The COVID-19 Pandemic Drives People to Orthorexia and Anxiety with the Influence of Social Media: A Cross-Sectional Study of 525 Adults in Semi-Quarantine

Asli Devrim-Lanpir (✉ asli.devrim@medeniyet.edu.tr)

Istanbul Medeniyet University: Istanbul Medeniyet Universitesi <https://orcid.org/0000-0002-4267-9950>

Hatice Kübra Barcın Güzeldere

Istanbul Medeniyet University: Istanbul Medeniyet Universitesi

Elif Ede Çintesun

Istanbul Sabahattin Zaim University: Istanbul Sabahattin Zaim Universitesi

Research article

Keywords: orthorexia nervosa, anxiety, COVID-19, social media, coronavirus, nutritional supplement

Posted Date: April 30th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-441898/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background

The COVID-19 pandemic hit the world tremendously, causing an increased risk of eating and anxiety disorders. Increased social media exposure and obsession with healthy eating to minimize the risk of catching the COVID-19 may cause orthorexia and anxiety symptoms in individuals during pandemic. We aimed to assess the presence and interaction between orthorexia and anxiety symptoms during the first phase of the COVID-19 pandemic. We also determined the influences of social media and nutritional supplement use on orthorexic and anxiety symptoms.

Methods

We performed an online survey of individuals in COVID-19 quarantine ($n = 525$) using Google forms. We determined their orthorexia and anxiety symptoms using ORTO-11 and General Anxiety Disorder (GAD-7) questionnaire, respectively. We also assessed their nutritional supplement and social media use, and how these patterns were affected during the first phase of the COVID-19 pandemic.

Results

Higher orthorexia (67% in men, 83.2% in women) and anxiety (62.4% in men; 95.4% in women) symptoms were detected in individuals in COVID-19 pandemic. Orthorexia symptoms were found positively associated with anxiety symptoms in both sexes. The time spent on social media to follow the COVID-19, health, and nutrition news were closely associated with higher orthorexic symptoms in both sexes, and higher anxiety symptoms in women ($r = -0.638$ in men; $r = -0.560$ in women, $p < 0.001$). The use of multivitamins and β -glucan to mainly support immunity were linked to orthorexic symptoms in both sexes.

Discussion

The COVID-19 pandemic has detrimental influences on mental well-being that drove individuals into psychologic problems. Increased social media use to follow healthy eating news has also create an undesirable impact on orthorexic problems. Therefore, it is crucial to detect orthorexia and anxiety symptoms earlier and modulate daily behaviours during the pandemic in order to prevent long-term detrimental consequences.

Plain English Summary

This study aimed to evaluate healthy eating obsession and anxiety problems in people who are semi-quarantined due to the COVID-19 outbreak. We also evaluated the relationship between social media

exposure and nutritional supplement use with anxiety and healthy eating obsession. The findings show that healthy eating obsession and anxiety are quite high in people who are semi-quarantined due to COVID-19. In addition, people who follow healthy nutrition and COVID-19 issues more on social media have more orthorexia problems and consume more multivitamin and B glucan supplements. Overall, the increase rate of anxiety and orthorexia symptoms may cause tremendous alteration on well-being. These findings may benefit people by highlighting the fact that constant exposure to social media news about healthy eating and supplement suggestions during the pandemic can lead to undesirable consequences such as increasing anxiety and obsession with healthy eating and leading to unconscious use of nutritional supplements.

Background

The entire world has been faced with the Coronavirus (SARS-CoV-2 or COVID-19), a new epidemic that has hit millions of people catastrophically years after the flu epidemic that broke out more than a century ago [1,2]. Considering the process of the disease, it has been observed that COVID-19 is transmitted faster than other types of coronavirus, and it can cause severe respiratory distress that requires treatment in intensive care [3,4]. In order to prevent the spread of the coronavirus, people had to stay in semi-quarantine at home after the government and the Ministry of Health obligatory calls to "stay at home to stay safe" [5]. It has been stated that the prolongation of the stay at home, combined with the fear of getting the virus, affects the psychological well-being of people in quarantine and increases anxiety symptoms [6]. In a study conducted in the first phase of the COVID-19 outbreak in China, it was reported that the pandemic caused moderate to severe paranoia and panic in Chinese people and approximately one-third of the participants had moderate to severe anxiety [7].

The coronavirus infection occurs in three phases in the body [8]. The asymptomatic incubation period, when the virus is sometimes not recognized, is defined as the first stage. The symptomatic period in which the virus is diagnosed but does not seriously affect the body is stated as the second phase, while the period when the virus load increases significantly and causes severe respiratory symptoms is defined as the third phase. It is emphasized that the adaptive immune response that develops in the body in the first two phases can change the disease process. It has been reported that in individuals with a strong adaptive immune response can eliminate the virus by preventing the disease from progressing to a severe period. [8,9]. Therefore, a healthy and balanced diet high in antioxidants and vitamins is of great importance in combating COVID-19 to strengthen immune functions. [9]. Although dietary guidelines in COVID-19 direct individuals to strengthen immunity naturally [10], it is observed that many people, with or without nutrition expertise, have made dietary recommendations on social media to increase immunity and direct people to use supplements to protect against COVID-19. However, it has been reported that the coronavirus utilizes the ACE-2 receptor as the main receptor in its entry into the lungs [11] and some nutritional supplements may cause detrimental effects on the COVID-19 process by increasing the number of these receptors [12,13]. In addition, cytokine storm is defined as the overproduction of cytokines by the immune system, which usually occurs at the terminal stage of some viral diseases (SARS, MERS, SARS-CoV-2), and is considered partially responsible for the high mortality rates in infected

individuals [14] The potential impact of nutritional supplements on cytokine storm is not fully elucidated [15]. Therefore, it is crucial to avoid the unconscious use of nutritional supplements to maintain health during the COVID-19. To our knowledge, the effect of nutritional advices stated on social media on individuals in semi-quarantine and the tendency of individuals to use nutritional supplements has not been investigated.

It was stated that the constant exposure to COVID-19 news on social media and the increasing virus spread has affected both mood and eating behaviours [9]. It is well-known that the symptoms of Orthorexia Nervosa (ON), one of the eating disorders known as healthy eating obsession, increase considerably with the follow-up of the news about healthy eating on social media [16]. However, it is not investigated whether individuals in semi-quarantine display orthorexic behaviours, such as obsessions about whether the food they buy is safe and healthy enough to protect their immunity.

Eating disorders and anxiety disorders are often described as comorbid psychiatric disorders [17]. To our knowledge, there is no data in the literature on the relationship between anxiety arising from semi-quarantine and fear of catching the virus, and obsession with healthy eating.

We aimed to evaluate the presence of obsessive eating behaviours and general anxiety disorders and the use of nutritional supplements during the COVID-19 pandemic. In addition, we also investigated the impact of social media news on orthorexia and anxiety symptoms in individuals in semi-quarantine.

Methods

Study design

This study was a cross-sectional study conducted during the first wave of COVID-19 (between 01-21 April 2020) during the government-imposed lockdown due to the COVID-19 outbreak.

This lockdown included weekend curfews, everyone except cargo and food workers worked from home, and the obligation to wear masks everywhere. Data was collected using a digital platform (Google forms) due to the eliminate the risk of face-to-face interviews. The researchers shared a link with the participants to access the study questionnaire, which they can fill out online. No incentives were used in this cross-sectional study.

Sample Size Calculation

The power analysis was calculated based on the study conducted by Turner et al. [16], which was stated the rate of orthorexia nervosa in individuals using social media was 49%, and the estimation of this ratio for our study as 60 %. At least 348 adults were needed to be included into the study according to the G power software, based on a power of 80% and a reliability of 95%. At the end of the data collection, a total of 525 participants from 1021 people were enrolled to the study.

Participants

Participants were recruited through social networks (Facebook, Instagram, Twitter, WhatsApp), e-mail, and faculty websites of the researchers. All individuals over the age of 18 were allowed to participate in this study. Body mass index (BMI) was calculated using the following formula; $[\text{weight (kg)} \cdot (\text{height})^{-2} (\text{m}^2)]$. BMI that less than 18.5 is classified as underweight range, between 18.5 to < 25, as healthy range, between 25 to < 30, as overweight range, higher than 30 as obese range [18].

Questionnaire

The questionnaire consisted of 45 questions and three parts detailed below.

The first part included the sociodemographic characteristics: age, sex, education level, smoking status, presence of any chronic disease, marital status, dietary practice.

The second part included questions about the use of social media and supplements during semi-quarantine. Questions aimed to collect information about the use of nutritional supplements before and after COVID-19, whose recommendation and why they need to use them, which foods they believe are healthy to improve immunity. There were also questions regarding the time spent using social media, the applications they use, and how long they follow the news on COVID-19, health and nutrition on a daily basis.

The last part dealt with the determination of orthorexia and general anxiety disorders using the following scales described in detail.

ORTO-11 Scale

ORTO-11 scale was used to detect healthy eating obsession in individuals. The ORTO-11 scale consists of 11 multiple-choice questions that are rated using a four-point Likert scale. The ORTO-11 scale cut-off value is 27, and individuals with lower scores are thought to have more orthorexic symptoms [19,20].

General Anxiety Disorder-7 Scale

The scale consists of seven questions rated using a four-point Likert scale. With a maximum score of 21, the results of 0-4 are evaluated as mild, 5-9 as moderate, 10-14 as high, and 15-21 as severe anxiety [21,22].

Statistical Analysis

Statistical analyses were performed using the SPSS Software version 21. The variables were tested using visual (histogram, probability plot) and analytic (Kolmogorov-Smirnov/ Shapiro-Wilk's test) methods to determine if they are normally distributed. Descriptive results were presented as mean and standard deviation. In order to compare the differences between the sexes, the independent two sample t-test or the Mann-Whitney test was used, where appropriate. The Chi-square test or Fisher's exact test (when chi-square test assumptions do not hold due to low expected cell counts), where appropriate, was used to

compare the proportions of education, occupation, presence of chronic diseases, and diet applied between sexes. The Wilcoxon test was used to verify differences in supplement use between before and the current pandemic period. As both ORTO-11 and time spent on per day using social media to read information related to the COVID-19, health and nutrition were normally distributed, the correlation coefficients and their significance were calculated using Pearson test. However, Spearman test was applied to calculate the correlation between GAD-7 scores and time spent on social media to read information related to the COVID-19, health and nutrition as GAD-7 scores were not normally distributed. A multiple linear regression model was used to identify the impact of orthorexic behaviours on starting the supplement use during the COVID-19. A 5% type-1 error level was applied to infer statistical significance.

Results

Participants

Descriptive characteristics of the participants age, weight, height, BMI, education level, occupation status, presence of any chronic diseases, smoking status and diet practice were presented in Table 1. No differences were observed in age, weight and height between sexes. Most of the participants were omnivorous (98.9% of men; 98.0% of women), highly educated, actively working and had no known chronic diseases.

Table 1
General characteristics of the subjects (n = 535)

	Men (n = 179)	Women (n = 346)	<i>p</i>
Age	31.0 ± 11.4 ^a	30.8 ± 9.8 ^a	0.103 [⊕]
Weight (kg)	77.8 ± 12.2 ^a	61.7 ± 10.7 ^a	0.068 [⊕]
Height (cm)	176.0 ± 14.5 ^a	164.2 ± 5.9 ^a	0.716 [⊕]
BMI (kg/m ²)	24.9 ± 3.6 ^a	22.9 ± 3.8 ^a	0.384 [⊕]
ORTO-11	26.0 ± 4.9 ^a	23.6 ± 4.1 ^a	0.002 ^{*⊕}
Orthorexia presence			
Yes	120 (67.0 %) ^c	288 (83.2 %) ^c	0.001 ^{*⊕}
No	59 (33.0 %) ^c	58 (16.8 %) ^c	
GAD-7	7.0 (4.0–11.0) ^b	8.0 (3.0–13.0) ^b	0.001 ^{*⊕⊕}
No	67 (37.4 %) ^c	16 (4.6 %) ^c	
Mild	47 (26.3 %) ^c	140 (40.5 %) ^c	
Moderate	37 (20.7 %) ^c	119 (34.4 %) ^c	
Severe	28 (15.6 %) ^c	71 (20.5 %) ^c	
Education			
< High school	16 (9.0 %) ^c	33 (5.0 %) ^c	0.635 ^{⊕⊕⊕}
≥ High school	163 (91.0 %) ^c	313 (95.0 %) ^c	
Occupation			
Not working	0 (0.0 %) ^c	27 (7.8 %) ^c	0.001 ^{*⊕⊕⊕}
Student	18 (10.1 %) ^c	83 (24.0 %) ^c	

^a Mean ± SD ^b Median (IQR) ^c n (%).

[⊕]Independent two-sample t-test. ^{⊕⊕}Mann–Whitney U test. ^{⊕⊕⊕}Pearson chi-squared test. ^{⊕⊕⊕⊕}Fisher's exact test.

*p < 0.001. **p < 0.05.

	Men (n = 179)	Women (n = 346)	<i>p</i>
Working	150 (89.0 %) ^c	235 (67.9 %) ^c	
Retired	11 (6.1 %) ^c	1 (0.3 %) ^c	
Presence of any chronic diseases			
Yes	12 (6.7 %) ^c	35 (10.0 %) ^c	0.008 ^{⊕⊕⊕}
No	167 (93.3 %) ^c	311 (89.0 %) ^c	
Smoking Status			
Ever	60 (33.5 %) ^c	256 (74.0 %) ^c	0.001* ^{⊕⊕⊕⊕}
Used to smoke, but quit	42 (23.5 %) ^c	40 (11.6 %) ^c	
Still smoking	77 (43.0 %) ^c	50 (14.5 %) ^c	
Number of cigarette (per day)	12.0 (6.0–20.0) ^b	7.0 (5.0–15.0) ^b	0.025** ^{⊕⊕}
Smoking periods (years)	8.0 (5.0- 14.50) ^b	10.0 (5.8–20.0) ^b	0.066 ^{⊕⊕}
Diet			
Omnivore	177 (98.9 %) ^c	339 (98.0 %) ^c	0.725 ^{⊕⊕⊕⊕}
Vegetarian	2 (1.1 %) ^c	7 (2.0 %) ^c	
Vegan	0 (0.0 %) ^c	0 (0.0 %) ^c	
^a Mean ± SD ^b Median (IQR) ^c n (%). [⊕] Independent two-sample t-test. ^{⊕⊕} Mann–Whitney U test. ^{⊕⊕⊕} Pearson chi-squared test. ^{⊕⊕⊕⊕} Fisher's exact test. *p < 0.001. **p < 0.05.			

Orthorexia Risk

With significant differences across sex, 67.0% (n = 120) of men and 83.2% (n = 288) of women were at risk for orthorexia (Table 1).

Presence of General Anxiety Disorder

Higher general anxiety symptoms ranging from mild to severe were detected in both sexes (62.4% of men; 95.4% of women) (Table 1). Women had higher general anxiety symptoms compared to men, with predominantly moderate levels (40.5%) ($p < 0.001$).

Interaction between orthorexia disorder and general anxiety disorder

Lower ORTO-11 scores were significantly associated with higher GAD-7 scores in both sexes ($r = -0.4$ in men; $r = -0.2$ in women; $p < 0.05$) (Fig. 1).

Social Media Use

Table 2 represents the information about social media use according to sexes. The majority of the participants actively used social media on a daily basis (98.3% of men; 99.1% of women), with no significant differences between sexes. With an average time of $53.9 \text{ min.day}^{-1}$ for men and $51.2 \text{ min.day}^{-1}$ for women, participants spent time on social media apps to seek for information related to COVID-19, health and nutrition.

Table 2
Information about social media use

	Men (n = 179)	Women (n = 346)	<i>p</i>
Social Media Use			
Yes	176 (98.3 %) ^a	343 (99.1 %) ^a	0.415 [⊕]
No	3 (1.7 %) ^a	3 (0.9 %) ^a	
Number of social media apps	3.0 (2.0– 3.0) ^b	3.0 (2.0– 4.0) ^b	0.795 ^{⊕⊕}
Average time subjects spent on social media apps to track information about COVID-19, health and nutrition	53.9 ± 10.9 ^c	51.2 ± 13.4 ^c	0.725 ^{⊕⊕⊕}
< 15 min	48 (26.8 %) ^a	72 (20.8 %) ^a	0.423 [⊕]
15–30 min	64 (35.8 %) ^a	112 (32.4 %) ^a	
30–60 min	31 (17.3 %) ^a	93 (26.9 %) ^a	
> 60 min	36 (20.1 %) ^a	69 (19.9 %) ^a	
Percentage of using the apps daily			
Instagram	131 (73.2 %) ^a	311 (89.9 %) ^a	0.001 ^{⊕*}
Facebook	101 (56.4 %) ^a	131 (37.9 %) ^a	0.001 ^{⊕*}
Twitter	92 (51.4 %) ^a	179 (51.7 %) ^a	0.942 [⊕]

^a n (%); ^b Median (IQR); ^c Mean ± SD.

⊕ Pearson chi-squared test ⊕⊕ Mann–Whitney U test. ⊕⊕⊕ Independent two-sample t-test *p < 0.001.

	Men (n = 179)	Women (n = 346)	p
LinkedIn	37 (20.7 %) ^a	52 (15.0 %) ^a	0.123 [⊕]
^a n (%); ^b Median (IQR); ^c Mean ± SD.			
[⊕] Pearson chi-squared test ^{⊕⊕} Mann–Whitney U test. ^{⊕⊕⊕} Independent two-sample t-test *p < 0.001.			

Effect of social media use on orthorexia disorder and general anxiety disorder

The potential effects of social media on orthorexic and general anxiety symptoms were shown in Table 3. Mean time participants spent on social media apps to track information about COVID-19, health and nutrition were negatively correlated with ORTO-11 scores in both sexes. On the other hand, GAD-7 scores of women were found to be positively linked with the time spent on social media to check for health and nutrition solutions for COVID-19.

Table 3

Correlation between time spending social media, and orthorexia and general anxiety disorders status

Average time subjects spent on social media apps to track information about COVID-19, health and nutrition				
	Men (n = 179)		Women (n = 346)	
	r	p	r	p
ORTO-11	-0.638	0.001 ^{a*}	-0.560	0.001*
GAD-7	0.746	0.909 ^b	0.444	0.001*
^a Pearson correlation. ^b Spearman' rho correlation. *p < 0.001.				

Determination of nutritional supplements use after COVID-19

Figure 2 represents the alteration in supplement use before and after COVID-19 according to the sex. The use of vitamin C, Beta glucan (β-glucan), and Pelargonium Sidoides were significantly increased after COVID-19 outbreak in both sexes (p < 0.05). The utilization rate of multivitamin, zinc, black elderberry and propolis in women were significantly elevated after COVID-19 (p < 0.05). The use of Vitamin D in men was significantly increased after COVID-19 (p < 0.05).

Participants predominantly preferred to use nutritional supplements to improve their immunity (24.0 % of men; 32.9 % of women) (Fig. 3). Most of the participants started using nutritional supplements with “belief effect” (52.6 % of men; 50.3 % of women) (Fig. 4).

Tendency to supplement use according to presence of orthorexic symptoms

Table 4 shows the multiple linear regression analysis of supplement utilization and orthorexia symptoms taking the ORTO-11 score as the dependent variable. The regression analysis showed that as the ORTO-11 scores decreased, multivitamin ($R^2 = 0.377$ in men; 0.055 in women) and β -glucan ($R^2 = 0.379$ in men; 0.199 in women) utilization rates were increased in participants regardless of sex. In addition, the utilization rates of Pelargonium Sidoides ($R^2 = 0.172$), vitamin C ($R^2 = 0.142$) and D ($R^2 = 0.199$) were increased in parallel with the decrease in ORTO-11 scores in women.

Table 4
Linear regression analysis taking the ORTO-11 score as the dependent variable

Food Supplement (Pre COVID-19/ during COVID-19)	Sex	<i>B</i>	SE	Confidence Interval (95%)	R ²
Multivitamin					
No/Yes	Men	-0.557*	0.201	(-1.005)- (-0.109)	0.377
No/Yes	Women	-0.243*	0.135	(-0.518)- (0.031)	0.055
B group vitamins					
No/Yes	Men	-	-	-	-
No/Yes	Women	-0.200	0.216	(-0.698)- (0.298)	-0.016
Vitamin C					
No/Yes	Men	-0.432	0.313	(-1.154)- (0.289)	0.092
No/Yes	Women	-0.435*	0.189	(-0.823)- (-0.047)	0.142
Vitamin D					
No/Yes	Men	-0.320	0.298	(-0.976)- (0.337)	0.012
No/Yes	Women	-0.319*	0.147	(-0.633)- (-0.005)	0.199
Zn					
No/Yes	Men	-0.380	0.232	(-1.117)- (0.357)	0.297
No/Yes	Women	-0.164	0.192	(-0.573)- (0.245)	-0.017
Mg					
No/Yes	Men	-	-	-	-
No/Yes	Women	-0.398	0.251	(-1.042)- (0.247)	0.202
Fe					
No/Yes	Men	-	-	-	-
No/Yes	Women	-0.372	0.223	(-0.919)- (0.174)	0.203
Omega-3					
No/Yes	Men	-	-	-	-
No/Yes	Women	-0.347	0.214	(-0.890)- (-0.214)	0.152

*p < 0.05.**p < 0.001.

Food Supplement (Pre COVID-19/ during COVID-19)	Sex	<i>B</i>	SE	Confidence Interval (95%)	R ²
β-glucan					
No/Yes	Men	-0.405**	0.127	(-0.678)- (-0.132)	0.379
No/Yes	Women	-0.508**	0.183	(-0.883)- (-0.132)	0.199
Black Elderberry					
No/Yes	Men	-0.384	0.230	(-0.929)- (0.160)	0.182
No/Yes	Women	-0.265	0.154	(-0.586)- (0.056)	0.081
Pelargonium Sidoides					
No/Yes	Men	-0.333	0.253	(-0.983)- (0.317)	0.110
No/Yes	Women	-0.347*	0.147	(-0.653)- (-0.041)	0.172
Propolis					
No/Yes	Men	-0.324	0.640	(-3.076)- (2.428)	-0.329
No/Yes	Women	-0.437	0.197	(-0.844)- (-0.030)	0.130
*p < 0.05.**p < 0.001.					

Discussion

The purpose of the study is to investigate the interaction between orthorexia and general anxiety symptoms and the tendency to use nutritional supplements during the semi-quarantine period due to the COVID-19 pandemic. We also sought to the psychological impact of social media news about COVID-19 and nutrition. We achieved five fundamental results: (1) A positive association was found between Orthorexia and generalized anxiety disorder symptoms, with the fact that these disorders were reasonably high in both sexes during the COVID-19 semi-quarantine; (2) Individuals in semi-quarantine spent an average of 52 minutes on social media seeking information about COVID-19, health and nutrition; (3) A significant positive link was observed between social media use and orthorexic symptoms in both sexes; (4) A positive interaction was obtained between general anxiety disorder symptoms and social media use; (5) Most people in semi-quarantine (an average of 51.6 %) decided to take supplements believing they support their immunity, and a positive interaction was observed between orthorexic symptoms and multivitamin and β-glucan use in both sexes. A positive correlation was also found between orthorexia symptoms and the use of Pelargonium Sidoides, vitamin C, and D in women.

Our results suggest increased orthorexia (67.0 % in men and 83.2 % in women) and general anxiety disorder (62.6 % in men and 95.4 % in women) risks for individuals in the COVID-19 pandemic. The

unexpected coronavirus pandemic has made extraordinary changes in physical and psychological health by being isolated from almost everyone and creating fear of contracting the disease [23]. Although the COVID-19 lockdown provides better protection to prevent catching the virus, its impact on mental health has been reported to drive individuals into depression, anxiety, stress, and even suicide [4,24,25]. Our study revealed a higher percentage of anxiety compared to the world anxiety prevalence (3.6%) [26], and previous studies using the same GAD-7 questionnaire in China (22.6%) [25], Brazil (23.3%) [27], and Ireland (20.0%) [28]. Higher anxiety may also be due to economic instability, as noted by Puccinelli et al [27]. As higher anxiety levels have highly compromised mental health and closely related to eating disorders [23,25], early detection and underlying problems need to be deeply considered.

As it is claimed that mental distress such as loneliness and boredom trigger eating disorders and the COVID-19 pandemic also prompts this mood [29], a series of studies have been conducted to investigate the potential effect of COVID-19 on eating disorders [29–32]. Previous research has indicated that individuals with psychological distress tend to eat more, leading to emotional [30] and binge eating symptoms [31,32]. A study of 5,469 participants found that self-reported dietary restriction, binge eating and purging behaviours increased in 64.5%, 35.5% and 18.9% of the participants, respectively [31]. Elmacioğlu et al. [30] stated that emotional eating and uncontrolled eating behaviours had significantly increased during the COVID-19 isolation, however; no alteration was observed in cognitive restrictive behaviours. However, these studies commonly focused on the presence of binge eating and emotional eating symptoms. A recent review by Rodgers et al. [33] noted that orthorexic symptoms may increase due to the rise in concerns about healthy eating during the COVID-19 outbreak. We conducted the survey at the beginning of the COVID-19 pandemic (i.e., approximately one month after the semi-quarantine announcement by the Ministry of Health), when the fear of getting the disease and the unknowns about the disease are most intense, revealing that people had experienced orthorexia symptoms even at the beginning of the COVID-19 pandemic.

Orthorexic symptoms not only affect psychotic well-being [34] but may also create an undesirable energy deficit [35] that weakens immunity. Since there is a possibility that the symptoms of eating disorders developed/ or increased during COVID-19 may last for a lifetime, it is crucial to diagnose these nutritional disorders in time. However, it has previously stated that the orthorexia diagnosis is rather complicated due to the lack of certain criteria for diagnosis [19]. In addition, as exercise habits weaken during the pandemic [27], individuals may restrict their daily diet consumption. Orthorexia development may be overlooked, as orthorexic behaviours and dietary restriction behaviours to avoid weight gain during the pandemic appear quite similar. As we found that general anxiety was closely related to orthorexia in both sexes, evaluating individuals identified as having general anxiety during COVID-19 pandemic in terms of the presence of orthorexia may be an effective strategy as it can provide early intervention to effectively manage the process. This strategy can be also recommended for early detection of general anxiety in the presence of orthorexia symptoms.

To our knowledge, this is the first study to investigate orthorexia and general anxiety disorder by questioning the use of social media and nutritional supplements. In line with other studies [25,29,33], we

reported that nearly all participants (99.2 %) were constantly using social media. It has been shown that constant exposure to social media during the COVID-19 may have paramount effects on psychological state [25]. In a study evaluating the interaction between the social media use and orthorexia, Turner and Lefevre [16] reported that a significant interaction between orthorexia and social media use, and Instagram is the most commonly used application to follow a healthy eating environment. Similar results were obtained from our study indicating that Instagram was the most frequently used application for both sexes (73.2% in men, 89.9% in women). The significant interaction between social media use and orthorexia symptoms may be due to the higher exposure time to Instagram. Following or interacting with like-minded individuals using social media can lead to an echo chamber effect, which reinforces the correctness of their point of view regarding eating behaviours by constantly underlining common views [36]. In addition, the restrictions of nearly all outdoor activities and daily schedules during the pandemic led to intense exposure to news about COVID-19 and healthy eating on social media [29], thus increasing fears of contracting COVID-19, and rising the obsession about healthy eating.

We revealed that the main reason why individuals in COVID-19 pandemic chose to take nutritional supplements was to support their immunity. Rising concerns about healthy eating during the pandemic [37] may drive individuals to take these supplements to improve adaptive immunity to minimize the risk of contracting COVID-19. In addition, one of the major reasons why individuals increase their use of nutritional supplements without consulting any healthcare professional during the COVID-19 pandemic may also be the echo effect of social media.

Studies of orthorexia and dietary supplement use have revealed conflicting results [19,34,38,39]. Although the general belief is that dietary supplement use is significantly higher in people with orthorexia symptoms [38], most of the studies have indicated no significant interaction between dietary supplement use and orthorexia symptomatology [19,34,38]. In contrast to most studies [19,34,38], we found a meaningful positive association between multivitamin and β -glucan use and orthorexia symptoms in both sexes, indicating that individuals with orthorexia symptoms tend to use multivitamins ($R^2 = 0.377$ in men; 0.055 in women) and β -glucan ($R^2 = 0.379$ in men; 0.199 in women) to support their immunity and become healthier during the COVID-19 pandemic. In addition, we found that as orthorexia symptoms increased in women, the use of Pelargonium Sidoides ($R^2 = 0.172$), vitamin C ($R^2 = 0.142$) and D ($R^2 = 0.199$) also increased. Although the main purpose of supplement use is to support immunity, it should be kept in mind that it may affect the body in the opposite direction, especially in the case of COVID-19 [40]. Nutritional supplements mainly zinc, selenium, vitamin C, and D have been applied to attenuate the severity and duration of viral diseases; however, the efficiency of nutritional supplements were still controversial [40,41]. Although there is no evidence-based consensus regarding recommendation of nutritional supplements during COVID-19, social media and supplementary industry have been bombarding a variety of nutritional supplement recommendation to improve immunity and, thereby, prevent COVID-19 infection. In addition, the possible effects of nutritional supplements on cytokine storm should also need to be evaluated. Although it is well known that both cytokines and chemokines have great effects on the innate immune response during viral infections as the first guardian of the body's

defence against the virus, excessive production of these molecules during the viral infections may induce immunopathology, causing a cytokine storm that may lead to several detrimental consequences including attenuated T cell response, enhanced vascular leakage, and impaired virus clearance [14]. It is unclear how nutritional supplements affect the occurrence or presence of cytokine storm. Therefore, we need randomize-controlled clinical trials to better understand the impact of nutritional supplements on the body defence [40]. Several research [41,42] and reviews [43–45] have been conducted to unveil the unknowns of nutritional supplements during COVID-19. In a randomized clinical trial investigating the efficiency of high dose zinc and/or ascorbic acid supplements in outpatients with the COVID-19 infection, Thomas et al. [42] indicated that administration of high-dose zinc (50 mg) and ascorbic acid (8000 mg) supplements alone or in combination did not reduce the duration and severity of symptoms. Similar with the study, in a longitudinal app-based study of 327,720 UK subjects revealed that no potential impact of zinc, vitamin C, or garlic supplements were observed in both sexes regarding of the COVID-19 risk [41]. However, it was also stated that individuals taking multivitamins, omega-3 vitamin D and probiotics had lower risk of COVID-19 infection by 13%, 12%, 9% and 14%, respectively. This results may be promising for the use of multivitamins, omega-3, probiotics, and vitamin D; however, due to the nature of this study, health professionals need more scientific clarification to recommend their supplementations to individuals [41]. In addition, checking the national dietary guidelines before recommending any nutritional supplements during the COVID-19 pandemic is also a great strategy to eliminate misutilization of these supplements. Coelho- Ravagnani et al. [43] outlined the current dietary guidelines for COVID-19, underlining that nutritional supplements, such as zinc, vitamins C, A, and D may be applied to improve immunity in case of any deficiency is detected.

Since the beginning of the pandemic, researchers particularly focused on the potential efficiency of vitamin D on COVID-19 infection due to its modulatory mechanisms on immunity by dampening the entry and replication of the coronavirus and attenuating proinflammatory cytokines and provoking production of anti-inflammatory cytokines to fight the virus [46]. A systematic review and meta-analysis by Bassatne et al. [44] has underlined that high quality studies are needed before implementing vitamin D supplementation to treat or prevent the infection, although there is a pattern between vitamin D deficiency and COVID-19 outcomes. All studies considered, even vitamin D supplementation is only recommended for people with low vitamin D status or limited access to sunlight [47]. Furthermore, the risks of taking high doses of vitamin D have also been highlighted due to potential harmful effects on health, especially in individuals with other health problems such as decreased kidney function [47]. Therefore, individuals should be cautioned that a detailed nutritional evaluation is necessary to determine if there is a nutritional deficiency before starting any nutritional supplements during the COVID-19 pandemic and that otherwise supplements may cause detrimental effects on health.

Our study has several strengths and limitations to consider. To our knowledge, this is the first study to compare orthorexia nervosa and anxiety in relation with the use of social media and nutritional supplements. The use of an online survey enabled data to be collected from all over the country. We implemented the ORTO-11, the valid and reliable version of ORTO-15 in our country as it eliminates the false prediction of the disorder. It is crucial to apply a valid questionnaire since we are aware that one of

the main reasons why orthorexia is not included in DSM-V is the psychometric limitations of the ORTO-15 questionnaire, such as lack of cultural adaptation, internal validity, and reliability.

Since there are no specific diagnostic criteria for orthorexia in DSM-5 [48] and we cannot independently be confirmed the presence of eating disorders, we did not ask if they had been diagnosed with orthorexia or any eating disorders before. However, previous eating disorder history may elevate the exaggerated obsession about food and orthorexic behaviours during the COVID-19 pandemic.

Conclusion

The current results suggest that individuals in COVID-19 semi-quarantine have higher orthorexic and anxiety symptoms in both sexes. A meaningful interaction was observed between orthorexia and anxiety, and higher social media use was significantly associated with orthorexia nervosa in both sexes, and anxiety in women. More than half of the participants applied nutritional supplements to improve the immune response. We indicated that as orthorexia symptoms increased, both sexes administered more multivitamins and β -glucan. In addition, a significant association was observed between orthorexic symptoms and the use of Pelargonium Sidoides, vitamin C and D in women. Overall, these findings suggest that orthorexia and anxiety are closely related to each other, and health, nutrition and COVID-19-related news on social media trigger these symptoms. In addition, the increase in the self-supplementation without consulting the healthcare personnel may cause detrimental consequences on health. Therefore, individuals who are concerned or obsessed with healthy eating should be encouraged to consult a healthcare professional so that any psychological problems can be detected early before they cause long-term detrimental consequences. In addition, they should be informed about the undesirable impact of social media news and also encourage to decrease the time spend on social media.

Abbreviations

COVID-19

the new type of coronavirus

BMI

Body mass Index

GAD-7

General Anxiety Disorder-7

ON

Orthorexia Nervosa

β -glucan

Beta-glucan

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Istanbul Medeniyet University Institutional Review Board Human Subjects Committee and all participants consented to participating in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they do not have any conflicts of interest.

Authors' contributions

ADL was the main writer of the paper, assisted with data interpretation, and gave final approval of this version to be published. HKBG and EEÇ conducted the data analysis, critically reviewed the paper, and gave final approval of this version to be published.

Funding

Not applicable.

Availability of data and materials

Not applicable.

Acknowledgements

Not applicable.

References

1. Shi Y, Wang Y, Shao C, Huang J, Gan J, Huang X, et al. COVID-19 infection: the perspectives on immune responses. Cell Death Differ. Springer Nature; 2020. p. 1451–4.
2. COVID-19 CORONAVIRUS PANDEMIC Coronavirus Cases [Internet]. 2020 [cited 2020 May 8]. p. 1–22. Available from: <https://www.worldometers.info/coronavirus/coronavirus-cases/#daily-cases>
3. Perlman S. Another decade, another coronavirus. N. Engl. J. Med. Massachusetts Medical Society; 2020. p. 760–2.
4. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. Lancet. Lancet Publishing Group; 2020. p. 470–3.
5. COVID-19 - Yeni Koronavirüs Hastalığı [Internet]. [cited 2020 May 8]. Available from: <https://covid19bilgi.saglik.gov.tr/tr/>

6. 6. Torales J, O'Higgins M, Castaldelli-Maia JM, Ventriglio A. The outbreak of COVID-19 coronavirus and its impact on global mental health. *Int J Soc Psychiatry* [Internet]. SAGE Publications Ltd; 2020 [cited 2020 May 8];002076402091521. Available from: <http://journals.sagepub.com/doi/10.1177/0020764020915212>
7. 7. Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, et al. Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *Int J Environ Res Public Health* [Internet]. MDPI AG; 2020 [cited 2020 May 8];17:1729. Available from: <https://www.mdpi.com/1660-4601/17/5/1729>
8. 8. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA - J Am Med Assoc*. American Medical Association; 2020;323:1061–9.
9. 9. Muscogiuri G, Barrea L, Savastano S, Colao A. Nutritional recommendations for CoVID-19 quarantine. *Eur J Clin Nutr*. Springer Nature; 2020;1–2.
10. 10. Türkiye Diyetisyenler Derneği. COVID-19 BESLENME ÖNERİLERİ [Internet]. [cited 2020 May 8]. Available from: <http://www.tdd.org.tr/index.php/duyurular/69-covid-19-beslenme-onerileri>
11. 11. Cao Y, Li L, Feng Z, Wan S, Huang P, Sun X, et al. Comparative genetic analysis of the novel coronavirus (2019-nCoV/SARS-CoV-2) receptor ACE2 in different populations. *Cell Discov*. Springer Nature; 2020;6:1–4.
12. 12. Ulu A, Harris TR, Morisseau C, Miyabe C, Inoue H, Schuster G, et al. Anti-inflammatory effects of ω -3 polyunsaturated fatty acids and soluble epoxide hydrolase inhibitors in angiotensin-II-dependent hypertension. *J Cardiovasc Pharmacol*. NIH Public Access; 2013;62:285–97.
13. 13. Pang XF, Zhang LH, Bai F, Wang NP, Garner RE, McKallip RJ, et al. Attenuation of myocardial fibrosis with curcumin is mediated by modulating expression of angiotensin II AT1/AT2 receptors and ACE2 in rats. *Drug Des Devel Ther*. Dove Medical Press Ltd.; 2015;9:6043–54.
14. 14. Channappanavar R, Perlman S. Pathogenic human coronavirus infections: causes and consequences of cytokine storm and immunopathology. *Semin. Immunopathol*. Springer Verlag; 2017. p. 529–39.
15. 15. Chen L, Hu C, Hood M, Zhang X, Zhang L, Kan J, et al. A Novel Combination of Vitamin C, Curcumin and Glycyrrhizic Acid Potentially Regulates Immune and Inflammatory Response Associated with Coronavirus Infections: A Perspective from System Biology Analysis. *Nutrients* [Internet]. MDPI AG; 2020 [cited 2020 May 8];12:1193. Available from: <https://www.mdpi.com/2072-6643/12/4/1193>
16. 16. Turner PG, Lefevre CE. Instagram use is linked to increased symptoms of orthorexia nervosa. *Eat Weight Disord*. Springer International Publishing; 2017;22:277–84.
17. 17. Godart NT, Flament MF, Perdereau F, Jeammet P. Comorbidity between eating disorders and anxiety disorders: A review. *Int J Eat Disord* [Internet]. John Wiley & Sons, Ltd; 2002 [cited 2020 May 8];32:253–70. Available from: <http://doi.wiley.com/10.1002/eat.10096>

18. 18. World Health Organization. WHO/Europe | Nutrition - Body mass index - BMI [Internet]. World Heal. Organ. 2020 [cited 2021 Apr 10]. Available from: <https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>
19. 19. Donini LM, Marsili D, Graziani MP, Imbriale M, Cannella C. Orthorexia nervosa: A preliminary study with a proposal for diagnosis and an attempt to measure the dimension of the phenomenon. *Eat Weight Disord* [Internet]. *Eat Weight Disord*; 2004 [cited 2021 Apr 10];9:151–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/15330084/>
20. 20. ARUSOĞLU G, KABAKÇI E, KÖKSAL G, MERDOL TK. Ortoreksiya Nervosa ve Orto-11'in Türkçeye Uyarlama Çalışması. *Türk Psikiyatr Derg*. 2008;19:283–91.
21. 21. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: The GAD-7. *Arch Intern Med*. 2006;166:1092–7.
22. 22. Konkan R, Şenormancı Ö, Güçlü O, Aydın E, Sungur MZ, Prof B, et al. Yaygın Anksiyete Bozukluğu-7 (YAB-7) Testi Türkçe Uyarlaması, Geçerlik ve Güvenirliği. *Nöropsikiyatri Arşivi*. 2013;50:53–8.
23. 23. Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, et al. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res* [Internet]. Elsevier Ireland Ltd; 2020 [cited 2021 Apr 10];287:112934. Available from: [/pmc/articles/PMC7102633/](https://pubmed.ncbi.nlm.nih.gov/32329582/)
24. 24. Tanaka T, Okamoto S. Increase in suicide following an initial decline during the COVID-19 pandemic in Japan. *Nat Hum Behav* [Internet]. Nature Research; 2021 [cited 2021 Apr 10];5:229–38. Available from: <https://doi.org/10.1038/s41562-020-01042-z>
25. 25. Gao J, Zheng P, Jia Y, Chen H, Mao Y, Chen S, et al. Mental health problems and social media exposure during COVID-19 outbreak. Hashimoto K, editor. *PLoS One* [Internet]. Public Library of Science; 2020 [cited 2021 Apr 10];15:e0231924. Available from: <https://dx.plos.org/10.1371/journal.pone.0231924>
26. 26. Depression and Other Common Mental Disorders Global Health Estimates. 2017.
27. 27. Puccinelli PJ, da Costa TS, Seffrin A, de Lira CAB, Vancini RL, Nikolaidis PT, et al. Reduced level of physical activity during COVID-19 pandemic is associated with depression and anxiety levels: an internet-based survey. *BMC Public Health* [Internet]. BioMed Central Ltd; 2021 [cited 2021 Apr 10];21:425. Available from: <https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-021-10470-z>
28. 28. Hyland P, Shevlin M, McBride O, Murphy J, Karatzias T, Bentall RP, et al. Anxiety and depression in the Republic of Ireland during the COVID-19 pandemic. *Acta Psychiatr Scand* [Internet]. Blackwell Publishing Ltd; 2020 [cited 2021 Apr 10];142:249–56. Available from: <https://pubmed.ncbi.nlm.nih.gov/32716520/>
29. 29. Vuillier L, May L, Greville-Harris M, Surman R, Moseley RL. The impact of the COVID-19 pandemic on individuals with eating disorders: the role of emotion regulation and exploration of online treatment experiences. *J Eat Disord* [Internet]. 2021 [cited 2021 Apr 10];9. Available from: <http://creativecommons.org/licenses/by/4.0/>.TheCreativeCommonsPublicDomainDedicationwaiver

30. 30. Elmacloğlu F, Emiroğlu E, Ülker MT, Özyılmaz Kırca B, Oruç S. Evaluation of nutritional behaviour related to COVID-19. *Public Health Nutr* [Internet]. Cambridge University Press; 2021 [cited 2021 Apr 10];24:512–8. Available from: <https://www.cambridge.org/core>.
31. 31. Phillipou A, Meyer D, Neill E, Tan EJ, Toh WL, Van Rheenen TE, et al. Eating and exercise behaviors in eating disorders and the general population during the COVID-19 pandemic in Australia: Initial results from the COLLATE project. *Int J Eat Disord*. John Wiley and Sons Inc.; 2020;53:1158–65.
32. 32. Ramalho SM, Trovisqueira A, de Lourdes M, Gonçalves S, Ribeiro I, Vaz AR, et al. The impact of COVID-19 lockdown on disordered eating behaviors: the mediation role of psychological distress. *Eat Weight Disord* [Internet]. 2021 [cited 2021 Apr 10];1:3. Available from: <https://doi.org/10.1007/s40519-021-01128-1>
33. 33. Rodgers RF, Lombardo C, Cerolini S, Franko DL, Omori M, Fuller-Tyszkiewicz M, et al. The impact of the COVID-19 pandemic on eating disorder risk and symptoms. *Int J Eat Disord* [Internet]. John Wiley and Sons Inc.; 2020 [cited 2021 Apr 7];53:1166–70. Available from: [/pmc/articles/PMC7300468/](https://pubmed.ncbi.nlm.nih.gov/32987773/)
34. 34. Varga M, Thege BK, Dukay-Szabó S, Túry F, van Furth EF. When eating healthy is not healthy: Orthorexia nervosa and its measurement with the ORTO-15 in Hungary. *BMC Psychiatry* [Internet]. BMC Psychiatry; 2014 [cited 2021 Apr 10];14. Available from: <https://pubmed.ncbi.nlm.nih.gov/24581288/>
35. 35. Koven NS, Wabry A. The clinical basis of orthorexia nervosa: Emerging perspectives. *Neuropsychiatr Dis Treat* [Internet]. Dove Medical Press Ltd.; 2015 [cited 2021 Apr 10];11:385–94. Available from: [/pmc/articles/PMC4340368/](https://pubmed.ncbi.nlm.nih.gov/24581288/)
36. 36. Cinelli M, de Francisci Morales G, Galeazzi A, Quattrociocchi W, Starnini M. The echo chamber effect on social media. *Proc Natl Acad Sci U S A* [Internet]. National Academy of Sciences; 2021 [cited 2021 Apr 10];118. Available from: <https://www.alexandria.com/siteinfo/reddit.com>
37. 37. Al-Musharaf S. Prevalence and predictors of emotional eating among healthy young Saudi women during the COVID-19 pandemic. *Nutrients* [Internet]. MDPI AG; 2020 [cited 2021 Jan 4];12:1–17. Available from: <https://pubmed.ncbi.nlm.nih.gov/32987773/>
38. 38. Oberle CD, Dalton J, Klare L, Patyk KC. Health beliefs, behaviors, and symptoms associated with orthorexia nervosa. *Bulim Obs* [Internet]. 2019 [cited 2021 Apr 10];24:495–506. Available from: <https://doi.org/10.1007/s40519-019-00657-0>
39. 39. Bo S, Zoccali R, Ponzio V, Soldati L, De Carli L, Benso A, et al. University courses, eating problems and muscle dysmorphia: Are there any associations? *J Transl Med* [Internet]. BioMed Central Ltd.; 2014 [cited 2021 Apr 10];12:1–8. Available from: [/pmc/articles/PMC4256707/](https://pubmed.ncbi.nlm.nih.gov/24581288/)
40. 40. Michos ED, Cainzos-Achirica M. Supplements for the Treatment of Mild COVID-19-Challenging Health Beliefs With Science From A to Z [Internet]. *JAMA Netw. open*. NLM (Medline); 2021 [cited 2021 Apr 10]. p. e210431. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/>

41. 41. Louca P, Murray B, Klaser K, Graham MS, Mazidi M, Leeming ER, et al. Dietary supplements during the COVID-19 pandemic: Insights from 1.4M users of the COVID Symptom Study app - a longitudinal app-based community survey [Internet]. medRxiv. medRxiv; 2020 [cited 2021 Apr 9]. p. 0. Available from: <https://doi.org/10.1101/2020.11.27.20239087>
42. 42. Thomas S, Patel D, Bittel B, Wolski K, Wang Q, Kumar A, et al. Effect of High-Dose Zinc and Ascorbic Acid Supplementation vs Usual Care on Symptom Length and Reduction Among Ambulatory Patients With SARS-CoV-2 Infection: The COVID A to Z Randomized Clinical Trial. JAMA Netw open [Internet]. NLM (Medline); 2021 [cited 2021 Apr 10];4:e210369. Available from: <https://pubmed.ncbi.nlm.nih.gov/33576820/>
43. 43. de Faria Coelho-Ravagnani C, Corgosinho FC, Sanches FLFZ, Prado CMM, Laviano A, Mota JF. Dietary recommendations during the COVID-19 pandemic. Nutr Rev [Internet]. Oxford University Press (OUP); 2021 [cited 2021 Apr 10];79:382–93. Available from: <https://pubmed.ncbi.nlm.nih.gov/32653930/>
44. 44. Bassatne A, Basbous M, Chakhtoura M, Zein O El, Rahme M, Fuleihan GE-H. The link between COVID-19 and Vitamin D (VIVID): a systematic review and meta-analysis. Metabolism [Internet]. Metabolism; 2021 [cited 2021 Apr 10];154753. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0026049521000536>
45. 45. Santaolalla A, Beckmann K, Kibaru J, Josephs D, Van Hemelrijck M, Irshad S. Association Between Vitamin D and Novel SARS-CoV-2 Respiratory Dysfunction – A Scoping Review of Current Evidence and Its Implication for COVID-19 Pandemic [Internet]. Front. Physiol. Frontiers Media S.A.; 2020 [cited 2021 Apr 10]. Available from: <https://pubmed.ncbi.nlm.nih.gov/33324234/>
46. 46. Kumar R, Rath H, Haq A, Wimalawansa SJ, Sharma A. Putative roles of vitamin D in modulating immune response and immunopathology associated with COVID-19 [Internet]. Virus Res. Elsevier B.V.; 2021 [cited 2021 Apr 10]. Available from: <https://pubmed.ncbi.nlm.nih.gov/33232783/>
47. 47. Lanham-New SA, Webb AR, Cashman KD, Buttriss JL, Fallowfield JL, Masud T, et al. Vitamin D and SARS-CoV-2 virus/COVID-19 disease. BMJ Nutr Prev Heal [Internet]. BMJ; 2020 [cited 2021 Apr 9];3:106–10. Available from: <http://nutrition.bmj.com/>
48. 48. Cena H, Barthels F, Cuzzolaro M, Bratman S, Brytek-Matera A, Dunn T, et al. Definition and diagnostic criteria for orthorexia nervosa: a narrative review of the literature [Internet]. Eat. Weight Disord. Springer International Publishing; 2019 [cited 2021 Apr 10]. p. 209–46. Available from: <https://doi.org/10.1007/s40519-018-0606-y>

Figures

Figure 1

Correlation between ORTO-11 and GAD-7 scores according to sex Spearman' rho correlation. a $R^2 = 0.4$ in men. b $R^2 = 0.4$ in women.

Figure 2

Determination of the differences in nutritional supplement use before and during COVID-19 semi-quarantine

Figure 3

Difference in the use of nutritional supplements before and after COVID-19 according to sex

Figure 4

Main reason for the use of nutritional supplements in subjects according to sex