



Attitudes of female respondents about the use of immunity supplements before and during the COVID-19 pandemic

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ABSTRACT

Introduction: With the advent of the COVID-19 pandemic, people's dietary habits have changed, so the importance of additional supplementation has become a current topic. The aim of this study is to analyze the attitude of female respondents toward dietary supplementation before and during the COVID-19 pandemic.

Methods: The research is a cross-sectional study conducted in two different time periods. The sample consisted of two female subsamples who purchased immunity preparations from Verdant Pharmacy before the pandemic (n = 81) and during the pandemic (n = 120). Female respondents in both subsamples were: Of the same age, in the same health condition, residing in the same area (municipality), users of a local pharmacy located near the health center. The research instrument was a non-standardized questionnaire "Assessment of attitudes towards nutritional supplementation," which consisted of nine questions.

Results: During the pandemic COVID-19, the attitude toward the use of preparations to strengthen immunity differs by 7% compared to the pre-pandemic check. The attitude toward the use of preparations to strengthen immunity throughout the year increased by 32.3% (53.3%) during the pandemic, and the attitude toward the choice of preparations to strengthen immunity changed by 13% during the pandemic COVID-19 based on own experience and by 17% based on the recommendation of the pharmacist.

Conclusion: The pandemic COVID-19 has contributed to a change in female respondents' attitudes toward nutritional supplementation to strengthen the immune system during a pandemic. With the help of the media, public health recommendations, and people's fear of disease, the COVID-19 pandemic led to a change in respondents' attitudes compared to the pre-pandemic period.

Keywords: Immunity; COVID-19 pandemic; pharmacies

INTRODUCTION

The basic function of the immune system is to protect the human body from infectious agents from the external environment such as bacteria, viruses, fungi, and parasites (1). Proper nutrition plays an important role in maintaining the proper functioning of the immune system: Varied, balanced, with as many raw foods as possible, and fewer canned and heat-treated foods. Adequate intake of necessary micronutrients, special food groups, and adherence to special diets has a positive effect on maintaining health (2). Insufficient intake of the necessary micronutrients may reduce the immune response (3). Therefore, it is

very important to pay attention to diet and intake of key micronutrients during various diseases and thus also during the pandemic COVID-19 (4).

With the spread of the COVID-19 pandemic, public health authorities around the world have implemented isolation and movement control measures as a measure to prevent the spread of coronavirus infection (SARS-CoV-2). The introduction of measures to prevent the spread of coronavirus infection has had a negative impact on healthy lifestyles, that is, the reduction of physical activity and the development of a sedentary lifestyle in humans, the impairment of sleep quality, and changes in dietary habits (5).

Infectious diseases have caused a large number of deaths throughout history. During infectious disease pandemics, people usually experience a sense of fear that causes people to change their behavior. Because of the increase in false news and unverified information in the media and social media during a pandemic, people are unable to distinguish

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scientific evidence from less reliable sources of information (6). Dietary supplements have been promoted in the media without any evidence as a preventive measure or remedy against COVID-19 (7).

The use of dietary supplements increased rapidly after the outbreak of coronavirus disease (COVID-19), and the main reason given for the increased use was to strengthen the immune system. The instructions for the treatment of COVID-19 do not include the use of dietary supplements, although there is scientific evidence that dietary supplements influence the strengthening of the immune system through their anti-inflammatory, antiviral, and antioxidant effects (8). In the study of viral infections, especially acute respiratory infections, nutritional status plays an important role in patient outcomes (9). Viral infections occur due to a weakened immune system associated with an inadequate supply of micronutrients such as vitamins (Vitamin A, B6, B9, B12, C, D, and E) and minerals (zinc, iron, selenium, magnesium, and copper) (10).

Proper diet sometimes cannot provide sufficient amounts of micronutrients needed for optimal functioning of the immune system, and they must be supplied to the body as an additional supplement. The supplements most commonly used in the treatment of acute respiratory infections are: Vitamin C, Vitamin D, selenium, and zinc. It has been shown that supplemental intake of Vitamin C, Vitamin D, and zinc plays an important role in the proper functioning of the immune system and reduces the risk of coronavirus infection (11). Dietary principles based on the use of vitamins (C, D, and E), minerals (zinc, iron, and selenium), and probiotics may contribute to the treatment and prevention of COVID-19 due to their anti-inflammatory and antioxidant effects (12).

Because of changes in dietary habits during the COVID-19 pandemic, public health was forced to raise people's awareness of the importance of proper food choices and essential micronutrient intake to improve immune system function and maintain overall health (13). The aim of this article was to analyze the attitudes of female respondents toward dietary supplementation before and during the COVID-19 pandemic, emphasizing the importance of dietary supplementation in maintaining health during the COVID-19 pandemic.

METHODS

The research is a cross-sectional study conducted on two different subsamples of female respondents at Verdant Pharmacy. The survey was conducted twice using a questionnaire: The 1st time before the pandemic COVID-19 (February 2020) and the 2nd time during the pandemic COVID-19 (June 2021). Data collection lasted 1 month in both periods. Study is approved by Ethical committee of University of Sarajevo - Faculty of Health studies.

The sample consists of two different subsamples of female respondents: One before the pandemic COVID-19 ($n = 81$) and the other during the pandemic COVID-19 ($n = 120$). Female respondents in both subsamples were of the same age (between 31 and 45 years), had the same health status (healthy, without symptoms of COVID-19 disease at the time of filling out the questionnaire), lived in the same area (area of the municipality of Novo Sarajevo, the city of Sarajevo, Bosnia and Herzegovina), and used the services of the local pharmacy next to the health center, Verdant

Pharmacy. To participate in the study, female respondents were randomly selected during a visit to the pharmacy. >Before completing the questionnaire, participants were introduced to the study and signed their formal consent. Participation in the study was voluntary and anonymous. The questionnaire was in printed form and was completed in the part of the pharmacy designated for consultation with visitors. The pharmacist was available to assist respondents during both periods if they were uncertain about how to complete the questionnaire.

A small number of male respondents participated in the research at the time of data collection. Fifteen male respondents participated in the study before the pandemic COVID-19 and 21 male respondents participated during the pandemic COVID-19, so the author decided to process the results of the female respondents' answers. Criteria for inclusion in the research: Female respondents, persons aged 31–45 years, and persons residing in Novo Sarajevo municipality. Exclusion criteria: Male respondents, persons younger than 31 years, persons older than 45 years, and persons not residing in Novo Sarajevo municipality.

The research was conducted using a non-standardized survey questionnaire: "Assessment of attitudes toward nutritional supplementation" consisting of nine questions. Answers were offered for the first eight questions, and respondents could only check one answer. The last, ninth question consisted of five assertions with Likert scale response options, where respondents had to tick a number on a scale of 1-5 that best described their position (level 1 – *I completely agree* and level 5 – *I completely disagree*).

Data were computed using the statistical package SPSS ver. 23.0. For research purposes, the percentages to the questions were calculated and the differences between the answers for the first eight questions were determined by the Chi-square independence test (χ^2), whereas for the ninth question, the difference between the views was tested by the Mann–Whitney U-test. In calculating the χ^2 test, the Cramer's V coefficient (CV) was calculated. A criterion at $p \leq 0.05$ level was chosen to assume statistical significance.

RESULTS

The results show that female respondents from both subsamples used preparations to strengthen immunity. During the pandemic COVID-19, attitudes toward the use of preparations to strengthen immunity differ by 7% compared to pre-pandemic controls. Respondents in both subsamples were most likely to purchase immunity supplements for themselves. Before the pandemic, 46% of respondents bought immunity boosting preparations for themselves, while during the pandemic, 63% of them bought immunity boosting preparations. The attitude to the use of preparations for immunity strengthening over half a year differs by 18.9% in favor of respondents who answered the questionnaire during the pandemic. The attitude toward the use of preparations to strengthen immunity over the whole year increased by 32,3% (53.3%) during the pandemic. The purpose of using preparations to strengthen immunity changes in the observed subsamples. In the pre-pandemic subsample, the use of preparations to strengthen immunity to prevent recurrence after cure is 10% lower than in the

pandemic responses, and the preventive purpose of using immunity preparations is 14% higher among female respondents during the pandemic COVID-19. Both subsamples are of the opinion that they used vitamin-mineral preparations the most (53.1–54.2%), while the opinion on the use of preparations to strengthen beta-glucan-based immunity (21.7%) and royal jelly (18.3%) increased in the pandemic period between 3.5 and 7%, and most respondents use preparations to strengthen immunity that is of natural origin (83–85%), while the percentage of the use of preparations of synthetic origin (15–17%) increased slightly (2%) in the responses to the questionnaire during the pandemic period COVID-19. Masters of pharmacy have an impact on the choice of preparations to strengthen immunity, and almost every other respondent takes preparations on their recommendation. It is noticeable that the percentage of own choice of preparations to strengthen immunity during a pandemic decreases (9%) and the choice of preparations based on experience increases by 11% (Table 1).

When analyzing the differences in the responses of female respondents before and during the pandemic COVID-19, statistically significant differences were found for several questions. Based on the results of the response to the question about the frequency of the use of immunity preparations, we note that there is a statistically significant difference between the attitudes toward the use of preparations to strengthen immunity (Pear. $\chi^2 = 57.78, p = 0.00$) and should be used to a greater extent during the pandemic period. When examining the magnitude of impact or strength of impact between variables, Cramer's V coefficient shows a high relationship between respondents' attitudes before and during the pandemic ($CV = 0.54$). In examining differences in female respondents' attitudes toward the choice of preparations to strengthen immunity, we found that there were differences between responses during the pandemic and before the pandemic COVID-19. Respondents' attitudes toward the choice of preparations to strengthen immunity changed based on their own experience by 13% and the recommendation of the master of pharmacy by 17%. The results are statistically significant between attitudes in the observed samples (Pear. $\chi^2 = 26.41, p = 0.00$), and the Cramer's V coefficient shows a high-level relationship between respondents' attitudes before and during the pandemic COVID-19 ($CV = 0.36$) (Table 2).

When examining personal attitudes toward preparations to strengthen immunity, female respondents during the pandemic COVID-19 believe that effective preparations must be recommended to others, that the price of the preparation does not determine the use of preparations to strengthen immunity, and that a healthy diet is not sufficient to strengthen immunity. Analysis of the results of the Mann-Whitney U-test showed that there were differences on three questions: Assessment of recommendation to use supplements for others ($Z = -2.61, p = 0.01$), assessment of use conditioned by product price ($Z = -2.41, p = 0.03$), and assessment of attitude that a healthy diet does not require use of supplements ($Z = -2.21, p = 0.03$) (Table 3).

DISCUSSION

The World Health Organization (WHO) has announced that there is no food or natural remedy proven to prevent

the development of COVID-19 (14). The use of dietary supplements to prevent and treat coronavirus infection has been promoted in public health since the beginning of the pandemic, emphasizing the importance of nutritional status to patient outcomes. With the development of the COVID-19 pandemic, there has been increased use and purchase of preparations to strengthen immunity (8). According to our research, attitudes toward the use of preparations to strengthen immunity differ by 7% during a pandemic compared with before the pandemic. Greater use and purchase of preparations to strengthen immunity during a pandemic compared with the pre-pandemic period COVID-19 was also found in studies in Lebanon (7) and the United States (15). The most common reasons for increased nutritional supplementation in healthy people during the pandemic COVID-19 are: Strengthening the immune system, maintaining general health, and reducing the risk of developing serious diseases (7,16). A survey conducted in Lebanon found that female respondents were most likely to purchase supplements to strengthen immunity during both periods: Before and during the COVID-19 pandemic (7).

The introduction of measures such as isolation, social distancing, limiting the working hours of many institutions, and reducing the amount of basic services provided to people directly affected the way people lived. The greatest impact was observed on eating habits, diet, and physical activity. The decrease in physical activity as a result of the pandemic COVID-19 has a negative impact on mental and physical health. Limited movement and daily activities favor irregular diets that are associated with high-caloric intake. The way of eating and eating habits under the influence of fear of stress lead to an increased intake of unhealthy and poor quality foods (17). Allhuseini et al. pointed out that respondents' dietary habits changed significantly during the COVID-19 pandemic and that public health played an important role in raising awareness of proper nutrition (13). A proper diet can improve health and reduce the risk of illness and death caused by SARS-CoV-2. Increased consumption of fruits, vegetables, and grain-rich foods is the basic recommendation of health experts and nutritionists. Health professionals are increasingly implementing nutrition strategy recommendations in their practice to improve the health status of people worldwide (18). During the pandemic COVID-19, the media showed greater interest in the role of preparations to boost immunity than in the pre-pandemic period (19).

People's interest in proper nutrition and in preparations to strengthen immunity increased after the pandemic than before the pandemic. The results of our research, in which we investigated the purpose of using preparations to strengthen immunity, confirm the changed attitude of the respondents. Respondents who participated in the survey before the pandemic COVID-19 used more immunity boosting supplements than respondents during the pandemic COVID-19 because of disease conditions, whereas respondents during the pandemic used more immunity boosting supplements for prevention purposes than respondents before the pandemic COVID-19. It is necessary to emphasize the rational use of dietary supplements in humans to prevent supplement intake from exceeding recommended levels (8).

TABLE 1. Percentage of respondent's responses before/during the pandemic coronavirus disease-19

Questions	Responses	Before the pandemic COVID-19, n (%)	During the pandemic COVID-19, n (%)
Do you use preparations to strengthen immunity?	Yes	70 (86)	112 (93)
	No	11 (14)	8 (7)
Who do you buy preparations to strengthen immunity for?	Myself	37 (46)	75 (63)
	Boyfriend	4 (5)	1 (1)
	Wife	12 (15)	16 (13)
	Children	17 (21)	19 (16)
	Parents	11 (14)	9 (8)
How often do you use preparations to strengthen immunity?	Once a year	14 (17.3)	3 (2.5)
	Two to three times a year	27 (33.3)	7 (5.8)
	Four to five times a year	12 (14.8)	7 (5.8)
	Over half a year	11 (13.6)	39 (32.5)
	Throughout the year	17 (21)	64 (53.3)
Purpose of using preparations to strengthen immunity?	Disease conditions	32 (40)	19 (16)
	Preventive purpose	40 (49)	76 (63)
	Preventing recurrence of the disease after cure	9 (11)	25 (21)
Which preparations to strengthen immunity you use?	Vitamin-mineral preparations	43 (53.1)	65 (54.2)
	Preparations based on beta-glucans	12 (14.8)	26 (21.7)
	Omega-3 fatty acids	10 (12.3)	3 (2.5)
	Royal jelly	12 (14.8)	22 (18.3)
	Natural juices	4 (4.9)	4 (3.3)
Origin of the preparation to strengthen immunity?	Natural origin	69 (85)	99 (83)
	Synthetic origin	12 (15)	21 (17)
Who influences your choice of preparations to strengthen immunity?	Master of pharmacy in pharmacy	37 (46)	60 (50)
	Internet	7 (9)	6 (5)
	Own choice in pharmacy	17 (21)	14 (12)
	Own choice based on previous experience	14 (17)	33 (28)
	Recommendation of a friend/family member	6 (7)	7 (6)
What matters to you when choosing an immunity boost?	Previous own experience	23 (28)	49 (41)
	Master of pharmacy recommendation	26 (32)	59 (49)
	Packaging and appearance of preparations to strengthen immunity	1 (1)	0 (0)
	The price of preparations to strengthen immunity	20 (25)	10 (8)
	Manufacturer of preparations to strengthen immunity	8 (10)	1 (1)
	Advertising of preparations to strengthen immunity	3 (4)	1 (1)

n: Number, %: Percentage, COVID: Coronavirus disease

Supplementation with vitamins and minerals such as zinc and Vitamins A, C, and D is recognized as successful for the proper functioning of the immune system in the prevention and treatment of viral infections (18). According to the European Food Safety Authority (EFSA), vitamins (A, C, D, B6, B9, and B12) and minerals (zinc, copper, iron, and selenium) benefit the prevention, treatment, and relief of COVID-19 symptoms due to their anti-inflammatory and antioxidant effects (20). Because of the anti-inflammatory effect of vitamin-mineral preparations, they can be used as supportive therapy in the treatment of COVID-19 disease (21). The efficacy of vitamin-mineral supplements was confirmed in a 2021 study (Shakoor et al.) (22), while the use of vitamin-mineral supplements with omega-3

fatty acids and probiotics has shown a lower risk of SARS-CoV-2 virus infection in the United Kingdom (23). High doses of Vitamin C by intravenous administration can prevent the occurrence of COVID-19 due to the strong antioxidant effect of Vitamin C and can be used in treatment (24). The results of our research show that respondents most frequently used vitamin-mineral supplements during both periods of the study. Beta-glucan and royal jelly preparations were used more frequently during the pandemic period. The study found no statistically significant difference between the attitudes of respondents before and during the pandemic regarding the use of preparations by origin. The origin of preparations to boost immunity was the focus during the pandemic COVID-19. Proven

TABLE 2. Differences in attitudes of the frequency of use of preparations to strengthen immunity and the importance of factors influencing the choice of supplements

Questions	Attitudes				Pear. χ^2	C.V
	Before the pandemic COVID-19		During the pandemic COVID-19			
	n (%) within attitude	Adj. r	n (%) within attitude	Adj. r		
How often do you use preparations to strengthen immunity?						
Once a year	14 (17.3)	3.69	3 (2.5)	-3.69	57.78**	0.54
Two to three times a year	27 (33.3)	5.10	7 (5.8)	-5.10		
Four to five times a year	12 (14.8)	2.13	7 (5.8)	-2.13		
Over half a year	11 (13.6)	-3.04	39 (32.5)	3.04		
Throughout the year	17 (21.0)	-4.59	64 (53.3)	4.59		
What is important to you when choosing an immunity boost?						
Previous own experience	23 (28)	-1.80	49 (41)	1.80	26.41**	0.36
Master of pharmacy recommendation	26 (32)	-2.40	59 (49)	2.40		
Packaging and appearance of preparations to strengthen immunity	1 (1)	1.22	0	-1.22		
The price of preparations to strengthen immunity	20 (25)	3.19	10 (8)	-3.19		
Manufacturer of preparations to strengthen immunity	8 (10)	3.04	1 (1)	-3.04		
Advertising of preparations to strengthen immunity	3 (4)	1.43	1 (1)	-1.43		

**0.01. Pear. χ^2 : Pearson correlation coefficient (χ^2), C.V: Cramer's V coefficient, Adj. R.: Corrected standard residues, Percentage within attitude: Percentage of responses within the sample, n: Number, COVID: Coronavirus disease

TABLE 3. General assessment of preparations to strengthen immunity

Attitude	Sample	M rank	Mann-Whitney U test	
			Z	p
Satisfaction with the use of preparations to strengthen immunity	Before pandemic	97.58	-1.12	0.26
	During pandemic	103.31		
Recommendation for the use of preparations to strengthen immunity	Before pandemic	91.15	-2.61	0.01
	During pandemic	107.65		
The use of preparations to strengthen immunity is conditioned by the price	Before pandemic	111.17	-2.14	0.03
	During pandemic	94.13		
Preparations to strengthen immunity are not effective	Before pandemic	106.60	-1.36	0.17
	During pandemic	97.22		
A healthy diet does not require the use of preparations to strengthen immunity	Before pandemic	110.44	-2.21	0.03
	During pandemic	94.63		

M rank: Mean rank value, p: Signification

nutraceuticals that have been shown to help boost immunity are zinc, Vitamin D, Vitamin C, curcumin, cinnamaldehyde, probiotics, quercetin, lactoferrin, etc. Mrityunjaya et al. pointed out that grouping some of the aforementioned phytonutrients in the form of immunity boosting supplements may provide immunity boosting, prevent the spread of coronavirus infection, prevent the disease from progressing to advanced stages, and reduce inflammatory conditions, as well as provide a prophylactic effect against COVID-19 (25).

In medicine and health care, teamwork is the key to achieving significant outcomes during a pandemic. Individual health can be improved through a multidisciplinary approach (26). For the health-care system to respond adequately to the demands of the pandemic, health care

workers who have worked in contact with people have proven to be the most important resource (27). Because of the reliance on health care workers, the main source of information for additional supplement use was health care workers. According to Mohsen et al., the number of respondents seeking information about the need for supplementation increased to 63.6% during the pandemic, whereas in the pre-pandemic period COVID-19, interest was lower at 61.4% (7). The same results were obtained in our research, where respondents indicated great confidence in the masters of pharmacy when choosing an immunity preparation. Almost every other respondent takes preparations based on the recommendation of the master of pharmacy. When factors influencing the choice of preparations to strengthen immunity were examined, no statistically significant differences were found before and during the pandemic COVID-19. Amariles et al. emphasized the importance of the role of pharmacists in educating the patient, obtaining new knowledge, referral, and management of cases in which they have some doubts (28).

For respondents in both subsamples, their personal experience in the pharmacy proved to be significant. When examining respondents' attitudes toward factors in choosing specific preparations to boost immunity, we find that there are differences between respondents' responses before and during the pandemic COVID-19. During the pandemic, the attitude of respondents in choosing preparations to strengthen immunity changed based on their own experience (13%) and the recommendations of the master of pharmacy's recommendations by 17%. The price of the preparation and the manufacturer of the product did not play an important role in the choice of preparations for strengthening immunity, as was the case before the pandemic. Respondents during the pandemic believe that the price of immunity boosting preparations is not a determining factor for their use, that a healthy diet is not sufficient, and that effective immunity boosting preparations must be recommended. Mohsen et al. came to the same conclusions in their research. Despite the high cost of supplements,

more supplements were purchased during the pandemic COVID-19 (24.8%) than before the pandemic COVID-19 (20.4%) (7).

Health professionals are increasingly implementing nutrition strategy recommendations in their practice to improve the health status of people worldwide. The COVID-19 pandemic, like all previous pandemics, has led to lifestyle adjustments to the situation and demonstrated the importance of dietary habits and nutritional intake in maintaining normal immune system function. Taking dietary supplements is a safe, effective, and simple strategy that helps maintain optimal immune function (29).

Research on the use of preparations to strengthen immunity in healthy individuals and those infected with coronavirus should form the basis for global clinical trials that would allow the development and establishment of guidelines for the use of immunity boosting preparations in the prevention and treatment of coronavirus infection based on clinical evidence. The development of guidelines on the use and importance of preparations to strengthen immunity in the COVID-19 pandemic can serve as a guide for the appropriate protection of health in all potential future pandemics.

CONCLUSION

The importance of diet and nutritional supplementation is reflected in their synergistic effect, which allows the proper functioning of the immune system. Therefore, it is important to make people aware of the importance of proper nutritional habits and intake of essential micronutrients during pandemics. The pandemic COVID-19 has helped to change the attitude of female respondents toward nutritional supplementation to strengthen the immune system during the pandemic. Respondents' attitudes toward the use of preparations to strengthen immunity during the pandemic COVID-19 differ by 7% compared with the pre-pandemic period. Respondents' attitudes toward the use of preparations to strengthen immunity throughout the year increased by 32.3% during the pandemic, and attitudes toward the preventive use of preparations to strengthen immunity increased by 14% during the pandemic. Respondents' attitudes toward the selection of preparations to strengthen immunity changed during the pandemic COVID-19 by 13% based on their own experience and by 17% based on the recommendations of the master of pharmacy. Respondents during the pandemic COVID-19 believe that it is necessary to recommend effective preparations to others and that a healthy diet is not enough to strengthen immunity. The topic is current, especially since the COVID-19 pandemic is still ongoing and its consequences will be felt for a long time.

DECLARATION OF INTERESTS

Authors declare no conflict of interests.

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