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ORIGINAL ARTICLE

FOOD CONSUMPTION AND THE SUPPLEMENT PRODUCTS TAKEN FOR PREVENTION PURPOSES AGAINST COVID-19 DISEASE

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ABSTRACT

Aim: In this study, we aimed to examine the frequency of food consumption and the supplement products taken for prevention purposes by those who have or have not had COVID-19 disease.

Methods: This study was a single-center, case-control research. Volunteers were questioned about whether they used complementary medicine methods through nutrition to protect themselves from COVID-19. In addition, the questionnaire evaluating the consumption frequency of 51 different nutrients in 6 different food groups was questioned by face to face interview.

Results: In this study, it was observed that there was an increasing trend in the number of theses on health literacy as a family medicine specialty thesis. The publication status of the theses on health literacy of family medicine residents who received specialization training at the university hospitals was lower than that of the family medicine residents at the training and research hospitals (p=0.015). When the health literacy scales used in the thesis research were examined, it was seen that the 3 most commonly used scales were TSOY-32, ASOY-TR, and Adult Health Literacy Scale.

Conclusions: Patients with high consumption of fish, hard margarine and lard had less covid-19 disease, and the group with high consumption of red meat, oil seeds, dried fruits and vegetables, and simit had less hospitalization. There are a limited number of studies in the literature examining the relationship between COVID-19 disease and consuming food types. Further studies are needed in this regard.

Keywords: COVID-19 disease, fish, food, meat, olive oil, vegetables

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INTRODUCTION

Maintaining a healthy diet is essential to support the immune system during the COVID-19 pandemic [1]. Macro and micronutrients in the diet affect immune cells [2]. It is known that some micronutrients, essential fatty acids, probiotics and some nutritional supplements have activating effects on the immune system. It is known that especially vitamins A, C, E, D and minerals such as iron, zinc, copper and selenium strengthen the immune system, and taking these nutritional components in required amounts according to individual metabolic parameters has a protective and enhancing effect on the immune system [3].

Since there is so far no known reliable and effective treatment method for Covid-19, protective measures and strong immunity are important. Traditional and complementary methods such as medicinal plants and bee products have been used for centuries to strengthen the immune system and protect against viral infections and their pathological consequences. Medicinal plants can interfere with the pathogenesis of the virus, such as prevention of viral attachment and entry, inhibition of viral replication, as well as reducing the effects of the virus in the body and preventing clinical worsening. Likewise, bee products not only support the immune system, but also protect it from infections with their antiviral properties, and improve the clinical course by correcting comorbid conditions [4, 5].

In this study, we aimed to examine the frequency of food consumption and the supplement products taken for prevention purposes by those who have or have not had COVID-19 disease.

METHODS

Ethics committee approval was obtained from the hospital ethics committee. This study was a single-center, case-control research. It was conducted with volunteers aged 18-65 between 01.11.2021 and 30.11.2021. 200 volunteers who had the COVID-19 disease registered in the Family Medicine Unit and 200 volunteers who had not yet had the disease were included in the study. The definitive registered patient list on 31.10.2021 was sorted from young to old according to age. Healthy volunteers were selected from the patient list, just below the covid-19 positive volunteers, who were not covid-19 positive during the study, and volunteers who met the criteria for participation in the study. Gender was not taken into account when selecting volunteers. Volunteers were informed about the research and an informed consent form was obtained. Volunteers were questioned about their sociodemographic characteristics, whether they had diagnosed chronic diseases, and whether they used complementary medicine methods through nutrition to protect themselves from COVID-19. In addition, the questionnaire evaluating the consumption frequency of 51 different nutrients in 6 different food groups was questioned by face to face interview.

Food Consumption Frequency Questionnaire

One of the most widely used methods to evaluate nutrition in epidemiological studies is the food consumption frequency questionnaire. With the questionnaire method, answers are sought to questions of how long, how often and how much food is consumed. Surveys are advantageous because of their ease of implementation and low cost. However, the most important disadvantage is that there are not enough studies in terms of the validity of such questionnaires. It is recommended that survey-based studies be conducted with a face-to-face interview technique in order to prevent false data that may occur due to reluctance to fill out questionnaires or random markings [6].

In our study, we prepared a food consumption frequency questionnaire based on the Turkey Nutrition and Health Survey-2010 (TBSA-2010). We questioned the volunteers about 51 different nutrients with 7 different consumption options with the help of a questionnaire. We administered our survey using the survey technique under observation.

Statistical Analysis

Conformity of the scores of age and frequency of consumption of foods to a normal distribution was examined with the Shapiro-Wilk test, and the variables were characterized using median (minimum: maximum) and mean ± standard deviation (minimum: maximum) values; categorical variables were expressed as n (%). Mann Whitney U test was used to compare the scores of age and frequency of consumption of foods between groups. Categorical variables were analyzed using Chi-square, Fisher's exact chi-square and Fisher-Freeman-Halton tests. SPSS (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) program was used for statistical analysis, and type I error level was accepted as 5% in statistical analysis.

RESULTS

Comparisons of socio-demographic characteristics of those who had Covid-19 disease and those who did not are given in Table 1. It was determined that there was a difference between the groups according to the level of education ($p=0.039$). While the rate of those with primary and secondary education was higher in the group that did not have Covid-19 disease, the rate of those with an associate's degree, undergraduate or higher education level was higher in the group that had Covid-19.

It was determined that smoking rates differed between groups. The rate of smoking was 24.50% for those who had Covid-19 disease and 49% for those who did not have the disease, and it was observed that the rate of smoking was higher in the group that did not have Covid-19 disease ($p<0.001$). It was determined that there was a difference between the groups according to the rate of alcohol use ($p=0.046$). The rate of alcohol use was 5.50% in the patients who had Covid-19 disease and 11% in the group who did not have Covid-19 disease, and it was observed that the rate of alcohol use was higher for those who did not have Covid-19 disease.

Table 1. Sociodemographic characteristics of the participants

	COVID-19 group (n=200)	**Control group (n=200)**	**p-value**
Age (years)	35.50(18:64)	35.50(18:64)	>0.99[a]
Gender			
Female	106(%53)	104(%52)	0.841[b]
Male	94(%47)	96(%48)	
Education			
Illiterate	1(%0.50)	2(%1)	**0.039[c]**
Primary-secondary education	70(%35)	94(%47)	
High school	58(%29)	54(%27)	
Associate degree-graduate-postgraduate	71(%35.50)	50(%25)	
Income			
≤200 USD	60(%30)	69(%34.50)	0.272[b]
200-400 USD	115(%57.50)	115(%57.50)	
> 400 USD	25(%12.50)	16(%8)	

Data are expressed as median (minimum: maximum) and n%.a: Mann Whitney U test. b: Chi-Square test. c: Fisher-Freeman-Halton test

The distribution of chronic diseases among those who had Covid-19 disease and those who did not have the disease is given in Table 2. The rate of chronic diseases did not differ between the groups.

The comparison of the consumption frequency of food groups between the groups of patients who had Covid-19 disease and those who did not is given in Table 3. Consumption frequency score was obtained according to the consumption frequency of each food group, and a scoring system was established according to the consumption frequency of foods (did not consume: 0 points, 1 day per month: 1 point, 1 day in 15 days: 2 points, 1 or 2 days a week: 3 points, 3 or 4 days a week: 4 points, 5 or 6 days a week: 5 points and 6 points per day). When the consumption frequency scores of the meat, egg and legumes group are examined, it is seen that there is no difference in the consumption frequency of meat and chicken (p=0.153 and p=0.151), while it is seen that fish consumption is higher in the group that did not have Covid-19 disease (p=0.043). When examined according to the beverage group, while the consumption frequency did not differ according to ready-made fruit juices, carbonated beverages, mineral water,

coffee, tea and herbal tea (p>0.05), it was determined that the frequency of alcohol use was higher in the group that did not have Covid-19 disease (p=0.039). In the analysis of the foods in the fat, sugar and sweet group, it was observed that olive oil consumption was higher in the group with Covid-19 disease, and the median score of olive oil consumption frequency was 6 for those who had Covid-19 disease and 5 in the group that did not have Covid-19 disease (p=0.019). It was determined that the frequency of hard margarine consumption was higher in the group that did not have Covid-19 disease (p=0.004). It was determined that the frequency of tail oil consumption was higher in the group that did not have Covid-19 disease (p=0.002).

Table 2. General characteristics of the participants

	Patient group (n=200)	**Control group (n=200)**	**p-value**
Smoking	49(%24.50)	98(%49)	**<0.001[b]**
Alcohol Consumption	11(%5.50)	22(%11)	**0.046[b]**
Diabetes Mellitus	10(%5)	12(%6)	0.661[b]
Hypertension	20(%10)	20(%10)	>0.99[b]
Stroke	1(%0.50)	0	>0.99[d]
Musculoskeletal Disease	13(%6.50)	5(%2.50)	0.054[b]
Cancer	1(%0.50)	4(%2)	0.372[d]
Coronary Artery Disease	9(%4.50)	8(%4)	0.804[b]
Chronic obstructive pulmonary disease/asthma	19(%9.50)	11(%5.50)	0.129[b]
Others	26(%13)	22(%11)	0.538[b]

Data are expressed as n%. b: Chi-Square test. d:Fisher's Exact chi-square test

While the rate of those who stated that they were protected by nutrition from disease in the group that had Covid-19 disease was 25% (n=50), the rate of those who stated that they were protected through nutrition to prevent the disease in the group that did not have Covid-19 disease was 47.50% (n=95). It was observed that the tendency to assume protection from the disease through nutrition was higher in the group who did not have Covid-19 (p<0.001).

Table 3. Comparison of the consumption frequency of food between the groups

	COVID-19 group (n=200)	**Control group (n=200)**	**p-value[a]**
Milk and milk products			
Milk	3(0:6)	3.77(0:6)	0.078
Yoghurt, ayran, kefir, etc.	6(0:6)	5.50(0:6)	0.285
Cheese	6(0:6)	6(0:6)	0.998
Meat-eggs-legumes			
Red meat	3(0:6)	3(0:6)	0.153
Chicken, turkey	3(0:6)	3(0:6)	0.151
Fish	2(0:5)	2(0:5)	**0.043**
	1.82±1.19	*2.05±1.16*	
Offal	0(0:6)	0(0:5)	0.858
Prepared meat products	2(0:6)	1(0:6)	0.767
Homemade meat products	1(0:6)	0(0:6)	0.477
Eggs	6(0:6)	5(0:6)	0.055
Dry beans	3(0:6)	3(0:6)	0.137
Hazelnut, peanut, walnuts, almonds	3(0:6)	4(0:6)	0.409
Vegetable and fruit			
Green leafy fresh vegetables	4(0:6)	4(0:6)	0.365
Potatoes	3(0:6)	3(0:6)	0.984
Other fresh vegetables	4(0:6)	4(0:6)	0.147
Dried fruit vegetables	1(0:6)	1.50(0:6)	0.130
Bread and cereal			
Types of white bread	6(0:6)	6(0:6)	0.132
Whole grain breads	1.50(0:6)	1(0:6)	0.905
Rice, bulgur, pasta	4(0:6)	3.50(0:6)	0.423
Tarhana	3(0:6)	3(0:6)	0.456
Bicuits/crackers	3(0:6)	2(0:6)	0.328
Breakfast cereals	0(0:6)	0(0:6)	0.401
Simit	2(0:6)	2(0:6)	0.821
Beverages			

Instant juice	0(0:6)	0(0:6)	0.375
Carbonated drinks	0(0:6)	1(0:6)	0.368
Mineral water, soda	3(0:6)	3(0:6)	0.818
Coffee, nescafe	4(0:6)	4(0:6)	0.280
Tea (black, green)	6(0:6)	6(0:6)	0.103
Herbal teas	1(0:6)	1(0:6)	0.979
Alcoholic beverages	0(0:4)	0(0:5)	**0.039**
	0.13±0.52	*0.31±0.94*	
Fat-sugar-sweet			
Olive oil	6(0:6)	5(0:6)	**0.019**
	4.56±2.01	*4.10±2.18*	
Hazelnut oil	0(0:6)	0(0:6)	0.872
Sunflower oil	6(0:6)	6(0:6)	0.577
Corn oil	0(0:6)	0(0:6)	0.086
Soy oil	0(0:3)	0(0:2)	0.997
Canola oil	0(0:5)	0(0:4)	0.180
Hard margarine	0(0:6)	0(0:6)	**0.004**
	0.57±1.33	*0.97±1.70*	
Soft margarine	0(0:6)	0(0:6)	0.717
Butter	6(0:6)	6(0:6)	0.943
Lard, tallow	0(0:6)	0(0:6)	**0.002**
	0.32±1.06	*0.59±1.25*	
Sugar, honey, jam, molasses	5(0:6)	5(0:6)	0.974
Confectionery, Turkish delight, chocolate	3(0:6)	3(0:6)	0.451
Instant soups	0(0:6)	0(0:5)	0.725
Ready meals	0(0:4)	0(0:6)	0.899
Pita, lahmacun, pizza	1.50(0:5)	2(0:6)	0.551
Doner, kebab etc.	1(0:6)	1(0:6)	0.553
Hamburger	0(0:5)	0(0:4)	0.535
Chips	0(0:5)	0(0:6)	0.510
Frozen foods	0(0:6)	0(0:5)	0.660
Pastry dessert	2(0:6)	2(0:6)	0.515
Milk dessert, ice cream	2(0:6)	2(0:6)	0.719

Data are expressed as median(minimum:maximum) and mean ± standard deviation. a: Mann Whitney U test

Comparison of the distribution of food types consumed by those who stated that they were protected by nutrition and who had Covid-19 disease and those who stated that they were protected through nutrition and did not have Covid-19 disease are given in Table 4. It is seen that the distribution of food consumed to protect against Covid-19 does not differ between the groups (p>0.05).

Table 4. Comparison of food types consumed for protection against COVID-19

	COVID-19 group (n=50)	**Control group (n=95)**	**p-value**
Type of diet			
Fruit	18(%36)	35(%36.80)	0.920[b]
Vegetable	12(%24)	29(%30.50)	0.407[b]
Herbal teas	18(%36)	21(%22.10)	0.073[b]
Lemon	10(%20)	11(%11.60)	0.171[b]
Vinegar	7(%14)	11(%11.60)	0.674[b]
Oils	3(%6)	6(%6.30)	>0.99[d]
Spices	9(%18)	10(%10.50)	0.205[b]
Probiotics	7(%14)	17(%17.90)	0.549[b]
Honey-jam-molasses-syrup	16(%32)	24(%25.30)	0.388[b]
Vitamin-mineral-plant extracts	9(%18)	25(%26.30)	0.261[b]
Others	9(%18)	15(%15.80)	0.734[b]

Data are expressed as n%. b: Chi-square test. d: Fisher's exact chi-square test

The distribution of foods consumed by those who assumed protection by nutrition among Covid-19 patients is reported in Figure 1. When the distribution of consumed foods is examined, the frequency of fruit and herbal tea consumption was 36%, the frequency of honey-jam-molasses-syrup consumption was 32%, the frequency of vegetable consumption was 24%, the frequency of lemon consumption was 20%, the frequency of vitamins-minerals, and spices consumption was 18%, the frequency of consumption of probiotics and vinegar was 14% and the frequency of oil consumption was 6%.

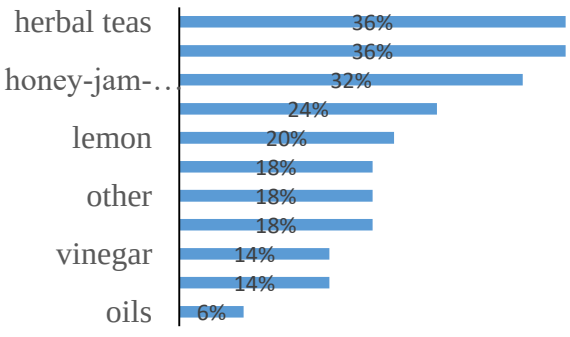

Figure 1. Distribution of foods consumed by those assuming protection by nutrition among Covid-19 patients

The distribution of foods consumed by those who assume to be protected by nutrition for those who did not have Covid-19 disease are given in Figure 2. When the distribution of consumed foods is examined, the frequency of fruit consumption was 36.80%, the frequency of vegetable consumption was 30.50%, the frequency of vitamin-mineral consumption was 26.30%, the frequency of honey-jam-molasses-syrup consumption was 25.30%, the frequency of herbal tea consumption was 22.10%, the frequency of probiotics consumption was 17.90%, the frequency of lemon and vinegar consumption was 11.60%, the frequency of spices consumption was 10.50%, the frequency of oil consumption was 6.30% and the frequency of other foods consumption was 15.80%.

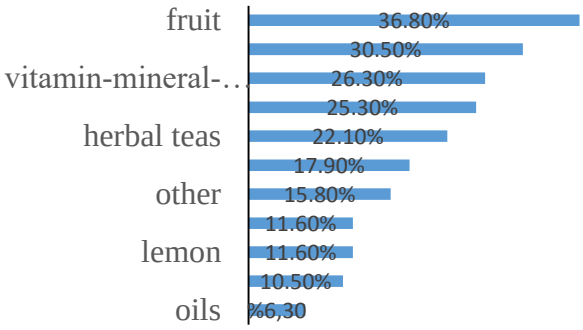

Figure 2. Distribution of foods consumed by those assuming protection by nutrition among those who did not have Covid-19 disease

DISCUSSION

The rate of smoking was higher in the group that did not have COVID-19. The rate of alcohol consumption was higher in the group that did not have COVID-19. Consumption of fish, hard margarine and lard was found to be higher in the group that did not have COVID-19 disease. Olive oil consumption was found to be higher in the group with COVID-19 disease. Consumption of red meat, nuts, peanuts, walnuts, almonds, dried fruits and vegetables, simit, and chips was found to be higher in the non-hospitalized group among COVID-19 patients. It was observed that the tendency to assume protection from the disease through nutrition was higher in the group that did not have COVID-19.

Simons et al. evaluated the test positivity and hospitalization rates of smokers, quitters, and never-smokers in a meta-analysis of 57 studies evaluating the relationship between smoking and COVID-19. They reported that test positivity was lower in smokers than in non-smokers [7]. Farsalinos et al. examined the clinical prognosis relationship between current smokers and ex-smokers of hospitalized COVID-19 patients in their meta-analysis by examining a total of 30 publications. As a result of their study, it was reported that the frequency of smokers in COVID-19 patient groups was lower than the incidence in the general population [8]. A low prevalence of current smokers among hospitalized COVID-19 patients has also been observed in case series outside of China. By examining 5 case series from the Czech Republic, Kralikova found that only 165 of a total of 1549 COVID-19 positive patients smoked, which is 1/3 lower than the prevalence of smoking in the general population [9]. Rossato et al. evaluated 132 patients who applied to the clinic at the University of Padova in the Veneto region of Italy. It was determined that 112 (84.8%)

patients had never smoked, and 20 (15.2%) patients had a history of smoking. This value is quite low compared to the prevalence of smokers in the Italian Veneto region [10]. Goyal et al. retrospectively reviewed the case series of 393 COVID-19 patients admitted to 2 hospitals in New York. Only 20 of the patients were smokers. This rate was well below the prevalence of smoking [11]. While the potential benefit of cigarette smoke components is unlikely given their toxic properties, oxidative stress, and inflammation-promoting properties, some researchers have hypothesized that these findings may show a protective effect of smoking from COVID-19. Recent studies have reported that most of the clinical manifestations of COVID-19 are caused by a dysfunction in the nicotinic cholinergic system and can be explained by restoring the function of the cholinergic anti-inflammatory pathway and modulating the immune response [12]. In parallel with the literature, in our study smokers were found to have lower COVID-19 test positivity.

Poor diet, physical inactivity, stress, smoking, loneliness, poor quality sleep, as well as alcohol use impair the immune system significantly and make people more susceptible to infectious diseases [13]. Alcohol abuse suppresses multiple arms of the immune response, resulting in an increased risk of infection. The course of both bacterial and viral infections is severely affected in patients who drink alcohol, increasing morbidity and mortality. Many mechanisms underlying the immunosuppressive effects of alcohol have been identified. The body's innate and adaptive immune system is disrupted by both direct and indirect effects of alcohol, and host defenses in the gastrointestinal and respiratory tract are adversely affected [14]. Dependent individuals are an at-risk population in terms of social and economic disadvantage, homelessness, housing instability and transportation difficulties. They face significant barriers to accessing health care, including stigma and discrimination by health professionals. Therefore, screening, isolation and treatment of COVID-19 becomes difficult for those with alcohol-substance use disorder. In addition, since the symptoms of COVID-19 can be confused with alcohol withdrawal syndrome, there may be some difficulties in early detection of the disease [15]. It is known that smoking and alcohol use negatively affect the immune system and make people more susceptible to infectious diseases. It is thought that there are difficulties in detecting the disease due to the social and economic disadvantages of individuals with alcohol and substance use disorder and the masking of COVID-19 symptoms with alcohol withdrawal.

Weill et al. stated that omega-3 fatty acids found in oily fish such as herring, mackerel, salmon, halibut, cod and mullet may help prevent infectious diseases, including COVID-19, with optimized omega-3 PUFA status in the body [16]. Omega-3 fatty acids contribute to the immune system by producing cytokines and chemokines from macrophages. Omega-3 fatty acids also have an effect on neutrophils. Neutrophil cells are the

first cells to be recruited to the area of inflammation and are responsible for eliminating pathogens [17]. Fish consumption is thought to be protective against COVID-19 due to the omega-3 content.

Margarine is a water-in-oil emulsified food made from vegetable oils. Today, there is an increasing trend towards fortifying margarine with additives such as phytosterols and polyunsaturated fatty acid groups, as a result of increasing interest in functional foods that can contribute to consumer health. Conjugated linoleic acid, a polyunsaturated fatty acid, has been found to have beneficial effects on the body in both human and animal studies, and it has also been found to improve the immune system. Margarines are a very important source of vitamins A and D compared to liquid oils. Margarines made from vegetable oils are very important because they contain omega-3 and omega-6 fatty acids, which are essential fatty acids [18]. Margarines have a positive contribution to the immune system due to the content of vitamins A and D, conjugated linoleic acid, omega-3 and omega-6.

While excess intake of saturated fatty acids leads to low-grade inflammation, adequate intake of mono and polyunsaturated fatty acids positively affects the immune system. The acceptable fatty acid intake rates in terms of their contribution to dietary energy are as follows: w-9 (olive oil, hazelnut oil, canola oil, etc.) 12-15%, w-6 (corn oil, soybean oil, sunflower oil, cottonseed oil, etc.) 5-10%, and w-3 (fish, fish oil, walnuts, flax seeds, etc.) 0.6-1.2%) [19]. Not only the type of fat taken into the body, but also the rate of contribution to dietary energy is important in supporting the immune system [20]. Tail fat and tallow are thought to support the immune system due to their contribution to dietary energy and the high content of unsaturated fatty acids.

Olive oil has anti-inflammatory properties as it is rich in various bioactive compounds such as oleanoic acid, oleuropein, oleocanthal and hydroxytyrosol. In silico studies have shown that phytochemicals in olive oil are potential candidates against SARS CoV-2 [21]. It is recommended to consume short-chain or medium-chain unsaturated fats from the fats consumed as food. The most valuable medium chain fatty acids are olive oil, coconut oil and hazelnut oil. However, since trans fats cause proinflammatory effects and immune system disorders, it is not recommended to be consumed [22,23]. Although the literature focuses on the protective aspect of olives and olive oil from infections, the high incidence of COVID-19 among those who consume olive oil in our study suggests that our study was adversely affected by confounding factors.

Red meat is a nutrient rich in iron and zinc [24]. Iron acts as a cofactor for reduction-oxidation reactions and vital enzymes [20,25]. Zinc has antioxidant effects against reactive oxygen (ROS) and reactive nitrogen species (RNT) [3]. Zinc inhibits the replication of viruses by inhibiting RNA polymerase. This indicates that zinc may be effective against RNA viruses such as SARS-CoV-2 [26,27]. It is thought to support the

immune system due to the iron and zinc in red meat.

In their study, Maiorino et al. stated that the Mediterranean diet, due to its anti-inflammatory and immunomodulatory properties, is beneficial for preventing or reducing the severity of infection in people affected by COVID-19 [28]. The Mediterranean diet is a diet rich in olive oil, olives, fruit and vegetables, whole grains, legumes and oil seeds, moderate in eggs, fish, poultry and dairy products, and low in red meat and meat products [29]. Benefits of the Mediterranean diet include monounsaturated fatty acids (MUFA) such as oleic acid in olive oil, omega-3 and polyunsaturated fatty acids (alpha linoleic acid) found in nuts, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) found in oily fish, excess antioxidants found in fruits and vegetables (flavonoids) and the excess fiber found in whole grains and low-GI foods [30]. Oil seeds such as hazelnuts, peanuts, walnuts and almonds in the Mediterranean diet support the immune system due to the omega-3 and unsaturated fatty acids such as alpha linoleic acid. Fruits and vegetables support the immune system due to antioxidants such as flavonoids in their content.

Simit is one of the traditional bakery products in our country. In the bakery industry, mixed microbial cultures such as kefir can be used naturally to prevent microbial spoilage and staleness and to extend shelf life [31]. Kefir is known to repair and strengthen the immune system [32]. It can be thought that it supports the immune system, since it is possible that kefir can be used during the production of simit. And, sesame used in simit production may also be effective against COVID-19 disease [33].

Considering that there is trans fat in chips, it is not among the healthy food recommendations. Trans fats are not recommended since they cause proinflammatory effects and immune system disorders [22,23]. In our study, it was determined that chips were consumed more in the non-hospitalized group among COVID-19 patients. This finding suggests that our study was adversely affected by confounding factors.

Although there is no food that can prevent or treat the transmission of coronaviruses on its own, it has been proven that a healthy and balanced diet, together with physical activity and regular sleep, strengthens the immune system [34]. In order to keep the immune system strong during the pandemic period, importance should be given to the consumption of antioxidant vitamins (vitamin A, C, E), vitamin D, omega-3, zinc and pre/probiotics [35]. Individuals who consume nutrients that support the immune system are less susceptible to infectious diseases.

In conclusion, we found that the group with high consumption of fish, hard margarine and lard had less covid-19 disease, and the group with high consumption of red meat, oil seeds, dried fruits and vegetables, and simit had less hospitalization. Studies in the literature have revealed the effects of mostly nutrients and food types on the immune system. There are a limited number of studies in the literature examining the relationship between COVID-19 disease and

consuming food types. Further studies are needed in this regard.

Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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