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Changes in individuals' eating habits and mood, sleep quality, and lifestyle during COVID-19

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ABSTRACT

Objectives: The COVID-19 outbreak was classified as a global epidemic after it emerged in the first quarter of 2020 and the virus spread rapidly after only three months. The quarantines implemented during the COVID-19 period, the deterioration of economic income, and the uncertain situation about the future have affected the changes in physical inactivity, mood changes, sleep quality, lifestyle, and eating habits. Our study aimed to investigate the changes in individuals' mood, sleep quality, lifestyle, and eating habits during the COVID-19 pandemic period.

Patients and Methods: COVID-19 phobia scale (C19P-S) and coronavirus anxiety scale (CAS) were used to assess the emotional state of individuals. Pittsburgh sleep quality index was used to assess sleep quality. The data required for the research were collected with an online questionnaire. The study was carried out on individuals over 18 years of age between November 2020 and January 2021. Changes in mood, sleep quality and lifestyle with eating habits of individuals during the COVID-19. The data obtained from the studies were analyzed with appropriate statistical methods using the SPSS 22.0 program.

Results: A total of 6,609 individuals between the ages of 18-70 participated in the study, and 69.8% of the participants were female. Sleep quality and the mean score obtained from the C19P-S in female individuals (50.4±10.63) were found to be significantly higher than in male individuals (46.9±9.94) ($p<0.001$). Sleep quality showed a positive and significant relationship with CAS and C19P-S, respectively ($r=0.190$, $r=224$) ($p<0.001$). Before the COVID-19 period, the individuals consumed the highest rate of fruit (68.8%), tea, herbal teas (48.4%), vegetables (50.8%), and milk and yogurt (48.4%), while after the pandemic the highest rate of industrial packaged bakery products (41.0%), sugar or sweeteners (36.2%), processed meat products (34.7%), and sugar-sweetened soft drinks (30.3%) were consumed.

Conclusions: The COVID-19 may cause changes in individuals' mood, sleep quality, lifestyle, and eating habits. This is the first study to evaluate these factors together in the Turkish population. We believe that complications related to COVID-19 may have a negative impact on public health in the long term. In the future, we recommend that governments develop policies to improve public health regarding adequate and balanced nutrition, physical activity, and mood management.

Keywords: COVID-19, sleep quality, mood, lifestyle, nutrition

INTRODUCTION

The World Health Organization (WHO) on March 11, 2020, declared the novel coronavirus (COVID-19) outbreak a global pandemic that emerged in Wuhan, China, in December 2019 [1]. After the COVID-19 outbreak emerged in the first quarter of 2020 and the virus spread rapidly just three months later, it caused WHO to declare a public health emergency and classify the situation as a global epidemic [2]. COVID-19 quarantines have brought along a series of psychological and psychopathological conditions, such as emotional exhaustion, irritability, phobia, increased anxiety, depressive symptoms, and post-traumatic stress disorder in individuals, along with the deterioration of economic income, uncertain situations about the future, and physical inactivity [3-6]. In addition, long quarantine periods have been associated with social isolation and a sedentary lifestyle, as well as decreased sleep quality, increased food intake, and deterioration in eating habits [7, 8].

A meta-analysis reported that the prevalence of sleep disorders in the general population was 44% [9]. Although acute stress typically reduces appetite, chronic stress acts on the adrenal glands to secrete cortisol, increasing appetite and the consumption of palatable foods with high calorie, sugar, and fat content and high dietary energy density. Early research conducted during the COVID-19 pandemic period revealed

that the consumption of pasta, flour, and frozen foods increased, and the consumption of fresh fruits and vegetables decreased [10]. In the study, it was determined that individuals with low sleep and sleep quality consumed more foods containing high amounts of fat or refined carbohydrates [11].

With all its effects, the purchasing power of individuals has decreased significantly due to the loss of income during the COVID-19 pandemic. The prices of foods with high dietary quality have increased considerably. Social isolation increased the waste of nutritious fresh foods, and the restriction of the food supply chain for financial and logistical reasons has threatened food security and adequate and balanced nutrition [12].

Epidemiological and experimental studies point to the importance of diet in the triangle of nutrition, immune system, and infection. Proper nutritional interventions will potentially be effective in improving the immune system and general public health, with an adequate and balanced intake of both macro and micronutrients [13]. As a result, studies have shown that all these changes in lifestyles can negatively affect health with the development of chronic diseases and risk factors in many people [14-16]. There is limited evidence to assess the impact of quarantines and restrictions associated with the COVID-19 pandemic on changes in diet-lifestyle behaviors [5, 17]. Our study aimed to investigate the changes in mood, sleep quality, lifestyle, and eating habits of individuals during the COVID-19 pandemic period.

METHOD

Collection of Research Data

Research data were collected with an online questionnaire applied to individuals over the age of 18 between March 2021 and September 2021. The questionnaire includes demographic information (age, gender, education level, working status, marital status, and living place), statement of health (disease state diagnosed by the physician, COVID-19 diagnosis status), anthropometric measurements (body weight and height), COVID-19 phobia scale (C19P-S), coronavirus anxiety scale (CAS), and Pittsburgh sleep quality index (PSQI). Ethics commission permission dated February 16, 2021, and numbered E-77082166-604.01.02-35925 was obtained from Gazi University Ethics Commission for the research.

Evaluation of Mood State

C19P-S was developed as a 20-item self-report tool that addresses the specific phobia diagnostic criteria of the DSM-V [18]. Items on a five-point Likert-type scale are graded between “strongly disagree (1)” and “strongly agree (5)”. The score obtained from the scale can vary between 20 and 100. A higher score on the scale indicates a greater phobia [18]. CAS was developed to identify possible dysfunctional anxiety associated with the COVID-19 pandemic [19]. The scale consists of five questions, and the answers to the scale were determined as “never (0)”, “rarely, less than one or two days (1)”, “a few days (2)”, “more than seven days (4)”, and “almost every day in the last two weeks (5)”. CAS distinguishes between individuals with and without dysfunctional anxiety using a cut-off score of ≥9 (90% sensitivity and 85% specificity) [19].

Pittsburgh Sleep Quality Index

PSQI was developed as a scale that evaluates the sleep quality and the type and severity of the disorder in the last month and consists of 19 self-report questions and seven components consisting of 18 items participate in scoring [20]. Each item is evaluated over 0-3 points, and the sum of the seven component scores gives the total PSQI score. The total score is between 0-21, and a high total score indicates poor sleep quality. If the total PSQI score is in the range of 0-4 points, it is considered “good sleep quality”, and if it is in the range of 5-21 points, it is considered “bad sleep quality”. The Turkish validity and reliability study of PSQI was performed in [21].

Statistical Analysis of Data

The data obtained from the studies were analyzed with appropriate statistical methods using the SPSS 22.0 program. Descriptive values are expressed as number (n), percent (%), arithmetic mean (M), and standard deviation (SD). Pearson Chi-square test was used to compare categorical variables. The conformity of the variables to the normal distribution was examined by visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). Mann-Whitney U test and Kruskal-Wallis test were used to compare data that did not have a normal distribution. The relationship between the variables was examined by Spearman correlation analysis. The statistical significance level was determined as $p<0.05$.

RESULTS

This study, whose data were collected using an online questionnaire, was carried out on 6,609 individuals between the ages of 18-70. Approximately 70% of the individuals participating in the study were female (69.8%). When the demographic data were analyzed, it was found that the mean age of male individuals (27.8±10.44) was significantly higher than female individuals (26.8±9.97) ($p<0.001$).

When individuals were evaluated according to body mass index (BMI), the mean BMI (24.9±3.83) in male individuals was significantly higher than in female individuals (22.7±4.27) ($p<0.001$). In the BMI classification, 38.1% of individuals have severe malnutrition as a result of insufficient or excessive nutrition ($p<0.05$). The diagnosis of COVID-19 positive, loss of sense of smell and taste after the positive diagnosis of COVID-19, and changes in nutrition and lifestyle habits of the individuals participating in the study are presented in **Table 1** ($p<0.05$).

According to PSQI classification, 43.4% of male individuals; 59.3% of female individuals have good sleep quality. Sleep quality in female individuals was significantly higher than in male individuals ($p<0.05$).

According to the CAS, 97.4% of the individuals were classified as normal ($p>0.05$). The mean score obtained from the C19P-S in female individuals (50.4±10.63) was found to be

Table 1. Distribution of demographic characteristics, health data, anthropometric measurements, and nutrition style of individuals by gender

Demographic and health characteristics	Male (n=1,995)		Female (n=4,614)		p
	n	%	n	%	
Age (year)					
M±SD (min-max)	27.8±10.44 (18-70)		26.8±9.97 (18-70)		<0.001[a]
Age groups (years)					
18-30	3,586	77.7	1,503	75.4	
31-45	638	13.8	308	15.4	
46-65	372	8.1	173	8.7	
>65	19	0.4	10	0.5	
Body weight changed COVID-19					
No change	1,724	37.4	868	43.5	
Decreased	1,153	25.0	356	17.9	<0.001[b]
Increased	1,738	37.7	770	38.6	
Anthropometric measurements					
Height (cm) M±SD	177.7±6.80		163.9±5.87		<0.001[a]
Body weight (kg) M±SD	78.7±13.22		61.1±11.61		<0.001[a]
BMI (kg/m^2) M±SD	24.9±3.83		22.7±4.27		<0.001[a]
Class of BMI					
Underweight	504	10.9	39	2.0	
Normal weight	3,014	65.4	1,078	54.1	
Overweight	788	17.1	705	35.4	
Obesity I	236	5.1	137	6.9	<0.001[a]
Obesity II	52	1.1	30	1.2	
Obesity III	18	0.4	8	0.4	
No	4,136	89.6	1768	88.5	
Diagnosed with COVID-19 positive					
Yes	479	10.4	229	11.5	<0.001[b]
No	4,136	89.6	1,768	88.5	
Change in sense of smell during COVID-19					
No change	125	26.1	79	34.5	
I could not smell	288	60.1	107	46.7	<0.001[b]
I could not distinguish the smells	66	13.8	43	18.8	
Change in sense of taste during COVID-19					
No change	148	30.9	88	38.4	
I could not taste	247	51.6	110	48.0	<0.001[b]
I could not distinguish the taste	84	17.5	31	13.5	
Change in sense of appetite during COVID-19					
No change	176	36.7	94	41.0	
Increased	51	10.6	27	11.8	<0.001[b]
Decreased	253	52.7	108	47.2	
Change in lifestyle and eating habits during COVID-19					
No change	1,977	42.8	1,007	50.5	
Eating unhealthier	984	21.3	357	17.9	<0.001[b]
Eating healthier	1,654	35.8	630	31.6	
Hunger and fullness change during the time you spent at home during the COVID-19					
Eating less food	797	17.3	290	14.5	<0.001[b]
Eating more food	3,818	82.7	1704	85.5	
Especially at what time of the day do you feel hungry?					
Before main meals	2,178	47.2	977	49.0	
Between main meals	1,287	27.9	542	27.2	<0.001[b]
After the evening main meal	1,150	24.9	475	23.8	
Change in junk food consumption during COVID-19					
No change	1,157	33.7	791	39.7	
Increased < 10%	1,115	24.2	357	17.9	
Increased 10-30%	1,248	27.0	536	26.9	<0.001[b]
Increased 30-50%	455	9.9	212	10.6	
Increased > 50%	239	5.2	98	4.9	
Change in Water consumption during COVID-19					
<1 L	1,242	26.9	340	17.1	
1-2 L	2,224	48.2	921	46.2	<0.001[b]
>2 L	1,149	24.9	733	36.8	

Note. [a]Mann-Whitney U test & [b]Pearson Chi-square test

significantly higher than male individuals (46.9±9.94) (p<0.05) (**Table 2**).

According to CAS, there was a positive correlation between CP19-S, PSQI, change lifestyle and eating habits, change junk food consumption, respectively (r=0.397, r=0.224, r=0.154, and r=0.524) and a negative correlation with body Weight BMI, diagnosed respectively (r=-0.069, r=-0.572, and r=-0.065;) (p<0.05). PSQI, change in sense of appetite change, lifestyle

Table 2. Distribution of PSQI, CAD, and C19P-S classification by gender

	Male (n=1,995)		Female (n=4,614)		p
	n	%	n	%	
PSQI classification					
0-4 (good sleepers)	1,075	53.9	2000	43.4	<0.001[a]
6-9 (poor sleepers)	920	46.1	2614	56.6	
CAS classification					
<9 (normal)	1,935	97	4504	97.6	0.142[a]
≥9 (dysfunctional anxiety)	60	3	110	2.4	
CP19-S (M±SD)	46.9±9.94		50.4±10.63		<0.001[b]

Note. [a]Pearson Chi-square test & [b]Mann-Whitney U test

Table 3. The relationship between mood and lifestyle variables in the period of COVID-19 (Spearman correlation analysis)

Variables	Coronavirus anxiety scale		Coronavirus-19 phobia scale	
	r	p	r	p
Coronavirus-19 phobia scale (CP19-S)	0.397	<0.001	-	-
Pittsburgh sleep quality index (PSQI)	0.224	<0.001	0.190	<0.001
Body weight	-0.069	<0.001	-0.056	<0.001
BMI (kg/m2)	-0.034	<0.001	-0.010	0.413
Diagnosed with COVID-19 positive	-0.065	<0.001	-0.016	0.183
Change in sense of smell during COVID-19	0.011	0.765	0.043	0.256
Change in sense of taste during COVID-19	0.010	0.781	0.017	0.649
Change in sense of appetite during COVID-19	0.046	0.220	0.162	<0.001
Change in lifestyle and eating habits during COVID-19	0.154	<0.001	0.100	<0.001
Change in junk food consumption during COVID-19	0.113	<0.001	0.056	<0.001
Change in water consumption during COVID-19	-0.006	0.106	0.001	0.921

and eating habits, and change in junk food intake, respectively (r=0.224, r=0.162, r=0.154, and r=0.524) were positive correlations between CP19-S and body weight. Smoking pre and during COVID-19, respectively (r=-0.069, r=-0.073, and r=-0.082) were negative correlation between CP19-S (p<0.05) (**Table 3**).

During the COVID-19 quarantine period, sleeping hours were also significantly higher and associated with CAS (p<0.05). Mean sleep duration increased from 7.54±1.34 minutes to 8.45±1.51 minutes compared to the pre-COVID-19 period, and sleep duration was significantly associated with CAS (p<0.05). While smoking habits decreased during the COVID-19 quarantine period, it was found to be significantly associated with CAS (p<0.05). Physical inactivity (68.1%), which was high in the pre-COVID-19 quarantine period, continued to increase (70.6%) in the COVID-19 period (p<0.05). While inactive lifestyle was not significantly associated with CAS during pre-COVID-19 (p>0.05) but was significantly associated with CAS during COVID-19 (p<0.05) (**Table 4**).

Pre-COVID-19 period, the individuals consumed the highest rate of tea, herbal teas (48.4%), coffee, homemade pasta (26.7%), red meat (33.9%), cheese (28.4%), milk and yogurt (48.4%), fresh vegetables (50.8%), and fruit (68.8%). However, during COVID-19, the individuals consumed the highest rate of alcoholic drinks (25.5%), sweet beverages (30.3%), sugar or sweeteners (36.2%), packing baked products (41.0%), processed meat (30.3%). 34.7), and frozen vegetables (25.1%) (p<0.05).

DISCUSSION

In this study, we aimed to evaluate sociodemographic factors, COVID-19 period mood, sleep quality, changes in lifestyle, and diet relationship with health. Variables other than CAS were found to be correlated with each other. Demographics, health and anthropometric measurement, lifestyle variables, mood, and dietary changes had significant associations pre and during the COVID-19 period.

Mood (stress, anxiety, and depression), adequate and balanced nutritional intake, sleep quality, physical activity (PA), and healthy lifestyle deteriorated during the COVID-19 quarantine period [7, 22]. Obesity is a modifiable risk factor for mortality and morbidity associated with COVID-19. Although obesity is common among COVID-19 patients, long periods of physical isolation can reduce PA and increase the severity of the COVID-19 symptom with the increase in obesity [23]. Both observational [24, 25] and randomized controlled studies [26] demonstrated that the complications of COVID-19 in individuals with obesity are characterized by higher susceptibility and severe symptoms. In patients with increased abdominal obesity, respiratory function is further compromised, and ventilation becomes more difficult. In addition, increased obesity-related inflammatory cytokines may contribute to the increased obesity-related morbidity in COVID-19 infections [27]. According to the report of the Centers for Disease Control and Prevention, increased BMI was associated with the risk of severe COVID-19 symptoms, hospitalization, and death [28]. We predict that the associated mortality will be high in obese individuals during the COVID-19 period. In our study, 38.1% of individuals were found to be underweight or obese. In addition, the obesity rate in female individuals was significantly higher than in male individuals (p<0.05). However, in CAS, body weight, and BMI levels were negatively correlated respectively (r=-0.069 and r=-0.034) (p<0.05). Similar to our study, according to the study conducted in the UK intensive care unit during the COVID-19 period, while 31.3% of the patients were obese, 7.7% were found to be severely obese [29]. Qualitative olfactory disorders

Table 4. Relationship of lifestyle variables before and during the COVID-19 period

	Smoking pre-COVID-19		**Smoking during COVID-19**		**p**
	Anxiety condition: p<0.001[c]		**Anxiety condition: p<0.001[c]**		
	n	**%**	**n**	**%**	
No	4,501	68.1	4,469	70.6	<0.001[a]
<5 cigarettes/day	556	8.4	518	7.8	
5-10 cigarettes/day	741	11.2	688	10.4	
>10 cigarettes/day	811	12.3	734	11.1	
	Sleep habits pre-COVID-19		**Sleep habits during COVID-19**		
	Anxiety condition: p<0.001[c]		**Anxiety condition: p<0.001[c]**		
Average sleep time (hours)	7.54 (dak)±1.34 (dak)		8.45 (dak)±1.51 (dak)		<0.001[b]
	Anxiety condition: p<0.001[c]		**Anxiety condition: p>0.001[c]**		
	n	**%**	**n**	**%**	
<7 h/night	2,565	38.8	1,768	26.8	<0.001[a]
7-9 h/night	3,651	55.2	3,716	56.2	
>9 h/night	393	5.9	1,125	17.0	
	Training habits pre-COVID-19		**Traininig habits during COVID-19**		
	Anxiety condition: p>0.001[c]		**Anxiety condition: p<0.001[c]**		
	n	**%**	**n**	**%**	
No training	3,270	49.5	3,754	56.8	<0.001[a]
1-2 times/week	2,055	31.1	1,853	28.0	
3-4 times/week	939	14.2	762	11.5	
⩾5 times/week	345	5.2	240	3.6	

Note. [a]Pearson Chi-square test; [b]Mann-Whitney U test; & [c]One-way ANOVA

caused by viral infections reduce mood, enjoyment of food, and the ability to detect dangerous smells and affect health status and social life. The taste of food occurs through the combination of smell and taste. For this reason, the loss or deterioration of the sense of smell leads to the loss or deterioration of our sense of taste, which is generally defined as taste. The study revealed that the changing taste and smell with COVID-19 can lead to serious disruptions in daily life that affect psychological well-being, physical health, social relationships, and sense of self [30]. Another study emphasized that recognizing the flavor of foods is important in terms of hedonic value since the loss of taste and smell caused by COVID-19 makes the characterization of foods difficult [31]. In our study, the loss of taste and smell was found to be significantly higher in the male gender with a positive diagnosis of COVID-19 compared to the female gender ($p<0.05$).

The quarantines and social isolation, sedentary lifestyle, and behavioral and psychosocial changes caused by the COVID-19 pandemic have affected individuals' hunger, appetite, food intake, and sleep disturbances [32]. The quarantines and social isolation required of individuals have had serious adverse effects on both food access and consumption. Quarantines have been associated with (interruption of work routine) stress, anxiety, and increased energy intake, as well as increased higher consumption of fat, carbohydrates, and protein [33]. Foods rich in refined carbohydrates have a positive effect on mood and reduce stress along with the production of serotonin [34]. With all these effects, COVID-19 leads individuals to overeat, especially "comfort foods" rich in sugar, which is defined as "food cravings". However, eating too much added sugar and too many refined carbohydrates cause chronic inflammation, decreased energy expenditure, and a positive energy balance resulting from increased inactivity. Positive energy balance is associated with the increased risk of obesity and cardiovascular diseases and increases the risk of complications from COVID-19 [13, 35].

During the time spent at home during the COVID-19 epidemic, 82.7% of male individuals and 85.5% of female individuals consumed more food ($p<0.05$). In addition, CP19-S and change in sense of appetite were positively correlated ($r=0.162$) in our study ($p<0.05$). In addition, the effects of the quarantines and panic (the thought of supply chain disruptions and the effects on the global economy) brought by COVID-19, in order to avoid shopping constantly, make individuals prefer more ready-made and processed foods, such as snacks, junk food, and ready-made cereals, instead of fresh foods, especially fruits, vegetables, and fish, which reduced the diet quality of individuals [36]. The study determined that while most of the participants continued their usual diets, 38.2% of them increased their snack intake [37].

In our study, after the positive diagnosis of COVID-19, no changes were observed in lifestyle and eating habits in 42.8% of male and 50.5% of female individuals ($p<0.05$). However, CAS and CP19-S were positively correlated with changes in lifestyle and eating habits ($r=0.154$ and $r=0.100$), respectively ($p<0.05$). During the quarantine period, it is important to provide optimum, adequate, and balanced nutritional intake [8]. In a cross-sectional study conducted at a Bavarian University with the participation of 1,964 volunteers, an increase was observed in the consumption of bread (46.8%) and added sugar (64.4%) [38].

In our study, an increase was found in the consumption of junk food in 66.3% of men and 60.3% of women during the COVID-19 period. This rate was found to be significantly higher in males ($p<0.05$). In addition, CAS and CP19-S were positively correlated with change junk food ($r=0.113$ and $r=0.056$), respectively ($p<0.05$). Another study revealed that during quarantine, 32.8% of the participants increased in weight, 44.7% did not eat fresh fruit daily, 35.3% did not eat vegetables daily, and 72.9% drank less than eight glasses of water per day [39]. In our study, while 29.4% of men and 36.8% of women consumed >2 L of water per day, water consumption was found to be significantly higher in women ($p<0.05$).

Along with the chaos, the COVID-19 pandemic has led to negative psychological effects such as fear, panic, depression, stress, sleep disturbance and anger, anxieties about the health of the individual and his relatives, and alienation from society. The severity of these symptoms has associated with sleep quality and anxiety level of COVID-19-induced phobia and anxiety [40]. This phenomenon was called "coronaphobia" and defended that this new type of phobia had a great impact on human psychology [41]. Individual differences such as intolerance to uncertainty, perceived vulnerability to illnesses, and anxiety tendencies may play a role in the development of coronaphobia [41].

In our study, CAS positive showed a negative (r=-0.065) correlation with diagnosed with COVID-19 ($p<0.05$). A study determined that the severity of anxiety and coronavirus phobia were high during the COVID-19 pandemic, especially in women and students with chronic diseases. In addition, it was determined that the level of anxiety severity of the participants significantly affected the level of coronavirus phobia [42]. In our study, CAS and CP19-S showed a positive (r=0.397) correlation ($p<0.05$). Due to the COVID-19 pandemic, it is estimated that major depressive disorder (27.6%) increased to 53.2 million, and anxiety disorder (25.6%) increased to 76.2 million worldwide [43]. The systematic review and meta-analysis reported that the prevalence of depression was 37.12%, anxiety 41.42%, stress 44.86%, and insomnia 43.76% during the COVID-19 pandemic [44]. In a study of 2,215 individuals in China, COVID-19 uncertainty and intolerance and perceived stress were found to be significantly associated with sleep quality [45]. Another study found that increased anxiety during the COVID-19 epidemic also increased impaired sleep quality [46].

In another study of 521 adults from Bangladesh, fear of COVID-19, stress, and sleep quality were significantly correlated between genders [47]. In the study in Turkey, the female gender showed a positive relationship between COVID-19 anxiety and poor sleep quality compared to the male gender. The relationship between mood and good sleep quality was significant and positive for both genders [48]. In our study, 97.4% of individuals were classified as normal according to CAS. When the mean scores from CP19-S were evaluated, it was seen that female individuals (50.4±10.63) had a significantly higher mean score than male individuals (46.9±9.94) ($p<0.05$). In addition, sleep quality in female individuals was significantly higher than in male individuals ($p<0.05$). In addition, in our study consistent with the literature, CAS and CP19-S were positively correlated with sleep quality (r=0.224 and r=0.190), respectively ($p<0.05$).

The COVID-19 epidemic affects the psychological aspects of individuals such as fear, stress, anxiety, and sleep quality both with its threat to human life and its health and socio-economic effects. With all these effects, we think that providing psychological support can be effective in reducing the negative impact of the COVID-19 epidemic on people's mental and physical health. To this end, policy makers around the world should take the initiative to provide mental health support in such epidemics.

Changing lifestyles as a result of individuals working from home and decreasing social activities during the COVID-19 period have led to less PA and more unhealthy lifestyles [49]. In the study, smoking behaviour was associated with mental health concerns ($p<0.001$), anxiety ($p<0.001$), and stress ($p<0.001$) [50].

In another study, 14.1% of the smokers reported that they smoked less during the COVID-19 pandemic period, while 18.9% of the smokers reported that they smoked more [51]. Smoking suppresses lung immune function and is a risk factor for the progression of COVID-19 symptoms and associated respiratory diseases. In addition, smokers experience more severe COVID-19 symptoms than non-smokers [52]. In our study, the smoking habits of individuals decreased compared to the pre-COVID-19 quarantine period ($p<0.05$). In addition, CAS showed a significant relationship with smoking in the pre and during the COVID-19 period ($p<0.05$). This can be explained by the fear or awareness of the risk of contracting COVID-19 and the likelihood of being sick with severe symptoms, increased respiratory distress in smokers, and the risk of death from COVID-19 [53].

In a Spanish study investigating the relationship between COVID-19 and changes in sleep habits such as sleep duration and sleep quality, it was found that the percentage of adults who slept less than six hours a day decreased during the COVID-19 period [54]. Study shows that stress and anxiety associated with the COVID-19 pandemic may be linked to changes in sleep duration [55]. Another study reported that individuals who had a short sleep period before the epidemic increased their sleep duration during quarantine [56]. In our study, sleep hours increased during the COVID-19 quarantine period compared to before ($p<0.05$). In addition, CAS showed a significant relationship with mean sleep duration in the pre and during COVID-19 period ($p<0.05$). PA is important in building strong immune systems and reducing susceptibility to infection. The study showed that higher PA levels are associated with lower risk factors for COVID-19 [57]. Another study determined that the time spent inactive during the COVID-19 quarantine increased from 28.8% to 48% compared to the pre-quarantine, and PA decreased [58].

In our study, inactive individuals increased from 68.1% to 70.6% according to the COVID-19 quarantine period ($p<0.05$). In addition, while anxiety state did not show a significant relationship with PA during the pre-COVID-19 period ($p>0.05$), it showed a significant relationship during the COVID-19 period ($p <0.05$). It is related to the government policies implemented to prevent the spread of the disease due to increased inactivity during the COVID-19 pandemic period.

Nutrients with antioxidant and anti-inflammatory activities, which are indispensable for an adequate and balanced diet, can help reduce the chronic effects of the SARS-Cov-2 virus with immunomodulatory effects [59]. The study showed an increase in the consumption of alcoholic beverages (75%), appetizers (60%), eggs (59%), added sugar and dessert (52%), and vegetables (50%) in 2019 compared to 2020 during the COVID-19 pandemic period. While the average energy value of the foods purchased in April 2020 was 2,801 kcal/person/day, it was determined that there was an increase of 771 kcal/person/day (+38%) compared to the same month of 2019 [60]. The study was conducted on 2,680 individuals covering Denmark, Germany, and Slovenia. In this study, depending on the type of food, 15-42% of the study participants changed their consumption frequency during the

pandemic compared to the pre-pandemic period, and the food categories with the highest change rate were frozen food, canned food, cakes, and biscuits; food categories with a lower exchange rate were bread, alcoholic beverages, and dairy products [61].

In our study, the differences in food consumption pre- and during the COVID-19 period are given in **Table 4**. Before the COVID-19 period, the individuals participating in the research consumed the highest rate of fresh fruits (68.8%), tea, herbal teas, and coffee (48.4%), fresh vegetables (50.8%), and milk and yogurt (48.4%), followed by highest rate packing baked products (41.0%), sugar or sweeteners (36.2%), processed meat products (34.7%), and sugar-sweetened soft drinks (30.3%). The nutritional intakes of the individuals participating in the study changed significantly during the COVID-19 period compared to the pre-COVID-19 period ($p<0.05$). The reason why we found some results different from the literature in our study may be that the increased level of phobia and fear towards COVID-19 led individuals to healthier eating habits.

CONCLUSION AND RECOMMENDATIONS

This study, which aims to evaluate the changes in the mood, sleep quality, and lifestyle of individuals during the COVID-19 pandemic, is the first study to evaluate these factors together in the Turkish population. As a result, individuals' anxiety and phobia states, smoking, sleep and PA states, and nutrition styles have changed significantly during the COVID-19 pandemic period. We believe that COVID-19 may have a negative impact on complications related to public health in the long term. Adequate and balanced individual optimal intake of nutrients that modulate the immune system, control of mood, and adequate PA can help to cope with the negative health effects of the COVID-19 pandemic. A healthy, adequate, and balanced diet (both macro and micronutrients) for a more functional and active immune system is one of our most basic inferences that will contribute to increasing the quality of life while reducing the mortality of individuals. The factors brought by the COVID-19 period negatively affect the maintenance of a healthy lifestyle. We recommend that future governments develop policies to improve public health regarding adequate and balanced nutrition, PA, and mood management.

Limitations

There are some limitations in this research. The online collection of data during the COVID-19 period can be a limitation in this study. The lack of a control group in the study is another limitation that limits our ability to control the effect of COVID-19 on eating habits and mood, sleep quality and lifestyle. Since the study is an observational study, causality inference cannot be made exactly. In addition, the PA levels of individuals were not examined in the study. This cannot explain whether the changes in the study were affected by PA.

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REFERENCES

1. Zu ZY, Jiang MD, Xu PP, et al. Coronavirus disease 2019 (COVID-19): A perspective from China. Radiology. 2020;296:E15-25. https://doi.org/10.1148/radiol.2020200490 PMid:32083985 PMCid:PMC7233368
2. Hashem NM, Abdelnour SA, Alhimaidi AR, Swelum AA. Potential impacts of COVID-19 on reproductive health: Scientific findings and social dimension. Saudi J Biol Sci. 2021;28(3):1702-12. https://doi.org/10.1016/j.sjbs.2020.12.012 PMid:33519273 PMCid:PMC7831751
3. Mattioli AV, Sciomer S, Cocchi C, Maffei S, Gallina S. Quarantine during COVID-19 outbreak: Changes in diet and physical activity increase the risk of cardiovascular disease. Nutr Metab Cardiovasc Dis. 2020;30(9):1409-17. https://doi.org/10.1016/j.numecd.2020.05.020 PMid:32571612 PMCid:PMC7260516
4. Cirillo M, Rizzello F, Badolato L, et al. The effects of COVID-19 lockdown on lifestyle and emotional state in women undergoing assisted reproductive technology: Results of an Italian survey. J Gynecol Obstet Hum. 2021;50(8):102079. https://doi.org/10.1016/j.jogoh.2021.102079 PMid:33545410 PMCid:PMC8060062
5. Sidor A, Rzymski P. Dietary choices and habits during COVID-19 lockdown: Experience from Poland. Nutrients. 2020;12(6):1657.9 https://doi.org/10.3390/nu12061657 PMid:32503173 PMCid:PMC7352682
6. Wilder-Smith A, Freedman DO. Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak. J Travel Med. 2020;27(2):taaa020. https://doi.org/10.1093/jtm/taaa020 PMid:32052841 PMCid:PMC7107565
7. Ingram J, Maciejewski G, Hand CJ. Changes in diet, sleep, and physical activity are associated with differences in negative mood during COVID-19 lockdown. Front Psychol. 2020;11:588604. https://doi.org/10.3389/fpsyg.2020.588604
8. Muscogiuri G, Barrea L, Savastano S, Colao A. Nutritional recommendations for COVID-19 quarantine. Eur J Clin Nutr. 2020;74(6):850-1. https://doi.org/10.1038/s41430-020-0635-2 PMid:32286533 PMCid:PMC7155155
9. Marvaldi M, Mallet J, Dubertret C, Moro MR, Guessoum SB. Anxiety, depression, trauma-related, and sleep disorders among healthcare workers duirng the COVID-19 pandemic: A systematic review and meta-analysis. Neurosci Biobehav Rev. 2021;126:252-64. https://doi.org/10.1016/j.neubiorev.2021.03.024 PMid:33774085

10. Shen W, Long LM, Shih C-H, Ludy M-J. A humanities-based explanation for the effects of emotional eating and perceived stress on food choice motives during the COVID-19 pandemic. Nutrients. 2020;12(9):2712. https://doi.org/10.3390/nu12092712 PMid:32899861 PMCid:PMC7551550

11. da Silva FR, Junior AHL, Brant VM, et al. The effects of COVID-19 quarantine on eating and sleeping behaviors. Nutrire. 2020;45(2):1-4. https://doi.org/10.1186/s41110-020-00128-y PMCid:PMC7523687

12. Jayawardena R, Misra A. Balanced diet is a major casualty in COVID-19. Diabetes Metab Syndr. 2020;14(5):1085-6. https://doi.org/10.1016/j.dsx.2020.07.001 PMid:32652495 PMCid:PMC7333608

13. Di Renzo L, Gualtieri P, Pivari F, et al. Eating habits and lifestyle changes during COVID-19 lockdown: An Italian survey. J Transl Med. 2020;18(1):229. https://doi.org/10.1186/s12967-020-02399-5 PMid:32513197 PMCid:PMC7278251

14. Robinson E, Boyland E, Chisholm A, et al. Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults. Appetite. 2021;156:104853. https://doi.org/10.1016/j.appet.2020.104853 PMid:33038479 PMCid:PMC7540284

15. Cheval B, Sivaramakrishnan H, Maltagliati S, et al. Relationships between changes in self-reported physical activity, sedentary behaviour and health during the coronavirus (COVID-19) pandemic in France and Switzerland. J Sports Sci. 2021;39(6):699-704. https://doi.org/10.1080/02640414.2020.1841396 PMid:33118469

16. Chandrasekaran B, Ganesan TB. Sedentarism and chronic disease risk in COVID 19 lockdown–A scoping review. Scott Med J. 2021;66(1):3-10. https://doi.org/10.1177/0036933020946336 PMid:32718266 PMCid:PMC8685753

17. Rodríguez-Pérez C, Molina-Montes E, Verardo V, et al. Changes in dietary behaviours during the COVID-19 outbreak confinement in the Spanish COVIDiet study. Nutrients. 2020;12(6):1730. https://doi.org/10.3390/nu12061730 PMid:32531892 PMCid:PMC7353108

18. Arpaci I, Karatas K, Baloglu M. The development and initial tests for the psychometric properties of the COVID-19 phobia scale (C19P-S). Pers Individ Dif. 2020;164:110108. https://doi.org/10.1016/j.paid.2020.110108 PMid:32394993 PMCid:PMC7211675

19. Lee SA. Coronavirus anxiety scale: A brief mental health screener for COVID-19 related anxiety. Death Stud. 2020;44(7):393-401. https://doi.org/10.1080/07481187.2020.1748481 PMid:32299304

20. Buysse DJ, Reynolds III CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193-213. https://doi.org/10.1016/0165-1781(89)90047-4

21. Agargun M, Kara H, Anlar O. Pittsburgh uyku kalitesi indeksinin geçerliği ve güvenirliği [The validity and reliability of the Pittsburgh sleep quality index]. Turk Psikiyatri Derg [Turk J Psychiatry]. 1996;7(2):107-15.

22. Ruiz MC, Devonport TJ, Chen-Wilson C-HJ, et al. A cross-cultural exploratory study of health behaviors and wellbeing during COVID-19. Front Psychol. 2021;11:608216. https://doi.org/10.3389/fpsyg.2020.608216 PMid:33510684 PMCid:PMC7835515

23. Katsoulis M, Pasea L, Lai AG, et al. Obesity during the COVID-19 pandemic: Both cause of high risk and potential effect of lockdown? A population-based electronic health record study. Public Health. 2021;191:41-7. https://doi.org/10.1016/j.puhe.2020.12.003 PMid:33497994 PMCid:PMC7832229

24. Simonnet A, Chetboun M, Poissy J, et al. High prevalence of obesity in severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation. Obesity (Silver Spring). 2020;28(7):1195-9. https://doi.org/10.1002/oby.22831 PMid:32271993 PMCid:PMC7262326

25. Gao M, Piernas C, Astbury NM, et al. Associations between body-mass index and COVID-19 severity in 6.9 million people in England: A prospective, community-based, cohort study. Lancet Diabetes Endo. 2021;9(6):350-9. https://doi.org/10.1016/S2213-8587(21)00089-9

26. Leong A, Cole JB, Brenner LN, Meigs JB, Florez JC, Mercader JM. Cardiometabolic risk factors for COVID-19 susceptibility and severity: A Mendelian randomization analysis. PLoS Med. 2021;18(3):e1003553. https://doi.org/10.1371/journal.pmed.1003553 PMid:33661905 PMCid:PMC7971850

27. Dietz W, Santos-Burgoa C. Obesity and its implications for COVID-19 mortality. Obesity (Silver Spring). 2020;28(6):1005. https://doi.org/10.1002/oby.22818 PMid:32237206

28. Kompaniyets L, Goodman AB, Belay B, et al. Body mass index and risk for COVID-19–related hospitalization, intensive care unit admission, invasive mechanical ventilation, and death—United States, March-December 2020. MMWR Morb Mortal Wkly Rep. 2021;70:355-61. https://doi.org/10.15585/mmwr.mm7010e4 PMid:33705371 PMCid:PMC7951819

29. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. JAMA. 2020;323(20):2052-9. https://doi.org/10.1001/jama.2020.6775 PMid:32320003 PMCid:PMC7177629

30. Burges Watson DL, Campbell M, Hopkins C, Smith B, Kelly C, Deary V. Altered smell and taste: Anosmia, parosmia and the impact of long COVID-19. PloS One. 2021;16(9):e0256998. https://doi.org/10.1371/journal.pone.0256998 PMid:34559820 PMCid:PMC8462678

31. Høier ATZB, Chaaban N, Andersen BV. Possibilities for maintaining appetite in recovering COVID-19 patients. Foods. 2021;10(2):464. https://doi.org/10.3390/foods10020464 PMid:33672528 PMCid:PMC7923765

32. Alafif NO, Abdelfattah EH, Alanazi SB, et al. Effect of quarantine on eating behaviors and weight change among King Saud University students in Riyadh. J King Saud Univ Sci. 2021;33(8):101609. https://doi.org/10.1016/j.jksus.2021.101609

33. Ozlem A, Mehmet N. Eating habits changes during COVID-19 pandemic lockdown. ESTUDAM Public Health J. 2020;5:169-77. https://doi.org/10.35232/estudamhsd.796735
34. Montemurro N. The emotional impact of COVID-19: From medical staff to common people. Brain Behav Immun. 2020;87:23-4. https://doi.org/10.1016/j.bbi.2020.03.032 PMid:32240766 PMCid:PMC7138159
35. Bennett G, Young E, Butler I, Coe S. The impact of lockdown during the COVID-19 outbreak on dietary habits in various population groups: A scoping review. Front Nutr. 2021;8:626432. https://doi.org/10.3389/fnut.2021.626432 PMid:33748175 PMCid:PMC7969646
36. Ben Hassen T, El Bilali H, Allahyari MS. Impact of COVID-19 on food behavior and consumption in Qatar. Sustainability. 2020;12(17):6973. https://doi.org/10.3390/su12176973
37. Yang G-Y, Lin X-l, Fang A-P, Zhu H-l. Eating habits and lifestyles during the initial stage of the COVID-19 lockdown in China: A cross-sectional study. Nutrients. 2021;13(3):970. https://doi.org/10.3390/nu13030970 PMid:33802743 PMCid:PMC8002515
38. Huber BC, Steffen J, Schlichtiger J, Brunner S. Altered nutrition behavior during COVID-19 pandemic lockdown in young adults. Eur J Nutr. 2021;60(5):2593-602. https://doi.org/10.1007/s00394-020-02435-6 PMid:33258996 PMCid:PMC7705857
39. Ismail LC, Hashim M, Mohamad MN, et al. Dietary habits and lifestyle during coronavirus pandemic lockdown: Experience from Lebanon. Front Nutr. 2021;8:730425. https://doi.org/10.3389/fnut.2021.730425 PMid:34527692 PMCid:PMC8435593
40. Cankurtaran D, Tezel N, Ercan B, Yildiz SY, Akyuz EU. The effects of COVID-19 fear and anxiety on symptom severity, sleep quality, and mood in patients with fibromyalgia: A pilot study. Adv Rheumatol. 2021;61(1):41. https://doi.org/10.1186/s42358-021-00200-9 PMid:34193303 PMCid:PMC8243054
41. Asmundson GJG, Taylor S. Coronaphobia: Fear and the 2019-nCoV outbreak. J Anxiety Disord. 2020;70:102196. https://doi.org/10.1016/j.janxdis.2020.102196 PMid:32078967 PMCid:PMC7134790
42. Delibas L. COVID-19 fobisi ve endişe şiddeti: Meslek yüksekokulu örneği [COVID-19 phobia and anxiety severity: Vocational school example]. Hastane Öncesi Dergisi [Pre-Hosp J]. 2021;6(2):201-12.
43. Santomauro DF, Herrera AMM, Shadid J, et al. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet. 2021;398(10312):P1700-12. https://doi.org/10.1016/S0140-6736(21)02143-7
44. Mahmud S, Hossain S, Muyeed A, Islam MM, Mohsin M. The global prevalence of depression, anxiety, stress, and insomnia and its' changes among health professionals during COVID-19 pandemic: A rapid systematic review and meta-analysis. Heliyon. 2021;7(7):e07393. https://doi.org/10.1016/j.heliyon.2021.e07393 PMid:34278018 PMCid:PMC8261554
45. Wu D, Yang T, Hall DL, Jiao G, Huang L, Jiao C. COVID-19 uncertainty and sleep: The roles of perceived stress and intolerance of uncertainty during the early stage of the COVID-19 outbreak. BMC Psychiatry. 2021;21:306. https://doi.org/10.1186/s12888-021-03310-2 PMid:34126958 PMCid:PMC8200549
46. Eren HK. Anxiety levels and sleep quality of individuals during the COVID-19 outbreak. J Turk Sleep Med. 2021;3:235-42. https://doi.org/10.4274/jtsm.galenos.2021.47560
47. Siddique RF, Ahmed O, Hossain KN. Relationship between the fear of COVID-19 disease and sleep quality: The mediating role of stress. Heliyon. 2021;7(5):e07033. https://doi.org/10.1016/j.heliyon.2021.e07033 PMid:34027200 PMCid:PMC8123159
48. Yelpaze I. Predictiveness of COVID-19 anxiety and emotion regulation on sleep quality: The moderator effect of gender. Int J Psychol Educ Stud. 2021;8:45-56. https://doi.org/10.52380/ijpes.2021.8.4.586
49. Azuma K, Nojiri T, Kawashima M, et al. Possible favorable lifestyle changes owing to the coronavirus disease 2019 (COVID-19) pandemic among middle-aged Japanese women: An ancillary survey of the TRF-Japan study using the original "Taberhythm" smartphone app. PloS One. 2021;16(3):e0248935. https://doi.org/10.1371/journal.pone.0248935 PMid:33765024 PMCid:PMC7993768
50. Chen DT-H. The psychosocial impact of the COVID-19 pandemic on changes in smoking behavior: Evidence from a nationwide survey in the UK. Tob Prev Cessat. 2020;6:59. https://doi.org/10.18332/tpc/126976 PMid:33163705 PMCid:PMC7643580
51. Bommelé J, Hopman P, Walters BH, et al. The double-edged relationship between COVID-19 stress and smoking: implications for smoking cessation. Tob Induc Dis. 2020;18:63. https://doi.org/10.18332/tid/125580 PMid:32733178 PMCid:PMC7386200
52. Patanavanich R, Glantz SA. Smoking is associated with COVID-19 progression: A meta-analysis. Nicotine Tob Res.2020;22(9):1653-6. https://doi.org/10.1093/ntr/ntaa082 PMid:32399563 PMCid:PMC7239135
53. Genta FD, Rodrigues Neto GB, Sunfeld JPV, et al. COVID-19 pandemic impact on sleep habits, chronotype, and health-related quality of life among high school students: A longitudinal study. J Clin Sleep Med. 2021;17(7):1371-7. https://doi.org/10.5664/jcsm.9196 PMid:33666168 PMCid:PMC8314620
54. López-Bueno R, Calatayud J, Casaña J, et al. COVID-19 confinement and health risk behaviors in Spain. Front Psychol. 2020;11:1426. https://doi.org/10.3389/fpsyg.2020.01426 PMid:32581985 PMCid:PMC7287152
55. Tsang S, Avery AR, Seto EY, Duncan GE. Is COVID-19 keeping us up at night? Stress, anxiety, and sleep among adult twins. Front Neurosci. 2021;15:479. https://doi.org/10.3389/fnins.2021.665777 PMid:33981199 PMCid:PMC8107288

56. Li Y, Zhou Y, Ru T, Niu J, He M, Zhou G. How does the COVID-19 affect mental health and sleep among Chinese adolescents: A longitudinal follow-up study. Sleep Med. 2021;85:246-58. https://doi.org/10.1016/j.sleep.2021.07.008 PMid:34388503 PMCid:PMC8418314

57. Zhang X, Li X, Sun Z, et al. Physical activity and COVID-19: An observational and Mendelian randomisation study. J Glob Health. 2020;10(2):020514. https://doi.org/10.7189/jogh.10.020514 PMid:33312507 PMCid:PMC7719276

58. AlMughamis N, AlAsfour S, Mehmood S. Poor eating habits and predictors of weight gain during the COVID-19 quarantine measures in Kuwait: A cross sectional study. F1000Res. 2020;9:914. https://doi.org/10.12688/f1000research.25303.1

59. Romano L, Bilotta F, Dauri M, et al. Short report-medical nutrition therapy for critically ill patients with COVID-19. Eur Rev Med Pharmacol Sci. 2020;24(7):4035-9. https://doi.org/10.26355/eurrev_202004_20874

60. Del Pozo de la Calle S, Alonso Ledesma I, Nuñez O, et al. Composition and nutritional quality of the diet in Spanish households during the first wave of the COVID-19 pandemic. Nutrients. 2021;13(5):1443. https://doi.org/10.3390/nu13051443 PMid:33923258 PMCid:PMC8146770

61. Janssen M, Chang BP, Hristov H, Pravst I, Profeta A, Millard J. Changes in food consumption during the COVID-19 pandemic: Analysis of consumer survey data from the first lockdown period in Denmark, Germany, and Slovenia. Front Nutr. 2021;8:635859. https://doi.org/10.3389/fnut.2021.635859 PMid:33763443 PMCid:PMC7982667