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Use Knowledge and Beliefs regarding Performance-Enhancing Agents among Saudi Female Athletes

Mohammed Zaid Aljulifi[1]
[1]Department of family and community medicine, college of medicine, Majmaah University, Majmaah 11952, Saudi Arabia
*Corresponding author: Mohammed Zaid Aljulifi, Department of family and community medicine, college of medicine, Majmaah University, Majmaah 11952, Saudi Arabia,
Email: m.aljulifi@mu.edu.sa

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ABSTRACT

Women of all ages now have more opportunities to compete at higher levels because of the explosion in professional female sports. This additional potential may encourage female athletes to use performance-enhancing agents (PEAs). The objective of this study is to determine the use, knowledge, and beliefs regarding PEAs among Saudi female athletes. Adolescent and adult female Saudi athletes were included in this descriptive cross-sectional study. The data were collected using an online questionnaire. Overall, 335 female Saudi athletes participated in this study. Only 16.1% of participants reported using PEAs to enhance their performance and body image. Protein supplements were the most commonly used PEAs among the participants (47 participants; 14.6%), followed by energy drinks (45 participants; 14%). There was no significant difference between user knowledge, awareness of negative health consequences, and use of PEAs. To conclude, PEA abuse is rare among athletes in Saudi Arabia. In this study, we reported a lower level of PEAs among female athletes than those reported in a previous Saudi study. Concerning the risk of PEAs use, the study reported that females are exposed equally to protective or risk factors for PEAs use compared to previous studies concerning the male population.

Keywords: *athletes, beliefs, female, knowledge, performance-enhancing agents (PEAs), Saudi Arabia*

1. INTRODUCTION

People continue to use a range of medicines to enhance their appearance and performance (body image). Recreational athletes are looking to improve their muscular development as commercial exercise facilities are becoming increasingly common [1].

While "physical enhancement" refers to the use of legal or easily accessible substances to improve sports performance, "physical doping" is defined as the use of illegal or prohibited chemicals to improve physical performance in sports [2]. The World Anti-Doping Agency (WADA) defines a doping substance as "any chemical that fits at least two of the three criteria: it improves athletic performance; it breaches what WADA refers to as 'the spirit of sport'; or it poses a health risk to athletes" [3]. The Saudi Arabia Anti-Doping Committee was founded in 2004 to regulate and oversee the use of doping substances [4].

In the Gulf Cooperation Council, 46.9% of teenagers and emerging adults are thought to consume energy drinks [5].

Performance-enhancing agents (PEAs) are dietary supplements or pharmaceuticals used by gymgoers to increase performance or improve their appearance [6]. Among these substances, anabolic-androgenic steroid (AAS) hormones, stimulants, and diuretics are the most widely utilized [7]. PEAs have a wide range of harmful health effects [8]. The use of PEAs has recently increased, along with young male adults' growing interest in bodybuilding and fitness. However, the effects of PEAs on health are not well known [9].

The overuse of PEAs, especially when performed without doctor supervision, has the potential to seriously endanger health. Serious hepatic and cardiovascular health effects have been reported [10]. The nonprescribed use of AAS has been linked to aggression/violent conduct, suicidal thoughts, and even unexpected death [11]. Exogenous anabolic steroids impair male reproductive function by directly harming the testicles [12].

Women of all ages now have more opportunities to compete at higher levels because of the explosion in professional female sports. This increasing potential creates more pressure to succeed, which may encourage female athletes to use PEAs [13]. Health educators must comprehend what performance-enhancers are and how they function, in tandem with their potential negative effects and factors that impact their use among this demographic given the rising number of women who use them. AAS can cause particular side effects in women, including hirsutism, voice changes, male-pattern baldness, clitoral enlargement, and irregular menstruation [9,14].

In Saudi Arabia, several studies have been conducted to assess the prevalence, knowledge, beliefs, and awareness of PEA users regarding its side effects [15–29]. The need for further studies including female subjects has been recommended by many researchers [30]. In this study, we aimed to determine the use, knowledge, and beliefs regarding PEAs among Saudi female athletes.

2. MATERIALS AND METHODS

Adolescents and adult Saudi female athletes in Saudi Arabia were included in this descriptive cross-sectional study, whereas children and male athletes were excluded.

2.1. Study Tool

The data were collected using an online questionnaire, which was developed, validated, and translated by Alnozha and Alshatrat [16]. Permission was obtained from the authors to use the questionnaire [16].

The questionnaire consisted of three sections. The first section was designed to assess knowledge and attitudes toward PEAs; the second section assessed beliefs about the use of some popular PEAs in Saudi Arabia; and the third section assessed the knowledge and awareness of possible negative health consequences of PEAs. In the third section, participants responded on a five-point Likert subscale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree). To enhance the presentation and interpretation of the findings, the researchers combined "strongly disagree" and "disagree," and "strongly agree" and "agree." The questionnaire was tested, validated, and had high internal reliability (Cronbach's Alpha = 0.93).

Notably, one question about testosterone side effects was adjusted to include side effects for females instead of males (e.g., "clitoral enlargement" instead of "shrinking of the testicles" and "increased growth of beard and body hair" instead of "reduction in sperm production"). These specific female side effects were extracted from previously published articles and guidelines [9,14].

2.2. Sample Size

Convenience sampling was employed in this study. The assumption for sample size determination was based on 5% as an estimation of PEA used among female athletes, a 95% confidence level with precision ± 5, and a study power of 80%. Based on these variables, the estimated sample size was 377. However, all

available study populations were included in the study.

2.3. Statistical Analysis

Data were entered into Excel and examined via IBM-SPSS version 20 or a similar statistical package. Descriptive statistics, such as frequencies, percentages, means, and medians, were employed to describe categorical variables. Inferential statistical tests, such as the t-test and logistic regression, were utilized to assess the relationship between different variables, and statistical significance was set at $p < 0.05$.

2.4. Ethical Consideration

Patient privacy and confidentiality were assured, informed consent was obtained, no identifiers were collected, and all data were kept confidential.

3. RESULTS

Altogether, 335 female Saudi athletes participated in this study. Most of them (117 participants; 36.3%) were aged 26–35 years, 30.7% were aged 36-50 and 28.9% were between 15 - 25 year old. About 118 participants (36.6%) were from the central region. The majority of them 273 (84.8%) had a university degree or higher. Approximately 299 participants (92.9%) were non-smokers. Most of them (268 participants; 83.2%) did not suffer from chronic diseases. Regarding exercise type, 268 participants (83.2%) engaged in aerobic, 111 participants (34.5%) in flexibility, 109 participants (33.9%) in strength, and 50 participants (15.5%) in balance. Moreover, 151 participants (46.9%) exercised three to five times per week, and more than half of them (179 participants; 55.6%) exercised 30 minutes to one hour every day. However, approximately half of them (154 participants; 47.8%) started exercising three to six months ago and 41.3% started more than 12 months ago.

Several participants (266 participants; 82.6%) did not receive suggestions to use PEAs to enhance their performance or to change their appearance. Most who did receive suggestions were guided by friends or relatives (38 participants; 11.8%), whereas 23 participants (7.1%) took inspiration from social media, 12 participants (3.7%) were instructed by healthcare workers, and 8 participants (2.5%) were helped by gym trainers (38.5%). More than half of them (179 participants; 55.6%) reported that they did not know whether PEAs were easily accessible. Notably, 17 participants (5.3%) thought PEAs were found online, 13 participants (4%) thought PEAs were found in special shops, 11 participants (3.4%) thought PEAs were found in pharmacies, and 10 participants (3.1%) thought PEAs were found in gyms. Only 52 participants (16.1%) had used PEAs during the last six months. Protein supplements were the most used PEAs among our participants (47 participants; 14.6%), followed by energy drinks (45 participants; 14%) used over the last six months. Furthermore, 19 participants (5.9%) reported that they had used more than one of the PEAs over the last six months (Figure 1).

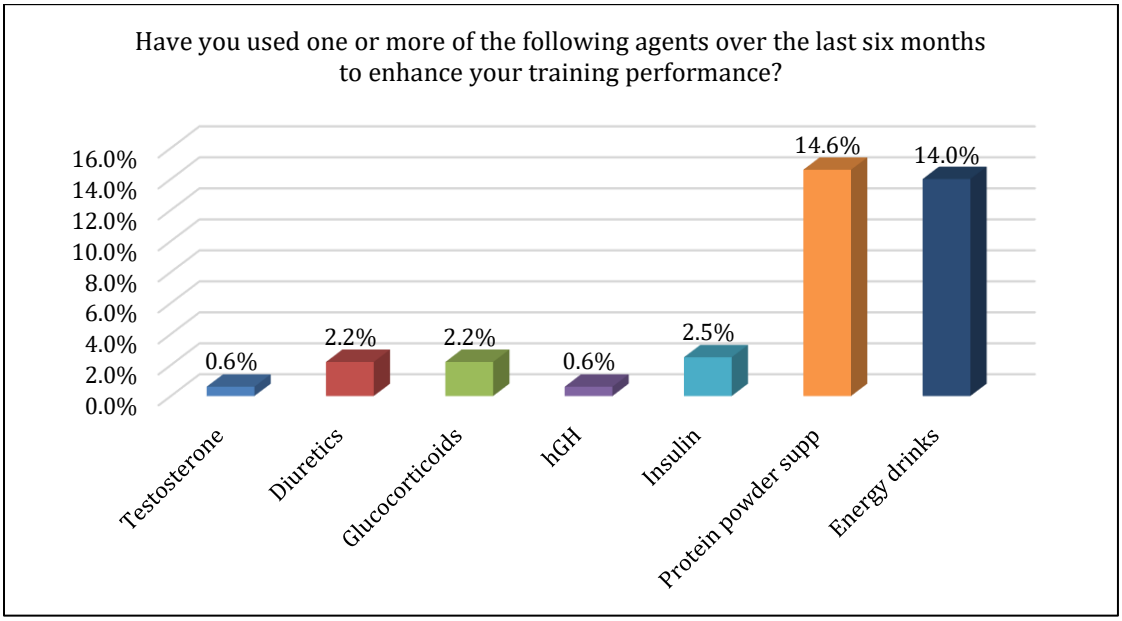

FIGURE 1: The percentage of use of different agents over the last six months to enhance the training performance

Nearly half of the participants (144 participants; 44.7%) thought that protein powder supplements enhance performance and about a quarter of them (79 participants; 24.5%) thought that energy drinks enhance performance. Most participants (272 participants; 84.5%) believed that glucocorticoids, testosterone (268 participants; 83.2%), human growth hormone (265 participants; 82.3%), insulin (255 participants; 79.2%), energy drinks (240 participants; 74.5%), diuretics (236 participants; 73.3%), and protein powder supplements (170 participants; 52.8%) would harm gym users. More than half of the participants (181 participants; 56.2%) reported that they had gained knowledge about the risks of PEAs from formal/informal sources (e.g., TV, Internet, etc).

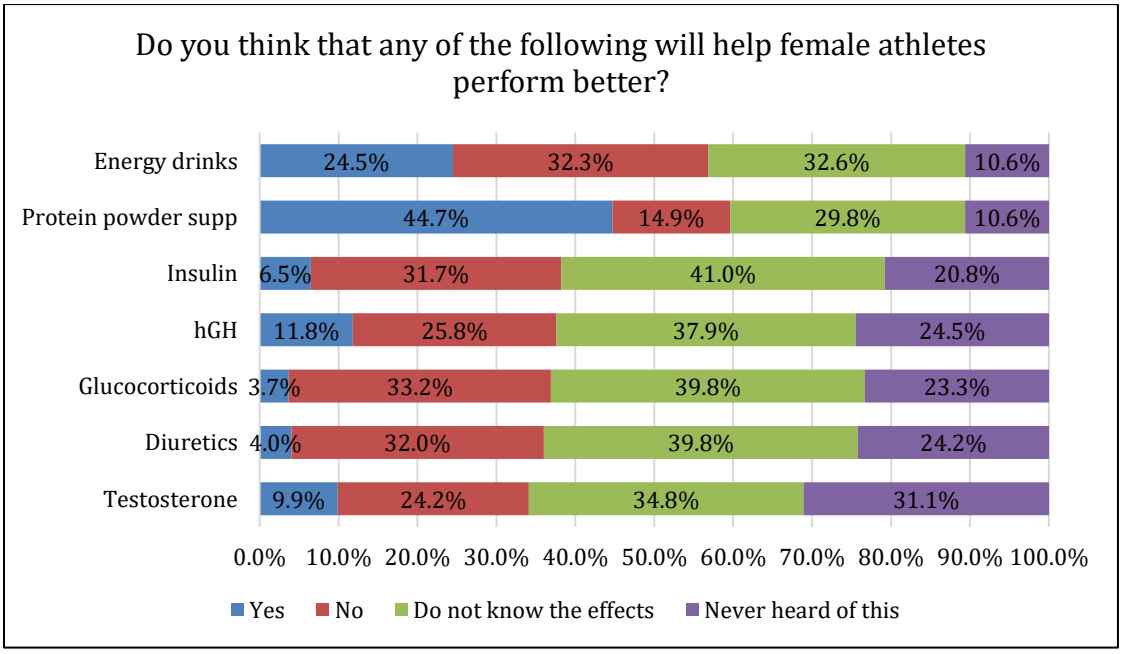

FIGURE 2: Gym users' beliefs regarding the use of PEAs

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Approximately half of the participants were aware that using testosterone in females may lead to acne (150 participants; 46.6%), deepening of voice (146 participants; 45.3%), and increased growth of beard and body hair (150 participants; 46.6%). Likewise, approximately half of the participants were aware that diuretics may cause dehydration (182 participants; 56.5%), drop in blood pressure (147 participants; 45.7%), dizziness or fainting (137 participants; 42.5%), and loss of coordination and balance (137 participants; 42.5%). Only about one-quarter of the participants were aware that using human growth hormone (hGH) may cause high blood pressure and heart failure (91 participants; 28.3%), acromegaly (89 participants; 27.6%), and diabetes and tumors (87 participants; 27%). More than half of them (181 participants; 56.2%) reported that they strongly agreed or agreed that insulin might lead to hypoglycemia, 129 participants (40.1%) thought that their bodies would become insulin resistant and lead to type 2 diabetes, and 109 participants (33.9%) thought that it could cause type 1 diabetes. Approximately half of the participants were aware that using protein powder supplements may lead to digestive problems (160 participants; 49.7%), imbalanced nutrition (155 participants; 48.1%), and weight gain (147 participants; 45.7%). Approximately two-thirds of the participants were aware that energy drinks may cause insomnia (212 participants; 65.8%), increased heart rate and blood pressure (208 participants; 64.6%), anxiety (199 participants; 61.8%), and increased risk of stroke, heart attack, and cardiac arrhythmia (172 participants; 53.4%) (Table 1).

TABLE 1: Gym users' knowledge and awareness of negative health consequences of using PEAs.

Using Testosterone Hormone on Females May Lead to the Following Negative Health Consequences:	Agree or Strongly Agree n (%)	Neither Agree nor Disagree n (%)	Disagree or Strongly Disagree n (%)
Acne	150 (46.6)	154 (47.8)	18 (5.6)
Male pattern baldness	120 (37.3)	172 (53.4)	30 (9.3)
Liver damage	105 (32.6)	185 (57.5)	32 (9.9)
Stunted growth and disruption of puberty	122 (37.9)	176 (54.7)	24 (7.5)
Increased aggressiveness and sexual appetite	120 (37.3)	174 (54)	28 (8.7)
Depression	119 (37)	173 (53.7)	30 (9.3)
Decreased breast size	118 (36.6)	178 (55.3)	26 (8.1)
Clitoral enlargement	94 (29.2)	192 (59.6)	36 (11.2)
Deepening of voice	146 (45.3)	157 (48.8)	19 (5.9)
Increased growth of beard and body hair	150 (46.6)	148 (46)	24 (7.5)
Using Diuretics on Females may Lead to the Following Negative Health Consequences:			
Dehydration	182 (56.5)	124 (38.5)	16 (5)
Muscle cramps	125 (38.8)	176 (54.7)	21 (6.5)
Dizziness or fainting	137 (42.5)	155 (48.1)	30 (9.3)
Drop in blood pressure	147 (45.7)	152 (47.2)	23 (7.1)
Loss of coordination and balance	137 (42.5)	160 (49.7)	25 (7.8)
Using hGH May Lead To:			
Severe headaches	85 (26.4)	204 (63.4)	33 (10.2)
Loss of vision	63 (19.6)	219 (68)	40 (12.4)
Acromegaly (Protruding or enlarged jaw, brow, skull, hands, and feet)	89 (27.6)	209 (64.9)	24 (7.5)

High blood pressure and heart failure	91 (28.3)	203 (63)	28 (8.7)
Diabetes and tumors	87 (27)	209 (64.9)	26 (8.1)
Crippling arthritis	79 (24.5)	212 (65.8)	31 (9.6)
Using Insulin May Lead to:			
Can cause low blood sugar (hypoglycemia)	181 (56.2)	122 (37.9)	19 (5.9)
Your body will become insulin resistant and lead to type 2 diabetes	129 (40.1)	159 (49.4)	34 (10.6)
Cause type 1 diabetes	109 (33.9)	162 (50.3)	51 (15.8)
Using Protein Powder Supplements May Lead to			
Imbalanced nutrition	155 (48.1)	109 (33.9)	58 (18)
Digestive problems	160 (49.7)	114 (35.4)	48 (14.9)
Weight gain	147 (45.7)	111 (34.5)	64 (19.9)
Heart and kidneys issues	112 (34.8)	152 (47.2)	58 (18)
Using Stimulants (e.g., energy drinks) May Lead to			
Insomnia	212 (65.8)	89 (27.6)	21 (6.5)
Anxiety	199 (61.8)	93 (28.9)	30 (9.3)
Weight loss	107 (33.2)	133 (41.3)	82 (25.5)
Dependence and addiction	168 (52.2)	103 (32)	51 (15.8)
Dehydration	152 (47.2)	125 (38.8)	45 (14)
Tremors	140 (43.5)	137 (42.5)	45 (14)
Increased heart rate and blood pressure	208 (64.6)	91 (28.3)	23 (7.1)
Increased risk of stroke, heart attack, and cardiac arrhythmia	172 (53.4)	112 (34.8)	38 (11.8)

Table 2 shows the association between gym users' beliefs about the hazards of PEAs and their use over the last six months. The utilization of protein supplements and energy drinks over the last six months was significantly associated with beliefs about the possible hazards of these PEAs (P-value = 0.010 and 0.019, respectively). About a quarter of participants who reported that they used protein supplements (33 participants; 21.7%) and those who used energy drinks (20 participants; 24.4%) over the last six months did not believe that using these agents would cause harm.

TABLE 2: Relationship between gym users' beliefs about hazards of PEAs and use over the last six months.

Gym Users Believe that the Following PEAs are: Harmful (Yes) / Not Harmful (No)		Used the Following Agents Over the Last Six Months		Chi-square Test Statistic	P-value
		Yes N (%)	No N (%)		
Testosterone	Yes	43 (16)	225 (84)	0.013	0.910
	No	9 (16.7)	45 (83.3)		
Diuretics	Yes	38 (16.1)	198 (83.9)	0.001	0.969
	No	14 (16.3)	72 (83.7)		
Glucocorticoids	Yes	45 (16.5)	227 (83.5)	0.202	0.653
	No	7 (14)	43 (86)		
hGH	Yes	41 (15.5)	224 (84.5)	0.507	0.476

	No	11 (19.3)	46 (80.7)		
Insulin	Yes	40 (15.7)	215 (84.3)	0.194	0.660
	No	12 (17.9)	55 (82.1)		
Protein powder supp	Yes	19 (11.2)	151 (88.8)	6.576	0.010
	No	33 (21.7)	119 (78.3)		
Energy drinks	Yes	32 (13.3)	208 (86.7)	5.518	0.019
	No	20 (24.4)	62 (75.6)		

No significant difference was evident between user knowledge and awareness of negative health consequences and the use of performance-enhancing agents (Table 3).

TABLE 3: Relationship between gym users' knowledge and awareness of negative health consequences and use of PEAs.

Knowledge about the Risks of using PEAs	Participants Using the Following Agents Over the Last Six Months		T-test Statistic	P-value
	Yes mean (SD)	No mean (SD)		
Total score of knowledge about negative health consequences of using testosterone	12.9 ± 4.4	13.1 ± 4.6	-0.191	0.849
Total score of knowledge about negative health consequences of using diuretics	6.9 ± 2.8	6.9 ± 2.5	0.000	1.000
Total score of knowledge about negative health consequences of using hGH	6.9 ± 2.9	7 ± 2.9	-0.123	0.902
Total score of knowledge about negative health consequences of using insulin	3.8 ± 1.7	4 ± 1.5	-0.946	0.345
Total score of knowledge about negative health consequences of using protein powder supplements	4.4 ± 2.9	5.2 ± 2.3	-1.773	0.081
Total score of knowledge about negative health consequences of using energy drinks	10.5 ± 4.8	11.3 ± 4.2	-1.165	0.245

4. DISCUSSION

The main goal of this study was to ascertain Saudi female athletes' use, knowledge, and beliefs about PEAs. Accordingly, participants must acquire sufficient knowledge about drugs used in sports, as well as positive attitudes about doping and its prevention through carefully crafted curricula.

Most individuals stated that social media and friends were the main sources of recommendations for PEAs. Additionally, the majority of people who responded favorably to the query about PEA accessibility in Saudi Arabia stated that PEAs were difficult to obtain in Saudi Arabia. These findings conflict with earlier research from Saudi Arabia [5,15,16,24,27,29] and other Arab nations including Jordan [30]. Previous research claimed that friends and fitness instructors were the main sources of recommendations to use PEAs, and the majority claimed that PEAs were simple to obtain in Saudi Arabia. These discrepancies may be caused by the fact that our study involved female athletes, while the majority of other

studies involved male athletes, or both, in the same study.

In most Arab nations, there is often little regulation of PEAs [31]. Only 16.1% of the participants in this study said that they used PEAs to improve their performance. These results differ from earlier research conducted in Saudi Arabia, reporting that a large number of gym-goers regularly consume a variety of PEAs that promote muscle building, decrease body fat, and boost physical endurance [15,16,18,24,32–34]. In this study, fewer participants consumed PEAs (16.1%) than in earlier Saudi publications [15, 16,18,24] and a Kuwaiti study (58%) [33]. The use of PEAs is dangerous, especially since a majority of consumers purchase these medications over the counter without seeking medical attention or even dietary advice [8,9,31].

There are similar and overlapping side effects due to the nature of these drugs, whereas the negative side effects and consequences of each form of PEA vary [35]. Despite being aware of PEAs' harmful side effects [9], participants lacked awareness of PEAs' potential dangers. Occasionally, knowledge was insufficient to prevent the ingestion of certain chemicals. In contrast to a study of a comparable nature conducted in Saudi Arabia [16], the knowledge and awareness of potential adverse side effects and health dangers of all types of PEAs were slightly lower.

The findings of this investigation support the hypothesis that the widespread use of protein supplements and energy drinks may be driven by the perception that these PEAs are safe for consumption. These results agree with those of an earlier Saudi study by Alnozha et al. [16]. It may be possible to limit PEA use by raising the perceived self-efficacy of gym patrons regarding their ability to combat the harmful effects of PEAs [36,37]. Hence, it is advisable to provide cognitive behavioral treatment and construct adequately structured health education programs to decrease the unchecked use of PEAs [36].

Our study's findings, which logically contradict those of Alnozha et al. [16], who claimed that participants were more likely to use insulin if they were aware of its potentially harmful effects, showed that most participants did not use different PEAs. Additionally, we compared earlier research from Australia [38] and the United States of America [39], wherein the participants stated that they would take PEAs despite health risks, problems, or even a shortened life [39] to improve athletic performance and body image. Owing to potential health risks, especially for teens and young adults, the utilization of supplements and PEAs for athletic performance has drawn the attention of numerous scientists. PEA use may potentially serve as a doorway for the use of illegal substances in addition to health risks and difficulties [38,40,41].

To reduce the use of PEAs, a combination of conventional cognitive strategies and affective education initiatives is advised [34]. It is also advised to employ social media to spread awareness of the health risks associated with PEAs. It was advised that gym members should be discouraged from using PEAs and encouraged to adopt healthy and safe alternatives to achieve fitness-related goals by involving gym instructors and trainers in appropriate health education programs [16]. Similarly, having fitness instructors as role models would be beneficial [37]. The enormous influence of others, including family, friends, and classmates, in offering social support to help gym users decide to stop using PEAs is another crucial element. When adolescents are clinically examined in primary healthcare facilities, during school visits, or as part of community education initiatives, health professionals can offer supportive counseling and motivational interviewing interventions [9]. To reduce the consumption of harmful options, gym facilities must make healthy drinks, such as milk and natural juices, in addition to unhealthy drinks, such as energy drinks. Regarding availability, sales, promotion, and supply to gym patrons, adequate regulation of PEAs and untested dietary supplements must also be considered [9,42]. The Saudi Food and Drug Authority must be properly involved in this matter.

This study had several limitations. The use of a self-administered tool was the first factor that might have introduced self-presentation bias and impacted the findings. Additionally, the study did not provide additional information about the

composition and dosage of nutritional supplements and doping products used by individuals. Researchers should consider these topics in the near future.

5. CONCLUSION

In Saudi Arabia, PEA abuse among athletes is rare. In this study, we reported a lower level of PEAs use among female athletes than those reported in a previous Saudi study, which may be due to the difference in populations, where most of the previous Saudi studies focused on male athletes. Regarding the risk of PEAs usage, the study reported that females are exposed equally to protective or risk factors for PEAs use when compared with previous studies concerned with the male population. Consequently, each sex requires a unique set of teaching and preventative strategies. The use of neuroenhancement drugs by sportspersons, which has recently increased, should be the subject of a future survey.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Central Institutional Review Board, Ministry of Health, Saudi Arabia (protocol code 21—69 E , date of approval 1-8-2021).”.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available on request from the author.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

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