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Evaluation of Using Dietary Supplements, Functional Foods and Herbal Products with Nutritional Habits of Individuals Diagnosed with COVID-19 Before, During, and After Disease

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ABSTRACT

Objective: This study aimed to evaluate the nutritional habits of individuals diagnosed with COVID-19 before, during, and after disease.
Methods: A total of 401 adult individuals, 125 males and 276 females, aged 19-65 years living in Turkey and diagnosed with COVID-19, were included in the study. The general and health information, anthropometric measurements, symptoms experienced during the disease, meal consumption, vitamin/mineral supplement use of functional foods and herbal products, and food consumption frequencies of the individuals were questioned by questionnaire form before, during, and after the COVID-19 disease.
Results: The mean age of the individuals diagnosed with COVID-19 was 29.7 ± 10.9 years. More than half of the individuals (57.1%) stated that they survived the disease at moderate or higher severity. More than half of the obese individuals (56.2%) survived the disease severely. More than half of the individuals (59.1%) stated that their appetite decreased during the disease. During the COVID-19 disease, more than 50% of individuals stated that there was no change in the consumption of milk, yogurt, eggs, meat/chicken, fish, legumes, oilseeds, green leafy vegetables, fast food, packaged food and there was an increase in consumption of fruit. It was determined that the use of at least one vitamin and mineral supplement during the disease (55.6%) increased compared to the pre-disease (38.4%). The most preferred vitamin and mineral supplements during the disease are vitamin C (41.1%) and multivitamin (18.2%). It was determined that all of the individuals (100%) used at least one functional food and herbal product during the disease. The functional foods and herbal products that increase in use during the disease are turmeric (28.2%), ginger (16.5%) and thyme (11.0%), respectively.
Conclusion: In the light of the study data, it was concluded that individuals used more vitamin and mineral supplements during disease preferred the use of more functional foods and herbal products, and increased their fruit consumption.

Keywords: COVID-19, functional foods, herbal product, nutritional habits, vitamin–mineral supplement

INTRODUCTION

Coronavirus disease-2019 (COVID-19) was first reported in Wuhan, China, in December 2019 and has caused many deaths and economic losses worldwide since then.[1] When coronavirus disease-related deaths have been investigated, it has been stated that death rates vary significantly by country, race, and socioeconomic level. Age, weak immune status, and the presence of a concomitant chronic disease have been shown to increase vulnerability to the disease.[2] Weakened immunity is an important risk factor for the development of infection by viruses that cause respiratory tract diseases. Providing adequate and balanced nutrition and improving nutritional status are very important to prevent infections. It has been stated that especially in this period, unhealthy, inadequate, and unbalanced nutrition and vitamin and mineral deficiencies due to nutritional problems will increase the burden of COVID-19 disease.[3,4] In addition, some symptoms that develop in association with the disease may adversely affect the food intake and thus the nutritional status of individuals. Respiratory problems that prevent eating, such as coughing and shortness of breath; loss of taste and smell, which negatively affects appetite and desire to eat; increased body temperature, which suppresses nutritional needs and appetite and increases the inflammatory response; and fatigue and weakness, which negatively affect normal life activities such as food shopping and cooking, are among the most common symptoms of the disease.[4]

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During the pandemic period, national and international organizations have talked about the importance of adequate and balanced nutrition in preventing disease and supporting the immune system. These organizations have emphasized taking adequate amounts from all food groups, increasing the consumption of fresh vegetables and fruits, ensuring daily fluid intake, maintaining a healthy body weight, sleeping adequately, and adopting a healthy lifestyle. Nutritional habits, food preferences, and food consumption amounts may change in individuals diagnosed with the disease, depending on the symptoms of the disease.[5,6] It is stated that the preference of use of vitamin, mineral, functional food, and herbal product support has increased in order to reduce the duration of illness and symptoms, especially in patients who continue to be treated at home.[7] However, there are no studies with a high level of evidence on the use of vitamin, mineral, functional food, and herbal product support during this pandemic period, and therefore, there is no recommended nutritional supplement. It is only recommended that nutrient deficiencies, if any, be eliminated and daily needs of individuals diagnosed with COVID-19 be met.[8,9]

When the literature is examined, it is seen that there are many studies evaluating the nutritional habits of healthy individuals during and after the pandemic but there is no study evaluating the nutritional habits of individuals diagnosed with COVID-19 before, during, and after the disease. We think that the results of this study, which aims to evaluate the eating habits of individuals diagnosed with COVID-19 before, during, and after illness, will contribute to the literature by filling this gap.

METHODS

This cross-sectional and descriptive study was conducted with 401 adult individuals at the ages of 19-65 years living in Turkey, who were diagnosed with COVID-19 and treated at home, between September and November 2021. Within the scope of the study, a web-based questionnaire was applied. Individuals diagnosed with COVID-19 and treated at home, who marked the statement "I voluntarily consent to participate in this study" at the beginning of the form and who completely filled out the questionnaire, constituted the sample of the study. Before starting the study, Ethics Committee Approval with decision number 703 dated September 29, 2021, was obtained from the Clinical Research Ethics Committee of the Faculty of Medicine at Akdeniz University. All procedures in the study were carried out in accordance with the Declaration of Helsinki.

Main Points

- During the pandemic period, there have been significant changes in the eating habits of individuals.
- During the pandemic period, the trend toward the use of vitamin–mineral support, functional food, and herbal products has increased in order to protect against COVID-19.
- During the pandemic period, individuals who survived COVID-19 displayed healthier eating habits during the disease.

With the help of the questionnaire, the socio-demographic characteristics of the individuals, their general and health information, anthropometric measurements, symptoms experienced during the disease, meal consumption before, during, and after the pandemic, vitamin/mineral support, functional food and herbal product use, and food consumption frequency were questioned.

Anthropometric Measurements

The anthropometric measurements (body weight and height) of the individuals were questioned based on their statement. Body mass index (BMI) was calculated by dividing the body weight by the square of the height. Those with a BMI below 18.50 kg/m^2 were classified as underweight, those with BMI between 18.50 and 24.99 kg/m^2 as normal, and those with BMI 25.0 kg/m^2 and above as overweight/obese.[10]

Nutrition Habits

Participants' appetite status, main and snack consumptions, food consumption frequencies, vitamin–mineral support, functional food and herbal product use were questioned.

Statistical Analysis

Statistical Package for the Social Sciences version 22.0. (IBM SPSS Corp.; Armonk, NY, USA) program was used in the statistical evaluation of the data obtained from the study. Data were expressed using mean and standard deviation for quantitative variables and using frequency and percentage for qualitative variables. The chi square analysis was employed to compare qualitative data and to detect differences between the groups. Changes in meal consumption status were determined using the McNemar Test, which is a dependent paired sample test. The results were evaluated at the 95% CI, and statistically at $P < .05$ significance level.

RESULTS

The general characteristics of the individuals included in the study, their health information, and the evaluation of the disease severity are shown in Table 1. Of the participating individuals diagnosed with COVID-19, 31.2% were

Table 1. Evaluation of the General Characteristics, Health Information, and Disease Severity of Individuals	
Variables	**X ± SD**
Age (years)	29.7 ± 10.9
	N (%)
Gender	
Female	276 (68.8)
Male	125 (31.2)
Diagnosed chronic disease	
Yes	73 (18.2)
No	328 (81.8)
Diabetes mellitus	6 (1.5)
Hypertension	16 (4.0)
Cancer	5 (1.2)
Kidney	5 (1.2)
Asthma or COPD	23 (5.7)
Allergy	25 (6.2)
Severity of the disease	
Very mild	57 (14.2)
Mild	115 (28.7)
Moderate	152 (37.9)
Severe	73 (18.2)
Very severe	4 (1.0)

SD, standard deviation.
In the chronic diseases section, individuals stated more than one disease.

male (n=125), 68.8% were female (n=276), and their mean age was 29.7 ± 10.9 years. Of the individuals, 18.2% had a diagnosed chronic disease. Allergy (6.2%) and asthma/Chronic obstructive pulmonary disease (COPD) (5.7%) had the highest rates among comorbidities. More than half of the patients (57.1%) stated that they survived the disease moderately, severely, and very severely.

The evaluation of the disease severity according to the BMI classification of the individuals, their appetite status, and the symptoms they experienced during the disease is shown in Table 2. More than half of the overweight/obese individuals (56.2%) stated that they experienced the disease severely. During the illness, weakness and fatigue (77.3%), headache (65.8%), loss of taste and smell (63.3%), joint and muscle pain (58.1%), and back pain (54.6%) were found to be the most common symptoms (data were not shown in the table). When the frequency of symptoms was evaluated according to BMI classification, a significant difference was found between the groups in terms of headache and muscle pain ($P < .05$). When the appetite status of the individuals was evaluated, more than half (59.1%) stated that their appetite decreased during the disease (data were not shown in the table). When the appetite status was evaluated according to BMI classification, although the decrease (51.1%) and increase (53.6%) in the appetite status of individuals with normal weight were found to be higher, no significant difference was found between the groups ($P > .05$).

The evaluation of the consumption of main meals and snacks before, during, and after the disease is shown in Table 3. It was found that the main meal consumption of individuals during the illness was lower than that before and after the illness, but a statistically significant difference was found only for the dinner ($P < .05$).

The evaluation of individuals' consumption of various food groups during the illness is given in Table 4. It was determined that there was no change in the consumption of milk, yogurt, eggs, meat/chicken, fish, legumes, oilseeds, green leafy vegetables, fast food, and packaged food, and there was an increase in fruit consumption in more than 50% of the individuals during the disease.

The evaluation of individuals' use of vitamin and mineral supplements before, during, and after the disease is shown in Table 5. It was determined that the use of at least 1 vitamin and mineral supplement increased during the disease (55.6%) compared to the pre-disease period (38.4%), and although it tended to decrease after the disease, it was more (51.6%) compared to the pre-disease period ($P < .05$). The most preferred vitamin and mineral supplement during the disease was detected to be vitamin C (41.1%) and multivitamin (18.2%).

The evaluation of the individuals' use of functional food and herbal products before, during, and after the disease is shown in Table 6. It was revealed that all individuals (100%) used at least 1 functional food and herbal product during the disease. Although they preferred functional foods before the illness, the functional foods and herbal products that increased in use during illness were curcuma (28.2%), ginger (16.5%), and thyme (11.0%), respectively.

DISCUSSION

Adequate and balanced nutrition has an important place in the prevention and management of viral respiratory tract infections and in the fight against COVID-19 due to

Table 2. The Evaluation of the Severity of Recovery, Appetite Status, and the Symptoms Experienced During the Disease of the Individuals According to the Body Mass Index Classification

Severity of recovery	Underweight N (%)	Normal Weight N (%)	Overweight/ Obese N (%)	χ^2; *P*
Very mild (n=57)	2 (7.0)	33 (57.9)	20 (35.1)	17.207; **.028***
Mild (n=115)	10 (8.7)	66 (57.4)	39 (33.9)	
Moderate (n=152)	13 (8.6)	85(55.9)	54 (35,5)	
Severe (n=73)	3 (4.1)[a, b]	29 (39.7)[b]	41(56.2)[a]	
Very severe (n=4)	-	-	4 (100)	
Symptoms during disease				
Cough (n=179)	17 (9.5)	92 (51.4)	70 (39.1)	1.944; .378
Shortness of breath (n=81)	5 (6.2)	37 (45.7)	39 (48.1)	3.260; .196
Nasal congestion (n=161)	15 (9.3)	88 (54.7)	58 (36.0)	32.110; .348
Loss of taste and smell (n=254)	17 (6.7)	134 (52.8)	103 (40.6)	0.825; .662
Headache (n=264)	27 (10.2)[a]	135 (51.1)[b]	102 (38.6)[b]	8.474; **.014***
Joint pain (n=233)	18 (7.7)	117 (50.2)	98 (42.1)	1.924; .382
Back pain (n=219)	18 (8.2)	108 (49.3)	93 (42.5)	2.814; .245
Muscle pain (n=191)	17 (8.9)[a,b]	89 (46.6)[b]	85 (44.5)[a]	6.310; **.043***
Weakness and fatigue (n=310)	25 (8.1)	161 (51.9)	124 (40.0)	1.104; .576
Appetite status				
Increased (n=28)	-	15 (53.6)	13 (46.4)	4.194; .380
Decreased (n=237)	18 (7.6)	121 (51.1)	98 (41.4)	
Not changed (n=135)	12 (8.9)	76 (56.3)	47 (34.8)	

Chi square test, *$P < .05$; [a,b]For groups of different letters $P < .05$, for groups of same letters $P > .05$.
Individuals stated more than one symptom in the symptoms experienced during the disease.

Table 3. The Evaluation of the Consumption of Main Meals and Snacks of Individuals Before, During, and After the Disease

	Breakfast	Lunch	Dinner
	N (%)	N (%)	N (%)
Before disease	338 (84.3)	245 (61.1)	379 (94.5)[a]
During disease	323 (80.5)	227 (56.6)	362 (90.3)[b]
After disease	328 (81.8)	241 (60.1)	380 (90.8)[c]
	Mid-morning	**Afternoon**	**Night**
	N (%)	**N (%)**	**N (%)**
Before disease	63 (15.7)	241 (60.1)	179 (44.6)[a]
During disease	77 (19.2)	222 (55.4)	146 (36.4)[b]
After disease	55 (13.7)	231 (57.6)	184 (45.9)[c]

McNemar test; a, b for groups of different letters $P < .05$, for groups of same letters $P > .05$.

the effects of individuals' nutritional habits and nutritional status on the immune response.[11] Especially during the pandemic period, individuals make changes in their dietary

Table 4. The Evaluation of Individuals' Consumption of Various Food and Food Groups During the Disease

Various Food and Food Groups	Increased N (%)	Decreased N (%)	Not changed N (%)
Milk	68 (17.0)	84 (20.9)	249 (62.1)
Yogurt	130 (32.4)	71(17.7)	200 (49.9)
Egg	91 (22.7)	91 (22.7)	219 (54.6)
Meat/chicken	100 (24.9)	89(22.2)	212 (52.9)
Fish	57 (14.2)	81 (20.2)	263(65.6)
Legumes (chickpeas, lentils, beans, kidney beans)	48 (12.0)	92 (22.9)	261(65.1)
Nuts and oilseed (hazelnuts, peanuts, almonds, walnuts)	99 (24.7)	87 (21.7)	215 (53.6)
Green leafy vegetables	120 (29.9)	76 (19.0)	205 (51.1)
Fruits	217 (54.1)	51(12.7)	133 (33.2)
Fast food (lahmacun, hamburger, pide, etc.)	27 (6.7)	157(39.2)	217(54.1)
Packaged foods (biscuits, cake, chocolate, etc.)	36 (9.0)	157 (39.2)	208 (51.9)

Table 5. The Evaluation of Individuals' Use of Vitamin and Mineral Supplements Before, During, and After the Disease

Use of Vitamin and Mineral Supplements	Before Disease	During Disease	After Disease
	N (%)	N (%)	N (%)
At least 1 vitamin and mineral supplement	150 (38.4)[a]	263 (55.6)[b]	207 (51.6)[b]
Multivitamin	31 (7.7)	73 (18.2)	43 (10.7)
Vitamin C	57 (14.2)	165 (41.1)	119 (29.7)
Vitamin D	43 (10.7)	22 (5.5)	36 (9.0)
Vitamin B_{12}	14 (3.5)	1 (0.2)	7 (1.7)
Iron	1 (0.2)	-	1 (0.2)
Zinc	1(0.2)	-	-
Calcium	1(0.2)	1 (0.2)	-
Omega 3	2 (0.5)	1 (0.2)	1 (0.2)

Chi square test, [a,b]For groups of different letters $P < .05$, for groups of same letters $P > .05$.

habits in order to protect themselves from the effects of the disease and to overcome the disease mildly.[12,13]

In order to ensure adequate and balanced nutrition during the pandemic period, national and international organizations have specified that it is important to include fruit, vegetables, whole grain products, high protein foods (legumes, meat, eggs, fish, chicken, oilseeds, etc.), and dairy products (milk, yogurt, ayran, cheese, etc.) in daily nutrition. In addition, they have recommended limiting daily caffeine consumption and avoiding consumption of sugary and carbonated beverages and packaged foods with high trans-fat content.[14] When studies examining the nutritional habits of individuals in the pandemic are examined, it is seen that there is an increase especially in fruit consumption.[15-17] The results of the present study are consistent with the literature, and it was determined in the study that there was an increase in fruit consumption of individuals during the disease. Although there are studies in the literature indicating that the consumption of foods cooked with the frying method, sugary/carbonated beverages, packaged foods such as sweets, chocolate, cake, and biscuits, and some unhealthy foods such as fast food has increased in this period,[18,19] our study revealed no change in the consumption of fast food and packaged food in more than 50% of individuals during the disease. In studies evaluating the frequency of consumption of main meals and snacks during the pandemic period, it was reported that individuals increased the frequency of snack consumption,[20-22] and particularly, breakfast from the main meals was skipped.[23] In the present study, it was found that the consumption of main (breakfast, lunch, and dinner) and snack (night and afternoon) meals, except for late-morning meal, was lower during the illness than that before and after the illness. The main reason for this is that the loss of taste and smell, which is among the symptoms that occur in patients due to the disease, suppresses the appetite and reduces the desire to eat.[4] According to the results of the study, it was found that more than half of the patients (63.3%) experienced loss of taste and smell.

Table 6. The Evaluation of the Individuals' Use of Functional Food and Herbal Products Before, During, and After the Disease

Use of Functional Food and Herbal Products	Before Disease	During Disease	After Disease
	N (%)	N (%)	N (%)
At least 1 functional food and herbal product	321 (80.0)[a]	401 (100)[b]	385 (96.0)[b]
Curcumin	59 (14.7)	113 (28.2)	67 (16.7)
Ginger	37 (9.2)	66 (16.5)	95 (23.7)
Thyme	41 (10.2)	44 (11.0)	40 (9.9)
Thyme oil	18 (4.5)	16 (4.0)	12 (2.9)
Black elderberry	3 (0.7)	1 (0.2)	6 (1.5)
Lemon	53 (13.2)	49 (12.2)	45 (11.2)
Honey	171 (42.6)	98 (24.4)	110 (27.4)

Chi square test, [a,b]For groups of different letters $P < .05$, for groups of same letters $P > .05$.
Individuals indicated more than one option.

There are studies conducted on the potential interactions between nutrition and the immune system during the pandemic period.[24] The role of vitamins, minerals, and some functional nutrients and herbal products has been mentioned more in order to protect from the effects of the disease, to reduce the negative effects of the disease on health, and to overcome the symptoms in the mildest way possible during the disease.[25] In studies in which the effect of micronutrient supplementation such as vitamin D, B_{12}, vitamin C, zinc, and magnesium has found to increase immune function in individuals diagnosed with COVID-19, it should be noted that although the supplement has been found to have a positive effect on some symptoms of the disease, the level of evidence is low.[26-31] In this study, it was determined that the use of at least 1 vitamin and mineral supplement during the disease (55.6%) increased compared to the pre-disease period (38.4%), and although it tended to decrease after

the disease, it was still higher (51.6%) compared to the pre-disease period. It was found that the most preferred vitamin and mineral supplements during the disease were vitamin C (41.1%) and multivitamin (18.2%), respectively.

Clinical studies are being conducted to evaluate the long-term effects of bioactive components in functional foods and herbal products, as well as vitamin and mineral supplements, during the pandemic.[32,33] In the studies carried out, it has been stated that individuals consider functional foods and some herbal products to be effective in protecting against the effects of diseases related to COVID-19.[33,34] In the present study, it was detected that all of the individuals (100%) used at least 1 functional food and herbal product during the disease. Although they preferred functional foods before the illness, the functional foods and herbal products that increased in use during illness were curcuma (28.2%), ginger (16.5%), and thyme (11.0%).

The pandemic period has caused two-way changes in the eating habits of individuals, as positive and negative. In this study, it was determined that there were some changes in the eating habits of COVID-19 patients during the disease process, compared to before and after the disease. In particular, it was concluded that individuals used more vitamin and mineral supplements during illness, preferred the use of more functional foods and herbal products, and increased their fruit consumption.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Akdeniz University Faculty of Medicine (Date: September 29, 2021, Decision No: 703).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

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