ORIGINAL ARTICLE

Study of the Knowledge and Practice toward Anabolic-Androgenic Steroid Use among Students at the King Abdulaziz University

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Abstract

This cross-sectional study was conducted to assess the knowledge and practice toward anabolic-androgenic steroid (AAS) use among 337 students of King Abdul-Aziz University, Kingdom of Saudi Arabia. A digital questionnaire with 36 questions was used during the study. Data entry and analysis were carried out using Statistical Package for Social Sciences version 22.0 Statistical software. The study demonstrated a significant gap in the beliefs, knowledge, and awareness among the participants. The majority exhibited a low level of knowledge about AAS. This was indicative of the insufficient educational programs concerning the risks associated with AAS use. The study recommended the implementation of an effective approach in universities to govern AAS.

Key words: Anabolic-androgenic steroids, Knowledge, Practice, University students, Biochemistry, Saudi Arabia

INTRODUCTION

The global public health community is increasingly concerned about using anabolic-androgenic steroids (AAS). Androgens, hormones that contribute to male trait development, benefit athletes and bodybuilders but are also at risk of being misused by students.[1]

Elevated androgen levels in women can result in conditions such as hirsutism, acne, disrupted menstrual cycles, and challenges with fertility. On the other hand, excessive androgen levels are associated with several adverse effects, such as cardiovascular diseases, liver damage, depression, and aggressive behavior. In men, side effects such as hair loss and a heightened risk of prostate cancer are linked to the use of androgen supplements.[1,2]

A 2008 study in Jordan surveyed 503 university students and 154 health club patrons regarding AAS usage. Findings revealed that 4.2% of the students and 26.0% of health club attendees had used AAS in the past month. Student users were predominantly 18–29, whereas health club users ranged from 18 to 45, with most under 30. Notably, AAS use among athletes rose with higher incomes. Educational levels showed no significant differences in usage among athletes. Regarding AAS acquisition, 67.4% of students were unaware of procurement methods, contrasted with 86.7% of athletes who knew. Students mainly acquired AAS through friends (66.7%), whereas athletes obtained it through friends or coaches (35.7% and 42.9%). Most students (74.9%) who had not used AAS were against using them, unlike 45.6% of similar athletes. Athletes primarily used AAS for enhancing athletic performance (61.5%), whereas students used them for

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performance (44.4%) or appearance (55.6%). Health concerns and cost, or side effects.[3]

In a 2018 study in Saudi Arabia, researchers delved into AAS usage among gym-goers. Most participants were single, well-educated, averaging 28.6 years of age, with a body mass index (BMI) of around 26.0. The study observed that personal interest drove most to the gym, with walking being the most common exercise. Notably, 9.8% of gym attendees actively used AAS, and another 6.8% considered future use. Information about AAS was primarily acquired through gym acquaintances, highlighting the impact of social circles on AAS consumption. Over half of the individuals who stopped using AAS experienced depression, muscle loss, and reduced fitness. Alarmingly, about 25% had a history of infertility related to prior AAS use. AAS users were typically older, more often married, with higher incomes, and had longer gym associations than non-users. They were also more inclined to use multivitamins and growth hormones and less likely to be in the medical profession. The study underscored the heightened awareness among non-users about AAS-related health risks, including infertility and cardiovascular issues. This awareness among gym-goers, particularly for health reasons, is critical in addressing the harmful impacts of AAS.[4]

The aforementioned studies offer significant insights into AAS usage among college students, health club members, and gym-goers. Nonetheless, our research can fill in several key areas that these studies overlook.

To begin with, both investigations are limited to particular groups and fail to encompass a broader perspective on AAS consumption across various university departments and academic disciplines. Moreover, they lack an examination of the psychological elements driving AAS usage, such as the influence of peer pressure, societal norms, or underlying mental health concerns. The effect of AAS on students' academic achievements and social interactions is also not addressed. Furthermore, these studies do not assess the impact and efficacy of educational programs or interventions aimed at curbing the use of AAS.

Hence, the primary aim of this study is to comprehensively evaluate the awareness, attitudes, and behaviors relating to AAS use among King Abdulaziz University (KAU) students. The current study includes assessing the students' knowledge levels, personal attitudes, and actual practices concerning the use of AAS. In addition, the study seeks to explore the correlation between the students' sociodemographic attributes (such as age, gender, academic discipline, and other relevant factors) and their understanding, opinions, and usage of AAS. Ultimately, this research aims to create a foundation for subsequent investigations by proposing detailed recommendations that could guide future research efforts in addressing steroid use, its perception, and its impact among university student populations.

MATERIALS AND METHODS

Study design

This cross-sectional study was conducted to assess the knowledge and practice toward AAS use among a sample of students of KAU, Saudi Arabia, regarding the impact of medical knowledge on AAS use. The study was carried out in 2023–2024. The study protocol was approved by the Research Ethics Committee of the KAU – Faculty of Medicine (Reference No 647-23).

Population

The sample size calculation was based on a prevalence of AAS of 30%, with a 95% confidence interval based on the study conducted in Riyadh, Saudi Arabia, among Gym users (1). The current study was directed to investigate the AAS users among Abdulaziz University students. The sample size was estimated (with a confidence level of 95% and a 5% margin of error). It includes 337 students using the Survey Monkey sample size calculator (https://www.calculator.net/sample-size-calculator.html). The inclusion criteria were male, older than 18 years, and willing to participate. All medical and non-medical KAU students were included. We excluded repeated registration in multiple centers or incomplete responses.

Questionnaire

A digital questionnaire with 36 questions was used during the study. An expert assessed the English-language questionnaire that was completed. The questionnaire's opening statement, which included a sentence indicating agreement to participate, described the goals of our study (item number 1). An initial pilot study, which included 20 male and 20 female students, was used to validate the questionnaire. The supervisor reviewed the results to assess their reliability. All KAU students had access to the questionnaire's URL. Three sections were created for the survey's components. There are closed-ended questions in each. The candidate data (2–8) were included in the first part. Questions concerning the usage of AAS were addressed in the second section (9–12). The opinions, knowledge, and awareness regarding the usage of AAS were assessed in the third section (13–34). In the third division, the questions were either yes or no. Each component of the data was submitted anonymously. The study comprised only completed surveys.

Statistical analysis

Data entry and analysis were carried out using IBM© Statistical Package for Social Sciences (SPSS©) version 22.0 Statistical software. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used for each answer. Data expressed as mean ± standard error of the mean for

parametric data and frequency (%) for categorized data. SPSS version 22 (SPSS, IBM Corp., Armonk, New York, USA) was utilized to analyze values. The Shapiro–Wilk test was used to determine whether value distributions were normal. As parametric data were not normally distributed, the Mann–Whitney test was used to compare two groups, the Kruskal–Wallis test was used to compare between two groups, and the Kruskal–Wallis test was used to compare more than two groups. $P < 0.05$ was considered statistically significant.

RESULTS

Table 1 shows the demographic characteristics of the participants. Most of the participants were males (80.1%), in the age group 19–21 years (71.4%), in pre-clinical academic years (68.1%), and in medical college (29.5%). BMI ranged from 14.45 to 49.27 kg/m^2, with most participants having normal BMI (45.9%), whereas 21.8% were overweight, 19.2% were obese, and 13.1% were underweight. Of the participants, 64 (15.0%) had chronic illnesses such as hypertension (57.8%), diabetes mellitus (20.3%), and others (21.9%), such as eczema, asthma, sickle cell disease, epilepsy, hypothyroidism, ulcerative colitis, and Gilbert syndrome. Of the participants, 41 (9.6%) used medications.

The relationship between students' sociodemographic characteristics and their level of total practice and total beliefs, knowledge, and awareness regarding AAS is shown in Table 2. Total beliefs, knowledge, and awareness scores were significantly higher in clinical versus pre-clinical students ($P = 0.003$), in Economic and administration versus other colleges ($P = 0.003$), and in patients with chronic illness than those without ($P < 0.001$). Total practice score was significantly higher in economics and administration versus other colleges ($p = 0.012$), in patients with chronic illness than those without ($P < 0.001$).

The details of the answers of the participants regarding practice towards the use of AAS are shown in Table 3. 121 participants (28.3%) gave a history of someone suggesting that they try drugs to enhance their performance or to change their appearance. The suggested persons were mostly friends (60.3%), then gym trainers (16.3%), relatives (10.7%), health professionals (5.8%), and others (6.6%). Of the participants, 103 (24.1%) think that AAS were easily accessible. Of the participants, 86 (20.1%) used AAS during the last 6 months, such as testosterone (33.7%), diuretics (18.6%), glucocorticosteroids (16.3%), human growth hormone (14.0%), insulin (14.0%), and others (3.5%). Of the participants who used AAS during the last 6 months, 43 (50.0%) used more than one type of these over the previous 6 months.

The practice score toward using AAS among participants is shown in Table 4. Four questions were included, with the correct answer taken (1) and the wrong answer taken (0), with a total score ranging from 0 to 4. The mean total score was 0.83, with most of the participants, 78.7%, having poor scores (<2), whereas only 21.3% had good scores (≥2).

Table 1: Demographic characteristics of participants (n=427)

Characteristics	Frequency (%)
Gender	
Male	342 (80.1)
Female	85 (19.9)
Age (years)	
19–21 years	305 (71.4)
22–24 years	113 (26.5)
≥25 years	9 (2.1)
Weight (kg)	73.34±20.99 (35–165)
BMI (kg/m^2)	25.00±6.03 (14.45–49.27)
Underweight (<18.5 kg/m^2)	56 (13.1)
Normal (18.5–24.9 kg/m^2)	196 (45.9)
Overweight (25.0–29.9 kg/m^2)	93 (21.8)
Obese (≥30.0 kg/m^2)	82 (19.2)
Academic year	
Pre-clinical years	291 (68.1)
Clinical years	136 (31.9)
Collage	
Medicine	126 (29.5)
Science	108 (25.3)
Engineering	90 (21.1)
Dental	26 (6.1)
Law	11 (2.6)
Economic and administrative	9 (2.1)
Others	57 (13.3)
Chronic illness	
No	363 (85.0)
Yes	64 (15.0)
Hypertension	37 (57.8)
Diabetes mellitus	13 (20.3)
Others	14 (21.9)
Currently used medications	
No	386 (90.4)
Yes	41 (9.6)

BMI: Body mass index

Table 5 shows the results from a survey involving 427 participants regarding their beliefs, knowledge, and awareness about AAS usage. The table details the responses to 23 questions related to the perceived benefits, risks, and personal experiences with steroids and associated substances. The findings from the survey indicate that over half of the respondents (53.9%) believe anabolic hormones can enhance student performance, although fewer think that diuretics (21.7%), glucocorticosteroids (23%), human

Table 2: Relationship between students' sociodemographic characteristics and their level of total practice and total beliefs, knowledge, and awareness regarding anabolic-androgenic steroid (*n*=427)

Characteristics	Total practice score	Total beliefs, knowledge, and awareness score
Gender		
Male	0.85±0.06	8.75±0.30
Female	0.75±0.13	8.84±0.59
Significance	*P*=0.321	*P*=0.925
Age (years)		
19–21 years	0.80±0.07	8.49±0.31
22–24 years	0.88±0.11	9.43±0.54
≥25 years	1.00±0.47	9.89±1.90
Significance	*P*=0.879	*P*=0.337
BMI (kg/m^2)		
Underweight (<18.5 kg/m^2)	0.88±0.14	6.93±0.62
Normal (18.5–24.9 kg/m^2)	0.80±0.09	9.10±0.39
Overweight (25.0–29.9 kg/m^2)	0.98±0.13	9.45±0.62
Obese (≥30.0 kg/m^2)	0.68±0.12	8.48±0.61
Significance	*P*=0.254	*P*=0.055
Academic year		
Pre-clinical years	0.87±0.07	8.24±0.31
Clinical years	0.73±0.09	9.90±0.49
Significance	*P*=0.606	*P*=0.003
Collage		
Medicine	0.75±0.09	10.18±0.48
Science	0.94±0.13	7.75±0.58
Engineering	0.82±0.12	7.89±0.49
Dental	0.77±0.26	10.27±0.90
Law	1.45±0.37	8.73±1.65
Economic and administrative	2.00±0.60	10.44±2.13
Others	0.51±0.13	8.04±0.75
Significance	*P*=0.012	*P*=0.003
Chronic illness		
No	0.57±0.05	8.29±0.28
Yes	2.28±0.18	11.50±0.72
Significance	*P*<0.001	*P*<0.001
Currently used medications		
No	0.82±0.06	8.63±0.28
Yes	0.88±0.19	10.12±0.90
Significance	*P*=0.730	*P*=0.105

Table 3: The practice toward the use of anabolic-androgenic steroids among participants (*n*=427)

No	Questions	Frequency (%)
1	Has someone ever suggested that you try drugs to enhance your performance or to change your appearance?	
	No	306 (71.7)
	Yes	121 (28.3)
2	If yes, who suggested the use of anabolic-androgenic steroids?	
	Friends	73 (60.3)
	Gym trainer	20 (16.5)
	Relatives	13 (10.7)
	Health professional	7 (5.8)
	Others	8 (6.6)
3	Do you think that anabolic-androgenic steroids are easily accessible?	
	No	94 (22.0)
	Yes	103 (24.1)
	I don't know	230 (53.9)
4	Have you ever used anabolic-androgenic steroids during the last 6 months?	
	No	341 (79.9)
	Yes	86 (20.1)
5	If yes, which of the following drugs and substances have you used over the last 6 months?	
	Testosterone	29 (33.7)
	Diuretics	16 (18.6)
	Glucocorticosteroids	14 (16.3)
	Human growth hormone	12 (14.0)
	Insulin	12 (14.0)
	Others	3 (3.5)
6	If yes, have you used more than one type of these over the last 6 months?	
	No	43 (50.0)
	Yes	43 (50.0%)

growth hormone (30%), and insulin (24.3%) contribute to better performance. A significant majority (56.9%) were not trained in any educational program about the risks of using AAS, and of those who were knowledgeable, 56.6% acquired this knowledge formally. Many respondents acknowledged the potential side effects of testosterone, including acne (48.2%), liver damage (40.7%), increased aggressiveness and sexual appetite (51.8%), and infertility (41.9%), with varying awareness of other risks such as baldness, testicle shrinkage, impotence, Breast tissue development, stunted growth, and disruption of puberty and

Table 4: The score of practice toward the use of anabolic-androgenic steroids among participants (*n*=427)

No	Questions	Right (%)	Wrong (%)	Mean±SEM
1	Has someone ever suggested that you try drugs to enhance your performance or to change your appearance?	121 (28.3)	306 (71.7)	0.28±0.02
2	Do you think that anabolic-androgenic steroids are easily accessible?	103 (24.1)	324 (75.9)	0.24±0.02
3	Have you ever used anabolic-androgenic steroids during the last 6 months?	86 (20.1)	341 (79.9)	0.20±0.02
4	If yes, have you used more than one type of these over the last 6 months?	43 (50.0)	43 (50.0)	0.50±0.05
	Total score (0-4)			0.83±0.06
	Poor (< 2)	336 (78.7)		
	Good (≥ 2)	91 (21.3)		

depression. The findings reveal that when asked if diuretics enhance student performance, 21.7% of participants agreed, whereas 34.3% disagreed, and 43.9% were unsure. In addition, there was significant awareness of the potential side effects of diuretics among the participants, with 40.5% believing that diuretics may lead to dehydration, 33.3% concerned about muscle cramps, 37.7% acknowledging the risk of dizziness or fainting, 39.3% aware of the possibility of a drop in blood pressure, and 30.9% believing they may cause a loss of coordination and balance. These results reflect mixed beliefs about the performance enhancement capabilities of diuretics, alongside considerable awareness of their potential side effects. In addition, a substantial portion of participants reported experiencing symptoms such as acne (31.6%) and hair loss (31.1%), though fewer reported more severe symptoms such as breast enlargement (10.1%), sexual dysfunction (6.3%), chest pain (13.1%), and behavioral problems (13.3%). Nearly half (46.4%) reported not experiencing any symptoms. Overall, the data reflect diverse levels of knowledge and beliefs about AAS, alongside significant concerns regarding their side effects among the surveyed participants.

The score of beliefs, knowledge, and awareness about the use of AAS among participants is shown in Table 6. Twenty-three questions were included, with the right answer score (1) and wrong answer score (0), with a total score ranging from 0 to 29, as question 23 consists of 7 items. The mean of the total score was 8.77, with most of the participants, 82.7%, having poor scores (<14.5), whereas only 17.3% had good scores (≥14.5).

The following table shows a comparison of the degree of practice toward the use of AAS between males and females. The results showed that the scores of males were significantly higher than those of females in the question "Do you think that AAS are easily accessible?" ($P = 0.034$). The results also showed that there were no differences between the scores of males and females in the question "Has someone ever suggested that you try drugs to enhance your performance or to change your appearance?" ($P = 0.607$), the question "Have you ever used AAS during the last 6 months?" ($P = 0.735$), and the question "If yes, have you used more than one type of these over the last 6 months?" ($P = 0.582$) [Table 7].

The score of males was significantly lower than that of females in the questions "If yes, what was the source of your Knowledge?" ($P = 0.029$), "Acne" ($P < 0.0001$), and "Hair Loss" ($P < 0.0001$). The score of the male was significantly higher than that of the females in question "Do you think that using testosterone hormone may lead to pattern baldness?" ($P = 0.029$), "Do you think that using testosterone hormone on males may lead to shrinking of the testicles?" ($P = 0.013$), "I have not experienced any" ($P < 0.0001$) [Table 8].

DISCUSSION

The study results indicated a low level of beliefs, knowledge, and awareness about the use of AAS among the participants, with an average total score of 8.77. Most participants (82.7%) scored poorly (<14.5), whereas only 17.3% scored well (≥14.5). The results also indicated a low level of AAS use among participants, with an average total score of 0.83. Most participants (78.7%) scored poorly (<2), whereas only 21.3% scored well (≥2). This may be due to the weakness of the programs offered to students about the risks of AAS use. The difference in the level of knowledge and awareness among students about AAS use may be due to the difference in the content of the curriculum between medical colleges and colleges of management and economics. The curriculum in medical colleges addresses the risks and benefits of AAS use, which helps students gain an acceptable level of beliefs, knowledge, and awareness about AAS use.[5]

In the Kingdom of Saudi Arabia, AAS use and popularity have grown significantly over time. Over the past few years, studies have been conducted in various regions of the nation to gauge AAS knowledge and the proportion of users who are aware of the threat facing us. AAS use among participants was reported in three distinct studies testing AAS knowledge in Riyadh,[1] Eastern Province,[2] and Jeddah.[6] These studies reported AAS use among participants with percentages of 29.3%, 17.69%, and 4.7%, respectively. All of these investigations showed that the majority of participants, including those who take AAS, had limited knowledge of the drug's negative effects.[2] In 2018, a survey was conducted to assess the attitudes and

Table 5: Beliefs, knowledge, and awareness about using anabolic-androgenic steroids among participants (*n*=427)

No	Questions	Yes (%)	No (%)	I don't know (%)
1	Do you think the anabolic hormones will help students perform better?	230 (53.9)	95 (22.2)	102 (23.9)
2	If yes, do you think that diuretics make students perform better?	50 (21.7)	79 (34.3)	101 (43.9)
3	If so, do you think that glucocorticosteroids make students perform better?	53 (23.0)	65 (28.3)	112 (48.7)
4	If yes, do you think that human growth hormone makes students perform better?	69 (30.0)	68 (29.7)	92 (40.3)
5	If yes, do you think that insulin makes students perform better?	56 (24.3)	68 (29.7)	106 (46.1)
6	Were you trained in an education program about the risks of using anabolic-androgenic steroids?	99 (23.2)	243 (56.9)	85 (19.9)
		Formal (1) (%)	**Non-formal (0) (%)**	**I don't know (0) (%)**
7	If yes, what was the source of your knowledge?	56 (56.6)	34 (34.3)	9 (9.1)
		Yes (%)	**No (%)**	**I don't know (%)**
8	Do you think that using the testosterone hormone may lead to acne?	206 (48.2)	62 (14.5)	159 (37.2)
9	Do you think that using the testosterone hormone may lead to pattern baldness?	170 (39.8)	73 (17.1)	184 (43.1)
10	Do you think that using the testosterone hormone may lead to liver damage?	174 (40.7)	55 (12.9)	198 (46.4)
11	Do you think that using the testosterone hormone may lead to stunted growth and disruption of puberty?	177 (41.5)	68 (15.9)	182 (42.6)
12	Do you think that using testosterone hormone may lead to increased aggressiveness and sexual appetite?	221 (51.8)	58 (13.6)	148 (34.7)
13	Do you think that using the testosterone hormone may lead to depression?	149 (34.9)	82 (19.2)	196 (45.9)
14	Do you think that using the testosterone hormone may lead to Breast tissue development?	130 (30.4)	114 (26.77)	183 (42.9)
15	Do you think that using testosterone hormone on males may lead to shrinking of the testicles?	155 (36.3)	81 (19.0)	191 (44.7)
16	Do you think that using testosterone hormone on males may lead to impotence?	145 (34.0)	65 (15.2)	217 (50.8)
17	Do you think that using testosterone hormone on males may lead to a reduction in sperm production (infertility)?	179 (41.9)	81 (19.0)	167 (39.1)
18	Do you think that using diuretics may lead to Dehydration?	173 (40.5)	60 (14.1)	194 (45.4)
19	Do you think that using diuretics may lead to Muscle cramps?	143 (33.3)	60 (14.1)	224 (52.5)
20	Do you think that using diuretics may lead to dizziness or fainting?	161 (37.7)	64 (15.0)	202 (47.3)
21	Do you think that using diuretics may lead to a drop in blood pressure?	168 (39.3)	55 (12.9)	204 (47.8)
22	Do you think using diuretics may lead to a loss of coordination and balance?	132 (30.9)	73 (17.1)	222 (52.0)
23	Have you experienced any of the following signs or symptoms in the past year?			
23.1	Acne	135 (31.6)	292 (68.4)	-
23.2	Hair loss	133 (31.1)	294 (68.9)	-
23.3	Behavioral problems	57 (13.3)	370 (86.7)	-
23.4	Breast enlargement	43 (10.1)	384 (89.9)	-
23.5	Sexual dysfunction	27 (6.3)	400 (93.7)	-
23.6	Chest pain	56 (13.1)	371 (86.9)	-
23.7	I have not experienced any	198 (46.4)	229 (53.6)	-

knowledge about AAS among gym users from various regions of Saudi Arabia, and the results revealed that 9.8% of them admitted to using AAS.[4]

Another study conducted in Jordan among college students and athletes revealed that the major goals of taking AAS were to enhance one's physical attributes and athletic performance.[3]

Table 6: Beliefs, knowledge, and awareness about using anabolic-androgenic steroids among participants (*n*=427)

No	Questions	Right (%)	Wrong (%)	Mean±SEM
1	Do you think the anabolic hormones will help students perform better?	230 (53.9)	197 (46.1)	0.54±0.02
2	If yes, do you think that diuretics make students perform better?	50 (21.7)	180 (78.3)	0.22±0.03
3	If yes, do you think that glucocorticosteroids make students perform better?	53 (23.0)	177 (77.0)	0.23±0.03
4	If yes, do you think that human growth hormone makes students perform better?	69 (30.0)	161 (70.0)	0.30±0.03
5	If yes, do you think that insulin makes students perform better?	56 (24.3)	174 (75.7)	0.24±0.03
6	Were you trained in an education program about the risks of using anabolic-androgenic steroids?	99 (23.2)	328 (76.8)	0.23±0.02
7	If yes, what was the source of your Knowledge?	56 (56.6)	43 (43.4)	0.57±0.05
8	Do you think that using the testosterone hormone may lead to acne?	206 (48.2)	221 (51.8)	0.48±0.02
9	Do you think that using the testosterone hormone may lead to pattern baldness?	170 (39.8)	257 (60.2)	0.40±0.02
10	Do you think that using the testosterone hormone may lead to liver damage?	174 (40.7)	253 (59.3)	0.41±0.02
11	Do you think that using the testosterone hormone may lead to stunted growth and disruption of puberty?	177 (41.5)	250 (58.5)	0.41±0.02
12	Do you think that using testosterone hormone may lead to increased aggressiveness and sexual appetite?	221 (51.8)	206 (48.2)	0.52±0.02
13	Do you think that using the testosterone hormone may lead to depression?	149 (34.9)	278 (65.1)	0.35±0.02
14	Do you think that using the testosterone hormone may lead to breast tissue development?	130 (30.4)	297 (69.6)	0.30±0.02
15	Do you think that using the testosterone hormone on males may lead to shrinking of the testicles?	155 (36.3)	272 (63.7)	0.36±0.02
16	Do you think that using the testosterone hormone on males may lead to impotence?	145 (34.0)	282 (66.0)	0.34±0.02
17	Do you think that using the testosterone hormone on males may lead to a reduction in sperm production (infertility)?	179 (41.9)	248 (58.1)	0.42±0.02
18	Do you think that using diuretics may lead to dehydration?	173 (40.5)	254 (59.5)	0.41±0.02
19	Do you think that using diuretics may lead to muscle cramps?	143 (33.3)	284 (66.5)	0.33±0.02
20	Do you think that using diuretics may lead to dizziness or fainting?	161 (37.7)	266 (62.3)	0.38±0.02
21	Do you think that using diuretics may lead to a drop in blood pressure?	168 (39.3)	259 (60.7)	0.39±0.02
22	Do you think that using diuretics may lead to loss of coordination and balance?	132 (30.9)	295 (69.1)	0.31±0.02
23	Have you experienced any of the following signs or symptoms in the past year?			
23.1	Acne	135 (31.6)	292 (68.4)	0.32±0.02
23.2	Hair loss	133 (31.1)	294 (68.9)	0.31±0.02
23.3	Behavioral problems	57 (13.3)	370 (86.7)	0.13±0.02
23.4	Breast enlargement	43 (10.1)	384 (89.9)	0.10±0.01
23.5	Sexual dysfunction	27 (6.3)	400 (93.7)	0.06±0.01
23.6	Chest pain	56 (13.1)	371 (86.9)	0.13±0.02
23.7	I have not experienced any	198 (46.4)	229 (53.6)	0.46±0.02
	Total beliefs, knowledge, and awareness (0–29)	8.77±0.27		
	Poor (<14.5)	353 (82.7)		
	Good (≥14.5)	74 (17.3)		

Only 26.3% of male gym users in Sulaymaniyah, Iraq, who participated in a study done in 2020 acknowledged using AAS actively, and 84.8% of them were aware of some of its side effects but continued using it.[7]

In the Al-Ain district, the United Arab Emirates reported in 2008 that 7% of non-users planned to use AAS in the future.[8] In 2015, a study conducted in Kuwait revealed that whereas 22.7% of the participants were AAS users, only 18.2% of them had a great awareness of it.[9] In Bahrain, out of the 14.6% who admitted to using AAS, only 18% believed that they were bad for their health.[10]

A 2011 study in Sweden found that, out of 1752 participants, 3.9% of men reported using AAS for the first time. It also

Table 7: Comparison of the score of practice toward the use of anabolic-androgenic steroids among males and females

No	Questions	Male (*n*=342)	Female (*n*=85)	Significance
1	Has someone ever suggested that you try drugs to enhance your performance or to change your appearance?	0.28±0.02	0.31±0.05	*P*=0.607
2	Do you think that anabolic-androgenic steroids are easily accessible?	0.26±0.02	0.15±0.04	***P*=0.034***
3	Have you ever used anabolic-androgenic steroids during the last 6 months?	0.20±0.02	0.19±0.04	*P*=0.735
4	If yes, have you used more than one type of these over the last 6 months?	0.49±0.06	0.56±0.13	*P*=0.582
	Total score (0–4)			0.657
	Poor (<2) (%)	267 (78.1)	69 (81.2)	
	Good (≥2) (%)	75 (21.9)	16 (18.8)	

Bold: Statistically significant*

expressed a great deal of concern since we should concentrate on the risk factors that lead to the use of AAS, as the numbers are thought to be rising annually.[11] Similar research among bodybuilders in Brazil revealed that AAS usage was 20.6%.[12]

According to the data, 15% of the surveyed students reported having a chronic illness. The most common chronic conditions reported include hypertension (57.8%), diabetes mellitus (20.3%), and other conditions such as eczema, asthma, sickle cell disease, epilepsy, hypothyroidism, ulcerative colitis, and Gilbert syndrome. Among students with chronic illnesses, a higher percentage reported using medications compared to those without chronic conditions. Specifically, 9.6% of the total participants were currently using medications, which might include those required to manage their chronic conditions. The data reveal that students with chronic illnesses have significantly higher total practice and knowledge scores regarding AAS than those without chronic illnesses. Similarly, their knowledge and awareness scores are significantly higher than the scores of students without chronic illnesses.

The higher scores among students with chronic illnesses could be explained by the fact that these students are more knowledgeable and cautious about drug use, possibly due to their regular exposure to healthcare systems and the necessity to manage their chronic conditions.[13] Their higher practice scores could also indicate a more informed approach toward the use of substances such as AAS, potentially reflecting a heightened awareness of the risks involved.

Our data revealed that the practice score increases slightly with age. Students aged 19–21 years have a practice score of 0.80 ± 0.07, whereas those aged 22–24 years have a score of 0.88 ± 0.11, and those aged 25 years or older have the highest score of 1.00 ± 0.47. However, the significance level (P = 0.879) indicates that these differences are not statistically significant. Moreover, the knowledge and awareness score also increases with age. The score is lowest in the 19–21 age group (8.49 ± 0.31) and highest in the 25+ group (9.89 ± 1.90), but the difference is not statistically significant (P = 0.337). This indicates that while there is a trend of increasing knowledge, awareness, and practice with age, the differences are not significant.

Regarding the gender factor in practice, knowledge, and awareness about the use of AAS, males have a slightly higher practice score compared to females. However, the difference is not statistically significant. While females have a marginally higher score than males, again, this difference is not statistically significant. The lower use rate in females is in agreement with Sekulic *et al*.[14] However, the results of the current study in general suggest that gender does not have a significant impact on AAS knowledge, beliefs, and practices among students.

The apparent increased AAS use among males could be explained by the fact that sociocultural expectations for males to attain a muscular and athletic physique might push some to use AAS to meet these ideals.[15] Naturally higher levels of testosterone in males might make them more inclined to seek performance enhancement through AAS.[16] Male-dominated social and athletic circles might have higher accessibility and acceptance of AAS use, leading to increased prevalence among males.[17]

The relation between gender and AAS use, according to prevalence and patterns of use, was that males were more likely to use AAS for bodybuilding and power sports. At the same time, females were more likely to use them for weight loss and endurance sports.[18] Moreover, males had more positive attitudes toward the acceptability of AAS use and tended to perceive the benefits as outweighing the potential risks, compared to females.[19] Males who were more influenced by the idealized muscular male body image were more likely to have positive attitudes toward AAS's use of social and cultural influence.[20] Regarding availability and access, males have more accessibility to AAS, and are more prevalent in male-dominated settings, such as gyms and sports teams; all of these conclusions lead to higher rates of AAS use among males.[21]

Regarding the practice, knowledge, and awareness of AAS use among medical students, the current study revealed that pre-clinical year students have a higher practice score

Table 8: Comparison in beliefs, knowledge, and awareness about the use of anabolic-androgenic steroids between males and females

No	Questions	Male (*n*=342)	Female (*n*=85)	Significance
1	Do you think the anabolic hormones will help students perform better?	0.53±0.03	0.59±0.05	*P*=0.306
2	If yes, do you think that diuretics make students perform better?	0.23±0.03	0.16±0.05	*P*=0.267
3	If yes, do you think that glucocorticosteroids make students perform better?	0.22±0.03	0.28±0.06	*P*=0.348
4	If yes, do you think that human growth hormone makes students perform better?	0.29±0.03	0.34±0.07	*P*=0.486
5	If yes, do you think that insulin makes students perform better?	0.24±0.03	0.24±0.06	*P*=0.948
6	Were you trained in an education program about the risks of using anabolic-androgenic steroids?	0.23±0.02	0.22±0.05	*P*=0.839
7	If yes, what was the source of your knowledge?	0.51±0.06	0.79±0.10	***P*=0.029***
8	Do you think that using the testosterone hormone may lead to acne?	0.48±0.03	0.48±0.05	*P*=0.999
9	Do you think that using the testosterone hormone may lead to pattern baldness?	0.42±0.03	0.29±0.05	***P*=0.029***
10	Do you think that using the testosterone hormone may lead to liver damage?	0.42±0.03	0.38±0.05	*P*=0.516
11	Do you think that using the testosterone hormone may lead to stunted growth and disruption of puberty?	0.42±0.03	0.38±0.05	*P*=0.427
12	Do you think that using the testosterone hormone may lead to increased aggressiveness and sexual appetite?	0.52±0.03	0.48±0.05	*P*=0.468
13	Do you think that using the testosterone hormone may lead to depression?	0.35±0.03	0.35±0.05	*P*=0.931
14	Do you think that using the testosterone hormone may lead to breast tissue development?	0.30±0.02	0.31±0.05	*P*=0.974
15	Do you think that using the testosterone hormone on males may lead to shrinking of the testicles?	0.39±0.03	0.25±0.05	***P*=0.013***
16	Do you think that using the testosterone hormone on males may lead to impotence?	0.35±0.03	0.29±0.05	*P*=0.323
17	Do you think that using the testosterone hormone on males may lead to a reduction in sperm production (infertility)?	0.44±0.03	0.33±0.05	*P*=0.061
18	Do you think that using diuretics may lead to dehydration?	0.41±0.03	0.40±0.05	*P*=0.914
19	Do you think that using diuretics may lead to muscle cramps?	0.34±0.03	0.32±0.05	*P*=0.707
20	Do you think that using diuretics may lead to dizziness or fainting?	0.39±0.03	0.34±0.05	*P*=0.446
21	Do you think that using diuretics may lead to a drop in blood pressure?	0.40±0.03	0.36±0.05	*P*=0.545
22	Do you think that using diuretics may lead to Loss of coordination and balance?	0.26±0.02	0.55±0.05	*P*=0.652
23	Have you experienced any of the following signs or symptoms in the past year?			
23.1	Acne	0.26±0.02	0.55±0.05	***P*=0.0001****
23.2	Hair loss	0.24±0.02	0.61±0.05	***P*=0.0001****
23.3	Behavioral problems	0.12±0.02	0.19±0.04	*P*=0.098
23.4	Breast enlargement	0.09±0.01	0.15±0.04	*P*=0.074
23.5	Sexual dysfunction	0.06±0.01	0.07±0.03	*P*=0.756
23.6	Chest pain	0.12±0.02	0.19±0.04	*P*=0.082
23.7	I have not experienced any	0.53±0.03	0.19±0.04	***P*=0.0001****
	Total beliefs, knowledge, and awareness (0–29)	8.75±0.30	8.84±0.59	*P*=0.925
	Poor (<14.5) (%)	284 (83.0)	69 (81.2)	
	Good (≥14.5) (%)	58 (17.0)	16 (18.8)	

Bold: Statistically significant*

compared to clinical students, despite this difference is not statistically significant. In addition, clinical years students have a significantly higher knowledge and awareness score compared to pre-clinical students, with a $P = 0.003$, indicating a significant difference. This suggests that students in more advanced academic years, particularly those in clinical years, have significantly better knowledge and awareness about AAS compared to those in earlier academic stages. These findings support the findings previously discussed in the systematic review published by Buckley *et al*.[22]

The influence of individuals' social and physical environment plays a critical role in the use of AAS, as revealed in the current study. Friends are a critical factor in taking decisions about AAS use, with data showing that 60.3% of users were encouraged by their peers to try these substances. This peer influence often leads to a social environment where AAS use is not only normalized but also actively encouraged, driven by desires for social acceptance, approval, or competitive edge.[23]

Similarly, gym trainers, who are responsible for about 16.5% of AAS recommendations, exert a considerable influence. Often seen in bodybuilding or competitive sports, trainers may suggest AAS as a shortcut to achieve quicker results or enhance physical performance, lending their expert advice a weighty influence on their clients' choices.[24]

The physical environment also contributes significantly to AAS use. The accessibility of gyms and sports facilities, which inherently emphasize physical prowess and appearance, can encourage its use for the promotion of performance-enhancing substances. Furthermore, the study points out that a significant 24.1% of participants perceive AAS as easily accessible, often facilitated by the very environments they frequent, such as gyms or athlete-centric social networks. This combination of social encouragement and physical availability creates a feedback loop, substantially elevating the likelihood of AAS use. Moreover, gyms that lack strict policies against AAS use or fail to provide adequate education on the risks associated with these substances can inadvertently foster an environment where AAS use is prevalent.[18]

Regarding the relationship between the possible risks and benefits of AAS use that the participants know, our study results revealed a weak degree of beliefs, knowledge, and awareness about the use of AAS among participants. This confirmed their perception of potential risks and benefits that may result from AAS use. Their opinions largely indicated their knowledge of the benefits of AAS use, most notably increased muscle strength and improved appearance. However, participants' responses revealed a significant gap in their understanding of the risks of physical and mental health problems that AAS users may face. This lack of understanding might be attributed to the scarcity of training programs that educate individuals about the risks associated with AAS use.

AAS include male sex hormones such as testosterone and synthetic derivatives with a similar structure and effect.[25] The use of AAS is associated with a wide range of physical side effects, such as hematological, metabolic, and cardiovascular diseases.[26] Anatomical changes in the brain,[26] reduced cognitive function,[27] hepatic impairment, and disturbance of the sexual hormone system.[28] Men can develop gynecomastia, and women can experience increased masculinization.[26] In addition, sexual function may be affected, in which increased libido during AAS use is often followed by decreased libido and erectile dysfunction upon discontinuation.[29] Some users may develop hypomanic, manic, or psychotic symptoms during AAS exposure, whereas post-cessation periods may be accompanied by depressive symptoms, anxiety, and sleep disorders.[30] AAS use is also found to be associated with aggressive behavior,[31] especially when combined with psychoactive substances.[32]

Our study on the use of AAS at KAU highlighted several limitations that could impact the applicability and accuracy of the findings. First, the risk of response bias is significant due to the reliance on self-reported data, where participants may not have experience or sufficient knowledge about AAS. To counter this, future studies should verify AAS use through methods such as blood tests or ensure participants are adequately informed before taking part in the research. Another limitation is the study's generalizability. Conducted in a single university, our findings cannot be assumed to represent other institutions or regions within the Kingdom of Saudi Arabia. Expanding the participant base to include a variety of universities and geographic areas could help enhance the study's applicability across different demographics.

The questionnaire's scope was also a concern, as it lacked depth in exploring the extent and nature of AAS use among participants. Future research could benefit from incorporating more comprehensive questions and additional data collection methods, such as personal interviews or focus groups, to gain a deeper understanding of AAS usage patterns. In addition, there was potential sampling bias, particularly with a higher reported prevalence of AAS use among males. This suggests a possible skew in data collection toward one gender. Equalizing the number of male and female participants in future surveys would help provide a more balanced view and better reflect the true prevalence of AAS use across genders.

Finally, the omission of significant variables such as psychological factors, ease of access to AAS, and other relevant influences was notable. Addressing these gaps by including a wider range of variables could offer a more comprehensive analysis of the factors driving AAS use, thereby enhancing the study's overall validity and relevance. Through these improvements, subsequent research could provide more robust and generalizable insights into the patterns and impacts of AAS use.

The current study recommends the following: an effective approach in universities to govern AAS use includes all the elements of a cross-sectional strategy from education, support, and community involvement. University settings afforded the ideal means of educating students about AAS risk, with potential via seminars and workshops promoted by student-athletes urging drug-free living through peer-led campaigns. College health companies ought to provide AAS evaluation and counseling services in order to acknowledge the onset of use quickly. Utilize platforms such as e-learning and

social media to share knowledge effectively. Collaborating with sporting regulatory bodies is necessary to sustain the integrity of anti-doping laws and natural training surrogates. Health fairs, in conjunction with posters and other standard means of health promotion, can also help spread the message throughout campus. Supervisors can help by incorporating AAS content into the courses that they teach so that students' understandings are enhanced. Specialists can provide non-government help anonymously, and these types of programs will have a much better effect if it include parents, toward their kids, and participants in regular monitoring with former addicts. By combining these efforts, university settings would be far better positioned to advance clinical procedures and health promotion among students – all while keeping them safe and healthy.

Moreover, future research on AAS use should focus on several key areas. Research should aim to standardize the methods used to assess AAS use across studies. Developing and implementing standardized assessment tools would improve the accuracy of prevalence estimates and allow for more reliable cross-study comparisons. Future studies should focus on the long-term physical and psychological consequences of AAS use. While some research has been conducted on the short-term effects, there is still much to learn about the chronic impact of these substances, particularly in non-athletic populations who may use AAS for esthetic purposes. In addition, more research is needed on the effectiveness of interventions aimed at reducing AAS use, particularly those targeting high-risk groups such as bodybuilders and young men. By conducting this research direction in our Middle East countries, we will address the gaps in current knowledge and support the development of more effective policies and interventions to reduce the prevalence of AAS use.

CONCLUSION

The results of our study at KAU concerning AAS usage demonstrate a significant gap in the beliefs, knowledge, and awareness among the participants. The majority exhibited a low level of knowledge about AAS. This is indicative of the insufficient educational programs concerning the risks associated with AAS use. It is also prominent that AAS use among KAU students was relatively low, which correlates with their limited awareness and knowledge. The study also revealed differences in knowledge levels potentially influenced by educational curricula, with medical students generally more informed than their peers in other faculties. This suggests that integrating AAS education into more curricula might increase overall awareness. In addition, no significant difference between the two genders in the practice, with females being more aware than males of its use. Furthermore, the presence of chronic conditions among participants seemed to influence their awareness and practices regarding AAS use positively. The study highlights a critical need for targeted educational interventions that are inclusive of all university faculties and extend beyond to reach younger populations potentially at risk. By broadening the scope of future research and enhancing educational curricula, there is an opportunity to significantly reduce the prevalence of AAS use and its associated health risks.

REFERENCES

1. Al-Harbi F, Gamaleddin I, Alsubaie E, Al-Surimi K. Prevalence and risk factors associated with anabolic-androgenic steroid use: A cross-sectional study among gym users in Riyadh, Saudi Arabia. Oman Med J 2020;35:e110.
2. Albaker W, Alkhars A, Elamin Y, Jatoi N, Boumarah D, Al-Hariri M. Anabolic-androgenic steroid abuse among gym users, Eastern Province, Saudi Arabia. Medicina (Kaunas) 2021;57:703.
3. Tahtamouni LH, Mustafa NH, Alfaouri AA, Hassan IM, Abdalla MY, Yasin SR. Prevalence and risk factors for anabolic-androgenic steroid abuse among Jordanian collegiate students and athletes. Eur J Public Health 2008;18:661-5.
4. Althobiti SD, Alqurashi NM, Alotaibi AS, Alharthi TF, Alswat KA. Prevalence, attitude, knowledge, and practice of anabolic androgenic steroid (AAS) use among gym participants. Mater Sociomed 2018;30:49-52.
5. Chiba T, Kobayashi E, Okura T, Sekimoto M, Mizuno H, Saito M, *et al*. An educational intervention improved knowledge of dietary supplements in college students. BMC Public Health 2020;20:633.
6. Ahmed MH, Al-Saud NS, Omar AM, Magadmi RM, Hassan SM, Al-Qudsi FM. Knowledge of and attitudes toward the use of anabolic-androgenic steroids among the population of Jeddah, Saudi Arabia. J Microsc Ultrastruct 2019;7:78-83.
7. Aziz SA. Attitude and health issue awareness of anabolic androgenic steroids use among male gym users in some gym centers in Sulaymaniyah city, Iraq. J Subst Use 2022;27:14-9.
8. Al-Falasi O, Al-Dahmani K, Al-Eisaei K, Al-Ameri S, Al-Maskari F, Nagelkerke N, *et al*. Knowledge, attitude and practice of anabolic steroids use among gym users in Al-Ain district, United Arab Emirates. Open Sports Med J 2008;2:75-81.
9. Alsaeed I, Alabkal JR. Usage and perceptions of anabolic-androgenic steroids among male fitness centre attendees in Kuwait--a cross-sectional study. Subst Abuse Treat Prev Policy 2015;10:33.
10. AlJasim N, Al Thawadi M, AlAnsari S, Qambar F, AlQayem F, Jawad JS. Prevalence, knowledge, attitude and practice of anabolic androgenic steroids use among adult male fitness centre attendees in Bahrain. Saudi J Med 2019;4:545-50.
11. Leifman H, Rehnman C, Sjöblom E, Holgersson S. Anabolic androgenic steroids--use and correlates among gym users--an assessment study using questionnaires

and observations at gyms in the Stockholm region. Int J Environ Res Public Health 2011;8:2656-74.
12. Nogueira FR, Brito Ade F, Oliveira CV, Vieira TI, Gouveia RL. Anabolic-androgenic steroid use among Brazilian bodybuilders. Subst Use Misuse 2014;49:1138-45.
13. Fayyazi Bordbar MR, Abdollahian E, Samadi R, Dolatabadi H. Frequency of use, awareness, and attitudes toward side effects of anabolic-androgenic steroids consumption among male medical students in Iran. Subst Use Misuse 2014;49:1751-8.
14. Sekulic D, Tahiraj E, Zvan M, Zenic N, Uljevic O, Lesnik B. Doping attitudes and covariates of potential doping behaviour in high-level team-sport athletes; gender specific analysis. J Sports Sci Med 2016;15:606-15.
15. Piatkowski TM, White KM, Hides LM, Obst PL. Australia's adonis: Understanding what motivates young men's lifestyle choices for enhancing their appearance. Aust Psychol 2020;55:156-68.
16. Linhares BL, Miranda EP, Cintra AR, Reges R, Torres LO. Use, misuse and abuse of testosterone and other androgens. Sex Med Rev 2022;10:583-95.
17. Adams NN. A triad of physical masculinities: Examining multiple 'hegemonic'bodybuilding identities in anabolic-androgenic steroid (AAS) online discussion groups. Deviant Behav 2023;44:1498-516.
18. Sagoe D, Molde H, Andreassen CS, Torsheim T, Pallesen S. The global epidemiology of anabolic-androgenic steroid use: A meta-analysis and meta-regression analysis. Ann Epidemiol 2014;24:383-98.
19. Parkinson AB, Evans NA. Anabolic androgenic steroids: A survey of 500 users. Med Sci Sports Exerc 2006;38:644-51.
20. Grogan S, Shepherd S, Evans R, Wright S, Hunter G. Experiences of anabolic steroid use: In-depth interviews with men and women body builders. J Health Psychol 2006;11:845-56.
21. Dodge T, Hoagland MF. The use of anabolic androgenic steroids and polypharmacy: A review of the literature. Drug Alcohol Depend 2011;114:100-9.
22. Buckley S, Coleman J, Davison I, Khan KS, Zamora J, Malick S, *et al*. The educational effects of portfolios on undergraduate student learning: A best evidence medical education (BEME) systematic review. BEME Guide No. 11. Med Teach 2009;31:282-98.
23. Nyemcsok C, Pitt H, Kremer P, Thomas SL. Young men's perceptions about the risks associated with sports betting: A critical qualitative inquiry. BMC Public Health 2022;22:867.
24. Paoli L, Joseph Cox LT. Across the spectrum of legality: The market activities of influencers specialized in steroids and other performance and image enhancing drugs. Int J Drug Policy 2024;123:104246.
25. Kicman AT. Pharmacology of anabolic steroids. Br J Pharmacol 2008;154:502-21.
26. Pope HG Jr., Wood RI, Rogol A, Nyberg F, Bowers L, Bhasin S. Adverse health consequences of performance-enhancing drugs: An endocrine society scientific statement. Endocr Rev 2014;35:341-75.
27. Westlye LT, Kaufmann T, Alnæs D, Hullstein IR, Bjørnebekk A. Brain connectivity aberrations in anabolic-androgenic steroid users. Neuroimage Clin 2016;13:62-9.
28. Rahnema CD, Lipshultz LI, Crosnoe LE, Kovac JR, Kim ED. Anabolic steroid-induced hypogonadism: diagnosis and treatment. Fertil Steril 2014;101:1271-9.
29. Horwitz H, Andersen JT, Dalhoff KP. Health consequences of androgenic anabolic steroid use. J Intern Med 2019;285:333-40.
30. Piacentino D, Kotzalidis GD, Del Casale A, Aromatario MR, Pomara C, Girardi P, *et al*. Anabolic-androgenic steroid use and psychopathology in athletes. A systematic review. Curr Neuropharmacol 2015;13:101-21.
31. Hall RC, Hall RC, Chapman MJ. Psychiatric complications of anabolic steroid abuse. Psychosomatics 2005;46:285-90.
32. Lundholm L, Frisell T, Lichtenstein P, Långström N. Anabolic androgenic steroids and violent offending: Confounding by polysubstance abuse among 10,365 general population men. Addiction 2015;110:100-8.

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