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Evaluation of the Use of Vitamin-Mineral and Herbal Products in Adults During the COVID-19 Pandemic

COVID-19 Pandemi Sürecinde Yetişkin Bireylerin Vitamin-Mineral ve Bitkisel Ürün Kullanımının Değerlendirilmesi

ABSTRACT

Objective

To assess the use of vitamins, minerals and herbal products by adults during COVID-19.

Material and Methods

The study population was 742 adults aged ≥18 years. An online cross-sectional study included questions about the use of vitamin-mineral, dietary supplements, and herbal products before and during COVID-19.

Results

The use of dietary supplements and herbal products by participants during the pandemic was statistically significantly higher than before the pandemic ($p<0.001$ for both periods). People aged 18-50 years (39.5%) were more likely to take supplements than people aged 51-64 years (8.3%) ($p=0.034$). Before and during the pandemic, women (41.6% and 48.3%, respectively) were statistically significantly more likely to take supplements than men (30.5% and 32.8%, respectively) ($p=0.008$ and $p<0.001$, respectively). A statistically significant difference was found between the educational status of individuals in relation to the use of supplements before and during COVID-19 ($p=0.004$ and $p<0.001$, respectively). People with a medically diagnosed disease before and during COVID-19 were more likely to use supplements (for both periods; $p<0.001$) and herbal products ($p=0.021$ and $p=0.002$, respectively) than people without a chronic disease. Vitamin D was found to be the most commonly used supplement before and during COVID-19. The most consumed dried herbs before and during the pandemic were thyme (68.0% and 71.8%, respectively) and black pepper (63.9% and 64.4%, respectively).

Conclusion

The pandemic increased health awareness and made individuals think more about their health. People have increasingly turned to supplements and herbal products to support their health and immune function in these difficult times.

Key Words

Dietary supplement, Herbal products, COVID-19

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ÖZ

Amaç

Bu araştırmanın amacı, COVID-19 sırasında yetişkinler tarafından vitamin, mineral ve bitkisel ürün kullanımını değerlendirmektir.

Gereç ve Yöntemler

Araştırma, ≥18 yaş ve üzeri 742 yetişkin üzerinde yürütülmüştür. COVID-19 öncesinde ve sırasında vitamin-mineral, diyet takviyeleri ve bitkisel ürünlerin kullanımına ilişkin soruları içeren anket formu çevrimiçi uygulanmıştır.

Bulgular

Pandemi sırasında katılımcıların besin takviyeleri ve bitkisel ürün kullanımı pandemi öncesine göre istatistiksel olarak anlamlı derecede yüksekti (her iki dönem için de p<0,001). On sekiz-elli yaş arasındaki bireyler (%39,5) 51-64 yaş arasındakilere (%8,3) kıyasla daha fazla takviye almıştır (p=0,034). Pandemi öncesinde ve sırasında kadınların (sırasıyla %41,6 ve %48,3) takviye alma olasılığı erkeklere (sırasıyla %30,5 ve %32,8) kıyasla istatistiksel olarak anlamlı derecede daha yüksektir (sırasıyla p=0,008 ve p<0,001). COVID-19 öncesi ve sırasında takviye kullanımı açısından bireylerin eğitim durumları arasında istatistiksel olarak anlamlı bir fark bulunmuştur (sırasıyla p=0,004 ve p<0,001). COVID-19 öncesinde ve sırasında hekim tarafından tanı konulmuş hastalığı olan kişilerin takviye (her iki dönem için; p<0,001) ve bitkisel ürün (sırasıyla p=0,021 ve p=0,002) kullanma olasılığı, kronik bir hastalığı olmayan kişilere göre daha yüksektir. COVID-19 öncesinde ve sırasında en sık kullanılan takviyenin D vitamini olduğu görülmüştür. Pandemi öncesinde ve sırasında en çok tüketilen kuru bitkiler kekik (sırasıyla %68,0 ve %71,8) ve karabiber (sırasıyla %63,9 ve %64,4) olmuştur.

Sonuç

Pandemi, sağlık bilincini artırmış ve bireylerin sağlıkları hakkında daha fazla düşünmelerini sağlamıştır. İnsanlar bu zor zamanlarda sağlıklarını ve bağışıklık fonksiyonlarını desteklemek için besin takviyelerine ve bitkisel ürünlere giderek daha fazla yönelmiştir.

Anahtar Kelimeler

Besin takviyesi, Bitkisel ürün, COVID-19

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a global pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1). The first COVID-19 case was detected in Türkiye on March 11, 2020, and in the following period, the number of cases increased in Türkiye as in the world (2). COVID-19 affects the immune system by producing a systemic inflammatory response or cytokine release syndrome. Lack of immunity to this virus increases the damaging impact of the disease (3, 4). It is currently known that there are no medicines that can definitively prevent or treat COVID-19 (4). Having a strong immune system is of great importance in protecting against viral infections such as COVID-19 or recovering from mild infections (5, 6).

The rapid spread of the COVID-19 pandemic has raised many concerns around the world and increased demand for alternative options, such as the use of vitamin-mineral and herbal products to boost immunity, prevent disease transmission, or mitigate the course of the disease (4, 7). In many countries, the sale of vitamin and mineral supplements increased during COVID-19 (7, 8). It was reported that 29.7% of adults in Türkiye use nutritional supplements, the most common being vitamin D (51.6%), multivitamins (31.0%) and vitamin C (27.0%) (9). About one-third of Egyptian adults have been shown to use vitamin C, immune-boosting drinks, honey and garlic to strengthen the body's immunity during the pandemic (10). Historically, herbal products have been used to boost the immune system and are still widely used today, often without the need for a prescription (11). In Saudi Arabia, 22.1% of adults were found to have used herbal products or dietary supplements to prevent illness during the pandemic (12). However, despite scientific evidence on the immune-boosting, anti-inflammatory, antioxidant and antiviral properties of various bioactive compounds, there are no recommendations for the use of nutritional supplements in the guidelines for the treatment of COVID-19 (13, 14). It has also been reported that unconscious use of nutritional supplements increased during this period (15). Although nutritional supplements contribute to the protection and promotion of health, their unconscious use can bring more harm than good to individuals. Vitamins A, D, E and K stored in the body cannot be excreted from the body when consumed in excess. An increase in these vitamins can lead to death by having a toxic effect. In addition, herbal products may interact with some medications and negatively affect health (15).

Assessing nutritional supplement use during the pandemic and understanding the associated factors can help design interventions aimed at motivating individuals towards healthy use of supplements and medicinal plants during the pandemic (10). Therefore, the aim of this study was to evaluate the vitamin-mineral and herbal product use of adult individuals during COVID-19.

MATERIAL and METHODS

Design and participants

This self-selection online cross-sectional study was conducted in Türkiye among individuals aged 18-64 years. The following criteria were used to determine eligibility: (1) use of social media platforms, (2) residence in Türkiye, and (3) 18 years or older. Participants who did not complete the survey were excluded from the study. To avoid duplicate submissions, participants were asked to provide their email addresses. Figure 1 shows the flowchart of the study.

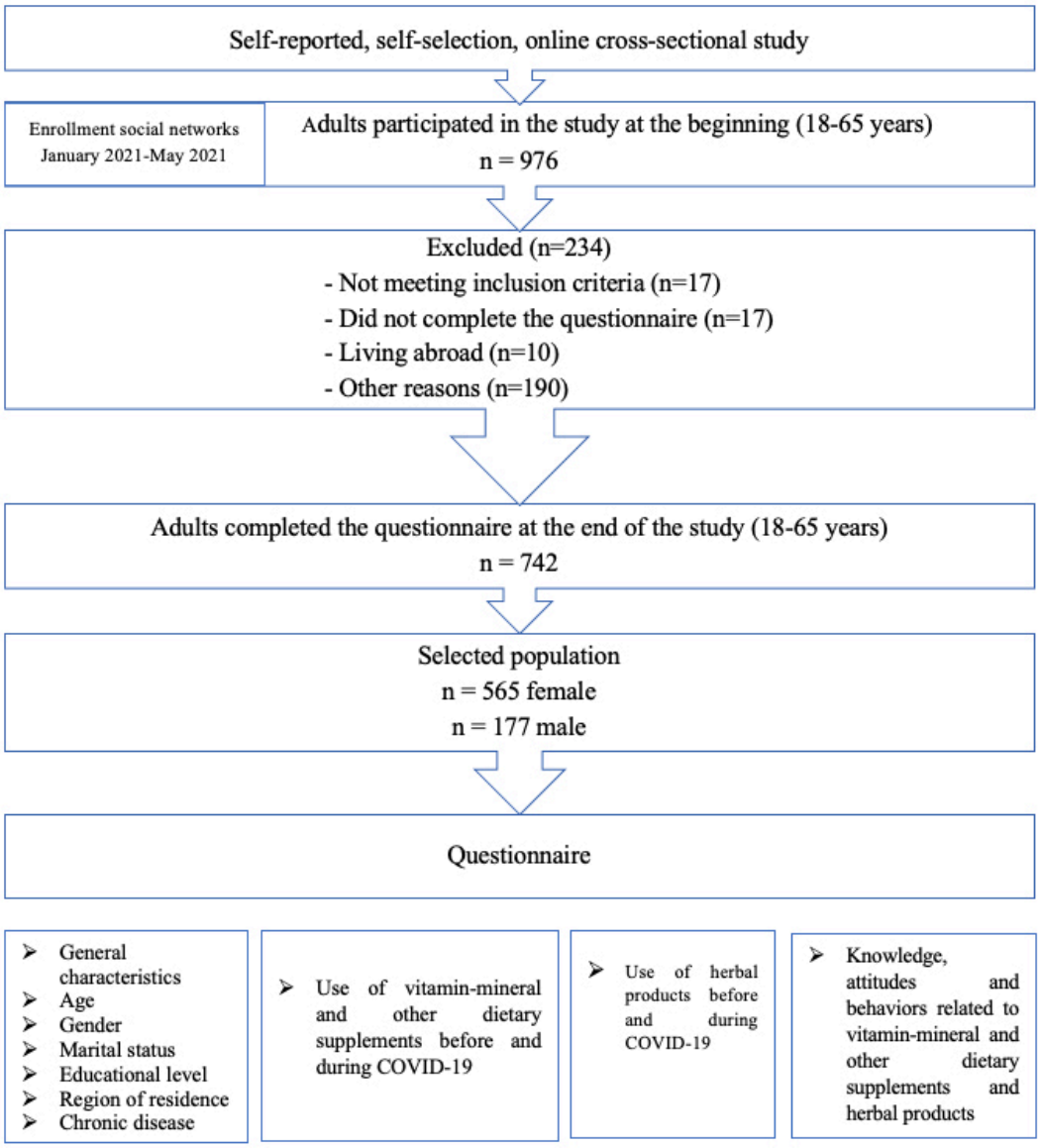

Figure 1. Study flow chart

Data Collection

Between January 2021 and May 2021, self-reported data was collected using the web survey software Google Forms. A snowball sampling method was used for this study. Social media platforms such as Facebook, WhatsApp, and Instagram were used to find respondents. Invitations to participate in the study were routinely sent out on Facebook and Instagram at different times of the day and on different days of the week. Respondents were also asked to forward the survey invitation to others. After feedback from the first 10 responses, the questionnaire was adjusted as needed.

The online questionnaire used for this study consisted of four sections. The first section of the questionnaire included questions on general characteristics such as gender (male and female), age, marital status (married and single), education level (primary, secondary, high school, university, master's or doctorate), geographical region of residence (Black Sea, Marmara, Aegean, Mediterranean, Southeastern Anatolia, Central Anatolia, Eastern Anatolia) and presence of chronic disease (yes or no). The second and third sections included the use of vitamin-mineral, other dietary supplements, and herbal products before and during COVID-19. The last section included knowledge, attitudes, and behaviors related to vitamin-mineral and other dietary supplements and herbal products.

Statistical Analysis of Data

Statistical analyses were performed using the SPSS (Statistical Package for Social Sciences) Windows 20.0 (SPSS Inc., Chicago, IL, USA) package program. Categorical data were presented as frequencies (n) and percentages (%). Significant differences between nominal variables were evaluated with a chi-square test. If the expected count of observations in any of the cells in the chi-square table is below 5, Fisher's exact chi-square test is applied. To determine differences in dichotomous dependent variables between two dependent groups, the McNemar test was used. Statistical significance was accepted as $p<0.05$ for all analyses.

RESULTS

The general characteristics of the subjects participating in the study are shown in Table I. A total of 742 subjects (M: 23.9%; W: 76.1%) with a mean age of 24.75±7.56 years participated in the study. Almost all subjects (98.4%) were between 18 and 50 years old, and almost half of them (47.7%) had a secondary or high school degree. More than a third (37.5%) of the participants lived in the Aegean region. A quarter of the individuals (25.2%) had a chronic illness diagnosed by a doctor.

Table I. Distribution of the general characteristics of participants (n=742)

Variables	n	%
Age group (year)		
18-50	730	98.4
51-64	12	1.6
Gender		
Men	177	23.9
Women	565	76.1
Marital status		
Single	612	82.5
Married	130	17.5
Education status		
Primary school and before	44	5.9
Secondary/high school	354	47.7
University/master's/doctoral	344	46.4
Geographical region of residence		
Black Sea	72	9.7
Marmara	126	17.0
Aegean	278	37.5
Mediterranean	97	13.1
Southeast Anatolia	56	7.5
Central Anatolia	69	9.3
Eastern Anatolia	44	5.9
Presence of a chronic disease		
Yes	187	25.2
No	555	74.8

Figure 2 shows the use of vitamin-mineral and other dietary supplements and herbal products before and during COVID-19. While 38.9% (n=289) of study participants used dietary supplements before COVID-19, this proportion increased to 44.6% (n=331) during the pandemic. It was found that 45.1% (n=335) of individuals used herbal products before the pandemic and 49.5% (n=367) during the pandemic. The use of dietary supplements and herbal products by participants during the pandemic was statistically significantly higher than before the pandemic ($p<0.001$ for both periods).

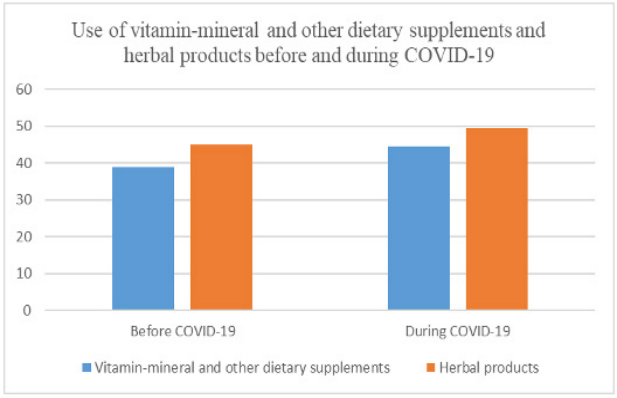

Figure 2. Use of vitamin-mineral and other dietary supplements and herbal products before and during COVID-19 (%) (Mc Nemar, *p<0.001)

The use of vitamin-mineral and other dietary supplements and herbal products before and during COVID-19 according to the general characteristics of the individuals is shown in Table II. Before the pandemic, people aged 18-50 years (39.5%) were more likely to take supplements than people aged 51-64 years (8.3%) ($p=0.034$). Before and during the pandemic, women (41.6% and 48.3%, respectively) were statistically significantly more likely to take dietary supplements than men (30.5% and 32.8%, respectively) ($p=0.008$ and $p<0.001$, respectively).

A statistically significant difference was found between the educational status of individuals in relation to the use of dietary supplements before and during COVID-19 ($p=0.004$ and $p<0.001$, respectively). The rate of supplement use before and during the pandemic was higher among people with a university degree (44.5% and 54.4%, respectively) than among people with a secondary/high school degree (32.8% and 35.9%, respectively).

A statistically significant difference was found between the use of dietary supplements depending on the geographical regions in which the participants lived ($p=0.040$ and $p=0.012$ respectively). The rate of supplement use before the pandemic is significantly higher among residents of the Marmara region (49.2%) than among residents of the Black Sea region (27.8%). In addition, the use of dietary supplements during the pandemic is higher among Marmara residents (54.0%) than among Black Sea (31.9%) and Southeastern Anatolia (28.6%) residents.

It was found that women (48.8% and 53.3%, respectively) used more herbal products before and during the pandemic than men ($p<0.001$). The use of herbal products before and during the pandemic was higher among those who had a university/master's/doctoral degree than among the other groups ($p=0.001$ and $p=0.030$, respectively). A statistically significant difference was also found between the use

Table II. Use of vitamin-mineral and other dietary supplements and herbal products before and during COVID-19 by general characteristics of participants (n=742)

Variables	Use of vitamin-mineral and other dietary supplements						Use of herbal products					
	Before COVID-19			During COVID-19			Before COVID-19			During COVID-19		
	Yes (n:289) n (%)	No (n:453) n (%)	p^a	Yes (n:331) n (%)	No (n:411) n (%)	p^a	Yes (n:335) n (%)	No (n:407) n (%)	p^a	Yes (n:367) n (%)	No (n:375) n (%)	p^a
Age classification (year)												
18-50	288 (39.5)	442 (60.5)	**0.034*[b]**	329 (45.1)	401 (54.9)	0.050	332 (45.5)	398 (54.5)	0.157	363 (49.7)	367 (50.3)	0.260
51-64	1 (8.3)	11 (91.7)		2 (16.7)	10 (83.3)		3 (25.0)	9 (75.0)		4 (33.3)	8 (66.7)	
Gender												
Male	54 (30.5)	123 (69.5)	**0.008***	58 (32.8)	119 (67.2)	**<0.001***	59 (33.3)	118 (66.7)	**<0.001***	66 (37.3)	111 (62.7)	**<0.001***
Female	235 (41.6)	330 (58.4)		273 (48.3)	292 (51.7)		276 (48.8)	289 (51.2)		301 (53.3)	264 (46.7)	
Marital status												
Married	55 (42.3)	75 (57.7)	0.387	66 (50.8)	64 (49.2)	0.120	66 (50.8)	64 (49.2)	0.156	73 (56.2)	57 (43.8)	0.093
Single	234 (38.2)	378 (61.8)		265 (43.3)	347 (56.7)		269 (44.0)	343 (56.0)		294 (48.0)	318 (52.0)	
Education status												
Primary school and before	20 (45.5)	24 (54.5)		17 (38.6)	27 (61.4)		13 (29.5)	31 (70.5)		17 (38.6)	27 (61.4)	
Secondary-high school	116 (32.8)	238 (67.2)	**0.004***	127 (35.9)	227 (64.1)	**<0.001***	144 (40.7)	210 (59.3)	**0.001***	163 (46.0)	191 (54.0)	**0.030***
University/master's/doctoral	153 (44.5)	191 (55.5)		187 (54.4)	157 (45.6)		178 (51.7)	166 (48.3)		187 (54.4)	157 (45.6)	
Geographical region of residence												
Black Sea	20 (27.8)	52 (72.2)		23 (31.9)	49 (68.1)		24 (33.3)	48 (66.7)		25 (34.7)	47 (65.3)	
Marmara	62 (49.2)	64 (50.8)		68 (54.0)	58 (46.0)		69 (54.8)	57 (45.2)		72 (57.1)	54 (42.9)	
Aegean	107 (38.5)	171 (61.5)		130 (46.8)	148 (53.2)		129 (46.4)	149 (53.6)		145 (52.2)	133 (47.8)	
Mediterranean	41 (42.3)	56 (57.7)	**0.040***	44 (45.4)	53 (54.6)	**0.012***	45 (46.4)	52 (53.6)	0.067	49 (50.5)	48 (49.5)	**0.017***
Southeast Anatolia	16 (28.6)	40 (71.4)		16 (28.6)	40 (71.4)		20 (35.7)	36 (64.3)		20 (35.7)	36 (64.3)	
Central Anatolia	24 (34.8)	45 (65.2)		33 (47.8)	36 (52.2)		31 (44.9)	38 (55.1)		37 (53.6)	32 (46.4)	
Eastern Anatolia	19 (43.2)	25 (56.8)		17 (38.6)	27 (61.4)		17 (38.6)	27 (61.4)		19 (43.2)	25 (56.8)	
Presence of chronic disease												
Yes	104 (55.6)	83 (44.4)	**<0.001***	116 (62.0)	71 (38.0)	**<0.001***	98 (52.4)	89 (47.6)	**0.021***	111 (59.4)	76 (40.6)	**0.002***
No	185 (33.3)	370 (66.7)		215 (38.7)	340 (61.3)		237 (42.7)	318 (57.3)		256 (46.1)	299 (53.9)	

*p<0.05 [a]Chi-Square Test [b]Fischer's Exact Test Line percentage was used

of herbal products depending on the geographical regions during the pandemic (p=0.017). The use of herbal products during the pandemic is significantly higher among the inhabitants of the Marmara region (57.1%) than among the inhabitants of the Black Sea region (34.7%). It was observed that people with a medically diagnosed disease before and during COVID-19 were more likely to use dietary supplements (for both periods; p<0.001) and herbal products (p=0.021 and p=0.002, respectively) than people without a chronic disease.

The vitamin-mineral and other supplements taken by the participants before and during the COVID-19 are shown in Figure 3. Vitamin D was found to be the most commonly used supplement before and during the pandemic. Approximately half (48.4%) of participants taking supplements before COVID-19 used vitamin D, and this rate increased to 63.7% during the pandemic. Vitamin C (40.5% and 48.9%, respectively) and multivitamin-mineral supplements (33.2% and 33.2%, respectively) were the most commonly used supplements in both periods.

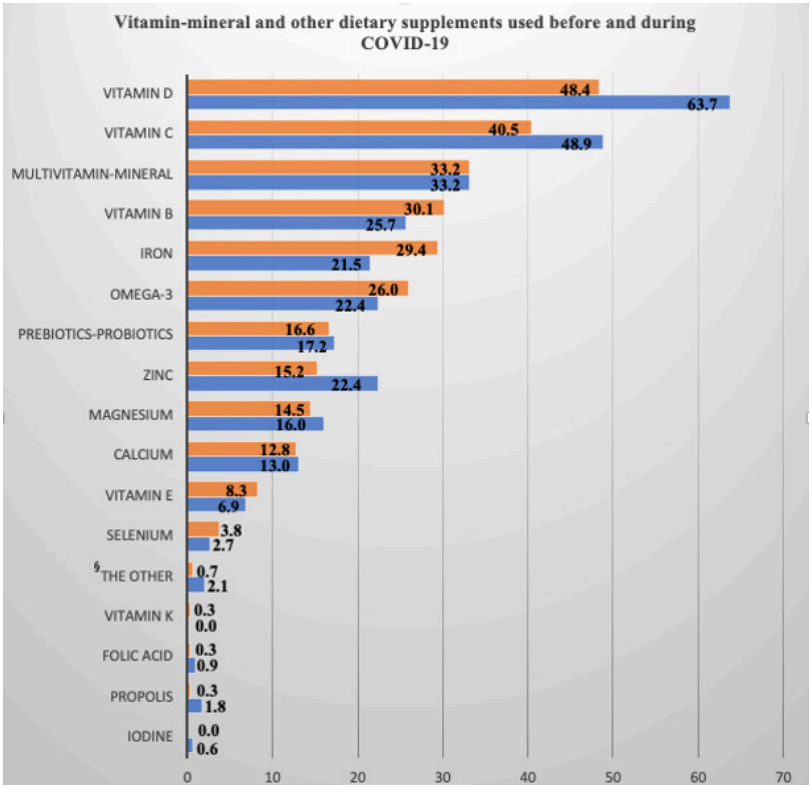

Figure 3. Vitamin-mineral and other dietary supplements used by participants before and during COVID-19 (%) (Multiple responses were allowed for this question)

§Before COVID-19: L-arginine, curcumin; During COVID-19: Quercetin, L-arginine, krill oil, alpha lipoic acid, beta-glucan, curcumin

Table III shows the herbal products used by the participants before and during COVID-19. It was found that the most consumed dried herbs before and during the pandemic were thyme (68.0% and 71.8%, respectively) and black pepper (63.9% and 64.4%, respectively).

Walnuts (76.0%), parsley (75.4%), and carrots (72.6%) were in the top three before the pandemic, while walnuts (77.5%), garlic (77.2%) and carrots (76.1%) were the most commonly consumed fresh herbs during the pandemic. Participants reported that they mainly consumed lime (75.1% and 77.8%, respectively) and green tea (67.7% and 68.5%, respectively) as herbal tea during both periods.

Table III. Herbal products used by participants before and during COVID-19

Variables	Before COVID-19 n (%)	During COVID-19 n (%)
Dry herbs†	**(n=316)**	**(n=348)**
Thyme	215 (68.0)	250 (71.8)
Black Pepper	202 (63.9)	224 (64.4)
Cinnamon	194 (61.4)	209 (60.1)
Red pepper	174 (55.1)	217 (62.4)
Ginger	166 (52.5)	204 (58.6)
Sumac	147 (46.5)	172 (49.4)
Cumin	144 (45.6)	158 (45.4)
Black cumin	133 (42.1)	171 (49.1)
Goat horn	63 (19.9)	76 (21.8)
Turmeric	8 (2.5)	163 (46.8)
Mint	6 (1.9)	4 (1.1)
Linden	4 (1.3)	1 (0.3)
Basil	3 (0.9)	3 (0.9)
Cantaron	3 (0.9)	1 (0.3)
Sage	2 (0.6)	2 (0.6)
Olive leaf	-	2 (0.6)
Other	2 (0.6)†	7 (2.0)††
Fresh herbs†	**(n=325)**	**(n=360)**
Walnut	247 (76.0)	279 (77.5)
Parsley	245 (75.4)	269 (74.7)
Carrot	236 (72.6)	274 (76.1)
Olive	229 (70.5)	242 (67.2)
Garlic	228 (70.2)	278 (77.2)
Nar	195 (60.0)	232 (64.4)
Onion	6 (1.8)	6 (1.7)
Dill	3 (0.9)	3 (0.8)
Cress	2 (0.6)	4 (1.1)
Roka	2 (0.6)	3 (0.8)
Fresh Onion	-	3 (0.8)
Citrus fruits (lemon. orange. tangerine etc.)	2 (0.6)	4 (1.1)
Cabbage	-	2 (0.6)
Ginger	1 (0.3)	2 (0.6)
Other	4 (1.2)†††	9 (2.5)††††
Herbal teas†	**(n=325)**	**(n=356)**
Linden	244 (75.1)	277 (77.8)
Green tea	220 (67.7)	244 (68.5)
Rosehip	128 (39.4)	144 (40.4)
Fennel	80 (24.6)	98 (27.5)
Echinacea	26 (8.0)	40 (11.2)
Daisy	15 (4.6)	14 (3.9)
Sage	14 (4.3)	18 (5.1)
Son grass	8 (2.5)	10 (2.8)
Thyme	5 (1.5)	9 (2.5)
Melisa	5 (1.5)	7 (2.0)
Turmeric	3 (0.9)	1 (0.3)
Cherry stalk	3 (0.9)	4 (1.1)
Jasmine	2 (0.6)	1 (0.3)
Ginger	2 (0.6)	1 (0.3)
Rosemary	2 (0.6)	2 (0.6)
Fruit teas	2 (0.6)	2 (0.6)
Cantaron	1 (0.3)	2 (0.6)
Hibiscus	1 (0.3)	3 (0.8)
Olive leaf	1 (0.3)	5 (1.4)
Mint lemon	1 (0.3)	2 (0.6)
Other	8 (2.5)†††††	9 (2.5)††††††

†Multiple responses were allowed for this question. † Dried peppers and tomatoes, †† Jasmine, chamomile, caramürver extract, clove, hibiscus, elderflower, thistle, ††† Turmeric, celery, pumpkin, and fruits containing vitamins, †††† Turmeric, sugar beet, mint, celery, thyme, pumpkin, radish, celery stalk, lettuce, ††††† Cloves, cinnamon, mint, marjoram, winter tea, ginkgo biloba, white tea, ††††††Cloves, lemon with honey, za'atar, cinnamon, mint, marjoram, thistle, white tea, winter tea.

The participants' knowledge, attitudes, and behaviors regarding dietary supplements and herbal products are shown in Table IV. 43.4% of participants sought information about dietary supplements from doctors, and almost half (45.8%) stated that they were influenced by advertising when choosing dietary supplements. It was found that 77.0% of people pay attention to "product safety" and 64.4% to "product content" when choosing dietary supplements. When participants' attitudes and behaviors regarding herbal products were examined, it was found that about half of the individuals (52.8%) purchased herbal products from herbalists/spice stores, and 78.4% did not share the herbal product they used with their doctor.

Table IV. Participant's knowledge, attitudes, and behaviors about vitamin-mineral and other dietary supplements and herbal products

Variables	n	%
Sources of information on vitamin-mineral and other nutritional supplements† (n=645)		
Friend recommendation	12	1.9
Dietitian recommendation	40	6.2
On the advice of my doctor	280	43.4
Pharmacist recommendation	60	9.3
By researching myself	149	23.1
Books	6	0.9
Internet	87	13.5
Television	15	2.3
Influence of advertising on preferences for vitamin-mineral and other dietary supplements (n=742)		
Yes	143	19.3
No	340	45.8
Sometimes	259	34.9
Criteria influencing preferences in the choice of vitamin-mineral and other dietary supplements† (n=739)		
Product content	476	64.4
Brand recognition	246	33.3
Reliable	569	77.0
Price	156	21.1
Doctor's advice	9	1.2
Friend's advice	3	0.4
Other	2	0.3
The belief that vitamin-mineral and other supplements are protective during COVID-19 (n=742)		
Yes	301	40.6
No	102	13.7
Sometimes	230	31.0
No opinion	109	14.7
Places where herbal products are offered† (n=362)		
From friends	19	5.2
Marketers	13	3.6
Grocery stores	86	23.8
Online	12	3.3
Pharmacies	47	13.0
Herbalists and spice shops	191	52.8
Research on the herbal products used in COVID-19 (n=364)		
Yes	247	67.9
No	117	32.1
Tell the doctor about the herbal product used during COVID-19 (n=366)		
Yes	79	21.6
No	287	78.4
Think that using herbal products during COVID-19 is more beneficial (n=742)		
Yes	286	38.5
No	125	16.8
Sometimes	210	28.3
No opinion	121	16.3
The idea that herbs and herbal products can interact with the medication used (n=742)		
Yes	393	53.0
No	111	15.0
No opinion	238	32.1
The idea that herbs and herbal products could be harmful		
Yes, maybe	468	63.1
No, plants can do no harm	127	17.1
No opinion	147	19.8

†Multiple responses were allowed for this question

DISCUSSION

The results of this study, which was conducted to assess the use of vitamin, mineral, and herbal products by adults during the COVID-19 pandemic, showed that the use of dietary supplements and herbal products increased significantly during the pandemic compared to the pre-pandemic period. Various factors such as gender, education level, geographical region, and presence of chronic diseases were associated with differences in the use of these products.

Over the last 20 years, the use of dietary supplements has increased in many countries. Awareness of the importance of health and the need to protect health has increased with the emergence of the COVID-19 pandemic. Dietary supplements with specific health benefits and/or the potential to regulate body systems have attracted more attention from consumers. The use of dietary supplements and herbal products as an alternative to treat the disease and boost the immune system for prevention has increased due to the public health crisis triggered by the COVID-19 pandemic and fears about COVID-19 vaccines (16). Consumers use dietary supplements for a variety of reasons, depending on their age, gender, physical activity or state of health (17). The most frequently cited reasons for taking dietary supplements and natural herbal products are to boost the immune system, increase energy and stamina, and maintain health (18, 19).

According to data from the Türkiye Nutrition and Health Survey (TNHS) 2019, the rate of supplement use among adults was 9.7%, while in a study conducted after COVID-19, the rate of supplement use among individuals was 36.1% (20, 21). In a study of university students, the use of dietary supplements has almost doubled compared to before the pandemic (15). Similarly, our study found that participants used significantly more dietary supplements and herbal products during the pandemic than before the pandemic. The increase in the use of dietary supplements and herbal products compared to before the pandemic may be due to the lack of a definitive treatment for the disease and the need for alternative ways to boost immunity and overall health, increased health awareness, and the potential for these products to boost the immune system.

The prevalence of supplement use tends to be higher in women than in men (22). One study reported that women used dietary supplements more frequently than men (19). According to the Centers for Disease Control and Prevention (CDC) report, 63.8% of women and 50.8% of men used dietary supplements between 2017 and 2018 (23). The use of herbal supplements during the pandemic was reported mainly by women, according to data from a study by Arora et al. (18). In our study, women were found to use supplements more frequently than men both before and during the pandemic. This could be because women have special nutritional needs due to life stages such as menstruation, pregnancy and menopause, and are therefore more health conscious than men.

This study found that the use of vitamins, minerals and herbal products varies by demographic group. When participants were assessed according to their level of education, it was found that those with a university degree or higher took more supplements before and during the pandemic. One study showed that there was a positive correlation between education level and supplement intake, with higher education levels being associated with higher intake (24). Another study also found that the use of dietary supplements increases with education (4). It is hypothesized that this result is due to higher health awareness as participants' education level increases and better access to supplements as purchasing power increases.

Our study also found geographical differences in the use of dietary supplements and herbal products. It was found that participants living in the Marmara region used more supplements and herbal products than those in other regions. This could be due to the different access to these products for people in different regions or different health awareness in different regions.

A better diet can prevent chronic diseases, which are responsible for most deaths in the world. Nowadays, vitamins and minerals are increasingly used to prevent diseases and alleviate their consequences. The use of vitamins and mineral supplements is particularly common for chronic diseases, as vitamins and minerals have vital functions in the body (25). When our study analysed the intake of dietary supplements by participants depending on their chronic disease, it showed that participants with chronic diseases took more dietary supplements during the pandemic. Studies have reported that the use of vitamin and mineral supplements is more common in patients with chronic diseases (26, 27).

A study examining the use of dietary supplements during the COVID-19 pandemic found that interest in immune-related substances, supplements such as vitamins C and D, zinc, omega-3, garlic, ginger or turmeric has increased worldwide (7). A cross-sectional study in Türkiye found that lemon, garlic, ginger and thyme were the most commonly used herbal products during the COVID-19 pandemic (28). In our study, the most commonly used dietary supplements during the pandemic were vitamin D, vitamin C and multivitamin/mineral supplements, which is consistent with the results of other studies (9, 18, 29).

A study in Türkiye found that people who do not take vitamin C and D become ill more quickly and believe that dietary supplements destroy the virus (30). Vitamin D is known to regulate the immune system. It can protect against COVID-19 by stimulating acquired and innate immunity and suppressing the cytokine storm (31). Observational studies have shown that patients with vitamin D deficiency are more susceptible to severe COVID-19 infections, and there is a significant correlation between vitamin D levels and the clinical severity of COVID-19 (32, 33).

Vitamin C is often used to treat respiratory tract infections (34). Vitamin C is known for its antioxidant properties and for supporting a healthy immune system. It has been reported that the body's need for vitamin C increases during an infection and that a lack of vitamin C increases the severity

of the infection (35). While in healthy people a vitamin C intake of 0.1 g/kg/day is sufficient to maintain plasma vitamin C levels within normal limits, it has been reported that higher doses of vitamin C (1-4 g/kg/day) are required to maintain these levels in critically ill patients (36). However, there is still no evidence that high-dose vitamin C supplementation is safe and effective for COVID-19 patients (37).

During the COVID-19 pandemic, the use of herbal products which are believed to boost immunity has increased (38). In both clinical and traditional practice, herbal products are used for COVID-19-like respiratory diseases. Traditionally, preference is given to plants that grow in the geographical area where one lives (39). In one study, ginger and garlic were the most commonly used herbal products, while in another study, ginger, onion and garlic were the most commonly consumed herbal products during the pandemic, and green tea was the most commonly consumed herbal tea (40, 41). In our study, the use of herbal products such as thyme and black pepper increased during the pandemic. Participants also reported that they consumed more fresh herbs such as walnuts, garlic and carrots, and that linden and green tea were the most commonly consumed herbal teas in both periods. These herbal products are traditionally used to treat colds (42). This change in consumption habits can be attributed to the perceived health benefits of these products in the fight against the pandemic.
The sources of information used before using dietary supplements and herbal products are another important topic. The most popular sources of information about supplements and herbal products before COVID-19 were television, the internet, social media and friends (43). Similarly, Alyami et al. reported that the most popular sources of information during the pandemic were social media and the internet, followed by friends and relatives (12). During the pandemic, consumers around the world have increased their consumption of dietary supplements due to information on various social media platforms and advertisements supporting the role of dietary supplements in the fight against COVID-19 (13). In our study, 43.4% of the participants received information about dietary supplements from doctors and almost half of them (45.8%) stated that they were influenced by advertising when choosing dietary supplements.

Although dietary supplements are widely available over the counter, for safety and quality reasons they should be purchased from a licensed pharmacy under the guidance of a physician. When the attitudes and behaviors of the participants in our study toward herbal products were examined, it was found that about half of the individuals (52.8%) purchased herbal products from herbalists/spice stores and 78.4% of them did not tell their doctor about the herbal product they used. However, 77.0% of respondents paid attention to "product safety" and 64.4% to "product content" when selecting these products. Interaction between patients and doctors may have been limited by the imposition of mandatory quarantine and curfews during the pandemic, as well as the reluctance of many people to enter hospitals due to the high risk of COVID-19 transmission. However, dietary supplements and herbal products are widely recognised as safe, so patients may not feel the need to disclose their intake to doctors.

CONCLUSION

The pandemic has heightened health awareness and made individuals think more about their health. People have increasingly turned to supplements and herbal products to support their health and immune function in these difficult times. Although supplements and herbal products are being used to support nutrition or boost immunity, individuals are experiencing adverse health effects from incomplete or incorrect information about supplements, easy accessibility and unknowing use of supplements. It is important to remember that interactions of supplements and herbal products with certain nutrients and medicines should be considered and that their use should be monitored by healthcare professionals. For these reasons, it is important for individuals to eat a healthy and natural diet, use supplements when needed under the supervision of professionals such as a doctor or nutritionist, and be aware of their effects on health. The use of herbal products and supplements should be evidence-based to ensure patient safety. It is anticipated that studies to raise public awareness of the conditions of use, indications and adverse effects of dietary supplements will be beneficial.

Ethics Committee Approval

This research complies with all the relevant national regulations, institutional policies and is in accordance with the tenets of the Helsinki Declaration, and has been approved by İzmir Katip Çelebi University Clinical Research Ethics Committee (approval number: 2020/1113).

Informed Consent

Since the study is web-based, the option “I agree to participate in the study” was added to the online questionnaire to obtain written informed consent.

Author Contributions

Concept – G.K., G.Ç.; Design - G.K., G.Ç..; Supervision – G.K.; Resources – G.K., G.Ç., T.Y., G.Y.D.; Materials - G.K., G.Ç., T.Y., G.Y.D.; Data Collection and/or Processing - G.K., G.Ç.; Analysis and/ or Interpretation – G.Ç.; Literature Search - G.K., G.Ç., T.Y., G.Y.D.; Writing Manuscript - G.K., G.Ç., T.Y., G.Y.D.; Critical Review - G.K., G.Ç., T.Y., G.Y.D.

Conflict of Interest

The authors have no conflict of interest to declare.

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