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ORIGINAL RESEARCH

The Effect Of The Covid-19 Pandemic On The Interest In Supplemental Food In Türkiye: A Google Trends Analysis Study

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Abstract
Objective: This study aims to assess the impact of the COVID-19 pandemic on consumer interest in dietary supplements in Türkiye through a Google Trends analysis.
Material-Method: The search volumes of 30 selected terms were evaluated using Google Trends between March 18, 2018, and March 15, 2022.
Results: During the study period, the term with the highest search volume was 'vitamin B12'. After the declaration of the COVID-19 pandemic, search volumes for biotin, probiotics, folic acid, calcium, magnesium, iron, prebiotics, fish oil, collagen, vitamin A, multivitamins, vitamin E, lipoic acid, zinc, glutathione, selenium, vitamin C, vitamin D, iodine, melatonin, propolis, vitamin K, bromelain, and curcumin showed statistically significant increases ($p<0.005$).
Conclusion: This study demonstrates an increased interest in dietary supplements in Türkiye following the onset of the COVID-19 pandemic. The findings underscore the growing attention to dietary supplements during this period.
Keywords: COVID-19, Dietary Supplements, Google Trends

INTRODUCTION

According to the U.S. Food and Drug Administration (FDA), Dietary Supplements (DS) are products intended to supplement the diet, which differ from conventional foods.[1] The Turkish Ministry of Agriculture and Forestry defines DS as products prepared in various forms, such as capsules, tablets, lozenges, single-use powder packets, liquid ampoules, dropper bottles, and similar liquid or powder forms. These products may contain concentrated or extracted nutrients or physiologically active substances of plant, plant-based, animal origin, or similar substances, either alone or in mixtures. They supplement normal nutrition by providing additional nutrients such as vitamins, minerals, proteins, carbohydrates, fiber, fatty acids, amino acids, or other physiologically active substances beyond the standard diet.[2]

A sufficient and balanced diet is essential for growth, development, maintaining good health, preserving well-being, enhancing health, and reducing the risk of chronic diseases.[3] While DSs are used in the context of supplementing nutrition, it is emphasized that there is no need for such supplements in a diet that is already sufficient and balanced.[4] However, due to the increasing population and busy lifestyles, dietary disruptions can occur, leading to a need for food supplements.[5] Nowadays, the belief that adequate nutrition, being healthier and more energetic, treating diseases, or preventing them can be achieved through supplements that are natural, reliable, free of side effects, and easily accessible has increased the interest in dietary supplements.[6-11]

COVID-19 is a viral infectious disease. It started in the Wuhan province of China in 2019, spread globally, and was declared a pandemic by the World Health Organization in March 2020. The absence of a specific treatment for COVID-19 has led individuals to take preventive measures. Studies have observed an increasing trend in advertising dietary supplements that are believed to assist in treating and preventing COVID-19. Despite scientific evidence regarding the immune-supporting, anti-inflammatory, antioxidant, and antiviral properties of various bioactive substances, guidelines for using dietary supplements in COVID-

19 treatment do not provide specific recommendations.[12-14]

Google Trends has provided real-time indices of user-entered queries on the Google search engine daily, weekly, monthly, and yearly since 2006. The data presented indicate the intensity of user interest, specifically in a given region, for a connected term rather than the absolute volume of searches.[15] The query index offered by Google Trends is based on the query share, calculated by dividing the total volume of searches for a specific search term in a particular geographic area by the total number of queries in that region for the specified period.[16] A value of "100" (hundred) represents the day with the highest search interest in the subject, while "0" (zero) signifies that there was insufficient search volume for the subject.

In this study, the impact of the COVID-19 pandemic on consumers' interest in DSs in Türkiye was aimed to be determined through Google Trends.

MATERIALS AND METHODS

The search volumes conducted on Google Trends between March 18, 2018, and March 15, 2022, were evaluated in the study. To investigate the interest in dietary supplements, 30 search terms were determined by examining studies on COVID-19 and nutrition from pubmed.ncbi.nlm.nih.gov (Vitamin A, Vitamin D, Vitamin C, Vitamin E, Vitamin K, Vitamin B12, Folic Acid, Biotin, Calcium, Magnesium, Iron, Iodine, Zinc, Selenium, Coenzyme Q, Omega-3, Glutathione, Collagen, Lipoic Acid, Arginine, Carnitine, Curcumin, Bromelain, Black Seed, Propolis, Probiotic, Multivitamin, Melatonin, Prebiotic, Ginseng). March 15, 2020, was the boundary date to distinguish between the pre-COVID-19 and post-COVID-19 pandemic periods. Data was transferred to the Microsoft Office Excel program by filtering in the Google Trends application based on geographical location (Türkiye), search term, and language (Turkish equivalents of the terms) categories. Türkiye's weekly COVID-19 case and death numbers were obtained from the World Health Organization's (WHO) website.

Statistical Analysis

The data were analyzed using IBM SPSS (Statistical Package for Social Sciences) Statistics 22.0 software. Descriptive statistics were presented in numbers. The Kolmogorov-Smirnov test was applied to investigate the normal distribution of continuous variables. The data were analyzed using descriptive statistics, a dependent sample t-test, a Wilcoxon test, and Pearson and Spearman correlation analyses. A p-value of <0.05 was considered statistically significant in the results.

RESULTS

Table 1 presents the periods when the peak search volumes were reached for the 30 search terms included in the study.

In the week when the WHO declared a pandemic, the terms probiotic, multivitamin, and propolis reached the highest search volumes.

Throughout the 209 weeks of the study, the term with the highest search volume is vitamin B12. Vitamin B12 also had the highest search volume in the pre-pandemic period. After March 15, 2020, the highest search volume was observed in the terms 'biotin' and 'probiotic.' There was no statistically significant difference observed between the pre-pandemic and post-March 15, 2020 periods in searches for vitamin B12, carnitine, coenzyme Q, black seed, arginine, and ginseng ($p>0.05$) (Table 2).

During the COVID-19 pandemic period, the correlation between the search volumes of DS and the search term 'COVID-19,' as well as Türkiye's weekly case and death numbers, was analyzed. A moderate correlation was observed between the search volume for 'COVID-19' and the search volumes for vitamin C and propolis ($p<0.05$). In Türkiye, there was a moderate positive correlation between the weekly case numbers and the search volumes for vitamin K, vitamin B12, vitamin C, folic acid, calcium, magnesium, glutathione, bromelain, and melatonin ($p<0.05$). Moderate positive correlations were also found between the weekly death numbers in Türkiye and the search volumes for folic acid, calcium, magnesium, iron, glutathione, bromelain, and melatonin ($p<0.05$). There was a strong positive correlation between the search volume for iodine and the weekly case and death numbers in Türkiye ($p<0.05$). The search volumes for vitamin E, coenzyme Q, collagen, and prebiotics showed a positive correlation with COVID-19 search volume, Türkiye's weekly case and death numbers, while carnitine and curcumin exhibited a negative correlation with Türkiye's weekly case and death numbers (Table 3).

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Table 1. Peak periods of search volume for dietary supplements

Search term	Date range	Peak value
Selenium	01.01.2019-07.12.2019	100
Carnitine	07.07.2019-13.07.2019	100
Prebiotic	06.01.2019-12.01.2019 04.10.2020-10.10.2020	100
Folic acid	05.01.2020-11.01.2020	100
Curcumin	23.02.2020-29.02.2020	100
Probiotic	15.03.2020-21.03.2020	100
Multivitamin	15.03.2020-21.03.2020	100
Propolis	15.03.2020-21.03.2020	100
Zinc	22.03.2020-28.03.2020	100
Vitamin E	05.04.2020-11.04.2020	100
Coenzyme Q	05.04.2020-11.04.2020	100
Biotin	10.05.2020-16.05.2020	100
Fish oil	06.09.2020-12.09.2020	100
Black seed	15.11.2020-21.11.2020	100
Vitamin C	15.11.2020-21.12.2020	100
Vitamin D	29.11.2020-05.12.2020	100
Melatonin	27.12.2020-02.01.2021	100
Vitamin A	03.01.2021-09.01.2021	100
Collagen	24.01.2021-30.01.2021	100
Vitamin K	31.01.2021-06.02.2021	100
Ginseng	23.05.2021-29.05.2021	100
Glutathione	19.09.2021-25.09.2021	100
Iron	19.12.2021-25.12.2021	100
Bromelain	30.01.2022-05.02.2022	100
Arginine	06.02.2022-12.02.2022	100
Lipoic acid	13.02.2022-19.02.2022	100
Vitamin B12	27.02.2022-05.03.2022	100
Magnesium	27.02.2022-05.03.2022	100
İodine	27.02.2022-05.03.2022	100
Calcium	27.02.2022-05.03.2022	100

Table 2. COVID-19 period change in search volumes of dietary supplements

Search Term	Total (209 weeks)	Before March 15, 2020 (104 weeks)	After March 15, 2020 (105 weeks)	p
Vitamin B12	15235	7489	7746	0.177[1]
Biotin	14654	6396	8258	**<0.001**[1]
Probiotic	14651	6568	8083	**<0.001**[1]
Black seed	14266	7137	7129	0.564[1]
Folic acid	14187	6852	7335	**0.001**[1]
Calcium	13007	5748	7259	**<0.001**[1]
Magnesium	12941	5358	7583	**<0.001**[1]
Iron	12010	5607	6403	**<0.001**[2]
Prebiotic	11568	5510	6058	**0.040**[1]
Fish oil	11263	5322	5941	**<0.001**[1]
Collagen	10675	4663	6012	**<0.001**[1]
Carnitine	9876	5020	4856	0.356[1]
Vitamin A	9639	4171	5468	**<0.001**[1]
Arginine	9441	4445	4996	0.068[1]
Multivitamin	9354	3402	5932	**<0.001**[2]
Vitamin E	9301	4375	4926	**<0.001**[2]
Ginseng	9196	4646	4550	0.130[2]
Lipoic acid	8704	3785	4919	**<0.001**[1]
Zinc	7559	2925	4634	**<0.001**[2]
Glutathione	7520	2011	5509	**<0.001**[1]
Selenium	6619	2686	3933	**<0.001**[2]
Vitamin C	6472	1582	4890	**<0.001**[2]
Vitamin D	6141	2590	3551	**<0.001**[2]
Iodine	4765	1573	3192	**<0.001**[2]
Melatonin	4722	1836	2886	**<0.001**[2]
Propolis	4364	1884	2480	**<0.001**[2]
Vitamin K	3187	1424	1763	**<0.001**[2]
Bromelain	2862	489	2373	**<0.001**[2]
Coenzyme Q	2761	1373	1388	0.983[2]
Curcumin	1790	788	1002	**0.006**[2]

[1]Dependent Sample T Test, [2]Wilcoxon Test

Table 3. Correlation between dietary supplements and COVID-19 search volume, weekly number of cases and deaths

Search Term	COVID-19 search volume		COVID-19 weekly cases		COVID-19 weekly death count	
	p	r	p	r	p	r
Vitamin A	0.219[1]	-0.121	**<0.001**[1]	**0.393**	**<0.001**[1]	**0.348**
Vitamin D	0.100[2]	0.161	**0.005**[2]	**0.272**	**0.030**[2]	**0.211**
Vitamin E	0.157[2]	0.139	0.123[2]	-0.151	0.868[2]	-0.016
Vitamin K	0.065[2]	-0.181	**<0.001**[2]	**0.435**	**<0.001**[2]	**0.399**
Vitamin B12	0.089	-0.167	**<0.001**[1]	**0.438**	**0.009**[1]	**0.253**
Vitamin C	**<0.001**[2]	**0.440**	**<0.001**[2]	**0.433**	**0.002**[2]	**0.304**
Folic acid	**<0.001**[1]	**-0.368**	**<0.001**[1]	**0.582**	**<0.001**[1]	**0.476**
Biotin	**0.005**[1]	**-0.272**	**<0.001**[1]	**0.352**	**<0.001**[1]	**0.367**
Calcium	**0.001**[1]	**-0.325**	**<0.001**[1]	**0.506**	**<0.001**[1]	**0.431**
Magnesium	**0.002**[1]	**-0.300**	**<0.001**[1]	**0.486**	**<0.001**[1]	**0.444**
Iron	**<0.001**[2]	**-0.419**	**<0.001**[2]	**0.379**	**<0.001**[2]	**0.425**
Iodine	**0.007**[2]	**-0.261**	**<0.001**[2]	**0.667**	**<0.001**[2]	**0.623**
Zinc	**0.012**[2]	**0.243**	**<0.001**[2]	**0.399**	**<0.001**[2]	**0.346**
Selenium	0.977[2]	0.003	**0.002**[2]	**0.303**	**<0.001**[2]	**0.379**
Coenzyme Q	0.683[2]	-0.040	0.411[2]	0.081	0.904[2]	0.012
Fish oil	0.712[1]	0.036	**0.011**[1]	**0.248**	0.298[1]	0.103
Glutathione	0.439[1]	0.076	**<0.001**[1]	**0.555**	**<0.001**[1]	**0.498**
Collagen	0.465[1]	-0.072	0.518[1]	0.064	0.505[1]	0.066
Lipoic acid	0.065[1]	-0.181	**<0.001**[1]	**0.312**	**0.014**[1]	**0.240**
Arginine	0.165[1]	-0.137	**0.013**[1]	**0.242**	0.655[1]	0.044
Carnitine	0.548[1]	-0.069	**<0.001**[1]	**-0.375**	**<0.001**[1]	**-0.479**
Curcumin	**<0.001**[2]	**0.335**	**<0.001**[2]	**-0.568**	**<0.001**[2]	**-0.532**
Bromelain	**<0.001**[2]	**-0.398**	**<0.001**[2]	**0.589**	**<0.001**[2]	**0.504**
Black seed	**0.045**[1]	**0.196**	0.914[1]	-0.011	0.859[1]	-0.018
Propolis	**<0.01**	**0.441**	0.492	0.068	0.567[2]	0.056
Probiyotik	0.710[1]	-0.037	**0.003**[1]	**0.286**	**0.014**[1]	**0.239**
Multivitamin	**<0.001**[2]	**0.345**	**<0.001**[2]	**0.322**	0.093[2]	0.165
Melatonin	**0.04**[2]	-0.197	**<0.001**[2]	**0.443**	**<0.001**	**0.552**
Prebiotic	0.605[1]	0.051	0.328[1]	0.096	0.206[1]	0.124
Ginseng	0.889[2]	-0.014	**0.040**[2]	**0.195**	0.394[2]	0.084

[1]Pearson Correlation Test, [2] Spearman Correlation Test

DISCUSSION

The increasing understanding of 'being healthy' has heightened interest in alternative ways such as dietary supplements.[17] Research conducted in various countries has shown that the usage rates of dietary supplements range from 22% to 53%.[18] The changes in lifestyle and dietary habits during the COVID-19 pandemic have also contributed to further acceleration in the dynamic growth of the dietary supplements market.[19-21]

In Türkiye, there are 18,449 registered dietary supplement products in various forms on the 'Approved List of Dietary Supplements' by the Ministry of Agriculture and Forestry[2]. According to a study conducted by the Dietary Supplements and Nutrition Association in 2021, the usage of dietary supplements was found to be 53%. In the same survey, 71% of participants reported using dietary supplements to boost their immunity during COVID-19.[22]

We observed a statistically significant increase in search volumes for 24 out of the 30 search terms included in our study during the post-pandemic period, and this is a noteworthy finding.

In a study conducted before the pandemic, it was found that the most commonly used dietary supplement was vitamin B12.[23] In our study, it was observed that the most searched dietary supplement on Google Trends was B12. There was no statistically significant difference in search volumes between the pre-pandemic and post-pandemic periods ($p>0.05$). This may be due to the widespread awareness of the B12 vitamin among people even before the pandemic.[23] This might be because the awareness of vitamin B12 was already widespread among people before the pandemic.

Anemia is one of the common health issues.[24] The most frequent causes of anemia in adulthood are iron deficiency, B12, and folate deficiencies. Additionally, the immune system requires iron, B12, and folate to maintain its active and continuous function.[25] Vitamins A, C, E, D, fish oil, zinc, and pre/probiotics, all known for their antioxidant properties, have immune-boosting capabilities.[26]

Glutathione is an antioxidant molecule in preserving the structural and functional integrity of cells, tissues, and organ systems.[27] Lipoic acid prevents

free radical damage and regenerates vitamins E, and C.[28] Bromelain and curcumin are known for their anti-inflammatory properties.[29,30] A review has indicated that selenium and coenzyme Q may positively impact the course of COVID-19 due to their effects on oxidative stress[31]. One study presented that propolis is an effective antioxidant and anti-inflammatory agent, particularly promising for cardiometabolic health.[32] In our results, the search volumes for iron, vitamin B12, folate, vitamins A, C, E, D, fish oil, zinc, pre/probiotics, bromelain, curcumin, selenium, and propolis were significantly higher after the pandemic. The lack of a known treatment for COVID-19 and people's inclination toward health-protective approaches could be the reason for this difference.

Similar to previous studies, search volumes for calcium, magnesium, vitamins D and K, collagen, and biotin, which are preferred for strengthening the musculoskeletal system, as well as personal care products, showed a significant difference in search volume before and after the pandemic.[33-35] With the advent of COVID-19, people spending more time at home due to quarantine and isolation measures, reduced physical activity, and increased exposure to social media could be the reasons for this situation.

Melatonin is the primary neurohormone secreted by the pineal gland and regulates the sleep-wake cycle.[36] Changes in people's sleep patterns and a decrease in sleep quality during the pandemic, along with their search for a solution to this issue, could explain the difference in melatonin search volumes.

Iodine is a trace element found in hormones necessary for the functioning of the thyroid gland.[37] During the pandemic, the potential effects of iodine-containing oral and nasal sprays, as well as iodine supplements, on inflammatory processes with antiviral activity against COVID-19 have been the subject of research.[38] In our study, a difference in search volumes was also observed in the post-pandemic period.

In one study, patients with post-COVID syndrome complaining of chronic fatigue were given carnitine, as well as vitamins B, C, and D, and it was suggested that dietary supplements could be helpful for health in post-COVID syndrome.[39] Another study indicated that ginseng use might be beneficial for chronic fatigue observed after viral infections.[40] Black seed, on the other hand, is a medicinal plant believed to be good for coughs in popular culture.[41] In our study, the search volume for carnitine, ginseng, and black seed did not differ between the pre-pandemic and post-pandemic periods. This might be because individuals did not prioritize dietary supplements in a symptomatic approach.

When examining the correlation between Türkiye's weekly COVID-19 case and death numbers and DSs, moderate positive correlations were found, respectively, between the search volumes for K vitamin, B12 vitamin, C vitamin, folate, calcium, magnesium, glutathione, bromelain, melatonin, and between the search volumes for folate, calcium, magnesium, iron, glutathione, bromelain, melatonin. Iodine showed a high level of positive correlation with weekly case and death numbers. This might be due to the prominent portrayal of these preparations for their immune-boosting and virus-eliminating properties on social media.

Limitations

This study presents search results from Google for the specific terms related to dietary supplements that were identified. However, the results may differ if research were conducted using other search engines, which could influence the overall findings. Additionally, changes in individuals' internet usage habits during the pandemic and the possibility that they used different search terms beyond those identified in this study may have affected the results.

CONCLUSION

The dietary supplement market is growing globally, and there is an increasing interest in dietary supplements.

The easy accessibility of dietary supplements and the lack of information regarding their effects and potential side effects can contribute to the increasing interest in them.

Raising public awareness about dietary supplements is important for protecting and improving public health.

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