



## Knowledge, attitudes and use of anabolic-androgenic steroids among male gym users: A community based survey in Riyadh, Saudi Arabia

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### ABSTRACT

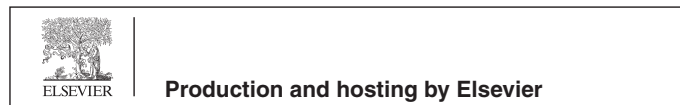
Recreational use of anabolic-androgenic steroids (AAS) is a growing worldwide public health concern. However, studies assessing the level of awareness and knowledge of its effects on health are fairly limited, especially in developing countries, including Saudi Arabia. This community-based cross-sectional study was conducted to assess knowledge, attitudes and practices among male gym members toward AAS in Riyadh (Saudi Arabia) from March to October 2016. Twenty gyms were randomly selected from four different geographical regions (clusters) within Riyadh. In total, 482 participants responded to the self-administered anonymous questionnaire, which covered socio-demographic data, data assessing knowledge, attitude and behavior related to AAS use. The mean ( $\pm$ standard deviation) age of study participants was 27.2 ( $\pm$ 6.9) years. Among these, 29.3% of participants reported having used AAS, while the majority (53.5%) reported hearing of AAS use, mostly through friends. Most study participants reported awareness of the effects of AAS on muscle mass, body weight and muscles strength (53.2%, 51.1% and 45.5%, respectively). In contrast, a higher proportion of study participants were unaware of the side-effects of AAS use. A high proportion of study participants (43.2%) reported that they had been offered AAS and 68.7% believed that AAS are easily accessible. Most of the gym users (90.1%) reported never having used any narcotics or psychoactive drugs. Regression analysis revealed that use of anabolic-androgenic steroids is significantly associated with “weight lifting practice” OR [95%CI] = 1.9[1.02 – 3.61],  $P = 0.044$ ; “using supplementary vitamins, OR [95%CI] = 7.8[4.05 – 15.03],  $P < 0.0001$ , knowing anyone using anabolic-androgenic steroids’ OR [95%CI] = 7.5[3.78 – 14.10],  $P < 0.0001$ , and someone advised Gym users to take anabolic-androgenic steroids” OR [95%CI] = 2.26[1.23 – 4.14],  $P < 0.008$ . Our findings suggest that the level of awareness regarding the possible side-effects of AAS is fairly limited. Thus, efforts directed toward educating the public and limiting access to AAS as well as health policy reforms are crucial to reduce future negative implications of AAS use.

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### 1. Introduction

Mounting evidence indicates that the use of anabolic-androgenic steroids (AAS) has become an alarming worldwide health problem, especially when used without medical supervision (Brower, 2002; Griffin and Wilson, 1998; Brody et al., 1998). Despite growing interest in studying the negative health effects related to the misuse of alcohol and illicit drugs, our understanding

of the level of knowledge and awareness associated with the misuse of AAS is still lacking, especially in the Middle East.

AAS are synthetic chemicals that are structurally similar to the male sex hormone testosterone. They are usually used to increase muscle size (anabolic) and enhance male-specific characteristics (androgenic) (Brower, 2002). They are prescribed medically for cases with low testosterone levels due to illness or as a result of inborn errors of metabolism. AAS have been used medically since the 1940s in the recovery from trauma, surgery, burns, chronic debilitating illness, and radiation therapy (Griffin and Wilson, 1998; Brody et al., 1998). According to the United States Food and Drug Administration, AAS are sometimes used as a replacement therapy for individuals with low levels of testosterone occurring naturally with age ([www.fda.gov/Drugs/DrugSafety/ucm436259.htm](http://www.fda.gov/Drugs/DrugSafety/ucm436259.htm)). Furthermore, AAS are often consumed orally; however, some individuals administer them via injection prior to exercise, aiming to achieve more robust effects.

There is a wide array of serious side-effects associated with AAS use or misuse. These include dyslipidemia, fluid retention, elevated blood pressure, jaundice and malignancies (Kibble and Ross, 1987). AAS can also produce some sex- and age-specific side-effects; such as, testicular atrophy, azoospermia, infertility, gynecomastia and breast and prostatic tumors in men. In women, it can produce voice changes, increased facial hair, male-pattern baldness, amenorrhea and clitoral enlargement (Goldberg, et al., 1990). In adolescents, AAS use can lead to premature skeletal maturation, arrest of growth and accelerated puberty. Moreover, AAS have been shown to produce some psychiatric side-effects such as, aggression, mood changes, irritability, impaired judgment, paranoia, violence, delusions, severe mood swings, depression, mania and psychosis (Landry and Primos, 1990; Rogol and Yesalis, 1992; Terney and McLain, 1990; O'Sullivan et al., 2000).

AAS use by athletes started in the mid-1940s. Weight-lifters and body-builders were the first athletes to use AAS in sports competitions and later, other athletes followed suit (Griffin and Wilson, 1998). In the early 1980s, AAS use began to spread to individuals engaged in recreational sports, for the purpose of improving body-image ([www.drugabuse.gov/publications/research-reports/anabolic-steroid-abuse](http://www.drugabuse.gov/publications/research-reports/anabolic-steroid-abuse)), as well as intravenous drug users, and sexual and gender minorities (Sagoe and Pallesen, 2018). Unfortunately, there are now millions of AAS users worldwide, with most using them to become leaner and more muscular and not for competitive purposes (Parkinson and Evans, 2006). Consequently, AAS use is becoming a major public health problem (Al Ghobain, 2017).

AAS represent a major group of doping agents on the prohibited list of all major sports authorities, including the World Anti-Doping Agency (WADA) ([www.wada-ama.org/en/resources/science-medicine/prohibited-list-documents](http://www.wada-ama.org/en/resources/science-medicine/prohibited-list-documents)). Moreover, AAS use has also been prohibited by the International Olympic Committee (IOC) as well as the National Collegiate Athletic Association (NCAA). According to the IOC, AAS are found in the majority of positive urine doping tests ([www.olympic.org/search?q=doping+statistics](http://www.olympic.org/search?q=doping+statistics)). Gyms are considered potentially important places for probing current as well as future AAS users due to the fact that, the majority of AAS users are regular visitors at fitness centers (Striegel et al., 2006) and are aiming to improve bodily appearance, enhance athletic performance, enhance muscle size and diminish body fat ([www.drugabuse.gov/publications/research-reports/anabolic-steroid-abuse](http://www.drugabuse.gov/publications/research-reports/anabolic-steroid-abuse)).

Recently, it has been reported that AAS abuse is more prevalent in Western countries, the Middle East and Brazil and is less prevalent in Africa and Asia (Sagoe and Pallesen, 2018). Prior to initiation of AAS, users are more likely to be participants in sports, have malfunctioning relationships, psychopathologies, suffer from low self-esteem, negative body image, deviant behavior and history of abusing other drugs, deteriorating school performance and certain personality disorders. They are often of a higher socio-

economic status, with a family history of substance abuse and a history of violence (Hall and Chapman, 2005; Sagoe et al., 2014).

In the Middle East, several lines of evidence support a high prevalence of AAS abuse. In Iraq, a nationally representative sample of 3200 people showed the lifetime prevalence of AAS use to be 1.3% (Al-Hemiery et al., 2017). Additionally, a study performed among 200 gym users in Kuwait showed a lifetime prevalence of 35% (Khullar et al., 2016). Furthermore, from 2008 to 2016, 141 of 4482 (3.6%) Saudi athletes tested for doping tested positive for prohibited substance use. In this study, AAS ranked the highest among the substances tested, constituting 32.8% of positive samples followed by stimulants at 27.6% (Al Ghobain, 2017). Another survey of 316 male gym users in north western Saudi Arabia revealed 11.4% AAS abuse (Al and Elshatarat, 2017). A study conducted among body-builders that abused AAS in the southern city of Jazan (Saudi Arabia) revealed a lifetime prevalence of 31% (Bahri et al., 2017).

To our knowledge, the available data regarding the level of awareness, attitudes and practices of AAS users in Saudi Arabia is fairly limited. We conducted the current study to identify the level of knowledge and awareness among gym members regarding the health hazards associated with the use or abuse of AAS. This knowledge will be beneficial in directing efforts and modification of policies aimed at addressing the issue of AAS abuse from the healthcare system perspective.

## 2. Methods

### 2.1. Study design, setting and sample

This cross-sectional analytical study was designed to assess the level of knowledge, attitudes and practices of AAS usage among gym users in Riyadh, Saudi Arabia. Riyadh is the capital and the largest city in Saudi Arabia, with an approximate population of 6,800,000 within the metropolitan area. We used a random sampling technique and obtained a list of all fitness centers from the general authority of sports welfare. There was a total of 187 gym facilities across four different geographical areas of Riyadh; north, south, east and west. We randomly selected the study participants using the cluster sampling technique. We selected 500 gym users from the gym facilities representing the four main different geographical areas. Based on the expected number of individuals per gym ( $n = 30$ ), we calculated the required number of clusters (or gyms) by dividing number of gyms (500) over each area by 30. Individuals who attended a selected gym were approached on a randomly selected day.

### 2.2. Participants

The sample consisted of all male adult gym users who attended any type of gym facility including those located in hotels, social clubs, and commercial clubs, and who gave informed consent to participate in the study and were available at these gyms during the study period (March 2016–October 2016). We excluded any person who was using, or had previously used, AAS to treat a medical condition. One person from our research team was available at each gym to address any inquiries from the participants responding to the questionnaire.

### 2.3. Data collection

A self-administered questionnaire based on previous similar studies reported in the literature was adapted and written in Arabic and English. The questionnaire was then subjected to a review and validation process by experts from the members of

the research team to ensure that the survey was sufficiently comprehensive. A pilot study was then carried out to determine the validity, reliability and clarity of the questionnaire. The feedback was analyzed and a finalized questionnaire was created accordingly. The questionnaire variables covered the demographics, attitudes and behavior associated with AAS use, assessed the participants' knowledge and awareness of their side-effects and inquired about the use of narcotics or psychiatric drugs for non-medical purposes. Eligible participants were approached, and the objective of the study was explained. The participants' names were not recorded and data kept confidential to protect the privacy of the participant. The study was approved by the Ethics Committee of the King Abdullah International Medical Research Center (KAIMRC; number RC15/125/R). Permission from the Saudi General Authority for Sports was obtained to conduct this study. Also, permission was obtained from each of the gym owners to distribute the questionnaire. Written informed consent was obtained from all participants and all responses were anonymous.

#### 2.4. Statistical analysis

Data were analyzed using SPSS version 21.0 statistical software (IBM Inc, Chicago USA). Descriptive statistics (frequency and percentages) were used to describe the categorical study and outcome variables. Pearson's Chi-square test was used to assess the association between the study variables and binary outcome variable: AAS (Yes/No). Odds ratios were calculated to measure the significant of association. Multivariate binary stepwise logistic regression was used to observe the independent association of study variables with AAS. Hosmer and Lemeshow test was used to test the goodness of fit of the models. Validation of the model was carried out using classification tables and Receiver operating curve (ROC) analysis was used to assess the final model. A p-value of  $\leq 0.05$  and 95% confidence intervals was used to report the statistical significance and precision of results in tables.

### 3. Results

#### 3.1. Socio-demographic characteristics of study participants

A total of 500 questionnaires were distributed among the gym users across 20 gyms in Riyadh, of which 482 (96.4%) responded to the study. The mean ( $\pm$ SD) age of the study participants was 27.2 ( $\pm$ 6.9) years. Our results showed that 61% of study participants were single, 35.5% were government employees and 62.7% had a bachelor's degree.

The participants were distributed across different types of fitness centers [social clubs (26.1%), private clubs (43.2%) and commercial clubs (30.7%)]. More than half (54.6%) of the participants used gyms for 'professional training' and 57.3% attended the gym on daily basis. In this study, 42.3% of study participants stated that the average time spent in the gym per session was 30 min to 1 h and 40.9% spent between 1 and 2 h. Aerobic exercise (58.7%) and weight-lifting (33.6%) were the most common types of sports practiced by the participants during their time at the gym (Table 1).

#### 3.2. Level of knowledge related to AAS use

As shown in Table 2, 53.5% of the participants reported that they heard about AAS use, with 24.9% having heard about it from their friends. Moreover, 45.4% of study participants reported being aware of AAS use in body-building, whereas 42.3% responded 'Don't know'. With regard to the three questions related to knowledge of the effect of AAS on muscle mass, body weight and muscles strength, the positive response 'Yes, it will increase' was expressed

**Table 1**  
Socio-demographic characteristics of study participants (N = 482).

Socio-demographic characteristics	No. (%)
<b>Age (y) (mean <math>\pm</math> SD)</b>	27.2(6.9)
<b>Marital status</b>	
Single	294(61.0)
Married	182(37.8)
Divorced	6(1.2)
<b>Occupation</b>	
Student	150(31.1)
Private employee	134(27.8)
Government employee	171(35.5)
Retired	4(0.8)
Other	23(4.8)
<b>Monthly income (Saudi Riyals)</b>	203(42.1)
<5000	
5000–9999	156(32.4)
10,000–14,999	76(15.8)
>15,000	47(9.8)
<b>Level of education</b>	6(1.2)
Illiterate	
Literate but not completed primary school	6(1.2)
Completed Intermediate school	11(2.3)
Completed secondary school	136(28.2)
Bachelor's degree or diploma	302(62.7)
Higher Education (master's or PhD)	21(4.4)
<b>Nationality</b>	
Saudi	408(84.6)
Non-Saudi	74(15.4)
<b>Area of residency in Riyadh</b>	81(16.8)
East	
West	167(34.6)
North	126(26.1)
South	108(22.4)
<b>Reason for using the gym</b>	
Medical need	50(10.4)
Work need	14(2.9)
Recreational use	155(32.2)
For professional training	263(54.6)
<b>How often do you come to the gym?</b>	
Once a week	25(5.2)
Twice a week	31(6.4)
Three times or more a week	150(31.1)
Daily	276(57.3)
<b>How long do you stay at the gym on each occasion?</b>	
<30 min	25(5.2)
30 min–1 h	206(42.7)
>1–2 h	197(40.9)
>2 h	54(11.2)
<b>What type of sport do you usually practice?</b>	
Aerobic	283(58.7)
Weight-Lifting	162(33.6)
Others	37(7.7)

by 53.2%, 51.1% and 45.5% of participants. In contrast, a higher proportion of study participants responded 'I don't know' to their awareness of the side-effects resulting from AAS use, such as acne (66.5%), behavioral changes (55%), blood pressure changes (59.9%), causing certain cancers (71.8%), affect cholesterol level (66.8%), stunt growth (56.2%), cause breast development (51.1%), affect the heart (59.2%), affect the liver (55.2%), affect fertility (59.6%) and affect sexual function (54.6%). There was a highly statistically

**Table 2**  
Knowledge regarding anabolic steroid use and related factors.

Knowledge level	No. (%)
<b>Have you heard about anabolic steroids OR anabolic hormones?</b>	
Yes	258(53.5)
No	224(46.5)
<b>If yes, from where did you hear about them? (n = 258)</b>	
Friends	120(24.9)
Public media (TV, newspaper, magazine, radio)	36(7.5)
Muscle magazine	20(4.1)
Internet	47(9.8)
Trainer	12(2.5)
Healthcare professional	23(4.8)
<b>Are you aware that anabolic steroids are being used in body-building? (n = 471)</b>	
Yes	214(45.4)
No	58(12.3)
I don't know	199(42.3)
<b>Do you think that anabolic steroid use can affect the size of the muscles? (n = 476)</b>	
Yes, it will increase	253(53.2)
Yes, it will decrease	9(1.9)
No, it will have no effect	13(2.7)
I don't know	201(42.2)
<b>Do you think that anabolic steroid use can affect your body weight? (n = 476)</b>	
Yes, it will increase	243(51.1)
Yes, it will decrease	23(4.8)
No, it will have no effect	14(2.9)
I don't know	196(41.2)
<b>Do you think that anabolic steroid use can affect muscle strength?(n = 479)</b>	
Yes, it will increase	218(45.5)
Yes, it will decrease	33(6.9)
No, it will have no effect	43(9.0)
I don't know	185(38.6)
<b>Do you think that anabolic steroid use can cause acne? (n = 472)</b>	
Yes	98(20.8)
No	60(12.7)
I don't know	314(66.5)
<b>Do you think that anabolic steroid use can affect behavior? (n = 480)</b>	
Yes, it will cause aggression	132(27.5)
Yes, it will improve mood	22(4.6)
No, it will have no effect	62(12.9)
I don't know	264(55.0)
<b>Do you think that anabolic steroid use can affect blood pressure? (n = 474)</b>	
Yes, it will increase	129(27.2)
Yes, it will decrease	16(3.4)
No, it will have no effect	45(9.3)
I don't know	284(59.9)
<b>Do you think that anabolic steroid use can cause certain cancers? (n = 471)</b>	
Yes	58(12.3)
No	75(15.9)
I don't know	338(71.8)
<b>Do you think that anabolic steroid use can cause affect cholesterol levels? (n = 479)</b>	
Yes, it will increase	69(14.4)
Yes, it will decrease	29(6.1)
No, it will have no effect	61(12.7)
I don't know	320(66.8)
<b>Do you think that anabolic steroid use can stunt growth? (n = 478)</b>	
Yes	111(23.2)
No	96(20.1)
I don't know	271(56.2)
<b>Do you think that anabolic steroid use can cause breast development? (n = 474)</b>	
Yes	178(37.6)
No	54(11.4)
I don't know	242(51.1)
<b>Do you think that anabolic steroid use can affect the heart? (n = 478)</b>	
Yes, it will become healthier	45(9.4)

Yes, it will cause disease	108(22.6)
No, it will have no effect	42(8.8)
I don't know	283(59.2)
<b>Do you think that anabolic steroid use can affect the liver? (n = 478)</b>	
Yes, it will cause damage	156(32.6)
Yes, it will be beneficial	15(3.1)
No, it will have no effect	43(9.0)
I don't know	264(55.2)
<b>Do you think that anabolic steroid use can affect fertility? (n = 478)</b>	
Yes, it will increase	31(6.5)
Yes, it will decrease	119(24.9)
No, it will have no effect	43(9.0)
I don't know	285(59.6)
<b>Do you think that anabolic steroid use can affect sexual function? (n = 477)</b>	
Yes, it will increase	49(10.3)
Yes, it will decrease	121(25.4)
No, it will have no effect	44(9.2)
I don't know	263(54.6)

significant ( $P < 0.001$ ) association between having knowledge of AAS use (ever hearing of AAS) and a history of AAS use.

Furthermore, a higher proportion of gym users who had used AAS responded positively ('Yes, it will increase') to knowledge of their use in body-building (56.1%), affecting the size of the muscles (64.4%), body weight (64.1%) and muscle strength (59.8%) compared to gym users who did not use AAS (40.8%, 48.4%, 46.3% and 39.8%, respectively). These findings indicated a highly significant association between the responses of participants related to knowledge of these four issues and AAS use ( $\chi^2 = 11.31$ ,  $P = 0.004$ ;  $\chi^2 = 15.51$ ,  $P = 0.001$ ;  $\chi^2 = 16.93$ ,  $P = 0.001$  and  $\chi^2 = 17.08$ ,  $P = 0.001$ ).

An opposite pattern of statistically significant associations was observed between the responses to questions regarding knowledge related to health issues (causes of acne, certain cancers, stunted growth, and breast development, and effects on behavior, blood pressure, cholesterol levels, heart, liver, fertility and sexual function) and use of AAS by gym users. Compared with the gym user who had used AAS, a higher proportion of the gym users who did not use AAS responded 'I don't know' to all the these questions regarding knowledge related to health issues compared with the responses of gym user who had used AAS (Table 3).

### 3.3. Attitudes toward AAS use

In this study, participants were asked to respond to nine statements designed to assess attitudes toward AAS use. Four of these statements supported the use of AAS and five discouraged AAS use. The responses were measured on a four-point scale (strongly agree, agree, disagree and strongly disagree). The proportion of participants responding with 'strongly agree' and 'agree' to the four statements supporting the use of AAS (AAS can make your muscles bigger, muscles stronger, a stronger athlete and look better) ranged from 48% to 66.5%. On the other hand, the proportion participants responding with 'strongly agree' and 'agree' to the five statements discouraging the use of AAS (AAS are bad for you, people who use AAS feel guilty, selling of AAS should be punished, use of AAS should be punished and the use AAS for non-medical reasons should be reported to authorities) ranged from 48.5% to 69.4% (Table 4). A statistically significant association was identified between the responses to the nine statements designed to assess attitudes of gym users and their use of AAS. For all nine statements, there was a significant difference in the distribution of the proportion of responses on a 4-point scale between the gym users who had used AAS and those who reported never having used them.

For the four statements supporting the use of AAS, a higher proportion of the gym users who did not use AAS responded with 'dis-

**Table 3**  
Association between knowledge level and use of anabolic steroids.

Knowledge toward anabolic steroids	Anabolic steroid use		P-value
	Yes n(%)	No n(%)	
<b>Have you heard about anabolic steroids? (anabolic hormones)?</b>			
Yes	81(60.4)	139(42.9)	0.001
No	53(39.6)	185(57.1)	
<b>If yes, what was the source?</b>			
Friends	48(56.5)	65(40.4)	0.059
Public media (TV, newspaper, magazine, radio)	5(5.9)	30(18.6)	
Muscle magazine	7(8.2)	12(7.5)	
Internet	13(15.3)	33(20.5)	
Trainer	5(5.9)	7(4.3)	
Healthcare professional	7(8.2)	14(8.7)	
<b>Are you aware that anabolic steroids are being used in body-building?</b>			
Yes	74(56.1)	129(40.8)	0.004
No	17(12.9)	35(11.1)	
I don't know	41(31.1)	152(48.1)	
<b>Do you think that anabolic steroids can affect muscle size?</b>			
Yes, it will increase	84(64.6)	156(48.4)	0.001
Yes, it will decrease	3(2.3)	6(1.9)	
No, it will have no effect	6(4.6)	6(1.9)	
I don't know	37(28.5)	154(47.8)	
<b>Do you think that anabolic steroids can affect your body weight?</b>			
Yes, it will increase	84(64.1)	149(46.3)	0.001
Yes, it will decrease	8(6.1)	14(4.3)	
No, it will have no effect	5(3.8)	8(2.5)	
I don't know	34(26.0)	151(46.9)	
<b>Do you think that anabolic steroids can affect muscle strength?</b>			
Yes, it will increase	79(59.8)	129(39.8)	0.001
Yes, it will decrease	10(7.6)	22(6.8)	
No, it will have no effect	9(6.8)	31(9.6)	
I don't know	34(25.8)	142(43.8)	
<b>Do you think that anabolic steroids can cause acne?</b>			
Yes	27(20.6)	65(20.4)	<0.0001
No	30(22.9)	29(9.1)	
I don't know	74(56.5)	225(70.5)	
<b>Do you think that anabolic steroids can affect behavior?</b>			
Yes, it will cause aggression	44(33.3)	82(25.3)	<0.0001
Yes, it will improve mood	9(6.8)	9(2.8)	
No, it will have no effect	26(19.7)	32(9.9)	
I don't know	53(40.2)	201(62.0)	
<b>Do you think that anabolic steroids can affect blood pressure?</b>			
Yes, it will increase	44(33.8)	81(25.2)	0.001
Yes, it will decrease	7(5.4)	7(2.2)	
No, it will have no effect	19(14.6)	24(7.5)	
I don't know	60(46.2)	209(65.1)	
<b>Do you think that anabolic steroids can cause certain cancers?</b>			
Yes	20(15.5)	35(10.9)	<0.0001
No	35(27.1)	38(11.9)	
I don't know	74(57.4)	247(77.2)	
<b>Do you think that anabolic steroids can cause affect cholesterol levels?</b>			
Yes, it will increase	26(19.8)	40(12.3)	<0.0001
Yes, it will decrease	12(9.2)	16(4.9)	
No, it will have no effect	24(18.3)	31(9.6)	
I don't know	69(52.7)	237(73.1)	
<b>Do you think that anabolic steroids can stunt growth ?</b>			
Yes	35(26.9)	73(22.5)	<0.0001
No	42(32.3)	46(14.2)	
I don't know	53(40.8)	205(63.3)	
<b>Do you think that anabolic steroids can cause breast development?</b>			
Yes	51(39.2)	117(36.6)	<0.0001
No	25(19.2)	24(7.5)	
I don't know	54(41.5)	179(55.9)	
<b>Do you think that anabolic steroids can affect the heart?</b>			
Yes, it will become healthier	14(10.7)	29(9)	<0.0001
Yes, it will cause disease	22(16.8)	81(25)	
No, it will have no effect	24(18.3)	16(5)	
I don't know	71(54.2)	197(61)	

Table 3 (continued)

Knowledge toward anabolic steroids	Anabolic steroid use		P-value
	Yes n(%)	No n(%)	
<b>Do you think that anabolic steroids can affect the liver?</b>			
Yes, it will cause damage	54(41.2)	94(29.1)	<0.0001
Yes, it will be beneficial	5(3.8)	9(2.8)	
No, it will have no effect	21(16)	21(6.5)	
I don't know	51(38.9)	199(61.6)	
<b>Do you think that anabolic steroids can affect fertility?</b>			
Yes, it will increase	13(9.8)	16(5)	<0.0001
Yes, it will decrease	34(25.8)	78(24.1)	
No, it will have no effect	22(16.7)	19(5.9)	
I don't know	63(47.7)	210(65)	
<b>Do you think that anabolic steroids can affect sexual function?</b>			
Yes, it will increase	18(13.6)	27(8.4)	<0.0001
Yes, it will decrease	35(26.5)	83(25.7)	
No, it will have no effect	23(17.4)	18(5.6)	
I don't know	56(42.4)	195(60.4)	

Table 4

Attitudes toward anabolic steroid use and related factors.

Attitudes toward anabolic steroid use	No (%)
<b>Anabolic steroid use can make your muscles bigger? (n = 462)</b>	
Strongly agree	134(29.0)
Agree	170(35.3)
Disagree	84(18.2)
Strongly disagree	74(16.0)
<b>Anabolic steroid use can make your muscles stronger? (n = 461)</b>	
Strongly agree	86(18.7)
Agree	161(34.9)
Disagree	136(29.5)
Strongly disagree	78(16.9)
<b>Anabolic steroid use can make anyone a stronger athlete? (n = 459)</b>	
Strongly agree	71(15.5)
Agree	149(32.5)
Disagree	151(32.9)
Strongly disagree	88(19.2)
<b>Anabolic steroid use can make you look better? (n = 464)</b>	
Strongly agree	119(25.6)
Agree	190(40.9)
Disagree	89(19.2)
Strongly disagree	66(14.2)
<b>Anabolic steroids are bad for you? (n = 465)</b>	
Strongly agree	156(33.5)
Agree	167(35.9)
Disagree	93(20.0)
Strongly disagree	49(10.5)
<b>People who take anabolic steroids feel guilty? (n = 466)</b>	
Strongly agree	76(16.3)
Agree	178(38.2)
Disagree	146(31.3)
Strongly disagree	66(14.2)
<b>People who sell anabolic steroids should be punished? (n = 465)</b>	
Strongly agree	148(31.8)
Agree	135(29.0)
Disagree	130(28.0)
Strongly disagree	52(11.2)
<b>People who use anabolic steroids should be punished? (n = 468)</b>	
Strongly agree	131(28.0)
Agree	152(32.5)
Disagree	127(27.1)
Strongly disagree	58(12.4)
<b>Health authorities should be informed about people who use anabolic steroids for non-medical reasons? (n = 466)</b>	
Strongly agree	138(29.6)
Agree	164(35.2)
Disagree	118(25.3)
Strongly disagree	46(9.9)

agree' and 'strongly disagree' compared with the gym users who used AAS. For the five statements discouraging the use of AAS, a higher proportion of the gym users who did not use AAS responded with 'strongly agree' and 'agree' compared with the gym users who used AAS (Table 5).

### 3.4. Practices associated with AAS use

An equal distribution of responses (yes/no) was obtained from the gym users asked 'Have you ever used supplementary vitamins, minerals or special diet?'. In our study, 29.3% of participants stated

**Table 5**  
Association between attitude and use of anabolic steroids.

Attitude toward anabolic steroids	Anabolic steroid use		P-value
	Yes n(%)	No n(%)	
<b>Anabolic steroids can make your muscles bigger?</b>			
Strongly agree	39(30.2)	91(29.1)	0.009
Agree	60(46.5)	101(32.3)	
Disagree	17(13.2)	63(20.1)	
Strongly disagree	13(10.1)	58(18.5)	
<b>Anabolic steroids can make your muscles stronger?</b>			
Strongly agree	31(23.8)	53(17)	0.003
Agree	56(43.1)	96(30.8)	
Disagree	30(23.1)	102(32.7)	
Strongly disagree	13(10)	61(19.6)	
<b>Anabolic steroids can make anyone a stronger athlete?</b>			
Strongly agree	29(22.3)	41(13.2)	0.005
Agree	50(38.5)	91(29.4)	
Disagree	33(25.4)	112(36.1)	
Strongly disagree	18(13.8)	66(21.3)	
<b>Anabolic steroids can make you look better?</b>			
Strongly agree	41(31.3)	72(22.8)	0.019
Agree	60(45.8)	125(39.6)	
Disagree	19(14.5)	67(21.2)	
Strongly disagree	11(8.4)	52(16.5)	
<b>Anabolic steroids are bad for you?</b>			
Strongly agree	36(27.5)	113(35.8)	0.013
Agree	59(45)	102(32.3)	
Disagree	29(22.1)	62(19.6)	
Strongly disagree	7(5.3)	39(12.3)	
<b>People who take anabolic steroids feel guilty?</b>			
Strongly agree	20(15.2)	54(17)	0.049
Agree	55(41.7)	115(36.3)	
Disagree	48(36.4)	97(30.6)	
Strongly disagree	9(6.8)	51(16.1)	
<b>People who sell anabolic steroids should be punished?</b>			
Strongly agree	34(26.2)	108(34)	<0.0001
Agree	27(20.8)	105(33)	
Disagree	57(43.8)	69(21.7)	
Strongly disagree	12(9.2)	36(11.3)	
<b>People who use anabolic steroids should be punished?</b>			
Strongly agree	27(20.5)	95(30)	<0.0001
Agree	34(25.8)	114(36)	
Disagree	54(40.9)	70(22.1)	
Strongly disagree	17(12.9)	38(12)	
<b>Health authorities should be informed about people who use steroids for non-medical reasons?</b>			
Strongly agree	25(19.1)	103(32.6)	0.001
Agree	44(33.6)	116(36.7)	
Disagree	50(38.2)	65(20.6)	
Strongly disagree	12(9.2)	32(10.1)	

that they had used AAS, of which 38.8% reported obtaining it from their coaches and 35.7% from friends who use AAS. Also, 40.8% of gym users with friends who use AAS reported that the drug was obtained from their coaches. Moreover, 43.2% of study participants reported that they had been offered AAS and 68.7% believed that these drugs are easy to obtain AAS. Most of the gym users (90.1%) had never used any narcotics or psychoactive drugs and furthermore, 95.2% of the gym users had not used narcotics or psychoactive drugs in the previous 30 days. Among those who

reported using these drugs, opioids and amphetamines were the most commonly used classes (Table 6). There was a statistically significant association between the distribution of responses of practices of other drugs in relation to the use of AAS. Moreover, significantly more gym users who had used AAS had also used supplementary vitamins, minerals or a special diet than those who did not use AAS (81.2% vs. 36.3%;  $\chi^2 = 75.95$ ;  $P < 0.0001$ ). Similarly, 84.7% of those who reported using AAS were aware that others were also using AAS compared with only 35.8% of gym users

**Table 6**  
Practices and use anabolic steroid and related factors.

Practices of anabolic steroid use	No (%)
<b>Have you ever used supplementary vitamins, minerals or a special diet? (n = 468)</b>	
Yes	230(49.1)
No	238(49.4)
<b>Have you ever used anabolic steroids? (n = 458)</b>	
Yes	134(29.3)
No	324(70.7)
<b>If yes, from where did you obtain them? (n = 126)</b>	
Coach	49(10.2)
Doctor	9(7.1)
Friend	45(35.7)
Fitness store	16(12.7)
Trainer	7(5.6)
Other	–
<b>Do you know anyone using anabolic steroids? (n = 464)</b>	
Yes	234(48.5)
No	230(47.7)
<b>If yes, from where were the anabolic steroids obtained? (n = 208)</b>	
Coach	85(17.6)
Doctor	14(6.7)
Friend	70(33.7)
Fitness store	17(8.2)
Trainer	22(10.6)
Other	–
<b>Have you ever been offered anabolic steroids? (n = 468)</b>	
Yes	202(43.2)
No	266(56.8)
<b>Do you believe that anabolic steroids are easy to obtain? (n = 463)</b>	
Yes	318(68.7)
No	140(30.2)
I don't know	5(1.1)
<b>Have you ever used narcotics or psychiatric drugs? (n = 467)</b>	
Yes	46(9.9)
No	421(90.1)
<b>If yes, which one of the following? (n = 46)</b>	
Opioid (heroin, morphine, etc.)	11(23.9)
Amphetamine	11(23.9)
Cocaine	6(13.0)
Cannabis or marijuana	10(4.6)
Benzodiazepine (Xanax, Valium, Rivotril, etc.)	8(17.4)
<b>Have you used any narcotic or psychiatric drug in the past 30 day? (n = 460)</b>	
Yes	22(4.8)
No	438(95.2)
<b>If yes, which one of the following? (n = 22)</b>	
Opioid (heroin, morphine, etc.)	9(41.0)
Amphetamine	4(18.1)
Cocaine	6(27.3)
Cannabis or marijuana	3(13.6)
Benzodiazepine (Xanax, Valium, Rivotril, etc.)	–

who did not use AAS ( $\chi^2 = 89.01$ ;  $P < 0.0001$ ). A highly statistically significant association was observed between the responses (yes/no) to the question 'Have you ever been offered AAS?', of which 68.2% of gym users who had used AAS gave a positive response compared with 32.1% of gym users who did not use AAS ( $\chi^2 = 49.83$ ;  $P < 0.0001$ ). A significantly higher proportion of gym users who use AAS (81.1%) believed that AAS are easy to obtain AAS compared to 62.7% of gym users who did not use AAS ( $\chi^2 = 15.27$ ;  $P < 0.0001$ ). There was a statistically significant association between the gym users who use AAS and their use of narcotics or psychiatric drugs ( $\chi^2 = 4.61$ ;  $P = 0.032$ ) (Table 7).

#### 4. Discussion

In this study level of knowledge and awareness among gym members regarding the health risk factors associated with the use

**Table 7**  
Association between attitude and practice and use of anabolic steroids.

Practice of anabolic steroids	Anabolic steroid use		P-value
	Yes n (%)	No n (%)	
<b>Have you ever used supplementary vitamins, minerals or a special diet?</b>			
Yes	108(81.2)	116(36.3)	<0.0001
No	25(18.8)	204(63.8)	
<b>Do you know anyone using anabolic steroids?</b>			
Yes	111(84.7)	115(35.8)	<0.0001
No	20(15.3)	206(64.2)	
<b>If yes, from where were the anabolic steroids obtained?</b>			
Coach	48(49)	35(34.3)	0.226
Doctor	4(4.1)	8(7.8)	
Friends	30(30.6)	37(36.3)	
Fitness store	8(8.2)	8(7.8)	
Trainer	8(8.2)	14(13.7)	
Other	–	–	
<b>Have you ever been offered anabolic steroids?</b>			
Yes	90(67.8.2)	103(32.1)	<0.0001
No	42(31.8)	218(67.9)	
<b>Do you believe that anabolic steroids are easy to obtain?</b>			
Yes	107(81.1)	198(62.7)	<0.0001
No	25(18.9)	113(35.8)	
I don't know	0(0)	5(1.6)	
<b>Have you ever used any narcotic or psychiatric drug?</b>			
Yes	19(14.4)	25(7.8)	0.032
No	113(85.6)	295(92.2)	
<b>If yes, which one of the following?</b>			
Opioid (heroin, morphine, etc.)	6(31.6)	5(20)	–
Amphetamine	3(15.8)	7(28)	
Cocaine	1(5.2)	3(12)	
Cannabis or marijuana	6(31.6)	4(16)	
Benzodiazepine (Xanax, Valium, Rivotril, etc.)	3(15.8)	6(24)	
Other	–	–	
<b>Have you used any narcotic or psychiatric drugs in the past 30 days?</b>			
Yes	10(7.9)	11(3.4)	0.046
No	117(92.1)	309(96.6)	
<b>If yes, which one of the following?</b>			
Opioid (heroin, morphine, etc.)	5(55.6)	4(36.4)	–
Amphetamine	2(22.2)	4(36.4)	
Cocaine	1(11.1)	2(18.1)	
Cannabis or marijuana	2(22.2)	1(9.1)	
Benzodiazepine (Xanax, Valium, Rivotril, etc.)	–	–	
Other	–	–	

or abuse of AAS. This knowledge could be beneficial in directing efforts and modification of policies aimed at addressing the issue of AAS abuse from the healthcare system perspective. Despite being aware of the positive effects of AAS on muscle mass and strength, most of study participants demonstrated a significant lack of knowledge regarding the possible negative side-effects of AAS on the different systems in the body. These findings are consistent with those reported by Alsaed and colleagues, who showed that AAS users and non-users in Kuwait City were similarly unaware of the side-effects of AAS (Alsaed and Alabkal, 2015). Similar findings were also reported in the United Arab Emirates (UAE), where 60% of users thought that the benefits of using AAS outweighed the harm (Al-Falasi et al., 2008). The present study revealed a negative association between AAS use and level of education, which is in accordance with the findings of a study conducted in Baghdad (Iraq) where 25% of study participants who used AAS had only completed middle school (Habeb et al., 2012). Furthermore, we identified a positive correlation between using AAS use and awareness of their positive effects on muscle strength and mass as well as knowledge of the neg-



ative effects compared to the non-users, who knew less about the side-effects of AAS use.

There are several reasons that could explain the prevalence of AAS use in this study. A significant proportion of AAS users reported obtaining them from their coaches and most responders (AAS users and non-users) believed that the drugs are easy to obtain. This is similar to findings in the neighboring UAE, where 60% of users believed that AAS are easily obtainable and reported multiple unregulated sources of AAS, including fitness stores (53%), trainers (26%), friends (24%), veterinarians (15%) and online shops (3%) (Al-Falasi et al., 2008). Similarly, in Iraq, study participants reported that AAS were easily accessible, with retail stores as the main source (Habeb et al., 2012).

When assessing attitudes to AAS use, gym members who did not use AAS showed a significant lack of support toward and strongly discouraged AAS use compared to the users. Most gym users (90.1%) reported never having used narcotics or any other psychoactive medication; however, among the participants who reported use of such substances, opiates and amphetamines were the most commonly used classes of drugs. Other practices associated with AAS use included the use of vitamins, minerals and special diets. These findings are in accordance with those of a study conducted in Saudi Arabia by Alshammari and colleagues, in which a positive association was identified between AAS use and nutritional and dietary supplements (Alshammari et al., 2017). Similarly, in the UAE study, 44% of participants reported the use of vitamins, minerals, or special diets in combination with AAS for body-building purposes (Al-Falasi et al., 2008). Furthermore, a systematic review performed on polypharmacy practices among AAS abusers demonstrated a significant association between the use of AAS use and legal and illicit substances. These substances included alcohol, amphetamines, cannabis, ephedrine, cocaine, heroin, insulin, growth hormone, human chorionic gonadotrophin, thyroxine, analgesics, anti-oestrogens, benzodiazepines and diuretics (Sagoe et al., 2015).

A significantly higher proportion of AAS users reported being offered AAS compared to those who reported not using AAS. We found that AAS use was more prevalent in participants over the age of 25, privately employed, practice weight-lifting, use supplementary vitamins, have friends who use AAS, have been offered AAS and use psychoactive drugs.

## 5. Limitations

The current study was conducted to provide a greater understanding of the causes of a growing and counter-intuitive epidemic of AAS use among gym users, whose main aim is to improve their health and fitness despite the detrimental side-effects of these drugs. This is the first study conducted to assess the prevalence as well as attitudes and knowledges of AAS use among gym users in Saudi Arabia. However, the following limitations of the present study should be noted in interpretation of the results: (1) We used a self-administered questionnaire which could have self-reporting bias; (2) It was performed in only one city (Riyadh) which has certain social and financial demographics that cannot be generalized to the rest of the country/region; (3) It was only performed among male gym members; (4) No blood tests or AAS level analysis were included in this study to investigate a potential association of AAS levels and their metabolites with their effects on the health of users; (5) No data were collected on dosage or frequency of AAS use among study participants; and (6) No comparison was performed to assess the prevalence of AAS in certain gyms and the socio-demographic characteristics of these gyms.

We believe that these limitations should be addressed in further separate studies in to investigate a dose response correlation between AAS use and their effects.

## 6. Conclusion and future directions

The results of this study provide clear and compelling evidence of a high lifetime prevalence of AAS use among male gym members in Riyadh. Health policy reforms are urgently needed to alleviate the rise in AAS use among young adults. These reforms could be directed toward improving awareness among gym attendees and, more importantly, among gym owners and trainers as they have been reported to be one of the primary sources of AAS. We believe that stricter policies should be implemented to criminalize trading of AAS in gyms and by gym trainers. Illicit substance abuse has been attracting increasing attention as a serious public health concern in the Kingdom of Saudi Arabia. However, the results of this study indicate that AAS use should be a major focus of these efforts. Public health awareness campaigns and limitation of access as well as improving knowledge regarding the health implications of AAS use represent suitable starting points to in the battle to mitigate AAS use in Saudi Arabia.

To obtain a more accurate and a generalizable assessment of the prevalence, knowledge and attitudes related to AAS use, further similar studies are warranted in other regions of the kingdom, which have different demographics and could yield interesting findings. Moreover, future studies correlating blood levels of AAS and frequency of use and potential side-effects would be of significant value to provide an improved understanding of the side-effects profile of AAS use in Saudi Arabia.

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