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Original article

Changes in diet, lifestyle, and Orthorexia Nervosa tendency during the COVID-19 pandemic: A web-based study

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SUMMARY

Objective: During the COVID-19 pandemic, our diet and lifestyle have changed significantly. In this study, it was aimed to determine the changes in diet, body weight and Orthorexia Nervosa (ON) tendency in the pandemic.

Method: This cross-sectional study was carried out among adults (n = 945). An online questionnaire was used to determine nutrition, lifestyle factors and ON tendency (via Google Docs). The questionnaire was also shared on social media groups and pages (instagram, twitter and facebook) managed by registered dietitians.

Results: During the COVID-19 pandemic individuals' body weight and total food consumption increased by 51.0% and 57.2%, respectively. Increased screen time (OR: 1.912, 95% CI: 1.374–2.661 p < 0.001), sleeping time (OR: 3.630, 95% CI: 2.551–5.166 p < 0.001) and decreased physical activity (OR: 2.051, 95% CI: 1.198–3.509 p < 0.01) were associated with weight gain. The ON tendency increased in all groups according to the change in food consumption status (p < 0.05).

Conclusions: Considering the ongoing pandemic, individuals should be provided with adequate nutritional support. It is very important to get that support from nutritionists in order to monitor and control body weight and ON tendency.

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1. Introduction

COVID-19 (Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)), which first appeared in late 2019, continues as a life-threatening danger all over the world. COVID-19, which was declared a pandemic by the world health organization (WHO) due to its high spread and death rate (2–3%), mostly affects the respiratory system [1]. Coughing, high fever, muscle pain and fatigue are the most common symptoms [2].

Despite the strict isolation measures taken since March 11, 2020, when the first case emerged in Turkey, 20.881 people died by the end of 2020 due to COVID-19, according to the data of the Turkish Ministry of Health [3]. Since there was no specific and effective treatment method in the initial phase of the pandemic, social distancing, mask and personal hygiene practices were

recommended and/or enforced to prevent infection. Due to all these social distance and isolation rules, our lifestyle has inevitably changed [1].

General dietary habits and physical activity are also among the lifestyle factors that have changed in the COVID-19 pandemic [4,5]. In particular, the fact that individuals spend more time at home with media and social media tools has led to an increase in sedentary time [6]. In addition to these, the change in the diet of individuals due to the fear and stress caused by the pandemic has led to an increase in healthy eating obsession, which is defined as Orthorexia Nervosa (ON) [7,8]. In the study of Zeynep et al., it was found that the fear of COVID-19 was related to an increase in the tendency toward ON [7]. Another study also reported that the time spent on social media to follow the COVID-19 and nutrition news were associated with higher ON symptoms [8]. Due to all these health concerns many individuals have consumed more organic/fresh food than they would usually require, assuming that it will boost immune against COVID-19 [9]. As a result of these new habits and trends, the risk of obesity and some eating behavior disorders have increased even more [6].

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Consequently, this study was conducted to determine the changes in diet, body weight and Orthorexia Nervosa (ON) tendency during the pandemic.

2. Methods

2.1. Design and sample

This cross-sectional study was conducted between September and November 2021, when the number of cases with COVID-19 was quite high in Turkey. Volunteers between the ages of 20–65 were included in the study. Registered dietitians were contacted to reach individuals, and a questionnaire including sections about informed consent, demographic characteristics, diet, lifestyle, and healthy eating obsession was sent online (via Google Docs). On the first page of the questionnaire, there were statements that the participation was on a voluntary basis. The research questionnaire was shared in social media groups (instagram, twitter and facebook) managed by registered dietitians.

During the research period, individuals who followed any diet or physical activity program, were pregnant/lactating, or were previously diagnosed with COVID-19 (due to its effects on food consumption and appetite) were excluded from the study. According to the preliminary data, 1040 people participated in the study. However, as a result of excluding questionnaires that did not meet the criteria ($n = 95$), the study was completed with 945 people. The research was conducted in accordance with the principles of the Declaration of Helsinki and received approval from the Amasya University Ethics Committee (number: 12/034-E-30640013).

2.2. Demographic information, dietary habits, and lifestyle factors

In the demographic information section age, gender, marital status, level of education and working status were collected. Dietary and lifestyle changes of individuals during the COVID-19 pandemic were compared with pre-pandemic through 'increased', 'decreased' and 'unchanged' options. Changes in diet were questioned through the headings of "total food consumption", "organic food consumption", "fruit consumption", "fast food consumption", "junk food consumption", "frozen food consumption", "number of main meals", "number of snacks", "food restriction status" and "night eating status". In order to determine the lifestyle changes of individuals, the parameters of 'physical activity duration', 'screen time', 'sleeping time' and 'body weight', 'use of vitamin-mineral supplements' and 'nutrition label reading habit' were also questioned.

2.3. Orthorexia Nervosa scale

The Turkish validated Orthorexia Nervosa (ON)-15 scale was used to evaluate the obsession with healthy eating [10]. The decrease in the score obtained from the scale indicates an increase in the ON tendency. Each question was asked twice to assess its impact before and during the COVID-19 pandemic.

2.4. Analysis of data

For sample size calculation G Power program was used. Number of predictor and total sample size of the similar study were taken as a reference and the study was completed with 95% power.¹⁵ The SPSS 22.0 (version 22, Chicago, IL, USA) software package was used for the evaluation of the data. Descriptive statistics were shown as number and percentage (n (%)). Multinomial logistic regression analysis was used to evaluate the body weight change of individuals in the pandemic. In dependent and independent

variables, the category 'unchanged' was taken as a reference. To adjust for potential confounding, age and gender were included into the regression model. Paired t-test was used to compare ON scores before and during COVID-19 pandemic. All statistical analyses were performed within a confidence interval of 95.0%, and p values of <0.05 were considered significant.

3. Results

3.1. Demographic information

The study population consisted of 945 people and the majority of whom were between the ages of 20–29 years (82.1%), women (75.8%) and single (91.6%). In total, 74.4% of individuals were university graduates and 62.1% were unemployed (Table 1).

3.2. Dietary habits, and lifestyle factors

During the COVID-19 pandemic, individuals' body weight (51.0%), total food consumption (57.2%), organic food consumption (56.6%), fruit consumption (52.6%), number of snacks (49.2%) and night eating status increased, while their fast-food consumption (53.0%) decreased (Table 2). According to the regression model given in Table 3, decreased physical activity (OR: 2.051, 95% CI: 1.198–3.509, $p < 0.001$) significantly affected the weight gain. Increased screen time (OR: 1.912, 95% CI: 1.374–2.661 $p < 0.001$), sleeping time (OR: 3.630, 95% CI: 2.551–5.166 $p < 0.001$), and total food consumption (OR: 3.770, 95% CI: 2.629–5.405 $p < 0.05$) were other factors influencing increased body weight (Table 3 and Fig. 1). When the factors affecting decreased body weight were examined, it was observed that only increased vitamin-mineral use (OR: 3.313, 95% CI: 1.262–4.807 $p < 0.05$) had a significant effect (Table 3).

3.3. ON scores by total food consumption

According to the change in total food consumption, ON scores decreased in all groups compared to the pre-pandemic period. The most significant change was observed in the group with increased food consumption ($p < 0.05$) (Table 4). Increased screen time (OR: 2.047, 95% CI: 0.980–3.112 $p < 0.001$), sleeping time (OR: 1.780, 95% CI: 1.219–2.805 $p < 0.001$) and decreased physical activity (OR: 2.254, 95% CI: 1.110–3.205 $p < 0.01$) significantly affected the increase in food consumption. The ON score also showed a positive relationship with increased food consumption (OR: 1.102, 95% CI: 0.790–1.805 $p < 0.01$) (Fig. 1).

Table 1
Demographic information of individuals ($n = 945$).

Age n (%)	
20–29	776 (82.1)
30–39	102 (10.8)
40+	67 (7.1)
Gender n (%)	
Women	716 (75.8)
Men	229 (24.2)
Marital status n (%)	
Married	79 (8.34)
Single	866 (91.6)
Level of education n (%)	
Primary-High school	124 (13.1)
University	703 (74.4)
Master+	118 (12.5)
Working status n (%)	
Employed	319 (33.8)
Unemployed	587 (62.1)
Left work	39 (4.1)

n: number. %: percentage.

Table 2
Altered nutrition habits and lifestyle factors of individuals in the COVID-19 pandemic.

	Increased	Decreased	Unchanged
Body weight	482 (51.0)	95 (10.1)	368 (38.9)
Total food consumption	446 (57.2)	114 (12.0)	385 (30.8)
Organic food consumption	534 (56.6)	68 (7.2)	343 (36.2)
Fruit consumption	497 (52.6)	37 (3.9)	421 (44.5)
Fast food consumption	132 (14.0)	501 (53.0)	312 (33.0)
Junk food consumption	382 (40.4)	231 (24.4)	332 (35.2)
Frozen food consumption	173 (18.3)	235 (24.9)	537 (56.8)
Number of main meals	225 (23.8)	172 (18.2)	548 (58.0)
Number of snacks	465 (49.2)	116 (12.2)	364 (38.6)
Food restriction status	198 (21.0)	134 (14.1)	613 (64.9)
Night eating status	445 (47.1)	125 (13.2)	375 (39.7)

4. Discussion

Since the advent of COVID-19 and consequent quarantine and isolation measures, our lifestyle has gone through many changes. Prolonged restrictions and our survival instincts have driven us largely away from our social life to maintain our health [11]. One of the most obvious changes in this regard has been seen in our diet. During the pandemic, when we mostly spend time at home, has not only changed the amount of food we consume but also the choice of our food [12]. People started to consume more fresh/organic food

by assuming that it would improve their immune system. In our study, the total food consumption (57.2%), organic food consumption (56.6%), fruit consumption (52.6%) and the number of snacks (49.2%) increased compared to the pre-pandemic period. In the study of Ruis-Roso et al., it was found that fruit/vegetable consumption and the number of snacks increased during the COVID-19 lockdown [13]. Another cross-sectional study conducted with young adults also found that participants' fruit and vegetable consumption increased during the COVID-19 lockdown [14]. Similarly, in other studies, total food consumption, organic-fresh food consumption and the number of snacks increased in the COVID-19 pandemic [15–17]. During the pandemic, fast food consumption tended to decrease due to the increase in home cooking practices and the fear of COVID-19 contamination from packaged products [18]. In this study fast food consumption decreased (53.0%) compared to the pre-pandemic period. In other studies, in parallel with our study, it was found that fast food consumption decreased during the pandemic [19–21].

The increase in body weight is expected to be a possible outcome of increased food consumption coupled with the decreased or unchanged physical activity [12]. According to the results of our study, one of the important factors affecting increased body weight during the pandemic was found to be an increased food consumption (OR: 3.770, 95% CI: 2.629–5.405 $p < 0.05$). The decrease in physical activity was another factor affecting both the increased body weight

Table 3
Lifestyle factors affecting body weight change in the COVID-19 pandemic.

Changes in body weight (ref: Unchanged)					
Increased body weight	B	OR [Exp(B)]	Lower 95% CI	Upper 95% CI	p
Total food consumption (ref: unchanged)					
Increased	1.327	3.770	2.629	5.405	0.014*
Decreased	0.710	1.635	0.902	2.562	0.175
Physical activity (ref: unchanged)					
Increased	0.180	1.085	0.532	1.394	0.721
Decreased	0.718	2.051	1.198	3.509	0.009**
Screen time (ref: unchanged)					
Increased	0.648	1.912	1.374	2.661	<0.001**
Decreased	0.526	1.225	0.869	2.101	0.062
Sleeping time (ref: unchanged)					
Increased	1.289	3.630	2.551	5.166	<0.001**
Decreased	−0.368	0.782	0.280	1.599	0.670
Use of vitamin-mineral supplements (ref: unchanged)					
Increased	0.266	1.204	0.946	1.798	0.105
Decreased	0.425	1.301	0.902	1.869	0.226
Food label reading (ref: unchanged)					
Increased	−0.221	0.712	0.576	1.570	0.681
Decreased	−0.075	0.890	0.406	1.395	0.563
Decreased body weight					
	B	OR [Exp(B)]	Lower 95% CI	Upper 95% CI	p
Total food consumption (ref: unchanged)					
Increased	0.701	1.715	0.803	3.162	0.202
Decreased	0.821	2.023	1.159	3.365	0.369
Physical activity (ref: unchanged)					
Increased	0.115	1.126	0.413	2.438	0.725
Decreased	0.260	0.986	0.307	1.374	0.528
Screen time (ref: unchanged)					
Increased	0.179	0.917	0.433	1.872	0.441
Decreased	0.520	1.572	1.020	2.112	0.108
Sleeping time (ref: unchanged)					
Increased	−0.223	0.792	0.421	1.697	0.608
Decreased	0.510	1.211	0.381	2.367	0.056
Use of vitamin-mineral supplements (ref: unchanged)					
Increased	1.198	3.313	1.262	4.807	0.015*
Decreased	0.729	1.578	0.781	2.364	0.116
Food label reading (ref: unchanged)					
Increased	1.032	1.263	0.986	2.657	0.063
Decreased	0.795	0.921	0.720	1.537	0.124

Multinomial logistic regression analysis was used Age and gender were included into the regression model.
OR: Odds Ratio. CI: Confidence Interval. * $p < 0.05$ ** $p < 0.01$.

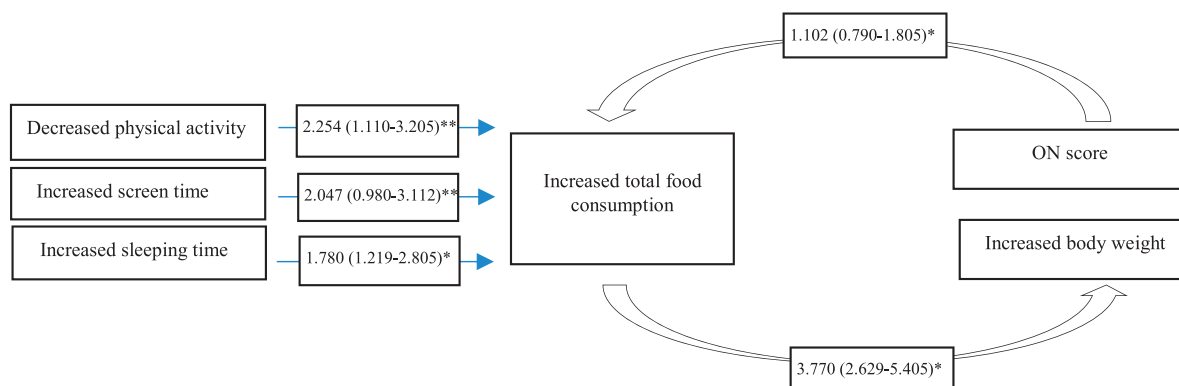


Fig. 1. Factors associated with increased total food consumption in the COVID-19 pandemic. Multinomial logistic regression analysis was used. The category ‘unchanged’ was taken as a reference. Age and gender were included into the regression model. Odds Ratio (Confidence Interval). * $p < 0.01$ ** $p < 0.001$.

(OR: 2.051, 95% CI: 1.198–3.509 $p < 0.001$) and food consumption (OR: 2.254, 95% CI: 1.110–3.205 $p < 0.01$). Zachary et al. reported that the increase in food consumption in the COVID-19 pandemic affected weight gain ($p < 0.05$). Physical activity was also found to be negatively associated with weight gain ($r = -0.155$, $p = 0.034$) [11]. Similarly, Allabadi et al. found that the increase in food consumption during the pandemic was associated with weight gain ($p < 0.01$) [12]. In the study of Tan et al., it was found that almost half (47.7%) of Indonesian students and more than half (57.8%) of Malaysian students gained weight during the COVID-19 pandemic [22]. In another cross-sectional study, conducted with 1101 students, it was found that approximately half of the students (46.9%) gained weight and the majority (56.7%) did not exercise regularly [23].

The changing sleep pattern during the pandemic has also been associated with diet. Less exposure to daylight, changing sleep/wake times and online work have affected individuals’ circadian rhythm and diet [24]. Our results suggest, increased sleep duration significantly affected individuals’ total food intake (OR: 1.780, 95% CI: 1.219–2.805 $p < 0.01$) and weight gain (OR: 3.630, 95% CI: 2.551–5.166 $p < 0.001$). Night eating status (47.1%) increased compared to the pre-pandemic period. In the cross-sectional study of Flanagan et al., delayed and increased sleep duration was found to be positively associated with weight gain ($p < 0.05$) [24]. Zachary et al. reported that sleeping time positively associated with weight gain ($r = -0.195$, $p = 0.021$) [11].

Increased screen time can delay mealtimes and change the amount of food consumed. Spending a long time with the media and social media in the COVID-19 pandemic has also affected food intake [25]. In this study, increased screen time was one of the factors affecting body weight (OR: 1.912, 95% CI: 1.374–2.661 $p < 0.001$) and increased food intake (OR: 2.047, 95% CI: 0.980–3.112 $p < 0.01$). Parallel to our study, other studies found that an increase in screen time increases body weight and food intake

[6,25]. However, in the study of Tan et al., no relationship was found between body weight change and screen time [26].

Since adequate and balanced nutrition have positive effects on health, as mentioned above, people tried to eat healthier during COVID-19 than before the pandemic. However, the fact that this situation turned into an obsession, resulting in increase of some eating behavior disorders [9]. According to the data we obtained, ON tendency, which evaluates individuals’ obsession with healthy eating, increased in all groups according to the change in food consumption status ($p < 0.05$). The ON score was found to be an important factor affecting the increase in food consumption (OR: 1.102, 95% CI: 0.790–1.805 $p < 0.01$). Similarly, Devrim et al. reported that the time spent on social media to follow the COVID-19 and nutrition news were associated with higher orthorexia symptoms [8].

This study has some limitation. The results cannot be generalized to the whole population, since the research was conducted on the internet and a certain number of people were reached. Due to pandemic conditions, detailed anthropometric measurements of individuals could not be taken. In addition, the results of the study were not compared with the physical activity record and macromicronutrient intake. Despite all these limitations, the comparison of diet, lifestyle factors and ON tendency with each other and with the pre-pandemic period has added strength to the research.

5. Conclusion

It was found that the total food consumption, body weight, and ON tendency of individuals increased in the COVID-19 pandemic. Increased sleep time, screen time, and decreased physical activity were the main factors affecting weight gain and increase in total food consumption. The ON score also showed a positive relationship with increased total food consumption. According to the results, considering the ongoing pandemic process, individuals should be provided with adequate nutritional support. It is very important to get support from nutritionists during the pandemic process in order to monitor and control both body weight and physical activity. For this purpose, correct information should be conveyed by experts in the media and on social media platforms as well.

Statement of authorship

UOY: Study design, data interpretation, drafting and revising the article. MY: Study design, data analysis-interpretation, revising the article and final approval.

Table 4

ON scores of individuals by total food consumption before and during the COVID-19 pandemic.

	Before	During	Change	p
Total food consumption				
Increased	37.6 ± 3.8	35.5 ± 3.8	2.1	0.010*
Decreased	36.9 ± 4.1	35.3 ± 4.0	1.6	0.025*
Unchanged	37.3 ± 3.8	36.2 ± 3.8	1.1	0.038*

Paired t-test was used. * $p < 0.05$.

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Declaration of competing interest

The authors declared no potential conflict of interests with respect to the research.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.clnesp.2022.04.011>.

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