

Prevalence and Use of Dietary Supplements Among Pharmacy Students in Saudi Arabia

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Purpose: Dietary supplements (DSs) are popular in many countries, and their use among individuals is increasing worldwide. Therefore, this study aimed to assess the prevalence and use of DSs among pharmacy students in King Saud University College of Pharmacy, Riyadh, Saudi Arabia.

Methods: This study used a cross-sectional design targeting male senior pharmacy students in their fourth and fifth years of Bachelor and Doctor of Pharmacy courses. The data were collected between August and October 2019 using paper-based questionnaires.

Results: A total of 46.8% of the students used DSs. Of all students surveyed, 19% used branded supplements whereas 9.7% used generic or local supplements and 12.3% used both generic and branded supplements. Furthermore, 8.2% students suffered from side effects, including 5.6% who suffered from nausea, vomiting, and diarrhea and 2.6% who suffered from headache, confusion, and disorientation. Approximately 24.6% of students used fiber DSs whereas 19% and 16.4% used DSs for protein and glucosamine/omega 3 fatty acids, respectively.

Conclusion: The study findings indicated that the prevalence of DS use is increasing. However, approximately half of the respondents encourage the use of DSs only with a doctor's recommendation. Educating about the safe use of DSs is warranted.

Keywords: dietary supplements, performance boosters, pharmacy students, minerals, vitamins, Saudi university

Introduction

One of the increasing trends in the healthcare industry is the use of dietary supplements (DSs), which significantly playing an increasingly important role in the global economy.^{1,2} The Food and Drug Administration (FDA) has defined DSs as the combination of one or more vitamins, minerals, amino acids, and traditional herbal medicines that is intended to add additional nutritional value to the diet.³ The use of DSs has increased and gained more popularity due to their safety and/or effectiveness for helping individuals meet their nutritional goals.⁴⁻¹³ Multiple studies have reported the widespread use of DSs among college students including those in Saudi Arabia and other countries.^{7,14-21} According to a recent online survey, approximately 76% of adults use DSs.²² Among DS users, 9 out of 10 were confident about the quality, safety, and effectiveness of DSs.²² The literature has reported that the prevalence of DS use is higher among college students compared with other populations. Additionally, previous findings have suggested that weekly use of different types of DSs was high among college students.²⁰

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A recent report among undergraduates stated that 52% of students were using at least one type of DS;⁷ similarly, a study among Nigerian college students reported a DS use prevalence of 86%, with the most common DSs being vitamins.²³ A nationwide survey of college students aged 18 to 24 years old from Tokyo reported a DS use prevalence of 16.8%, with the primary reasons for using DSs cited as building muscle to improve looks and to lose weight.²⁴

Most previous reports from Arab countries have revealed the increased use and demand for DSs.^{25,26} For example, a recent study among college students in Saudi Arabia revealed a high use (76.6%) of DSs.¹⁵ Similarly, a study among professional athletes reported a very high prevalence of DS use (93%).²⁷ Another study on college students from Qatar reported that 49.6% of students used DSs.²⁸ Similarly, a recent study among medical students from Dammam, Saudi Arabia reported a DS use prevalence of 47%.¹⁶

Several earlier studies demonstrated that a higher use of DSs was associated with knowledge about supplements and attitudes of individuals.^{19,29,30} However, studies also reported that individuals with higher economic status and healthier lifestyles were more likely to consume DSs.^{31,32} Furthermore, students who did not smoke and were physically active were more likely to consume DSs.^{31,32} The previous literature also highlights that students belonging to health-care disciplines were more likely to consume DSs compared with students in other disciplines.^{19,20}

Despite the benefits of DS use, evidence has suggested that there are potential problems. For example, users might see them as a substitute, rather than a supplement, for the intake of healthier food or poor food habits.^{14,33} More importantly, unintentional overdose may result in serious side effects associated with DS use.^{14–18,34} Additionally, studies found that high use of DSs was associated with serious adverse events such as convulsions, unconsciousness, palpitations, blood and hepatic disorders, allergic reaction, and death.^{35,36} Regardless of the popularity of DSs throughout the world, a limited number of studies have been conducted in Saudi Arabia that estimate the prevalence, views, and opinions about DS use among senior pharmacy students.^{15,17,19} Therefore, the present study was conducted to measure the prevalence and use of DSs among pharmacy students at King Saud University, College of Pharmacy, Riyadh, Saudi Arabia.

Materials and Methods

Study Design and Participants

This cross-sectional descriptive study was conducted between August and October 2018 among King Saud University Pharmacy Students, Riyadh, Saudi Arabia. Senior students in the fourth and fifth years of their Bachelors (B. Pharmacy degree) and PharmD courses who were currently living on the university campus were included. The data collection was performed using paper-based printed questionnaires and was self-administered. This study was approved by the Institutional Review Board of King Saud University, College of Medicine, Saudi Arabia (E-19-4280). All participants provided their written informed consent to participate in this study.

There were approximately 300 senior residential students from both courses (bachelors and PharmD) at the KSU campus from whom we could obtain the required sample size as calculated with the Raosoft sample size calculator (<http://www.raosoft.com/samplesize.html>) with a 95% confidence level and a pre-determined margin of error of 5%. We assumed that the response distribution for each question would be 50% because we were unsure of the potential results for each question. The calculated sample size was 169, but we decided to survey 210 students in an attempt to ensure a higher reliability.

Study Instrument and Data Collection

A self-administered paper-based questionnaire was collected and prepared from previous literature.^{15,16,19,27} The questionnaires consisted of three parts. The first part evaluated age, faculty type, health condition of the participants, cost of DSs, and residential status. The second part included the use of DSs recently, side effects from DS use, most frequently used DSs, types of DSs used, and opinions regarding DSs. The third part addressed the most common reasons for using DSs among the participants. The prepared questionnaire was reviewed and revised by a panel of experts (two professors and one researcher) who belonged to the College of Pharmacy, Clinical Pharmacy department, to validate the contents. The prepared study questionnaires were translated forward and then back-translated by a certified Arabic speaker. The reliability was determined from a pilot study conducted among a sample of 10 randomly selected pharmacy students. The Cronbach's alpha coefficient was 0.71, which indicated that the questionnaire could be used in this study. Data collection was performed using a convenience

sampling technique. Convenience sampling is a non-probability sampling technique in which the study subjects are selected based on certain criteria, such as availability at a given time, willingness to participate, easy accessibility, and geographical proximity to the researchers.³⁷

In this study, we defined a branded supplement as a pharmaceutical product developed by a pharmaceutical industry that was protected by a patent for a specified period of time by a health regulatory authority. A generic supplement is equivalent to a branded product and has a similar therapeutic effect as the branded product; it is developed after expiration of the patent that was originally granted for the branded product by obtaining legal permission from the regulatory agencies.¹⁹

The data collection mainly targeted senior students receiving their Bachelors (B. Pharmacy degree) and PharmD at KSU, College of Pharmacy. The participants were approached by the researcher from the College of Pharmacy, Clinical Pharmacy Department for the purpose of data collection. Before distributing the study questionnaire to the subjects, the purpose of the study was clarified, and the researcher explained how to complete the questionnaire. The data were collected by visiting the students during their free times. The participants were asked to complete the consent form and were then directed to complete the questionnaire within 30 minutes while being supervised in our presence.

Data Management

Data extraction is a crucial step in the research process and involves the careful examination of complete and incomplete questionnaires.³⁸ In the current study, data were checked for accuracy and completeness. Missing responses or incomplete responses were excluded from the study, as shown in Figure 1.

Statistical Analysis

The data were extracted to exclude the bias in the sample selection, which was limited to only senior students, and were analyzed using the Statistical Package for Social Sciences version 22.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics with numbers and frequencies were used to describe the various study variables. The Chi-square test was utilized to identify associations between the demographic variables and study questions. A *p* value of <0.05 was considered statistically significant.

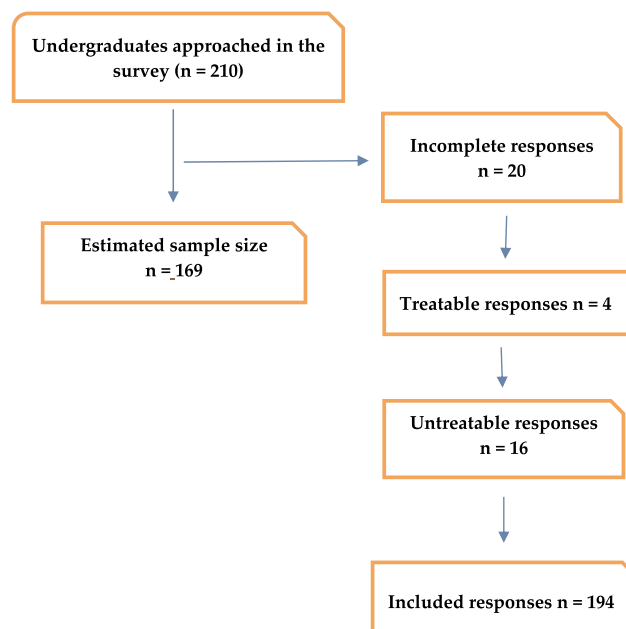


Figure 1 Flowchart of the responses.

Results

A total of 210 pharmacy students were approached in this study, and 16 (7.6%) questionnaires were excluded because of incomplete data. Among the respondents, 194 students completed the questionnaire, corresponding to a response rate of 92.3%. Most of the respondents were PharmD students (55.9%) and had an average age of 21.4 ± 1.3 years. Among the 194 students who completed the survey, most ($n = 114$, 58.5%) lived with family whereas 11.3% lived alone. Most of the respondents (89.7%) did not suffer from any ailments. Detailed information of the demographic characteristics are shown in Table 1.

The study reported a DS use prevalence of nearly 46.8% among the respondents. Interestingly, slightly less than half (43.8%) had never used any DSs recently whereas 9.2% were unsure about their use of DSs. Among the surveyed students, 19% used branded supplements, 9.7% used generic or local supplements, and 12.3% used both generic and branded supplements. Interestingly, 15.4% of students were unaware of the type of DSs they used. Approximately 8.2% of students suffered from side effects related to DS use, including 5.6% who suffered from gastrointestinal reactions such as nausea, vomiting, and diarrhea and 2.6% who suffered from headache, confusion, and disorientation. Among DS users, 24.6% used fiber DSs, followed by 19%, 16.4%, 11.3%, and 11.3% who used DSs for whey protein, glucosamine/omega 3 fatty acids, multivitamins (mixture of A-Z), and ginseng,

Table 1 Demographic Characteristics of the Respondents

Study Variables	Frequency (N)	Percentile (%)
Age (Mean \pm std)	21.48 \pm 1.3	
Cost of the dietary supplement (Mean \pm std)	164.2 \pm 122.1 (SR)	
Year of study at the Faculty of Pharmacy		
Fourth year	114	58.5
Fifth year	80	41.4
Faculty Type		
Doctor of Pharmacy (PharmD)	109	55.9
Bachelors in Pharmacy (B. Pharm)	85	43.8
Living status		
Living with family	172	88.2
Living alone	22	11.3
Do you suffer from any illness?		
Yes	19	9.8
No	175	89.7

Abbreviation: SR, Saudi riyals.

respectively. Detailed descriptions of the responses are shown in Table 2.

Table 3 indicates the attitudes of students toward DS use. Most students (86.7%) agreed that DSs are good for health while 2.6% disagreed. However, approximately half (51.8%) of the participants stated that they would only encourage the use of DSs upon doctor recommendations whereas 36.4% would always recommend the use of DSs (see Table 3).

Approximately one-third of the students (35.9%) agreed that DSs were necessary for all age groups. Although 25.1% of the students agreed that regular DS use prevents chronic diseases, 4.1% thought that DSs may prevent cancer. Figure 2 indicates the students' views regarding DSs.

The most common reasons for using DSs were general health and wellbeing ($n = 51$, 26.2%), followed by to achieve nutritional goals ($n = 40$, 20.5%), increase performance in sports ($n = 35$, 17.9%), obtain energy ($n = 31$, 15.9%), gain weight ($n = 29$, 14.9%), and to enhance memory ($n = 21$, 10.8%). Furthermore, detailed responses are shown in Figure 3. There were significant differences between faculty type and statements about whether "dietary supplements are good for health" ($p = 0.001$), residential status ($p = 0.125$), and suffering from illness ($p = 0.175$). Furthermore, there were significant associations

Table 2 The Frequency of the Use of Dietary Supplements

Variables	N (%)
Do you use any dietary supplements?	
Daily	43 (22.1)
Weekly	27 (13.9)
Monthly	21 (10.8)
Never	85 (43.8)
Am not sure if I have used dietary supplements in the last 3 months	18 (9.2)
Which type of dietary supplements do you use?	
Generic (local)	20 (9.7)
Branded (imported internationally)	37 (19)
Both	24 (12.3)
I do not know	30 (15.4)
I do not use dietary supplements	85 (43.8)
Have you experienced any side effects related to your dietary supplement use?	
Yes, I suffered from side effects	16 (8.2)
I suffered from side effects but am not sure whether they were related to dietary supplement use	8 (4.2)
No, I did not suffer from any adverse events	85 (43.6)
Not applicable because I did not use any dietary supplements	85 (43.6)
If you suffered from side effects related to dietary supplement use, please indicate the type of side effects:	
Adverse effects related to nausea, vomiting, diarrhea	11 (5.6)
Side effects related to headache, confusion, and disorientation	5 (2.6)
I did not suffer from any side effects	73 (37.4)
I did not use dietary supplements (Not applicable)	94 (48.2)
Other	3 (1.5)
Most commonly used dietary supplements	
Multivitamins (mixture of A-Z)	22 (11.3)
Ginseng	22 (11.3)
Ginkgo biloba	9 (4.6)
Glucosamine/omega 3 fatty acids	32 (16.4)
Whey proteins	37 (19)
Evening primrose oil	5 (2.6)
Fibers	48 (24.6)

Abbreviations: N, number; %, percentile.

between opinions on DSs and faculty type ($p = 0.004$) and suffering from illness ($p = 0.345$). However, there was no statistically significant difference in opinions regarding DSs between students who lived with or without family ($p = 0.994$). Similarly, there was no significant association between encouragement regarding the use of DSs and residential status ($p = 0.533$) (Table 4).

Table 3 Participants' Attitudes Regarding Dietary Supplements

	N (%)
Are dietary supplements good for health?	
Yes	169 (86.7)
I do not know	20 (10.3)
No	5 (2.6)
Do you encourage the use of dietary supplements?	
Yes, I always encourage them to use	71 (36.4)
Yes, only on doctors recommendation	101 (51.8)
Not at all	22 (11.3)

Abbreviations: N, number; %, percentile.

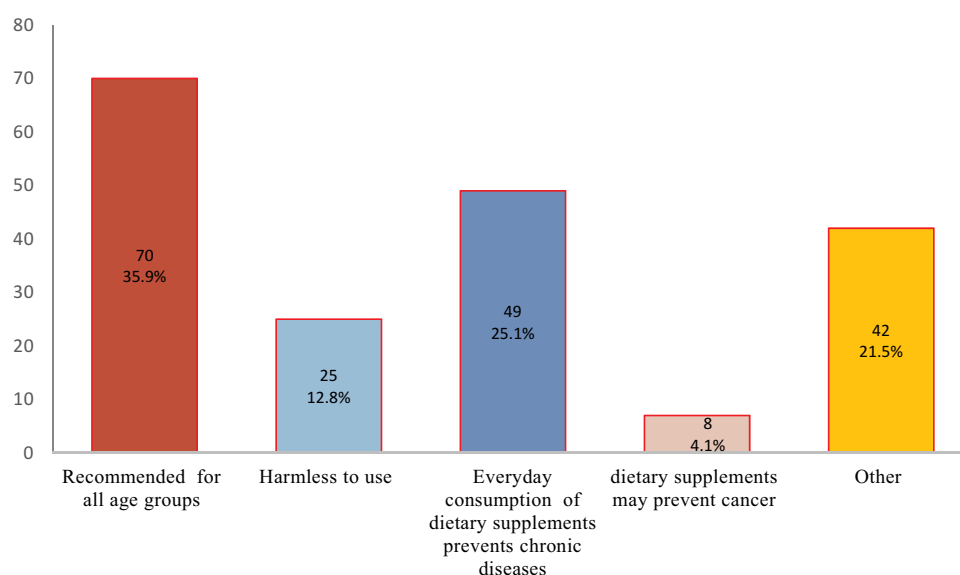
Discussion

The present findings indicated that 46.8% of the participants were using DSs, which was lower than that in previous studies conducted among a sample of pharmacy students by Naqvi et al (48.2%),³⁹ among health science students (53.6%) by Alowais and Selim,¹⁸ and in a study by Aljaloud and Ibrahim among professional athletes in Saudi Arabia (93.3%).²⁷ However, these results were higher than studies published by Žeželj et al among medical and nonmedical students in the University of Rijeka, Croatia⁴⁰ and by Kobayashi et al among Japanese students,²⁴ who reported that 30.5% and 16.8% of students used DSs, respectively. Additionally, these results were lower than those reported in studies by Jairoun et al among Emirati athletes¹⁷ and by Al-Johani et al among Saudi medical students.¹⁶ Furthermore, the findings of our

study are lower than previous studies conducted among British pharmacy students,⁷ Nigerian students,²³ and Saudi female students.¹⁵ Thus, the literature confirmed that the use of DSs is common among university students both in Saudi Arabia and worldwide.⁴¹ This relatively high prevalence of DS consumption may occur because beliefs about the need for supplement use are widespread.

The prevalence of DS use may differ from one study to another and may be influenced by several factors including the study method, types of respondents, and demographics of the subjects. However, in many developed and developing countries,^{42,43} supplement usage is increasing and is reported to be a common practice.^{44–47} Studies around the world have reported that many pharmacists do not strictly adhere to the health-care laws when prescribing DSs, although the results also revealed overprescribing in Saudi Arabia.^{44,45} Additionally, studies found that irrational prescribing is the most common practice in Arab countries and other developing countries, which may be responsible for the relatively high use of DSs in this study.

The most common justification among the students in this study to indulge in the use of DSs was to maintain general health and wellbeing, followed by overcoming nutritional deficits to increase performance in sports, gain weight, and increase immunity. Similar results were reported by Axon et al, 2017, who reported that DSs were used for disease prevention (24%), physical improvement (19%), to recover or improve immunity (16%), to improve sports performance (9%), to improve mental

**Figure 2** Student views toward the use of dietary supplements (n = 194).

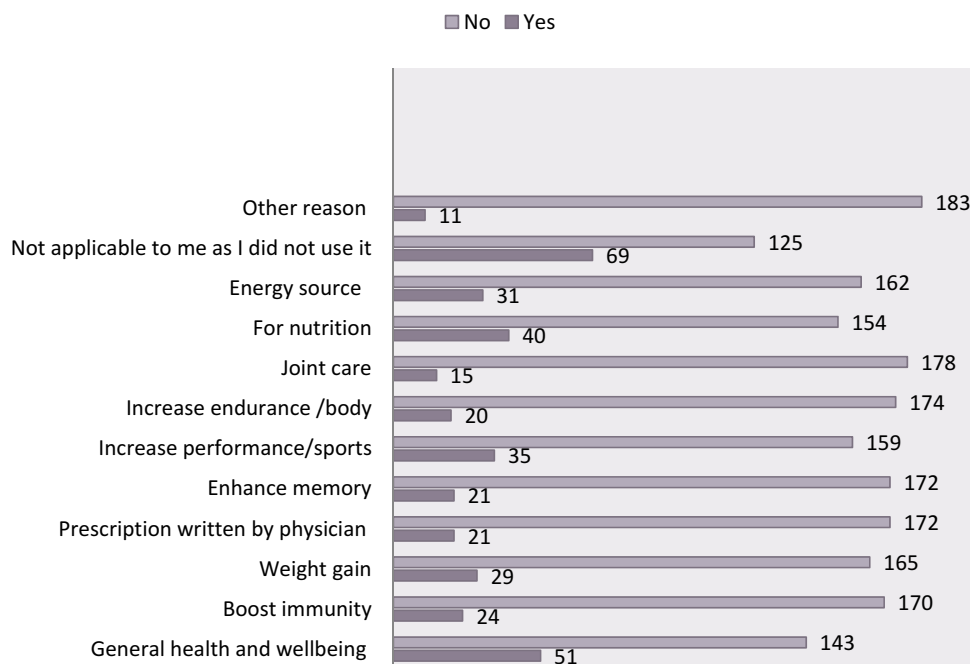


Figure 3 Reasons for taking dietary supplements.

ability or memory (8%), and to improve sexual performance (1%).⁷ Another study by Alhomoud FK 2016 on Health Sciences and Non-Health Sciences students from the University of United Arab Emirates reported justifications for the use of DSs included maintain good health (21%) and ensuring adequate nutrition (15%). Additionally, previous findings have reported a higher prevalence of DS use in female in than male students.^{41,45} Unfortunately, our results were limited to only male students because of the Islamic culture of Saudi Arabia, which prohibits the gathering of both males and females in one place. This is the main justification for excluding females from this study.

Most of the students in this study reported that DSs are good for health. Additionally, the students also believed that the everyday use of DSs prevents chronic diseases. Slightly more than half of the respondents reported that they encouraged the use of DSs. Conversely, a previous study by Axon DR who measured the attitudes of pharmacy students toward DSs reported that they believed DSs were not essential for health and wellbeing.^{7,47} This variation in the findings might be due to eating habits, prescribing patterns, or health-care regulations in the country.

The findings of the present study differed from those of previous studies conducted among practicing pharmacists rather than student pharmacists. A previous study reported that a balanced diet is better achieved by eating healthy

food rather than taking supplements; additionally, most community pharmacists reported that the use of DSs may be toxic, DSs may include some unlabeled harmful ingredients, and that antioxidants and vitamins have an unproven value and may cause chronic diseases.⁴⁸ This difference might be due to the nature of the pharmacist assessed; specifically, practicing pharmacists are more knowledgeable than student pharmacists.

Among the DS users in this current study, most used DSs for fibers, whey proteins, omega 3 fatty acids, and multivitamins. These study findings were consistent with those of two previous studies^{7,46} conducted in developed countries in which multivitamins (91%), vitamin C (71%), fish oil (65%), probiotics (53%), and fiber (53%) were the most common products among users.⁴⁵ However, another study among British pharmacy students in 2017 reported that glucosamine/chondroitin, fiber/psyllium, Echinacea, Tiger balm, and omega-3/fish oil was the most common DSs.⁷ A study by Naqvi et al 2019 reported that 51.5% of pharmacy students used multivitamins.³⁹ This increasing rate of DS consumption suggests the need to establish criteria for irrational prescriptions of DSs in health-system formularies should be as mandatory requirement as those established for non-prescription drugs. Additionally, determining by oneself to use DSs may increase the patients' risk of developing an adverse reaction. Therefore, an awareness of the usage of DSs should be integrated into everyday practice. One of the

Table 4 The Association Between Demographics and Some Variables

Questionnaire	Faculty Type			Residential Status			Suffering from Illness		
	BPhar n (%)	PharD n (%)	P-value	With Family n (%)	Without Family n (%)	P value	Yes n (%)	No n (%)	P value
Dietary supplements are good for health?									
Yes	67 (77.9)	102 (94.)	0.001	151 (88.)	18 (78.3)	0.12	20 (100)	149 (85.6)	0.17
I do not know	14 (16.3)	6 (5.6)		17 (9.9)	3 (13)		–	20 (11.5)	
No	5 (5.8)	0		3 (1.8)	2 (8.7)		–	5 (2.9)	
Your opinion about dietary supplements?									
1. Necessary for all ages	23 (26.7)	47 (43.9)	0.004	61 (35.9)	9 (39.1)	0.99	8 (40)	62 (35.8)	0.34
2. They are harmless	15 (17.4)	10 (9.3)		22 (12.9)	3 (13)		5 (25)	20 (11.6)	
3. Regular use may prevent chronic diseases	18 (20.9)	31 (29)		44 (25.9)	5 (21.7)		3 (15)	46 (26.6)	
4. May prevent cancer	6 (7)	1 (0.9)		6 (3.5)	1 (4.3)		0	7 (4)	
5. Other	24 (27.9)	18 (16.8)		37 (21.8)	5 (21.7)		4 (20)	38 (22)	
Do you encourage the use of dietary supplements?									
1. Yes, I always recommend them	29 (33.7)	42 (38.9)	0.312	62 (36.3)	9 (39.1)	0.533	6 (30)	65 (37.4)	0.392
2. Yes, only on doctors recommendation	44 (51.2)	57 (52.8)		91 (53.2)	10 (43.5)		13 (65)	88 (50.6)	
3. Do not recommend at all	13 (15.1)	9 (8.3)		18 (10.5)	4 (17.4)		1 (5)	21 (12.1)	

Notes: P < 0.5 = significant; p > 0.5 = insignificant.

strengths of this study was that students reported positive opinions and views toward the use of DSs. This indicates a good level of knowledge about the rational use of performance boosters, which they may have gained from the current curriculum. Health-care students are more knowledgeable about such topics than non-health-care students and other populations.^{39,41} This study has some limitations. Firstly, this study used a cross-sectional design and therefore only provides a snapshot of the participants' use and opinions relating to DSs at the time of the survey. Secondly, the study population was limited to male students due to gender restrictions in Saudi Arabia. Thirdly, this study used a convinced sampling method and considered only students who were present in class during the time the questionnaire was administered. Finally, this study only examined pharmacy students from one college of pharmacy; thus, the results may not be generalizable to all pharmacy students across Saudi Arabia or the general population.

Conclusions

Our study highlights the increasing trend of DS use among Saudi students living in the capital of Saudi Arabia, Riyadh

city. More importantly, the prevalence of DS use was on the rise compared with both national and international studies, which potentially predicts an increase in negative consequences. The present results could serve as support for faculties of pharmacy to improve their curriculum to encourage better and safer use of DSs and to support the development of messages aimed to safely use DSs. Therefore, we advocate the implementation of educational programs that teach students how to use DSs to avoid their complications and achieve the optimum therapeutic benefits.

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Author Contributions

All authors of this study made substantial contributions to the conception and design, acquisition, or analysis of

research data and data interpretation; took part in drafting the article or revising it critically for important intellectual content; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflicts of interest in this work.

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