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Risk Awareness and Demographic Characteristics Associated With the Use of Sexual Enhancement Supplements Among University Staff: A Cross-Sectional Study in the United Arab Emirates

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Abstract

Sexual enhancement supplements (SESs) that have illegal additions of pharmaceuticals or analogues pose a significant health risk, particularly with long-term usage. When supplements are adulterated with phosphodiesterase type 5 (PDE-5) inhibitors, dosages can vary widely and there may be an increase in adverse effects and drug–drug interactions which cannot be avoided. Consequently, there is a need to evaluate the public risk awareness toward SES and the associated adverse events as well as explore significant factors associated with knowledge and risk awareness. A cross-sectional community-based study was conducted among University male students and staff at Ajman University, United Arab Emirates (UAE), using a self-administered survey via a web-based electronic link to explore key issues. A total of 1,101 male subjects participated in the study and completed the questionnaire. Four hundred and thirty-three(39.3%) (95% confidence interval [CI]: 33.2–44.5) participants reported using SES products. Of these, 137 (31.6%) [95% CI: 28.6–37.2] experienced adverse effects from SES product use. SES use was more prevalent among participants aged 60 to 69 years (odds ratio [OR]: 2.94; 95% CI: 1.63–5.28), diabetic patients (OR: 2.61; 95% CI: 1.75–3.90), hypertension patients (OR: 2.12; 95% CI: 1.45–3.1), and those overweight or obese (OR: 1.84; 95% CI: 1.44–2.35). This study indicates that SES is a popular practice among the UAE university staff and students. However, there is a need to implement risk awareness programs to raise public awareness regarding SES use and safety. Regulatory bodies are encouraged to provide additional advice on the proper use and possible risks of consuming SES.

Keywords

sexual enhancement supplement, risk awareness, side effects, erectile dysfunction, UAE

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The global dietary supplement (DS) market size was valued at US$61.2 to 140.3 billion in 2020. The market is estimated to reach between US$128.6 and 272.4 billion in 2028, expanding at a compound annual growth rate of 8.6% to 8.7% (Fortune Business Insights, 2021; Grand View Research, 2021). This growth rate will be helped by greater awareness of personal health and well-being as well as a rise in sports-based supplements (Grand View Research, 2021). DS sales are likely to grow further, certainly initially, as a result of the current COVID-19 pandemic with the potential for immune-boosting supplements to help prevent the virus and reduce its severity (Brendler et al., 2021; Fortune Business Insights, 2021; Günalan et al., 2021; Hamulka et al., 2020; Sefah et al., 2021). For instance, there was a 44% (US$435 million) increase in the sales of DSs in the United States in the first 6 weeks of the pandemic compared with the same period in 2019, with continued growth expected (Lordan, 2021).

As the DS market has increasingly globally, and with the associated profitability, a greater emphasis is being placed on ensuring these supplements are of suitable quality. This is because there have been a rising number of cases in which users of DS have adverse reactions and even cases of death as a result of products containing contaminants (Jairoun, Al-Hemyari, El-Dahiyat et al., 2020; Jairoun et al., 2020a, 2020b). In addition, a rise in fraudulent claims with some of the DS potentially toxic (Lordan, 2021). Between 2004 and 2013 in the United States, there were an estimated 23,000 emergency room visits due to adverse effects from DSs, which subsequently resulted in 2,156 hospitalizations (Geller et al., 2015; Mathews, 2018). Some DSs can also cause skin sensitivity and severe reactions when taken during radiotherapy treatment impacting on its effectiveness (Cancer Research UK, 2022). Other DS including antioxidant supplements might also reduce the effectiveness of chemotherapy (National Institute of Health, 2022).

Appel et al. (2012) assessed the use of supplements containing ephedra, which has been suggested to correlate with certain conditions and unexpected death. Among the 48 deaths that had a temporal relationship with using these supplements, 18 subjects died from atherosclerotic coronary disease (37.5%), 16 subjects died from sudden unexplained death (33.3%), and six subjects died from hypertrophic cardiomyopathy (12.5%). This research concluded that idiopathic sudden death and atherosclerotic coronary disease were more common among those taking supplements (Appel et al., 2012). Cases of adverse effects have also resulted from producers knowingly selling substandard products. Many organizations have also developed intricate systems by which they hope to avoid regulatory scrutiny, with regulatory scrutiny growing to more clearly divide DS products from foods (Couch & Sayler, 2018).

During the past 5 years, the U.S. Food and Drug Administration (FDA) has identified more than 330 DSs adulterated with active pharmaceuticals (U.S. FDA). While the FDA has recalled some of these products, recent research suggests that even after the recalls, some of these products remain available over the Internet and on store shelves (Cohen et al., 2012). One of the largest categories of tainted supplements is those sold to enhance sexual performance. A combination of limited scruples among some manufacturers, coupled with consumer demand, has resulted in appreciable and growing sales of SESs in recent years. It is estimated that within the supplements market, the global sexual wellness market is expected to grow to US$40.4 billion by 2026, a compounded annual growth rate of 9.4% (Market Data Forecast, 2021).

Some men may choose these products to avoid the inconvenience, embarrassment, and cost of visiting a physician. Other men may have contraindications to PDE-5 inhibitors such as sildenafil citrate (Viagra; Pfizer) or tadalafil (Cialis; Lilly USA), and subsequently turn to natural products because they perceive them to be safer alternatives to treat their sexual troubles (Cohen & Venhuis, 2013). However, when supplements are adulterated with PDE-5 inhibitors, dosages can vary widely and there may be an increase in adverse effects and drug–drug interactions, which cannot be avoided (Cohen & Venhuis, 2013). This is a concern that should be avoided. However, there are currently major issues and challenges with the FDA's adverse event reporting system for DSs. One FDA-commissioned study estimated that the FDA receives less than 1% of all adverse events associated with DSs, potentially offering limited consumer protection (Department of Health and Human Services [DHHS], 2001). Factors that may contribute to under-reporting are that many consumers presume supplements to be safe (Jairoun et al., 2022). In addition, many patients using these DSs without the supervision of a health care professional and may be unaware that the regulatory bodies such as the FDA in the United States regulates them (DHHS, 2001). The lack of reporting is exacerbated by the lack of consumer awareness of the importance of reporting adverse events of DSs or even about the reporting system. Even if a patient is aware of the system, the lack of familiarity with the form, or the lack of clarity about the required information, might additionally deter submission (Dwyer et al., 2018).

The rise in the use of DSs, including SES, presents a significant concern for public health authorities (Phua et al., 2009). This is because DSs are widely available, do not require a prescription, and are heavily marketed, meaning many people choosing them initially for a variety of prevention and treatment of illnesses (Harvard Health Publishing, 2021; Rautiainen et al., 2016). Many people also regard DSs as a safer and more suitable alternatives to standard prescription medicines in view of their natural content (Jairoun et al., 2022).

With respect to UAE, the use of DSs appears widespread with 51.3% of respondents in a recent survey stating that they had at some point used a DS (Jairoun, Al-Hemyari, El-Dahiyat et al., 2020). Personnel attending fitness centers in Dubai felt that sports nutrition had positive effects on exercise performance, and they believed that sports nutrition makes the users healthier (Jairoun, Al-Hemyari, El-Dahiyat et al., 2020).

Under current UAE regulations, DS manufacturers must furnish proof that their products are manufactured in conditions that guarantee safety and purity to be able to be sold in UAE (Government of Dubai, 2022). Alongside this, samples of new products must undergo examination in municipal laboratories before being allowed onto the market in UAE (Government of Dubai, 2022). However, despite these precautions, there have been cases in which DSs contaminated with microorganisms have been approved and released for sale in UAE and wider (Consumer Products Safety Section [CPSS], 2016; Jairoun et al., 2020a, 2020b). Similarly, some products marketed under claims to enhance performance have been recalled in the United States because they were identified to be contaminated by either prescription medicines designed to boost sexual performance, for example, sildenafil, or amphetamine analogues (Carvajal, 2010; Cohen & Venhuis, 2013).

The Ministry of Health and Prevention (MOHP) of the UAE has warned against the dangers and serious adverse effects associated with sexual enhancement supplement products, which are commonly, yet illegally, sold online. The Ministry listed several harmful SESs that are not MOHP-registered and may have a negative impact on men who have cardiac diseases and high blood pressure. Macho Man 3000, Triple X 2000 Premium Zen Gold, Own the Knight 1750, and Love Zen 3000 are just some of the virility supplements named (MOHP, 2017).

Despite the risks associated with utilizing SESs, they continue to be offered for sale online on websites worldwide. In addition, the Dubai Municipality has issued a warning to citizens not to use a variety of SESs products that include prohibited substances that may have negative side effects. Supplements used for sexual enhancement are included in the most recent list of items that are prohibited (Government of Dubai, 2022).

Given current concerns with DSs especially SES, it is imperative to evaluate current risk awareness toward SES and associated adverse events. Subsequently, explore significant factors that are associated with knowledge and awareness of these key issues to guide future strategies in UAE and wider. This is because there is currently no control or efforts to increase the reporting of adverse events from SES in UAE, which may help explain why to date there have been no cases of adverse events from SES publicly notified to the authorities in UAE. This needs to change to protect the public in the future.

Method and Materials

Study Design and Setting

This was a descriptive-analytical cross-sectional community-based study conducted among Ajman University (AU) students and staff to evaluate their knowledge and risk awareness about SES and associated adverse events. In this study, students and academic staff were selected as the study population for a variety of reasons. This included the need to avoid the inconvenience and embarrassment that comes with using such products and the fact it was likely that students had not previously used these products but could be consumers in the future. Understanding students' perceptions, understanding, and risk awareness in respect to the use of SESs may, therefore, have a significant impact on issues relating to these supplements including potential adverse occurrences. In addition, it was assumed that conducting the study in the UAE's local colleges would minimize selection bias, guarantee a high response rate, avoid controversial topics related to the use of SES, and improve the generalizability of the study results. This approach was also chosen for this initial study as the survey was undertaken during the early stages of the COVID-19 pandemic in UAE, and we wanted to reach an appreciable number of possible participants. A survey link was subsequently sent to potential respondents' email addresses. Data collection started on May 10, 2020, and continued until August 5, 2020.

Study Participants

The target population contained both national and non-national male residents in Ajman University, UAE. All male individuals aged 18 years and older

who were willing to participate were directly included in this study. Females, those aged less than 18 years, and those unwilling to participate were excluded.

The study sample included students and academic personnel to better understand the irrational use of SESs and associated hazards. Educational staff were included on the basis that they have the ability to impart proper knowledge and practices around SESs. In addition, since students represent the potential future consumers of these supplements once they graduate, students in medical and nonmedical universities would benefit from being taught about the proper usage of SESs and the hazards associated with them. A thorough understanding of sexual enhancement products can encourage their responsible and ethical use, which enhances public health benefits and decreases health care-related expenditures. Because future students represent the next generation, it is crucial they are fully aware of the growing problem of excessive usage of sexual enhancement products.

Questionnaire Development

A structured self-administered questionnaire was designed and adapted based on previous studies addressing SES use (Cohen & Venhuis, 2013; Jairoun, Al-Hemyari, El-Dahiyat et al., 2020; Jairoun, Al-Hemyari, Shahwan et al., 2020). The aim was to cover all the key points of the study, with the questionnaire subsequently adapted to the local UAE population.

The draft questionnaire was subsequently reviewed and assessed by subject experts for its content, design, relevance, readability, and comprehension. The questionnaire was piloted and validated by four pharmacy practice lecturers at Ajman University after assessing its content for relevance and appropriateness. Minor modifications were made based on their comments.

The quantitative content validity of the instrument was ascertained based on Lawshe's content validity ratio (CVR) (Polit et al., 2007). The CVR was calculated for each item, and all items had CVR scores of at least 0.78. Items with CVR $\geq$0.78 are acceptable, and if an item does not reach this threshold, it is normally deleted from the final instrument (Lawshe, 1975). Subsequently, a content validity index (CVI) was obtained by calculating the mean of the CVR values for all items meeting the CVR threshold of 0.78 and retained for the final instrument. The instrument's final reported CVI value was 0.88, indicating acceptable content validity (Tilden et al., 1990). Reliability analysis of the instrument was performed by calculating Cronbach's alpha. The α-value of the questionnaire was 0.72, indicating acceptable internal consistency.

To enhance the robustness of the questionnaire, a pilot study was performed, and necessary changes were made accordingly.

By May 5, 2020, 300 respondents in the pilot study had completed the questionnaire satisfactorily out of 400 respondents approached yielding a response rate of 75%. No problems were reported, with the results of this pilot study were used to calculate the required sample size for the study. Those who participated in the pilot study were subsequently excluded from the final analysis.

Sample Size Determination and Sampling

The question on which the sample size calculation was based was as follows: "Are you aware of any hazards that might be associated with the use of the SES products." According to the pilot study, the proportion of people who answered yes to this question was approximately 50%. The alpha level was subsequently set to 5% so that we could have a 95% CI. The precision (D) of the 95% CI was fixed at 5% so that the width of the 95% CI would be at a maximum of 10%. According to these assumptions, a sample size of n = 1,280 participants was needed if we assumed a nonresponse rate of approximately 70% in line with the situation seen with the pilot study.

The Admission and Registration Department of Ajman University provided an Excel sheet of information, including staff and student names, college, study year, and email addresses. The simple random-sample selection was used for sampling, where the study population was randomly selected according to their ID numbers and stratified according to college and department.

Questionnaire Sections

The developed questionnaire was written in English and consisted of 17 questions divided into four sections. The first section highlighted demographic information, that is, age, educational level, smoking status, chronic disease, and body mass index. The second section comprised nine questions and evaluated knowledge and risk awareness regarding SES use. The third section included information on the type of SES consumed by the study participants. The fourth section examined any adverse events reported by the SES consumers. Questions evaluating the risk awareness about SES use were associated with categorical responses, that is, yes/no. Each correct answer was scored one point, while a wrong answer was given zero point. The

sum of the scores for risk awareness were subsequently calculated from the replies with a minimum of zero up to a maximum of seven points for each participant.

Questionnaire Administration

This survey was designed to be self-completed by the respondents who had been preselected according to the random sample chosen from the admission and registration. Excel sheet through a web-based electronic link sent to potential respondents' email addresses. The nature and purpose of the study were explained on the first page of the survey. If participants continued to the following page, this was taken as their consent to participate in the study. Reminder emails were sent to possible respondents every month from the start of the survey. At the end of the survey, a "Thank You" message was shown to all respondents. No incentives were provided for completing the survey.

Social Desirability Bias

This study had an inherent embarrassment and social desirability bias, which is the propensity for respondents to act in ways they believe are proper or in line with social expectations. This represents a further limitation of the study. It is common for people to overstate "positive behavior" and conduct and understate "negative behavior" in relation to SESs in the study. In recognition of this, the following strategies were employed in this study to minimize the desirability bias:

- Using an anonymous survey (no identifying information): Respondents can complete surveys anonymously by omitting their IP address and other identifying information. Participants will be more forthcoming with their answers if they feel assured they may do so without fear of being identified or facing potential repercussions.
- Conducting online surveys (no in-person contact). One of their main benefits is that participants in online surveys can complete them without an interviewer being present. The probability of social desirability bias is greatly reduced because there is no longer a third party who can unintentionally affect how a responder answers the study question. This also helps to decrease costs.
- Correctly farming the survey questions to guarantee the questionnaire's relevance, readability, and understanding.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences software (Statistical Package for the Social Sciences [SPSS], IBM Corporation, version 24). Categorical quantitative variables were summarized using frequencies and percentages as appropriate, whereas continuous quantitative variables were summarized using means $\pm SD$. Risk awareness scores were created to measure awareness regarding SES use. Each score was defined as the proportion of questions for which the answers were correct. This score ranged from 0% to 100% and was a good approximation of overall risk awareness. The level of risk awareness among the respondents regarding SES was determined by generating the median score from the descriptive analysis to classify them into "Good awareness" (median score ≥ 4) and "Poor awareness" (median score < 4) based on the median score value of 4 from the study. Univariate and multivariate logistic regression were used to investigate associations between risk awareness scores for SES use and other significant risk factors. Variable selection and model construction were performed using the stepwise technique. Forward stepwise selection procedure was used for model building; variables who showed a statistically significant association in bivariate analysis were entered in the final model. $p < .05$ was considered statistically significant.

Ethical Considerations

The Institutional Ethical Review Committee of Ajman University, UAE, approved the study. Participation in the study was voluntary, and the purpose of the study was explained on the cover page of the survey. As mentioned, if a participant continued to the next page, this was considered their consent to participate in the study. Participants' identities were not recorded, and their confidentiality was assured.

Results

Baseline and Demographic Characteristics of the Study Participants

The demographic information of the respondents is displayed in Table 1. One thousand two hundred and eighty (1,280) questionnaires were distributed; 1,101 male subjects participated in the study and completed the full questionnaire (response rate = 86%). Half of the participants ($n = 536$, or 48.7%) were 60- to 69-years-old, and 60.8% ($n = 669$) had a university degree education. The majority of the study

Table 1. Number and Percentages on the Questions of Baseline Characteristics (n = 1,101)

Demographic	Groups	Frequency	Percentage
Age (years)	20–29	67	6.1
	30–39	78	7.1
	40–49	155	14.1
	50–59	265	24.1
	60–69	536	48.7
Education	Primary school/elementary	12	1.1
	High school	122	11.1
	Diploma	87	7.9
	University degree	669	60.8
	Postgraduate degree (Master/PhD)	211	19.2
Smoking	Smoker	204	18.5
	Nonsmoker	897	81.5
Chronic diseases	No disease	187	17.0
	Asthma	307	27.9
	Diabetes	254	23.1
	Hypertension	353	32.1
BMI categories	Overweight/obese	568	51.6
	Normal weight	533	48.4

Note. BMI = body mass index.

participants were nonsmokers (n = 897, or 81.5%). Of the total participants, 187 (17%) had no disease, 307 (27.9%) had asthma, 254 (23.1%) had diabetes mellitus, and 353 (32.1%) had hypertension. There were 568 (51.6%) respondents who were overweighted or obese, and 533 (48.4%) who were normal weight.

The Use of SESs Among the Participants and Related Side Effects

Four hundred thirty-three (39.3%) [95% CI: 33.2–44.5] participants reported using SES products. The ingredients consumed by the study participants were as follows: 25 (5.8%) used Maca, 110 (25.4%) used Ginseng, 69 (15.9%) used L-arginine, 4 (0.9%) used Horny goat, 19 (4.4%) used Ginkgo, 46 (10.6%) used Yohimbe, and 160 (37%) used zinc and other minerals (Table 2).

Of these 433 participants, 137 (31.6%) [95% CI: 28.6–37.2] had experienced side effects from using SES products. Among those who reported side effects, the most prevalent complaints were palpitation or shortness of breath (36.5%), gastrointestinal symptoms (24.1%), and cutaneous symptom (16.8%) (Table 3).

The use of SES was more prevalent among participants aged 60 to 69 years (OR: 2.94; 95% CI: 1.63–5.28), diabetic patients (OR: 2.61; 95% CI: 1.75–3.90), hypertension patients (OR: 2.12; 95% CI: 1.45–3.1),

Table 2. Major Ingredients of SESs Used Among Users (n = 433)

Ingredients	Frequency	Percentage
Maca	25	5.8
Ginseng	110	25.4
L-arginine	69	15.9
Horny goat	4	0.9
Ginkgo	19	4.4
Yohimbe	46	10.6
Zinc and other minerals	160	37.0

Table 3. Major Side Effects of Sexual Enhancement Supplements Were Reported (n = 137)

Side effects	Frequency	Percentage
Nausea or heartburn	11	8
Gastrointestinal symptoms	33	24.1
Cutaneous symptom	23	16.8
Headaches	8	5.8
Warmth or redness in the face, neck, or chest	10	7.3
Dizziness	2	1.5
Palpitation or shortness of breath	50	36.5

and overweight/obese participants (OR: 1.84; 95% CI: 1.44–2.35) (Table 4).

Assessment of Risk Awareness About SESs Use

Table 5 presents the results of the 10 questions related to risk awareness about SES. In general, a good proportion of the participants reported a good level of awareness of the majority of the risk awareness items.

Note. SESs = sexual enhancement supplements; UAE = United Arab Emirates.

Of the total, 663 (60.2%) did not know that SES products are registered in the country by the concerned Regulatory Authority, and 675 (61.3%) were not aware that SES products might be adulterated with a prescription drug or undeclared chemicals. In addition, 524 participants (47.6%) did not check the circulars issued by the regulatory authorities for adulterated SES. Among the participants, 590 (53.6%) believed that adulterated SES are a national health problem in the UAE.

Factors Associated With Risk Awareness About SESs Use and Safety

Table 6 presents the univariate and multivariate analysis for the factors associated with risk awareness about

Table 4. Use of SESs According to Demographic Factors (n = 1,101)

Demographic	Groups	Use of SESs				
		Proportions	OR	95% CI		*P* value
Age	20–29	16 (23.9%)	1	—	—	—
	30–39	15 (19.2%)	0.76	0.34	1.68	.497
	40–49	59 (38.1%)	1.96	1.02	3.75	.052
	50–59	86 (32.5%)	1.53	0.83	2.84	.176
	60–69	257 (47.9%)	2.94	1.63	5.28	<.001
Education	Primary school/elementary	3 (25%)	1	—	—	—
	High school	26 (21.3%)	0.81	0.21	3.22	.77
	Diploma	30 (34.5%)	1.58	0.39	6.27	0.52
	University degree	281 (42%)	2.17	0.58	8.09	.25
	Postgraduate degree (Master/PhD)	93 (44.1%)	2.36	0.62	8.98	.21
Smoking	Smoker	87 (42.6%)	1	—	—	—
	Nonsmoker	346 (38.6%)	1.18	0.87	1.61	.28
Chronic diseases	No disease	53 (28.3%)	1	—	—	—
	Asthma	90 (29.3%)	1.05	0.70	1.57	.82
	Diabetes	129 (50.8%)	2.61	1.75	3.90	<.001
	Hypertension	161 (45.6%)	2.12	1.45	3.10	<.001
BMI categories	Normal weight	170 (31.9%)	1	—	—	—
	Overweight/obese	263 (46.3%)	1.84	1.44	2.35	<.001

Note. OR = odds ratio; CI = confidence interval; SESs = sexual enhancement supplements; BMI = body mass index.

Table 5. Risk Awareness Items Toward SESs

Risk awareness items	Groups	Frequency	Percentage
Are you aware of any hazards that might be associated with the use of the SESs products	Yes	834	75.7
	No	267	24.3
SESs have side effects	Yes	719	65.3
	No	382	34.7
Do you consult a physician before using SESs products	Yes	778	70.7
	No	323	29.3
Do you ensure that SESs products are registered in the country by the concerned Regulatory Authority	Yes	438	39.8
	No	663	60.2
Are you aware that SESs products may be adulterated with prescription drugs or undeclared chemicals	Yes	426	38.7
	No	675	61.3
Do you check the circulars issued by the regulatory authorities for adulterated SESs products	Yes	577	52.4
	No	524	47.6
Is it necessary to get more information about SESs products	Yes	1,051	95.5
	No	50	4.5
Adulterated SESs is a national public health problem in the UAE	Yes	590	53.6
	No	511	46.4
Have you ever used SESs	Yes	433	39.3
	No	668	60.7
Have you ever experienced any adverse event related to SESs products use (*n* = 391)	Yes	137	31.6
	No	296	68.4

SES use and safety. Better awareness scores were observed in the 50- to 59-year-olds (OR: 1.40; 95% CI: 1.19–1.66) and 60- to 69-year-olds (OR: 1.76; 95% CI: 1.49–2.06).

Similarly, university degree holders were more likely to score higher in risk awareness regarding SES use than other participants (OR: 1.11; 95% CI: 1.109–2.30). Asthmatic patients, diabetic patients, and hypertension patients were also more likely to score higher in risk awareness about SES use and safety (OR: 1.38, 95% CI: 1.23–1.55; OR: 1.79, 95% CI: 1.58–2.04; OR: 1.29, 95% CI: 1.15–1.45, respectively).

Table 6. Univariate and Multivariate Analysis of Factors Associated With Risk Awareness Toward SESs Use and Safety

	Risk awareness toward SESs (median score ≥4)							
	Univariate				Multivariate			
Factors	OR	95% CI		*P* value	OR	95% CI		*P* value
Age (Ref. 20–29)								
30–39	1.18	0.96	1.45	.188	—	—	—	—
40–49	1.24	1.03	1.48	.020	—	—	—	—
50–59	1.40	1.19	1.66	.001	—	—	—	—
60–69	1.76	1.49	2.06	<.001	1.30	1.03	1.65	.029
Education (Ref. primary/secondary)								
High school	1.34	0.92	1.95	.99	—	—	—	—
Diploma	1.49	1.05	2.13	.13	—	—	—	—
University degree	1.11	1.109	2.30	.03	—	—	—	—
Postgraduate degree (Master/PhD)	0.99	0.69	1.44	.12	—	—	—	—
Smoking status (Ref. nonsmoker)								
Smoker	1.04	0.94	1.16	.42	—	—	—	—
Chronic disease (Ref. No disease)								
Asthma	1.38	1.23	1.55	<.001	—	—	—	—
Diabetes	1.79	1.58	2.04	<.001	1.27	1.06	1.52	.01
Hypertension	1.29	1.15	1.45	<.001	—	—	—	—
BMI categories (Ref. Normal weight)								
Overweight obese	1.04	0.96	1.13	0.32	—	—	—	—

Note. P values less than .05 were considered statistically significant, "—"not included in the multivariate logistic regression model. OR = odds ratio; CI = confidence interval; SESs = sexual enhancement supplements; BMI = body mass index.

From the multivariate analysis, higher risk awareness scores regarding the use of SES were significantly associated with the participants aged 60 to 69 years and diabetic patients.

Discussion

We believe our study is the first study in UAE to evaluate public knowledge and the risk of DSs and SES in the UAE starting with university personnel. This is important with currently no cases of adverse events from SESs publicly notified to the authorities in UAE.

Thirty-nine percent of participants reported using SES products, similar to males in Japan where 23% of males taking part in an online nationwide survey reported using SES (Nishijima et al., 2019). In addition in the United Kingdom, 41% of men who engaged in sex with other men reported sexualized drug use (Hibbert et al., 2019). This is very different to pharmacy students in Lebanon where only 1.8% reported using herbal DSs to improve sexual performance (Hibbert et al., 2019) and among pharmacy students in the United States where only 1% reported using dietary or herbal supplements to improve their sexual performance (Axon et al., 2017). The low proportion of SES consumed by these young people may be because these supplements are being taken for recreational purposes only and not as a possible treatments to try and enhance sexual performance (Bechara et al., 2010).

Concerning the type of SES that was used, the most common SES was zinc and other minerals, reaching 37%, while a quarter of respondents indicated that they took ginseng supplements. Zinc has many unique properties in humans, especially males, as a hormone balancer aiding hormones such as testosterone and the prostate aiding sexual health and functions (Fallah et al., 2018). Zinc also plays a role in epithelial integrity, with zinc essential for maintaining the lining of the reproductive organs. These properties are reflected in the global increase in zinc DS consumption (Global Market Insights, 2021), with its use seen as safer than other sexual supplements (Fallah et al., 2018). It was also not surprising that ginseng was one of the most used SESs in our study as ginseng is reported to improve sperm quality and count among healthy individuals and in males with treatment-related infertility (Fallah et al., 2018). Our findings of 25.4% were appreciably higher than seen in South Australia where only 4.2% of interviewed infertile subjects used ginseng supplements (Leung & Wong, 2013). Consequently, there is a need to improve the knowledge of individuals toward different types of SES and the risk of overconsuming SES. This is because the side effects of SES ingredients are often not fully understood and people believe the safety of DSs and

SES is similar to normal food products (Chan & Fu, 2007). This is endorsed by the fact that 31.6% of SES users in our study experienced side effects due to SES. The most reported complaints were palpitation or shortness of breath in 36.5% of participants, gastrointestinal symptoms at 24%, and cutaneous symptoms at 16.8%. The symptoms were similar to a study among Japanese males who also experienced flushing, palpitation, and dizziness from SES (Nishijima et al., 2019). Consequently, public awareness campaigns need to be developed and disseminated through appropriate media channels as men typically do not consult about potential side effects of SES often because of the temporality of their symptoms and due to a sense of shame (Nishijima et al., 2019).

The highest use of SES in our study among University personnel was observed among those aged 60 to 69 years (47.9%), followed by 40 to 49 years (38.1%); similar to a study in Japan, where the greatest use of SES was among those aged between 60 and 69 years (48.7%), followed by 50 to 59 years (Chiba et al., 2015). Nishijima et al (2019) also found the use of SES to treat erectile dysfunction (ED) increased with age, especially among sexually active older-aged men (Nishijima et al., 2019). This is perhaps not surprising with one study reporting that the proportion of ED among men who lived with their spouses varied from 6.0% for 50- to 59-year-olds; 15.9% to 25.9% for 60- to 69-year-olds; and 27.9% to 36.4% for 70- to 79-year-olds, respectively (Marumo et al., 2001).

Since a high proportion of ED patients have chronic conditions including heart diseases, hypertension, and diabetes (Kimura et al., 2013), there should be a warning against the simultaneous use of SES (Tucker et al., 2018). Diabetes is a chronic condition and one of the established risk factors of ED in men, with a threefold increased risk of ED among diabetic men (Maiorino et al., 2014). Some studies have reported the prevalence of ED in patients with diabetes at up to 90%, although others have reported lower rates, with rates typically double that of nondiabetic people (Ibrahim, 2019). Hypertension is also a significant risk factor for ED (Sasaki et al., 2005). In addition to diabetes and hypertension, obesity, and in particular central obesity, is associated with both arteriogenic ED and reduced testosterone (T) levels (Corona et al., 2014). There should be concerns regarding potential adverse reactions from SES in these patients. These concerns can be expanded to the use of DS-containing food ingredients in high concentrations, as supplements such as ginkgo and ginseng used for sexual enhancement have been reported to influence the kinetics of some medicines (Malati et al., 2012; Nishijima et al., 2019; Yin et al., 2004). Alongside this, the majority of SES also contains multiple concentrated ingredients that can be associated with serious adverse events with ginseng-inducing anaphylaxis (Lee et al., 2012). These findings further endorse the need to make male patients, especially those with co-morbidities such as hypertension and diabetes, more aware of the potential adverse effects from SESs.

While the relationship between smokers and nonsmokers was not statistically significant, we observed that smokers used SESs more than nonsmokers. This is a concern with the added risk of heart disease in these patients. A study among the male population in Western Australia also found that compared with nonsmokers, the odds of ED were significantly higher among smokers, and ED among smokers increased with the number of cigarettes smoked (Chew et al., 2009).

We are aware of a number of limitations with this study. First, we conducted this study in only one country (UAE). Second, only among national and nonnational male residents in Ajman University, UAE, aged 18 years and willing to participate for the reasons stated. Third, we were reliant on participants accurately reporting their usage, beliefs, co-morbidities, and adverse events with SESs, with no way of checking their replies. A further limitation of this study concerned the fact that men without university degrees and men of UAE nationality who are studying overseas were not included in the survey. Given the population involved, the study authors could potentially generalize their findings to men attending universities in the UAE; however, any generalization beyond that to include additional populations would be questionable. This reduces the external validity of the study. The convenience sample, which is linked to the difficulty generalizing the survey results to a larger population and the potential for under- or over-representation of the population, are further drawbacks of the study.

Despite these limitations, we believe our findings are robust providing additional guidance to the health authorities in UAE and wider to reduce potential adverse events from SESs. We will be following this up with more extensive research in UAE.

Conclusion

This study indicated that the use of SES is a popular among males in universities in UAE, especially older males. Males should become more aware of the ingredients of SES, follow the advice regarding their use,

and understand any associated adverse effects, especially among those with chronic diseases, elderly, smokers, and those overweight. There is a need for the authorities in UAE to implement risk awareness programs to raise public awareness regarding SES use and safety to protect the populations. Moreover, regulatory bodies are encouraged to provide counseling on the proper use of SESs and the possible risks. In addition, encourage SES users to report any adverse events to build up a clearer picture of their prevalence in UAE to guide future practice.

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Author Contributions

A.A.J and S.S.A. conceptualized the project. M.S. and S.H.Z. contributed in the methodology development. M.S. and S.S.A. contributed to data collection. A.A.J., S.H.Z., and S.S.A. contributed to data analysis and interpretation. B.G., A.K., and B.I. involved in investigation and wrote the discussion. The final article has been developed, written, and agreed by all authors. All authors read and approved the final article.

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Ethics Approval and Consent to Participate

This study received approval from the Institutional Ethics Review Committee of Ajman University. All participants were informed of the study purpose before data collection. They were also told that their consent was required for the questionnaire to be administered; all participants gave their written informed consent. The participants' identities were not recorded, and they were assured of complete confidentiality.

Consent for Publication

All authors are agreed for publication of this article.

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Availability of Data and Materials

All data will be provided upon request.

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