudi women, it was reported that 40.4% of the participants had a "moderate" and 12.4% had a "high" level of emotional eating [26]. Although these results differ between societies, they show that emotional eating is a common problem during the pandemic period and this problem should be addressed.

The COVID-19 pandemic affected the individuals' lifestyles significantly. During the pandemic, there was an increase in emotional and mental health problems as well as a change in the individuals' sleep and dietary patterns, particularly associated with the quarantine measures [19, 76–78]. According to this study, fear of COVID-19 was minimally associated with emotional eating and when combined with other variables, this association disappeared. It was thought that this may be due to the overlap between the scale items that assess fear and sleep quality. Unlike our findings, one study reported that psychological distress was strongly associated with emotional eating [75]. In a study carried out in Turkey, although there was a relationship between fear and emotional eating, in further analyses, no direct association between fear of COVID-19 and emotional eating was observed, but depression was associated with emotional eating and it mediated the relationship between fear of COVID-19 and emotional eating [19]. As a result, it was thought that in the second wave of the pandemic, the fear might have been replaced by depression. In this study, the level of COVID-19 fear felt by individuals was not high. This may have reduced the association of fear with emotional eating. Being less exposed to the sunlight due to staying at home behind closed doors during the pandemic can change sleep patterns by leading to circadian rhythm abnormalities [79]. The changes occurring in sleep patterns and sleep quality due to the change in circadian rhythm may also trigger emotional eating behavior. It was reported that the change in circadian rhythm exacerbated the risk and symptoms of emotional eating in individuals [59]. According to this study, sleep quality was associated with emotional eating. Before the pandemic, some studies demonstrated that poor sleep quality was found to be associated with emotional eating [39–41]. A study conducted among healthy young Saudi women during the COVID-19 pandemic stated that sleep quality was not associated with emotional eating [26]; on the other hand, Dos Santos Quaresma et al. (2021) evaluated 724 adults (with a mean age of 32.6 years for women and 33.5 years for men) in Brazil and reported that the sleep quality score was positively correlated with emotional eating [80]. It was thought that these heterogeneous results might be because the studies were conducted in populations consisting of individuals with different characteristics (such as age, gender, and marital status) at different times and that countries took different measures such as lockdown, partial closure, or weekend quarantine to reduce the spread of the virus during the pandemic.

In this study, we found that having high fear of COVID-19, having poor sleep quality, having a high BMI, being of young age, and being female were associated with emotional eating. Emotional eating is a type of eating behavior triggered by various emotional changes. In the literature, it

was stated that people consumed more food especially when they feel negative emotions and the individuals with negative emotions prefer high-fat and sugary foods [13, 17, 81, 82]. The long-term results of this unhealthy eating process may be weight gain, resulting in increased BMI and certain health problems [83]. Emotional eating has been associated with a higher BMI [18, 82]. During the COVID-19 pandemic, Al-Musharaf S. (2020) demonstrated that emotional eating was more common in individuals with a higher BMI [26]. The association between BMI and emotional eating is not surprising since emotional eaters tend to turn to high-energy and high-density foods to cope with their feelings. The age variable was a negatively significant predictor of emotional eating [84]. Similar to the results of our study, Kontinen et al. (2019) showed that there was a negative and significant association between emotional eating behavior and age and argued that age-related changes in body composition and weight offer one potential explanation for this observation [85]. It is uncertain when the COVID-19 pandemic will end. Botessi et al. (2019) reported that younger participants had a higher level of intolerance to uncertainty, arguing that older people coped with intolerance better than younger people because of their longer life experiences [86]. Studies on COVID-19 have reported that age was negatively associated with intolerance to uncertainty [19] and older people have fewer symptoms of anxiety, depression, and fear of COVID-19 [87, 88]. It was thought that emotional eating, which is one of the maladaptive coping strategies, might be triggered because young people have difficulty in coping with all these negative emotions. Supporting our study, it has been reported that emotional eating was more common in women during the COVID-19 pandemic [19, 75]. Women have more intense negative emotions than men [55]. Therefore, being a woman may have triggered emotional eating.

### Strengths and limits

This study was cross-sectional. Cross-sectional studies are observational studies, and due to their cross-sectional nature, one of the major limitations is to analyze population data at a single point in time, using self-reported measures. Not using a scale that evaluated the depression level in this study was a significant shortcoming. Therefore, it is recommended to use emotional eating and depression scales together in future studies. Furthermore, it is recommended to obtain a food consumption record as it will provide better information about the nutritional habits of individuals. It was thought that it would be useful to evaluate emotional eating in different populations. As the results of the study are limited to the sample, they may not be generalized to the entire society.

### What is already known on this subject?

The pandemic led to the deterioration of the physical and mental health of individuals by influencing daily life deeply across the world. Compulsory quarantines and restrictions to protect public health that were implemented for a long time gave rise to psychological disorders, a decrease in physical activities, sleep problems, and changes in dietary habits and body weight. Psychological problems such as fear, depression, and stress, along with physical restrictions, may cause changes in individuals' eating habits or trigger emotional eating. However, to our knowledge, no study has investigated the association of fear of COVID-19 and sleep quality with emotional eating, independent of sociodemographic characteristics, during the pandemic period.

### What does this study add?

During the pandemic, the fear of COVID-19 and sleep quality were associated with emotional eating independently of BMI, age, and gender. The present study revealed that high fear of COVID-19, poor sleep quality, high BMI, young age, and being female may contribute to emotional eating. We hope that this study will help in the development of different guidelines and strategies by understanding the factors associated with nutritional behavior during the pandemic period.

### Conclusions

In this study, more than half of the individuals had low sleep quality and one-third of them exhibited emotional eating behavior. It was determined that during the pandemic period, high fear of COVID-19, poor sleep quality, high BMI, younger age, and being female were associated with emotional eating. Good management of mental health will help people to maintain their psychological wellness and make it easier to cope with negative emotions. In the treatment of emotional eating, which is one of the maladaptive coping strategies, more permanent solutions can be obtained by gaining emotion regulation and mindful eating skills instead of focusing on calorie-restricted diets or dietary interventions. If the underlying psychological trigger is not resolved, emotional eating behavior cannot be resolved permanently and may recur. Therefore, it is recommended to implement interventions to provide psychological support during the COVID-19 pandemic. Lockdown or quarantine are good measures to stop the spread of the virus, but these measures can lead to risks of health associated with physical inactivity, weight gain, poor sleep quality, and behavioral changes. Public health strategies that focus on healthy nutrition and physical activity

should be developed to minimize the health risks that may be experienced due to quarantines. For future studies, it is suggested that during social isolation or restrictions, mood, stress, and depression levels may also be evaluated. As a result of these evaluations, it is recommended that individuals with insufficient psychological well-being should be screened in terms of emotional eating. Thus, emotional eating may be prevented or treated earlier without causing long-term eating behavior disorders.

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**Availability of data and material** The datasets generated or analyzed during the current study are available from the corresponding author on reasonable request.

**Code availability** Not applicable.

## Declarations

**Conflict of interest** The authors have no relevant financial or non-financial interests to disclose.

**Ethics approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and the national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Approval was obtained from the Istanbul Medeniyet University Social and Human Sciences Ethics Committee (27.10.2020/38) and the Scientific Research Platform of the Ministry of Health of Turkey (2020–10-22T19\_39\_16). Written informed consent was obtained from all subjects.

**Consent to participate** Informed consent was obtained from all individual participants included in the study.

**Consent for publication** Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.

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