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ORIGINAL PAPER

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Dietary Supplementation Practices Among Undergraduate Students in Greece During the COVID-19 Pandemic and Their Association with COVID-19-related Anxiety

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ABSTRACT

Background: Despite the lack of evidence-based guidance on supplement use for the prevention and treatment of COVID-19, consumption of dietary supplements has been shown to increase in many countries. **Objective:** This study aimed to explore the use of dietary supplements among undergraduate students. **Methods:** An online cross-sectional survey was conducted between May and June 2021, involving a total of 536 participants (57.8% female) aged between 18-30 years in two university towns in central and northern Greece. Two validated questionnaires were used regarding dietary supplements and stress during COVID-19. **Results:** The prevalence of dietary supplement use was 67.5%. The three most popular supplements consumed were vitamin C (65.2%), followed by vitamin D (58.3%), and multivitamin and mineral supplements (56.9%). The use of CAS-5 indicated that 13.1% of students were classified as having dysfunctional anxiety due to COVID-19 (CAS-5 score ≥ 5). Logistic regression analysis showed that those who exhibited CAS-5 ≥ 5 were over two times more likely to consume supplements compared to no-stress participants (OR 2.29, 95%CI: 1.09-4.82). Particularly vitamin D use was associated with CAS score ≥ 5 (OR 2.18, 95%CI 1.22-3.89) a finding that was not observed with other types of dietary supplements. **Conclusion:** Women, passive smokers, and those who believe that DS are necessary during the COVID-19 pandemic were also more

likely to consume dietary supplements. The use of dietary supplements is widespread among Greek students. Future studies should be conducted to monitor whether these increases in DS use are maintained.

Keywords: Dietary Supplements, COVID-19, Students, Anxiety.

1. BACKGROUND

The use of nutritional supplements during the pandemic increased worldwide. The main reason for the increase in the use of supplements was to improve immunity. There has been particular interest in vitamins such as C and D as well, as elements or foods such as zinc, omega-3 fatty acids, garlic, ginger, and turmeric (1). Reviews conducted in the midst of COVID-19 have shown that taking vitamins and micronutrients can improve the body's immune system, as well as have a positive impact on recovery from the COVID-19 infection (2, 3). In the studies carried out, the reinforcing, antiviral, antioxidant, or anti-inflammatory effects of dietary supplements were particularly emphasized (4).

The use of various natural compounds may provide an alternative prophylactic or even therapeutic support always in combination with treatment for COVID-19 (5). In a study carried out in 2021 in Lithuania by Arlauskas R et al., it showed that vitamins C and D, omega-3 fatty acids, magnesium were among

		Total sample		Supplements Consumption				p
				No (N=174)		Yes (N=362)		
		N	%	N	%	N	%	
Gender	Men	226	42.16%	97	55.75%	129	35.64%	<0.001
	Women	310	57.84%	77	44.25%	233	64.36%	
Age		23.0(2.8)		22.8(2.9)		23.2(2.8)		0.148
BMI category	Underweight	46	8.58%	10	5.75%	36	9.94%	0.442
	Normal weight	344	64.18%	115	66.09%	229	63.26%	
	Overweight	106	19.78%	35	20.11%	71	19.61%	
	Obesity	40	7.46%	14	8.05%	26	7.18%	
Smoking	Active smoker	81	15.11%	28	16.09%	53	14.64%	0.013
	Ex-smoker	30	5.60%	9	5.17%	21	5.80%	
	Passive smoker	27	5.04%	17	9.77%	10	2.76%	
	Vaper	11	2.05%	3	1.72%	8	2.21%	
	Non-smoker	387	72.20%	117	67.24%	270	74.59%	
Nutrition type	Mixed diet / No special diet	449	83.77%	153	87.93%	296	81.77%	0.327
	Egg-dairy-vegetarian	16	2.99%	4	2.30%	12	3.31%	
	Hypocaloric for weight loss	27	5.04%	7	4.02%	20	5.52%	
	Low in carbohydrates	13	2.43%	1	0.57%	12	3.31%	
	Purely Vegetarian	6	1.12%	1	0.57%	5	1.38%	
	Other	25	4.66%	8	4.60%	17	4.70%	
Nutrition assessment	Balanced	310	57.84%	104	59.77%	206	56.91%	0.654
	Not balanced	171	31.90%	55	31.61%	116	32.04%	
	Don't know	55	10.26%	15	8.62%	40	11.05%	
Immune system status	Stronger compared to others my age	138	25.75%	53	30.46%	85	23.48%	0.055
	Same as the rest of the population my age	348	64.93%	111	63.79%	237	65.47%	
	Weak compared to others my age	50	9.33%	10	5.75%	40	11.05%	
Vaccination against COVID-19	Yes	423	78.92%	147	84.48%	276	76.24%	0.09
	No	43	8.02%	10	5.75%	33	9.12%	
	I haven't decided yet	70	13.06%	17	9.77%	53	14.64%	
Nutritional supplements necessary during COVID-19	Yes	165	30.78%	19	10.92%	146	40.33%	<0.001
	No	212	39.55%	99	56.90%	113	31.22%	
	I do not know	159	29.66%	56	32.18%	103	28.45%	
CAS-5		1.8(2.4)		1.2(1.9)		2.0(2.6)		<0.001

Table 1. Univariate analysis of supplement consumption's association with demographic, health, and nutritional characteristics

the most commonly used dietary supplements consumed most under the effects of the COVID-19 pandemic (4).

In another study conducted in Poland by Hamulka et al., their results showed that the most common nutrients used during the first and second wave of the pandemic were vitamin D, C and omega-3 fatty acids (1).

Also, the findings of the study carried out in the United Arab Emirates by Radwan et al., showed widespread use of nutritional supplements, with the most common practice being the intake of special foods, followed by the intake of citrus fruits, immediately after the supplements, water and finally herbal decoctions (6).

Another area that needs special investigation in the midst of COVID-19 is chronic fear which can be harmful and tends to lead to various psychological problems. During a pandemic, fear increases anxiety and stress

levels (7).

In a study conducted in Pakistan, the results showed that the largest percentage of participants suffered from anxiety (71.0%) and depression (52.0%) during the COVID-19 pandemic (8). In another study conducted by Jacques-Aviñó C et al., in Spain, it was reported that 31.2% of women and 17.7% of men reported anxiety. Also, levels of depression were reported respectively in 28.5% and 16.7% of women and men. In the younger population between the ages of 18-35 and especially in women, there was a higher percentage of anxiety and depression levels (9).

2. OBJECTIVE

The main objective of our study is to evaluate the intake of nutritional supplements and their correlation

with stress in the midst of COVID-19, in students in Greece.

3. MATERIAL AND METHODS

Participants

An online cross-sectional survey was conducted among undergraduate students between 18-30 years old, in two university cities: Larisa in central Greece (University of Thessaly) and Thessaloniki in northern Greece (Aristotle University of Thessaloniki). The students were recruited by the researchers through professional mail databases. Participants were not incentivized. Participation in this research was voluntary and anonymous. There were no exclusion criteria. The participants declared their consent on the 1st page of the electronic form of the questionnaire. Data collection began in June 2021 and ended in November 2021. The questionnaire was in Greek language and the response time was around 8 to 10 minutes.

All procedures performed in this study were in accordance with the Declaration of Helsinki. The study protocol was registered and approved by the Ethics Committee of the Nursing Department of the University of Thessaly (approval number 656 / 07.27.2021).

Questionnaire

A validated questionnaire was used to collect data from participants (10). Briefly, the questionnaire consisted of three sections: a. personal and demographic information, b. section on Dietary Supplements (DS) use, and c. assessment of COVID-19 related anxiety. In the first section, Body Mass Index (BMI) was calculated as the self-reported weight in kilograms divided by the square of the self-reported height in meters (kg/m²). Classification of BMI was done according to World Health Organization data for adults aged 18 years and older (11). The second section included questions about the individual DS used by the participants during the two-week period prior to their study participation, the perceived necessity of DS during the COVID-19 pandemic, their information sources, where they obtain DS from, and whether they exceed the recommended doses. Details of the questionnaire has been previously described (10). In the third section, anxiety was assessed using the Coronavirus Anxiety Scale (CAS-5) (12), which was translated into Greek by the Medical School of the University of Patras, Greece and has previously been used (10). Participants were asked to indicate the frequency of certain physiological symptoms related to fear and anxiety (dizziness, sleep disturbances, tonic immobility, loss of appetite, abdominal stress) in the past 2 weeks,

	95% C.I.			
	OR	Lower	Upper	p
Females vs Males	1.975	1.292	3.019	0.002
Age	1.027	0.953	1.106	0.487
BMI (Ref. Underweight)				0.704
Normal weight	0.651	0.284	1.494	0.311
Overweight	0.783	0.309	1.986	0.606
Obesity	0.628	0.204	1.932	0.417
Smoking (Ref. active)				0.020
Ex-smoker	2.044	0.755	5.531	0.159
Passive smoker	0.293	0.104	0.826	0.020
Vaper	1.383	0.273	7.007	0.695
Non-smoker	1.286	0.72	2.298	0.395
Nutrition type (Ref. mixed)				0.471
Egg-dairy-vegetarian	1.355	0.395	4.650	0.629
Hypocaloric for weight loss	1.833	0.655	5.127	0.248
Low in carbohydrates	4.675	0.555	39.38	0.156
Purely Vegetarian	3.466	0.382	31.415	0.269
Other	0.991	0.367	2.672	0.985
Nutrition assessment (Ref. balanced)				0.770
Not balanced	0.971	0.607	1.555	0.903
Don't know	1.271	0.628	2.571	0.506
Immune system status (Ref. Stronger)				0.645
Same as the rest of the population my age	1.248	0.777	2.005	0.360
Weak compared to others my age	1.278	0.526	3.106	0.588
Supplements necessary during COVID-19 (Ref. Yes)				<0.001
No	0.150	0.084	0.267	<0.001
Don't know	0.259	0.141	0.476	<0.001
Vaccination against COVID-19 (Ref. Yes)				0.318
No	1.853	0.817	4.203	0.140
Haven't decided yet	1.159	0.59	2.277	0.668
CAS-5 >5	2.289	1.088	4.818	0.029

Table 2. Multivariate analysis for supplement consumption's association with demographic, health, and nutritional characteristics

on a 5-point Likert scale. Patients with CAS scores equal to or greater than 5 were considered to be dysfunctional anxious (or functionally impaired by their anxiety about the coronavirus).

4. STATISTICAL ANALYSIS

Statistical analysis of the reported data was performed with SPSS Version 28.0 (IBM Corp., Armonk, NY, USA). Absolute and relative frequencies (N, %) were calculated for categorical variables while mean and standard deviation values were derived for scale variables. Supplements consumption (Yes=1, No=0) was associated univariate with each independent variable (demographics, health behaviors, nutritional data, immune system status, vaccination against COVID-19, CAS-5 score, etc.) by means of chi-square tests, and independent samples t-tests. To examine the cumulative effect of independent

Vitamin C				Vitamin D				Multivitamins and minerals			
p	OR	Lower	Upper	p	OR	Lower	Upper	p	OR	Lower	Upper
0.030	1.55	1.04	2.30	0.081	1.44	0.96	2.16	0.113	1.38	0.93	2.06
0.071	1.07	1.00	1.14	0.508	1.02	0.96	1.10	0.122	1.06	0.99	1.13
0.356				0.400				0.616			
0.118	0.58	0.30	1.15	0.087	0.55	0.28	1.09	0.703	0.88	0.45	1.71
0.123	0.54	0.25	1.18	0.185	0.59	0.27	1.29	0.266	0.64	0.30	1.40
0.620	0.78	0.30	2.07	0.244	0.56	0.21	1.49	0.686	0.82	0.31	2.16
0.035				0.132				0.288			
0.098	2.16	0.87	5.35	0.479	0.70	0.26	1.88	0.825	1.11	0.44	2.79
0.035	0.31	0.10	0.92	0.061	0.34	0.11	1.05	0.102	0.38	0.12	1.21
0.258	0.44	0.11	1.82	0.217	0.39	0.09	1.74	0.295	0.45	0.10	2.02
0.956	0.99	0.58	1.68	0.806	1.07	0.62	1.86	0.769	1.08	0.64	1.85
0.142				0.047				0.194			
0.846	1.11	0.39	3.20	0.363	1.66	0.56	4.92	0.429	1.53	0.54	4.35
0.376	1.49	0.62	3.58	0.232	1.72	0.71	4.17	0.65	1.22	0.52	2.88
0.012	7.79	1.58	38.44	0.005	8.23	1.92	35.30	0.024	4.94	1.23	19.83
0.293	0.30	0.03	2.83	0.605	0.56	0.06	5.10	0.967	0.96	0.17	5.61
0.919	0.96	0.39	2.32	0.188	1.82	0.75	4.42	0.257	0.58	0.22	1.49
0.344				0.514				0.942			
0.246	1.29	0.84	1.97	0.268	1.28	0.83	1.98	0.855	1.04	0.68	1.60
0.564	0.83	0.44	1.57	0.966	0.99	0.52	1.89	0.808	0.92	0.49	1.75
0.945				0.012				0.433			
0.855	0.96	0.61	1.50	0.017	1.79	1.11	2.88	0.716	1.09	0.69	1.71
0.867	1.07	0.51	2.24	0.654	0.84	0.38	1.83	0.35	0.70	0.33	1.48
<0.001				<0.001				<0.001			
<0.001	0.33	0.21	0.51	<0.001	0.33	0.21	0.52	<0.001	0.34	0.21	0.53
0.018	0.56	0.35	0.91	0.002	0.47	0.29	0.76	0.002	0.47	0.29	0.75
0.727				0.794				0.330			
0.624	1.19	0.59	2.41	0.617	0.83	0.40	1.73	0.139	1.68	0.85	3.35
0.503	1.21	0.69	2.12	0.676	1.13	0.64	1.99	0.775	1.09	0.62	1.90
0.282	1.37	0.77	2.43	0.008	2.18	1.22	3.89	0.796	1.08	0.61	1.90

Table 3. Multivariate analyses for Vitamin D, C and multivitamin consumption's association with demographic, health, and nutritional characteristics

variables on supplements consumption, binary logistic regression analysis was performed. Secondary logistic regression analyses were also performed to account for the factors that contribute to the consumption of specific supplement types.

5. RESULTS

The sample consisted of 536 participants, 42.2% men, and 57.8% women. Participants who provided incomplete data were excluded from the analysis. Participants were in the age range of 18-30 years old. The mean age was 23 years (SD=2.8). 86.9% of participants presented CAS-5<5 and 13.1% CAS-5≥5. The majority (64.2%) had normal weight and 19.8% were overweight. Most participants were nonsmokers (72.2%), followed a mixed diet (83.8%), perceived their nutrition as balanced (57.8%), their immune system as average (64.9%), and have been vaccinated against COVID-19 (78.9%). Only 30.8% of participants reported perceiving supplements to use as

necessary during the pandemic.

Table 1 presents the sample's characteristics in relation to supplements consumption. Chi-square tests indicated that supplements consumption was related to gender (p<0.001), with women consuming supplements at a greater rate (64.4%) compared to men (35.6%). Passive smokers and vapers are less likely to consume supplements (2.8% and 2.2% respectively), while non-smokers are mostly more likely to take supplements w (74.6%), p<0.013. 40.3% of supplement consumers perceive supplements as necessary during the pandemic, while 56.9% of non-consumers do not think that supplements are necessary (p<0.001). Interestingly CAS-5 score was significantly different between groups of consumption (p<0.001), i.e., supplement consumers reported a higher mean CAS-5 score of 2.0 (SD=2.6) compared to the mean score of 1.2 (SD=1.9) for non-consumers.

Following, the multivariate analysis of supplement consumption's association with independent variables

	Iron				B-complex				Fish oil			
	p	OR	Lower	Upper	p	OR	Lower	Upper	p	OR	Lower	Upper
Females vs Males	<0.001	3.87	2.48	6.06	0.031	1.61	1.04	2.49	0.954	1.01	0.66	1.56
Age	0.142	1.06	0.98	1.14	0.157	1.06	0.98	1.14	0.312	1.04	0.97	1.12
BMI (Ref. Underweight)	0.899				0.41				0.583			
Normal weight	0.871	0.95	0.48	1.87	0.104	0.57	0.29	1.13	0.199	0.63	0.31	1.27
Overweight	0.538	0.78	0.35	1.73	0.175	0.58	0.26	1.28	0.212	0.60	0.26	1.35
Obesity	0.787	0.87	0.31	2.41	0.508	0.72	0.26	1.93	0.265	0.56	0.20	1.55
Smoking (Ref. active)	0.296				0.459				0.402			
Ex-smoker	0.683	0.80	0.27	2.38	0.52	1.38	0.52	3.67	0.754	1.16	0.45	3.02
Passive smoker	0.518	0.69	0.22	2.15	0.308	0.54	0.17	1.75	0.119	0.36	0.10	1.30
Vaper	0.868	0.88	0.19	4.08	0.365	0.46	0.09	2.47	0.236	0.34	0.06	2.02
Non-smoker	0.192	1.49	0.82	2.70	0.592	1.18	0.65	2.13	0.662	0.88	0.49	1.57
Nutrition type (Ref. mixed)	0.175				0.039				0.034			
Egg-dairy-vegetarian	0.936	0.96	0.32	2.89	0.063	2.73	0.95	7.84	0.876	1.09	0.36	3.35
Hypocaloric for weight loss	0.345	0.63	0.24	1.66	0.804	1.12	0.45	2.79	0.367	1.50	0.62	3.63
Low in carbohydrates	0.027	4.63	1.20	17.94	0.005	6.50	1.74	24.30	<0.001	11.59	2.83	47.50
Purely Vegetarian	0.191	3.22	0.56	18.59	0.828	0.78	0.08	7.38	0.999	0.00	0.00	0.00
Other	0.888	0.93	0.36	2.40	0.26	1.68	0.68	4.14	0.845	1.10	0.43	2.83
Nutrition assessment (Ref. balanced)	0.303				0.077				0.985			
Not balanced	0.438	1.20	0.76	1.89	0.999	1.00	0.63	1.58	0.934	1.02	0.64	1.62
Don't know	0.260	0.67	0.33	1.35	0.027	0.39	0.17	0.90	0.869	1.06	0.53	2.12
Immune system status (Ref. Stronger)	0.339				0.093				0.322			
Same as the rest of the population my age	0.357	1.27	0.77	2.08	0.17	1.42	0.86	2.35	0.164	0.71	0.44	1.15
Weak compared to others my age	0.584	0.80	0.37	1.76	0.382	0.69	0.29	1.60	0.257	0.63	0.28	1.40
Supplements necessary during COVID-19 (Ref. Yes)	0.006				0.065				0.007			
No	0.015	0.56	0.35	0.89	0.041	0.61	0.38	0.98	0.005	0.50	0.31	0.81
Don't know	0.003	0.45	0.27	0.76	0.047	0.59	0.35	0.99	0.011	0.51	0.30	0.86
Vaccination against COVID-19 (Ref. Yes)	0.689				0.28				0.167			
No	0.665	0.84	0.38	1.86	0.798	1.11	0.50	2.44	0.322	0.66	0.28	1.51
Haven't decided yet	0.479	1.23	0.69	2.19	0.112	1.59	0.90	2.82	0.124	1.57	0.88	2.79
CAS-5 >5	0.501	1.22	0.69	2.16	0.93	1.03	0.56	1.89	0.597	1.18	0.64	2.15

Table 4 Multivariate analyses for Iron, B-complex vitamins, and fish oil consumption's association with demographic, health, and nutritional characteristics

(Table 2), indicated that women were approximately two times more likely, compared to men, to consume nutritional supplements of any kind (OR 1.98, 95%CI 1.29-3.02). Moreover, passive smokers were less likely to consume supplements compared to active smokers

(OR 0.293, 95%CI: 0.104-0.826). The attitude towards the importance of nutritional supplements consumption during the COVID-19 pandemic was a significant predictor of nutritional supplements consumption, i.e., a negative attitude was less likely to be linked to supplements

consumption (OR 0.150, 95%CI 0.084-0.267). Lastly, the CAS-5 score was also a significant predictor of nutritional supplements consumption during the pandemic. More specifically, people who exhibited CAS-5 \geq 5 were over two times more likely to consume supplements compared to no-stress participants (OR 2.29, 95%CI: 1.09-4.82).

Following, the percent consumption of nutritional supplement types is presented in Figure 1. Vitamin C was preferred by 65.2% of supplement consumers, following Vitamin D (58.3%), multivitamins and minerals (56.9%), Iron (49.5%), and B-complex vitamins (42%).

Factors contributing to the consumption of Vitamin C, Vitamin D, and multivitamins/minerals are presented in Table 3. Vitamin C consumption was associated with female gender (OR 1.55, 95%CI 1.04-2.30), active smoking vs passive smoking (passive smoking: OR 0.31, 95%CI: 0.10-0.92), diet low in carbohydrates (OR 7.79, 95%CI 1.58-38.4) and perceiving nutritional supplements as necessary during the pandemic (Supplements not necessary: OR 0.33, 95%CI: 0.21-0.51). Vitamin D consumption was associated with a diet low in carbohydrates (OR 8.23, 95%CI 1.92-35.30), perceiving the immune system the same as others (OR 1.78, 95%CI 1.11-2.88), perceiving nutritional supplements as necessary during the pandemic (Supplements not necessary: OR 0.33, 95%CI: 0.21-0.52), and exhibiting CAS-5 \geq 5 (OR 2.18, 95%CI 1.22-3.89). Multivitamins and minerals consumption was associated with a diet low in carbohydrates (OR 4.94, 95%CI 1.23-19.83) and perceiving nutritional supplements as necessary during the pandemic (Supplements not necessary: OR 0.34, 95%CI: 0.21-0.53).

Table 4 presents results for Iron, B-complex vitamins, and fish oil supplements consumption. Nutritional supplements with iron were more likely to be consumed by women (OR 3.87, 95%CI 2.48-6.10) with a diet low in carbohydrates (OR 4.63, 95%CI 1.19-17.94), who perceive nutritional supplements as necessary during the pandemic (Supplements not necessary: OR 0.56, 95%CI: 0.35-0.89). B-complex vitamins consumption was associated with female gender (OR 1.61, 95%CI 1.04-2.49) and a diet low in carbohydrates (OR 6.50, 95%CI 1.74-24.3). Fish oil consumption was associated with a diet low in carbohydrates (OR 11.59, 95%CI 2.82-47.5) and perceiving nutritional supplements as necessary during the pandemic (Supplements not necessary: OR 0.50, 95%CI: 0.31-0.81).

6. DISCUSSION

The results of the present study, which was carried out on students of two universities in Greece, showed that young adults use more nutritional supplements than the elderly as shown by the results of the previous study we carried out on elderly people (10). In the present study, the results showed that women at a rate of 64.4% consume supplements compared to men that are at 35.6%. According to a previous study name "Epirus Health Study" carried out on the Greek population, the results showed that the prevalence of supplements use in the overall population was 31.4% and was higher in women than men (13). According to the study by Francis TV et al.,

the higher intake of supplements was observed mainly in women than in men (14). The possible explanation for the high intake of supplements during the COVID-19 pandemic is the fear of the risk of infection with COVID-19 which led to the need for further protection using the necessary supplements to boost immunity (15).

The frequency of vitamin intake among participants was with vitamin C being the first in participants' preference, followed by vitamin D, multivitamins and minerals, (iron), B vitamins, and then fish oils. More specifically, women consumed more vitamin C, iron, and vitamin B, while active smokers consumed more vitamin C.

The same results were also reported in the study by Khabour and Hassanein in Egypt where the higher use of vitamins C and D, as well as drinks, honey, and garlic were reported which strengthen the immune system (16). Also, in the Sri Lanka study by Francis et al., it is reported that the most commonly used drugs were vitamin supplements such as vitamins C, D, and B and multivitamins, as well as mineral supplements such as zinc (14). Vitamin D has a protective effect against respiratory infection through immunomodulatory factors and anti-inflammatory effects (17). Moreover, the intake of vitamin C in higher percentages in active smokers can be explained by the fact that smoking has been shown to significantly reduce the levels of circulating vitamin C in the plasma (18). According to European Food Safety Authority (EFSA) both vitamin D and vitamin C are considered to contribute to the normal functioning of the immune system (19, 20).

In terms of metals, the results of our research showed that a higher percentage of women receive an iron supplement, and we can understand this from the fact that at this age the needs are higher due to menstruation. According to the World Health Organization (WHO), iron deficiency anemia is a serious public health problem as it can affect psychological development, physical development, behavior, and overall performance at work. It is considered the most widespread nutritional problem in the world and affects more than 700 million people (21).

In addition, another nutrient that we observed in our study taken by participants as a dietary supplement is fish oil, which according to literature data, omega-3 polyunsaturated fatty acids (n3-PUFAs) can enhance anti-inflammatory responses, regulate immune function, block hyperinflammatory reactions and reduce the incidence of systemic inflammatory response syndrome and its complications from cells that activate the immune system infection (22).

Another interesting element of the present study was that people who were on the stress scale higher (CAS-5 \geq 5) were more likely to consume supplements compared to participants without stress and more specifically it was shown with a statistically significant difference ($p=0.008$) to receive vitamin D. These results may be related to a number of observational studies showing an inverse relationship between serum 25-hydroxyvitamin D3 concentrations and the severity and mortality rate of SARS-Cov-2. According to the study by Villasis-Keever and colleagues, the results of their double-blind,

placebo-controlled, prospective study demonstrated that vitamin D supplementation is effective in preventing SARS-CoV-2 infection (23). Also, according to Karonova and her colleagues, neither vitamin D intake nor vitamin D deficiency was associated with a reduction in SARS-CoV-2 morbidity. However, people who received a high dose of vitamin D had asymptomatic SARS-CoV-2. At the same time, participants receiving 2000 IU/day had twice as many cases of SARS-CoV-2, with half of them having mild clinical features (24). Supplementation of vitamins C and D, as well as zinc, may be an effective method of maintaining optimal immune function due to their immunomodulatory effects and given the widespread vitamin D deficiency (25).

The limitations of the present study are that the data are reported by the participants themselves. The sample consisted of university students from only 2 specific cities in Greece. The results cannot be generalized to the general population. Also, in the future, clinical trials should be done with the use of nutritional supplements so that the World Health Organization and other National Organizations can make specific recommendations regarding the intake of nutritional supplements to reduce both the likelihood of disease and the occurrence of serious symptoms in case of COVID-19.

With the results of the present study, we wanted to investigate the intake of dietary supplements by young adults in Greece in the midst of the COVID-19 pandemic and not the effectiveness of these supplements in the prevention or treatment of the disease.

7. CONCLUSION

The results of our study show a high-frequency intake of vitamins C, and D, multivitamins, iron, and fish oil. A person's good nutritional status can activate their immune system providing protection against viral infections. Large clinical studies are needed for taking nutritional supplements and their safe use as well as strict controls to guarantee the quality and safety of the various nutritional supplements in the context of public health.

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