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Research Article

Awareness of Dietary Supplements among the Saudi Population: A Cross-Sectional Study

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Abstract

In Saudi Arabia, there is a trend in vitamin and mineral deficiency. Low intake or overconsumption of a dietary supplement may have adverse health effects. Therefore, the objective of this study was to investigate the awareness of the Saudi population concerning the use of dietary supplements. A descriptive, cross-sectional study was conducted. Data were obtained using an online questionnaire designed to collect information about dietary supplements (DS). The study population consisted of 1572 participants. The knowledge scores were calculated as the mean ± the SD. For all participants (n = 1572), three categories were used to delineate the level of knowledge regarding DS: a high level, a medium level and a low level. The results demonstrated that 76% of the total number of participants had a low level of knowledge, while 24% had a moderate level and 0.1% had a high level of knowledge.

Significant associations were observed between gender and knowledge score ($P = 0.032$), education and knowledge score ($P < 0.001$), and the profession with knowledge score ($P < 0.001$). Moreover, monthly income was significantly correlated with the mean score ($P = 0.019$), and a significant association was observed between smoking and knowledge score ($P = 0.001$).

In this study, the participants had low knowledge and poor perceptions regarding dietary supplements. Of the total number of participants, 67.1% believed that there was no benefit to consuming DS, and 95.5% had a false perception that DS cause side effects. Furthermore, 48% of participants were uncertain about the safety of DS. These findings elucidate a current gap in knowledge among the Saudi population concerning the use of DS. Nevertheless, a significant proportion of the participants demonstrated overall proficiency regarding supplements. However, the results also demonstrate that there is a requirement to increase awareness concerning DS and to promote the safe use of these supplements. This can be achieved through cooperative educational projects between the Ministry of Health, the Ministry of Education, and the Saudi Food and Drug Administration (SFDA).

Keywords: Dietary Supplements; Knowledge; Awareness; Attitude; Vitamins

Abbreviations

DS: Dietary Supplements; USFDA: US Food and Drug Administration; SFDA: Saudi Food and Drug Administration

Introduction

Dietary supplements (DS) are defined by the US Food and Drug Administration (USFDA) as pharmaceutical dosage forms containing one or more necessary nutrients, vitamins, minerals or herbs. Their intended use is to supplement the diet for a specific therapeutic purpose or to maintain general health and well-being and protect against disease. Furthermore, they may be required for nutritional support in certain physiological conditions such as high endurance exercise [1]. Recently, an increase in education, health awareness and the availability of DS has led to the widespread use of these supplements [2]. In Saudi Arabia, a recent study conducted on 351 young adults (aged 18 to 25 years) reported that 85.9% of females consumed DS compared with 13.9% of males [3].

Dietary supplements may be consumed for a variety of reasons, including protection against infection or health issues such as stress, osteoporosis, and neural tube defects during pregnancy. Furthermore, DS can be used to boost energy, support physical performance, and correct various lifestyle deficiencies [4]. Alfawaz., *et*

al. discovered that reasons for purchasing DS among participants in Saudi Arabia included a doctor's prescription, a vitamin deficiency, the condition of hair and nails. The authors also revealed that males used more DS than females solely for bodybuilding goals [5]. Moreover, studies have shown that the factors that influence adolescent consumption of DS vary according to gender, family income and physical exercise [6,7].

The beliefs and attitudes of individuals concerning the use of DS vary among populations and social classes. It has been found that university athletes believe that a regular diet is not sufficient for optimum performance, and they tend to consume DS to enhance their diet or gain a competitive edge Additionally, the authors revealed that males consumed DS to gain (or maintain) muscle mass, strength, and to boost exercise recovery while females primarily consumed DS to increase energy, maintain health, and prevent nutritional deficiency [8]. According to a recent study conducted on adult male members of fitness centres in Saudi Arabia, approximately half of the participants used multivitamins and protein supplements for bodybuilding and muscle-building purposes, while approximately one-quarter of participants used the supplements to enhance fitness and body movement, and eliminate fatigue [5]. Conversely, most male athletes may consume protein supplements to build muscle mass. Similarly, it was found that South Korean male university students who attempted muscle-building, consumed protein supplements [9].

The level of knowledge regarding DS has also been shown to vary among different cultures. In South Africa, it was reported that high numbers of participants were aware of the benefits of consuming DS to combat disease [10]. In the western region of Saudi Arabia, it was revealed that many participants with chronic heart disease who had vitamin D deficiency may not have had sufficient knowledge concerning the importance of vitamin D consumption. Despite this, the same group of participants had a positive attitude to sunlight exposure [11]. AlTamimi (2019) reported that 89.9% of female university students had a good understanding concerning the definition of DS and greater than half of the participants (53.2%) believed that DS are safe for consumption. Additionally, 45.6% of the participants consumed DS for aesthetic purposes [12]. Awareness regarding the benefits of DS should be combined with an understanding of their side effects. For instance, the overconsumption of DS coupled with uncontrolled access to such supplements is a cause for concern due to the potential for toxicity [13]. One study proved that the excessive consumption of calcium supplements was associated with an increased risk of coronary artery calcification among older adults, although a high intake of calcium from the diet had a beneficial effect on the arteries [14]. Moreover, the overconsumption of iron supplements has been shown to negatively impact the gastrointestinal tract, resulting in symptoms such as abdominal pain and constipation, particularly when the supplements were consumed without food [15]. Many studies have been conducted regarding the relationship between the overconsumption of DS and certain cancers. Despite the health benefits of folic acids, they may aggravate colorectal cancer when consumed in high doses. Similarly, vitamin A generally has an antioxidant effect, however, it may be associated with the formation of lung cancer if consumed in high doses [16,17]. Thus, increased education and understanding concerning DS are important to reduce the potentially hazardous effects of over or under consumption. To achieve this, the level of prior knowledge of individuals must be assessed. A small number of studies have investigated the level of knowledge concerning DS among male university students [6,18]. This study aimed to fill a gap in the literature by examining the awareness of the adult Saudi Arabian population concerning the consumption of DS.

Materials and Methods

Study Design and Sampling

This was a descriptive, cross-sectional study. A self-administered questionnaire was distributed electronically via social media. Inclusion criteria: citizen of Saudi Arabia who aged between 18 and 65 years and anyone who didn't fit the criteria was excluded. The sample size was calculated using a confidence level of 95% and a 5% margin of error. The study consisted of 1572 participants.

Development of the questionnaire

The questionnaire was distributed between April 20th and May 20th, 2020. The questionnaire was created in Arabic and English. The questionnaire was divided into two main parts. The first part focused on questions regarding socio-demographic data, anthropometric measurements, and physical activity levels. The second part focused on measuring awareness regarding nutritional supplements. The knowledge and awareness part consisted of three questions. The first question investigated the extent of an individual's knowledge and consisted of 12 sub-questions to ascertain whether the participants believed that supplements have no benefits, whether consuming too much of a supplement may cause side effects, whether fat-soluble vitamins may cause toxicity, whether they believed that it is necessary to consume supplements, whether they believed it is acceptable to consume supplements without consulting a specialist, whether the requirement for supplements varies with age or weight, whether they believed that supplements interact with food or medication, whether they believed that certain factors reduce or improve the absorption of DS, and whether they believed that supplements should be consumed at certain times. These questions were scored according to the following points system: I don't know (0), yes (0), and no (1). The second question was multiple choice and asked which of the following options could be considered as supplements: iron, vitamin C, calcium, arginine, omega-3, melatonin, and ginseng. It was scored as (1) per each op-

tion that was selected. The third question was multiple choice and asked which of the following supplements boosted immunity: ginger, garlic, honey, turmeric, and Nigella sativa. It was scored as (1) per each option that was selected. Knowledge was scored according to the following levels: high (20-24), medium (12-19), and low (less than 12). The study was ethically approved by the Biomedical Ethics Committee at Um Al-Qura University, Makkah City (HAPO-02-K-012-2020-10-447).

Statistical analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp). The frequency and percentages were used to display the categorical variables, while the minimum, maximum, mean, and standard deviation were used to display the continuous variables. The independent t-test and analysis of variance (ANOVA) test were utilised to examine associations. A Tukey post-hoc test was conducted following the ANOVA test to determine where the exact significant difference between the groups existed. The level of significance was set at $P \leq 0.05$.

Results and Discussion

The socio-demographic data of 1572 participants are presented in table 1. A total of [296 (18.8%)] males and [1276 (81.2%)] females were included. Among the females, [30 (2%)] were pregnant and [43 (3%)] were breastfeeding. Most of the participants were in the age range of 18 to 39 years (68.8%). One thousand four hundred and sixty-three (93.1%) participants were Saudis, and most resided in the western region of the country.

Socio-Demographical Characteristics		n (%)
Gender	Male	296 (18.8)
	Female	1276 (81.2)
Age	18-39	1082 (68.80)
	40-50	289 (18.40)
	51-64	182 (11.60)
	65 years and older	19 (1.20)
Nationality	Saudi	1463 (93.1)
	Non-Saudi	109 (6.9)
Place of Residency	Central Region	88 (5.60)
	Eastern Region	41 (2.60)
	Northern Region	14 (0.90)
	Western Region	1360 (86.50)
	Southern Region	69 (4.40)
Marital Status	Single	739 (47.00)
	Married	749 (47.60)
	Divorced/Widowed/ Separated	84 (5.30)
Education	High school and lower	344 (21.90)
	Diploma and Bachelor	998 (63.50)
	Higher education (Masters/PhD)	230 (14.60)
Profession	Public sector	393(25.00)
	Health sector	108 (6.90)
	Private sector	137 (8.70)
	Business owner	20 (1.30)
	Not currently employed	516 (32.80)
	Student	398 (25.30)
Profession required contacting others during the quarantine period	Yes	322 (20.5)
	No	1250 (79.5)
Monthly Income	Less than 5000 SR/ Month	739 (47.00)
	5000-10000 SR/Month	304 (19.30)
	10000-15000 SR/ Month	276 (17.60)
	15000-20000 SR/ Month	145 (9.20)
	Greater than 20000 SR/Month	108 (6.90)
Smoking	Yes	145 (9.2)
	No	1330 (84.6)
	Occasionally	97 (6.2)
BMI	Underweight	144 (9.20)
	Normal Weight	582 (37.00)
	Overweight	407 (25.90)
	Obesity class 1	263 (16.70)
	Obesity class 2	104 (6.60)
	Obesity class 3	72 (4.60)

Table 1: Socio-Demographic Profile of the Participants (n = 1572).

A total of [1241 (78.9%)] participants were healthy and not taking any medication at the time of the study. However, the remaining [492 (31.3%)] participants stated that they had a chronic disease. A total of [1506 (95.8%)] participants stated that they had not had an operation in the past and [72 (4.5%)] stated that they had undergone an operation (for various reasons). A total of 737 participants (46.9%) did not perform any exercise. However, [526 (33.5%)] participants stated that they exercised for half an hour per day, [246 (15.6%)] spent one hour per day exercising, [55 (3.5%)] exercised for two hours per day, and [8 (0.5%)] exercised for more than 2 hours per day.

Knowledge concerning dietary supplements

Figure 1 shows the attitude of participants toward certain DS and whether an item was considered to be a supplement or not. The results showed that [1189 (75.6%)] of participants considered omega-3 as a supplement, [1036 (65.9%)] considered iron as a supplement, [992 (63.1%)] considered calcium as a supplement, [959 (61%)] considered vitamin C as a supplement, and [372 (23.7%)], [230 (14.6%)] and [209 (13.3%)] participants considered ginseng, melatonin, and arginine as supplements, respectively.

Figure 2 illustrates the awareness of participants regarding certain supplements that may boost immunity. A total of [1264 (80.4%)] participants believed that honey enhances immunity, [1165 (74.1%)] believed that garlic enhances immunity, [1026 (65.3%)] believed that Nigella Sativa (black cumin, nigella, kalojeera, kalonji) enhances immunity, [965 (61.4%)] believed that ginger enhances immunity, and [681 (43.3%)] participants believed that turmeric enhances immunity.

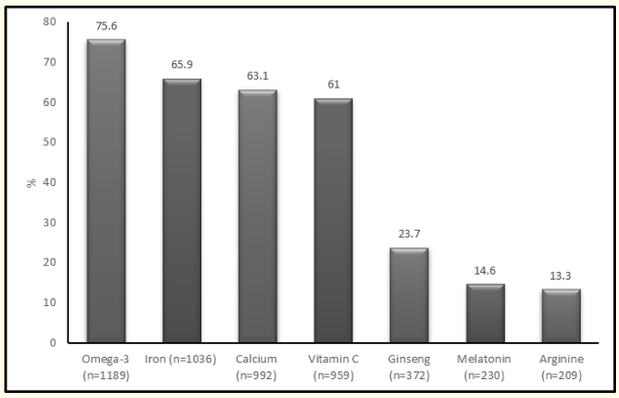

Figure 1: The attitude of participants concerning specific DS.

Next, the participants were asked about their reasons for consuming collagen supplements. A total of [197 (12.5%)] participants used this supplement to improve skin health, [141 (9%)] to improve the health of the hair and nails [35 (2.2%)], joint pain [18 (1.1%)], to boost the immune system [9 (0.6%)] or for weight loss [9 (0.6%)] whereas the vast majority of the participants did not hear about it [1365 (86.83%)].

Regarding the consumption of protein bars and protein shakes, most participants [1305 (83%)] did not consume these items. Of the remaining participants, [167 (10.6%)] consumed protein bars and protein shakes to build and repair muscle, [106 (6.7%)] consumed them as a snack, [62 (3.9%)] consumed them to promote health, [53 (3.4%)] consumed them for weight loss, [52 (3.3%)] consumed them because they were on a high protein diet, and fewer than [22 (1.5%)] participants consumed these products because they were on a vegetarian diet and wanted to fulfil their protein needs.

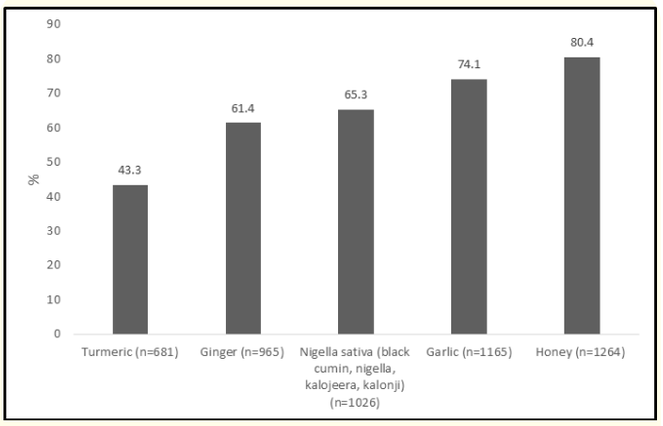

Figure 2: The perception of Participants regarding "Which of The Following Supplement Boosts Immunity?".

Figure 3 demonstrates the overall knowledge score of the participants and their *knowledge level* regarding supplements. The mean score for the knowledge level was 9.6 ± 2.76, and the lowest score was 2 and the highest score was 19 (out of 24). The level of knowledge of the participants was divided into three categories: a high level, a medium level, and a low level. A total of [1193 (76%)] participants had a low level of knowledge, [378 (24%)] had a moderate level, and [1 (0.1%)] had a high level.

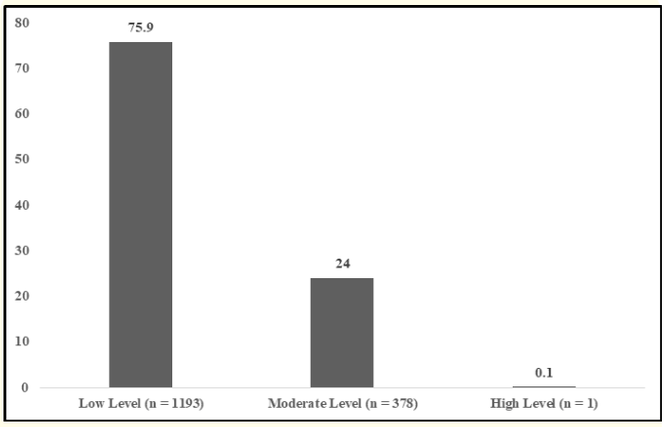

Figure 3: The knowledge level of participants.

Table 2 displays the relationship between socio-demographic factors and knowledge regarding supplements. A significant association was observed between gender and knowledge score (P = 0.032), and females had a higher mean score than males (9.67 ± 2.71 vs 9.29 ± 2.96). A significant association was also observed between education and knowledge score (P < 0.001). The Tukey post-hoc test revealed a significant difference between the groups (P < 0.05) whereas the higher the educational level the higher the knowledge score was. A significant relationship was also observed between profession and knowledge score (P < 0.001). The Tukey

post-hoc test revealed a significant difference between participants working in the health sector and participants working in all other areas ($P < 0.05$), and those working in the health sector had a higher knowledge compared with the other participants. Monthly income was significantly correlated with the mean score ($P = 0.019$). The Tukey post-hoc test revealed a significant difference between participants with an income higher than 20000 SR per month and those with an income less than 5000 SR per month ($P < 0.05$), and a higher level of knowledge was observed in participants with higher incomes. Smoking was also significantly associated with knowledge score ($P = 0.001$). The Tukey post-hoc test revealed a significant difference between smokers, participants who did not smoke, and those who occasionally smoked ($P < 0.05$). Moreover, smokers had a lower level of knowledge compared with the other groups.

Demographical Characteristics		Mean ± SD	P-value
Gender	Male	9.29 ± 2.96	0.032*
	Female	9.67 ± 2.71	
Age	18-39	9.62 ± 2.75	0.439
	40-50	9.41 ± 2.82	
	51-64	9.81 ± 2.75	
	65 years and older	9.32 ± 2.21	
Nationality	Saudi	9.63 ± 2.76	0.175
	Non-Saudi	9.26 ± 2.75	
Place of Residency	Central Region	10.19 ± 2.44	0.178
	Eastern Region	9.49 ± 2.69	
	Northern Region	9.71 ± 1.82	
	Western Region	9.59 ± 2.76	
	Southern Region	9.12 ± 3.16	
Marital Status	Single	9.55 ± 2.71	0.140
	Married	9.71 ± 2.80	
	Divorced/Widowed/ Separated	9.13 ± 2.77	
Education	High school and lower	9.11 ± 2.64	< 0.001**
	Diploma and Bachelor	9.58 ± 2.71	
	Higher education (Masters/PhD)	10.42 ± 2.96	
Profession	Public sector	9.34 ± 2.95	< 0.001**
	Health sector	10.85 ± 2.87	
	Private sector	9.48 ± 2.68	
	Business owner	8.55 ± 2.78	
	Not currently employed	9.43 ± 2.62	
	Student	9.85 ± 2.63	
Profession required contacting others during the quarantine period	Yes	9.76 ± 2.96	0.259
	No	9.56 ± 2.71	
Monthly Income	Less than 5000 SR/ Month	9.5 ± 2.63	0.019*
	5000-10000 SR/ Month	9.47 ± 2.85	
	10000-15000 SR/ Month	9.53 ± 2.80	
	15000-20000 SR/ Month	10.01 ± 2.85	
	Greater than 20000 SR/Month	10.3 ± 3.03	
Smoking	Yes	8.92 ± 2.77	0.001**
	No	9.64 ± 2.75	
	Occasionally	10.16 ± 2.66	
BMI	Underweight	9.44 ± 2.63	0.366
	Normal Weight	9.68 ± 2.76	
	Overweight	9.66 ± 2.78	
	Obesity class 1	9.49 ± 2.90	
	Obesity class 2	9.86 ± 2.57	
	Obesity class 3	9.04 ± 2.60	

Table 2: Factors Associated with Knowledge concerning Dietary Supplements (n = 1572)

* Significant at Level $P \leq 0.05$

** Significant at Level $P \leq 0.005$.

Perceptions Concerning Dietary Supplements

A balanced diet combined with physical activity optimizes health. Attaining the daily recommendations may be difficult, hence, DS can replace deficiencies in the diet. Vitamin D and iron deficiencies are widespread in Saudi Arabia [19]. A lack of knowledge and awareness among Saudi citizens may contribute to this situation. Assessing the level of knowledge of individuals regarding DS is extremely important to aid in solving this issue. This study aimed to assess the level of knowledge of Saudis regarding DS.

In the study, the participants reported the consumption of collagen supplements, and a small proportion of the participants (12.5%) stated that they consumed collagen supplements to improve their skin health. A previous study provided evidence to support the use of collagen supplements for skincare and reported that loss of collagen results in drier and thinner skin [20]. Moreover, it has been reported that a loss in the strength of collagen causes the skin biomatrix to collapse [21]. A small number of participants reported the use of collagen for joint pain, to boost immunity, of for weight loss.

Moreover, the findings of the present study show that most of the participants, specifically 75.6%, 65.9%, 63.1%, and 61% considered omega-3, iron, calcium, and vitamin C as supplements, respectively. However, only a small number of participants perceived

ginseng, melatonin, and arginine as supplements. These results demonstrate that most of the participants were not aware of the main DS. However, a separate study reported that vitamin C and calcium are the most used DS [22]. Similarly, it has been reported that the most used non-multimineral DS include ginseng, Echinacea, glucosamine, and chondroitin [23].

The participants in the present study believed that certain supplements boost immunity. For instance, 80.4% of the participants believed that honey enhances immunity. Moreover, 74.1% of participants believed that garlic boosts immunity. This finding is consistent with the results of a previous study in which a strong cellular immune response of garlic compounds was reported [24]. Furthermore, in the present study, the participants believed that Nigella Sativa and ginger are immune-boosting supplements and that turmeric was the least effective supplement at boosting immunity. To our knowledge, no other study has investigated the perception of participants regarding these DS. Furthermore, the participants may have failed to observe these items as supplements due to a lack of understanding of the definition of DS.

The knowledge scores revealed that 76% of participants had a low level of knowledge regarding the use of DS. Conversely, a study conducted among female university students in Saudi Arabia showed a high prevalence of dietary supplement use and its link to sociodemographic and lifestyle influences [18]. An additional study reported that athletes required education on the use of DS to prevent side effects [25]. It was also reported that athletes possess greater knowledge of DS [26]. In contrast, a separate study reported that participants lacked basic knowledge regarding the side effects of DS [27].

The findings of the present study demonstrated a significant association between knowledge of DS and gender (P = 0.032). Furthermore, females revealed higher scores compared with males. These findings are consistent with a previous study that reported females were more likely to consume DS owing to their health-conscious nature [28]. In contrast, an additional study reported no gender difference in the use of DS among students [29]. Furthermore, a study conducted in Riyadh, Saudi Arabia, demonstrated that the use of DS was greater in females with a normal BMI compared to that of males [30]. Alfawaz., *et al*. (2017) observed that, in general, a balanced diet combined with physical activity optimizes health. Attaining the daily recommendations may be difficult, hence, DS can replace deficiencies in the diet. Vitamin D and iron deficiencies are widespread in Saudi Arabia [19]. A lack of knowledge and awareness among Saudi citizens may contribute to this situation. Assessing the level of knowledge of individuals regarding DS is extremely important to aid in solving this issue. This study aimed to assess the level of knowledge of Saudis regarding DS.

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The present study also revealed a statistically significant association between education and knowledge score (P < 0.001). This suggests that participants with higher education had a greater knowledge of DS. This is in agreement with the results of a previous study that demonstrated that adequate evidence-based education is imperative to enhance knowledge about DS at all levels [31]. In the present study, income is also observed to be significantly associated with the mean knowledge score (P = 0.019). Similarly, a previous study reported that income was a major determinant of food and nutrient intake, and it was shown that individuals with a lower income tended to consume low-nutrient foods [32]. Furthermore, a study conducted in the US highlighted an increase in DS usage with an increase in income [33]. In the present study, participants who earned greater than 20,000 SR per month had a higher level of knowledge about DS (P < 0.05).

The present study also revealed a significant difference between the knowledge scores of smokers and non-smokers. The knowledge level of smokers regarding DS was significantly lower compared to non-smokers *(*P < 0.05). This result is similar to that obtained in a previous study which reported that non-smokers were more health-conscious and were more likely to use DS [34]. Previous studies have revealed inconsistent results regarding the association between social status and DS usage [30,35]. The present study demonstrated an insignificant association between marital status and knowledge scores for DS. In contrast, a previous study reported marital status as a major determinant of DS usage among adults [34].

The findings of the present study have potential limitations. Firstly, the sample size was too small to be a true representative of the Saudi population, resulting in a self-reporting bias. Another possible research limitation was that the majority of the participants were females. The requirement of different age group and social classes participants is one on the strength of this study. Additionally, we measured the reasons of consumption and avoiding DS. However, using an online survey, enabled data collection from different parts of the Kingdom. It also ensured the participants' anonymity, reducing the social desirability bias. Furthermore, the present study is the first to provide information on people's perception regarding certain supplements such as Nigella Sativa, ginger and turmeric in regard to boosting immunity. To our knowledge, no other study has investigated the perception of participants regarding these DS.

To conclude, future studies should include a larger sample size to facilitate a true understanding of the knowledge scores concerning DS. Moreover, future research should include studies that investigate the level of knowledge among physicians and healthcare providers who influence education on the awareness of DS.

Conclusion

Dietary supplements are vital for the human body but should only be consumed after consultation with a specialist who is sufficiently educated about them. The participants in the present study demonstrated a low level of knowledge and perceptions concerning DS. Moreover, most participants believed that nutritional supplements are vital for the normal functioning of the body. The results revealed that many factors were associated with the level of knowledge, including gender, income, smoking, and level of education. Moreover, these results provide a basic framework and can serve as a baseline for longitudinal studies that focus on elucidating the pattern of DS consumption among the public in all regions of Saudi Arabia. Additionally, the Ministry of Health and SFDA should provide sufficient educational campaigns throughout the country to increase awareness about DS.

Conflict of Interest

Authors declare there is no conflict of interest.

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