

Knowledge and perception towards anabolic steroid use by gym users in Jordan: a cross-sectional study

N. IZZAT¹, R. ABU FARHA¹, H. ALHAMAD², A. AKOUR^{3,4}

¹Department of Clinical Pharmacy, Faculty of Pharmacy, Applied Science Private University, Amman, Jordan

²Department of Clinical Pharmacy, Faculty of Pharmacy, Zarqa University, Zarqa, Jordan

³Department of Pharmacology and Therapeutics, College of Medicine and Health Sciences, United Arab Emirates University, Al-Ain, UAE

⁴Department Biopharmaceutics and Clinical Pharmacy, Faculty of Pharmacy, The University of Jordan, Amman, Jordan

Abstract. – OBJECTIVE: The dispensing of anabolic androgenic steroids (AAS) in Jordan is still unregulated, and AAS are available without a prescription. This study aimed to assess the prevalence of AAS abuse among gym users and their knowledge, perception, and practices towards using these AAS.

SUBJECTS AND METHODS: This cross-sectional study was conducted online in November-December 2022. Participants were recruited if they were adults attending any gym facility in Jordan.

RESULTS: A total of 365 adult participants agreed to participate in this study. Concerning participants' knowledge about AAS side effects, the median knowledge score of the participants was 7.0 scores (Interquartile range=7.0) out of 15. Indeed, 14.2% of the participants (n=52) reported using AAS during their gym participation. Participants reported that the most common source for obtaining AAS was the gym trainers (n=38, 70.4%), and the most common reason for using AAS was to increase lean body weight (n=52, 96.3%). Also, among the AAS users, two-thirds reported having never experienced side effects after using AAS. Finally, regression analysis revealed that males had 3.35 times higher usage of AAS than females (OR=3.351, *p*-value=0.008).

CONCLUSIONS: The findings of this study show a comparatively high prevalence of AAS use among gymgoers. Therefore, it is critical to have policies prohibiting their usage without a prescription. There should be more awareness about the negative effects of AAS in criminal activities, and it should be included in public awareness programs.

Key Words:

Knowledge, Perception, Practice, Gym, Anabolic steroids, Jordan.

Introduction

Anabolic steroids, which are known as anabolic-androgenic Steroids (AAS), are synthetic testosterone derivatives that have been explored, changed, and manufactured to improve their anabolic activities (promotion of protein synthesis and muscle growth)¹. Androgenic actions of these agents involve developing and maintaining primary and secondary sexual characteristics, whereas the anabolic actions positively stimulate protein synthesis, particularly in skeletal muscle².

Anabolic-androgenic steroids treat various illnesses, including reproductive system malfunction, breast cancer, and anemia³. Androgens are widely known to be critical in masculinizing the male reproductive tract, genitalia, and many other organ systems throughout the sexual differentiation process^{4,5}.

The use of AAS for therapeutic purposes seems to be safe. However, athletes usually use these drugs on their own. Professional athletes were the primary users of AAS until the early 1980s when recreational athletes began taking it to increase muscular strength and to improve their looks and performance⁶⁻⁸. The average AAS users are males between the ages of 20 and 40 who participate in weightlifting, bodybuilding, strongman contests, or martial arts, mainly kickboxing, and mixed martial arts⁹. Even though most bodybuilding organizations have a drug-free policy, drug testing is rarely administered. As a result, the use of AAS among athletes is prevalent and considered necessary to compete, particularly at the highest levels⁹.

Most people are not aware that the use of AAS can have detrimental effects on their mental health. The effect of these drugs is visible in athletes' central nervous system. Some users have reported^{10,11} experiencing behavioral and cognitive changes. These include mood swings, aggression, irritability, euphoria, suicidal thoughts, psychosis, and violence. In addition, the inappropriate use of these drugs can lead to various health problems, such as atherosclerosis, liver cancer, hypertension, cardiac arrhythmias, prostatic hypertrophy, altered libido, gynecomastia, and infertility¹².

Over the preceding years, there has been apparent growth in the number of commercial gyms and gym users in Jordan. Many gym users are young people with positive attitudes towards exercise and optimal body shapes. However, those gym users consume different AAS to enhance their muscle growth without having the appropriate knowledge about the detrimental effects of these agents. More attention must be drawn to this dangerous phenomenon; thus, the primary aims of this study are to assess the prevalence of AAS abuse among gym users and their knowledge, perception, and practices towards using these AAS.

Subjects and Methods

Study Design and Participants

This cross-sectional study was conducted in November-December 2022 to evaluate the prevalence of AAS abuse among gym users and their knowledge, perception, and practices towards using these agents. This study was performed using an online survey uploaded to the Google Form platform; then, it was distributed through different social media platforms (Facebook and WhatsApp). The participants recruited were adults (18 years old or above) attending any type of gym facility in Jordan during the study period and agreed to provide voluntary consent. The participants' recruitment was carried out through a non-probability convenience sampling strategy. The questionnaire was distributed using Arabic, the primary spoken language in Jordan.

Questionnaire Development and Validation

The study questionnaire was developed based on previous studies^{13,14} that evaluated the use of AAS among gym users. The initial questionnaire

draft was developed in English and was content face-validated by three experts who evaluated questionnaire items for their relevance, specificity, comprehensiveness, and appropriateness of the selected Likert scales. Minor comments were made by them, and the questionnaire was revised accordingly. The final questionnaire contained closed-ended questions and was designed to be completed within 10 minutes. It was translated to Arabic following the forward-backward translation method.

The final questionnaire version was divided into six main parts. The first part intended to retrieve participants' socio-demographic data. The second part was used to assess participants' activities in the gym. The third part intended to evaluate participants' awareness of the use of AAS and the complications they can cause. The fourth part was used to assess gym users' perceptions about the use of AAS. The fifth part included statements to assess participants' experience with AAS during gym participation. The last part of the study intended to investigate the side effects experienced by the users of AAS. For the knowledge section, participants gained one point for each correct statement identified and zero points for each incorrect answer. Then, the total knowledge score was calculated out of 15.

Before distributing the questionnaire, pilot testing was performed among ten gym users. The participants were requested to evaluate the structure, clarity, and length of the questionnaire and to give their overall impression. The piloting was considered a significant validity test to help reduce the risk of self-reporting bias that may be associated with self-administered questionnaires. The time to answer the whole questionnaire by each participant was recorded. The data obtained from the pilot test were not included in the final data analysis.

Sample Size Calculation

The sample size was calculated using this formula: $n = p \times (1 - p) \times z^2 / d^2$. A confidence level of 0.95 was used, and the desired precision was 5%. Also, considering the most conservative proportion of the public attending the gym as $p = 50\%$, the minimum number of subjects was 385.

Ethical Considerations

This study followed the World Medical Association's Declaration of Helsinki guidance¹⁵. The study was performed after the approval of the Re-

search and Ethics Committee at Applied Science Private University (Approval number 2022-PHA-29). The participation was voluntary, and the purpose of the study was explained before accessing the questionnaire. For those who choose to participate, electronic consent was at the beginning of the questionnaire by selecting “agree to participate”. Once the consent was given, participants were allowed to fill out the study questionnaire. For those who selected “disagree to participate”, the survey was submitted automatically without filling out the questionnaire. All participants were informed that they could defer from submitting their responses at any time. The anonymity of respondents was preserved, as the participants’ names, personal data, or any identifiers were not collected.

Statistical Analysis

The statistical package for social science (SPSS®) version 22 (IBM Corp., Armonk, NY, USA) was used for data analysis. The mean±SD, and frequency (percentages) were utilized for continuous and categorical variables, respectively.

Univariate and multiple logistic regression were used to screen the predictors of the use of AAS by gym users. Also, logistic regression was used to screen the predictors for the occurrence of side effects following AAS use. Significant variables ($p \leq 0.250$) resulting from the univariate linear regression were entered into a multiple linear regression model using enter analysis. Variables independence was checked using person correlation where < 0.9 indicates the absence of multicollinearity between the independent variables in regression analysis. Results with a p -value ≤ 0.05 , with a 95% confidence interval, were considered significant.

Results

A total of 365 adult participants agreed to participate and thus were enrolled in this study. The median age (years) of the participants was 24.0 years (IQR=9.0), and around two-thirds of them were males ($n=258$, 70.7%). More than two-thirds of the participants were either college students or graduates ($n=281$, 77.0%), and around 76.4% ($n=279$) were single. Moreover, less than 50% of participants ($n=151$, 41.4%) reported that they did not have a job, and more than two-thirds

were childless ($n=285$, 78.1%). Most participants reside in the center of Jordan ($n=265$, 72.6%), and around a third ($n=112$) had a health-related degree. Finally, 7.9% ($n=29$) reported chronic diseases. For more details about the socio-demographic characteristics of the participants, please refer to Table I.

Regarding participants’ activities in the gym, Table II reveals that more than half of the participants attended a commercial gym ($n=201$, 55.1%). Less than 50% of the participants ($n=150$) reported that the duration of gym participation was from one month to six months. In addition, most participants ($n=302$, 82.7%) stated that they visited the gym three times or more each week. The duration of gym sessions was between 1 hour to two hours, as reported by 65.8% of the participants ($n=240$). Moreover, around 49.6% of the included participants ($n=181$) revealed that weightlifting was the most common type of exercise. Most participants stated that there was a trainer in the gym ($n=341$, 93.4%), and nearly half of them reported that their trainers had health-related credentials ($n=182$, 49.9%). Additionally, around two-thirds of the participants ($n=223$, 61.1%) stated that they follow a particular diet or take multivitamin/mineral supplements. Finally, 14.2% of the participants ($n=52$) reported using AAS during their gym participation.

Participants had various reasons for participating in the gym (Figure 1). Most participants attended the gym for entertainment purposes ($n=271$, 74.2%), losing weight ($n=232$, 63.6%), and for health/medical purposes ($n=190$, 52.1%). Professional training was the least common reason for gym participation ($n=92$, 25.2%).

Concerning participants’ knowledge about AASs and their complications (Table III), the median knowledge score was 7.0 out of 15 (IQR=7.0). Participants showed insufficient knowledge about AAS side effects, where less than 50% of the participants were aware that AAS causes depression ($n=146$, 40.0%), aggressive behavior ($n=167$, 45.8%), acne ($n=145$, 47.9%), increase in cholesterol level ($n=134$, 36.7%), cancer ($n=112$, 30.7%), stunting in growth ($n=76$, 20.8%), hair loss ($n=3$, 0.8%), and suicidal thoughts ($n=64$, 17.5%).

Regarding the participants’ perception towards the use of anabolic androgenic steroids (AAS), (Table IV), Many participants agreed that using AAS can be used to enlarge muscles ($n=277$, 75.9%) and increase their strength ($n=199$, 54.5%). In addition, 39.7% of partici-

Table I. Demographic characteristics of the study participants (n=365).

Parameters	Median (IQR)	N (%)
Age (years)	24 (9.0)	
Gender		
• Female		107 (29.3)
• Male		258 (70.7)
Educational level		
• Not educated		27 (7.4)
• Diploma		27 (7.4)
• University students		136 (37.3)
• University graduate		145 (39.7)
• Post-graduate degree		30 (8.2)
Monthly income		
• < 400 JD		223 (61.1)
• 401-800 JD/month		95 (26.0)
• 801-1,200 JD/month		27 (7.4)
• > 1,200 JD/month		20 (5.5)
Marital status		
• Married		83 (22.7)
• Single		279 (76.4)
• Others (Divorced or widowed)		3 (0.8)
Do you have children?		
• No	285 (78.1)	
• Yes		80 (21.9)
Place of residence		
• Center of Jordan		265 (72.6)
• North of Jordan		67 (18.4)
• South of Jordan		33 (9.0)
Do you have a health-related degree?		
• No	253 (69.3)	
• Yes		112 (30.7)
Do you suffer from chronic diseases?		
• No	336 (92.1)	
• Yes		29 (7.9)

IQR: Interquartile range, 1 JD = 1.41 US\$.

pants (n=145) agreed that using AAS enhances athletic performance, and around 44.9% (n=164) accepted that utilizing AAS improves overall muscle shape and appearance. About half of the participants (n=201, 55.1%) agreed that AAS was accessible, but 17.0% (n=62) agreed they were safe. Moreover, 37.0% of the participants (n=135) agreed that AAS sellers should be punished, while 27.4% (n=100) agreed that punishment should be reserved for users.

AAS users (n=54, 14.8%) were asked about their previous experience, as reported in Table V. Deca durabolin® (Nandrolone Decanoate) was the most commonly used type of AAS by the study participants (n=39, 72.2%), followed by Testosterone Enanthate® (Testosterone Enanthate) (n=38, 70.4%). Around two-thirds of the participants used AAS in an oral and in-

jectable form (n=34, 63.0%). The participants' most common sources for obtaining AAS were gym trainers (n=38, 70.4%), followed by local drug stores (n=33, 61.1%). Participants were asked about the most common reasons for using AAS, and the most common reported motives were increasing lean body weight (n=52, 96.3%), increasing muscle mass (n=51, 94.4%), and enhancing recovery from injury (n=51, 94.4%). Finally, among the AAS users, two-thirds reported that they had never experienced side effects from their use.

Finally, logistic regression analysis was performed (Table VI). The logistic model was statistically significant: $\chi^2(5)=21.926$; $p=0.001$. The Hosmer-Lemeshow χ^2 statistic was 7.700, and the associated p -value was 0.463, denoting a good model fit.

Table II. Gym/physical activities related data (n=365).

Parameters	N (%)
Type of gym	
• Hotel gym	25 (6.8)
• Social club gym	139 (38.1)
• Commercial gym	201 (55.1)
Duration of gym participation	
• < 1 month	52 (14.2)
• 1 month-6 months	150 (41.1)
• 6 months-1 year	36 (9.9)
• > 1 year-2 years	27 (7.4)
• > 2 years	100 (27.4)
Number of visits to gym/Week	
• Once	22 (6)
• Twice	41 (11.2)
• Three times or more	302 (82.7)
Duration of a gym visit	
• < 1 hour	71 (19.5)
• 1 hour-2 hours	240 (65.8)
• > 2 hours	54 (14.8)
Type of exercise you have participated in	
• Aerobic	75 (20.5)
• Weight-lifting	181 (49.6)
• Others	109 (29.9)
Presence of a Trainer in the Gym	
• No	24 (6.6)
• Yes	341 (93.4)
Does the trainer have any health-related qualifications?	
• No	25 (6.8)
• Yes	182 (49.9)
• I do not know	158 (43.3)
Did you use any multivitamin/mineral supplements or a special diet?	
• No	142 (38.9)
• Yes	223 (61.1)
Have you ever used any anabolic-androgenic steroids during gym participation?	
• No	313 (85.8)
• Yes	54 (14.8)

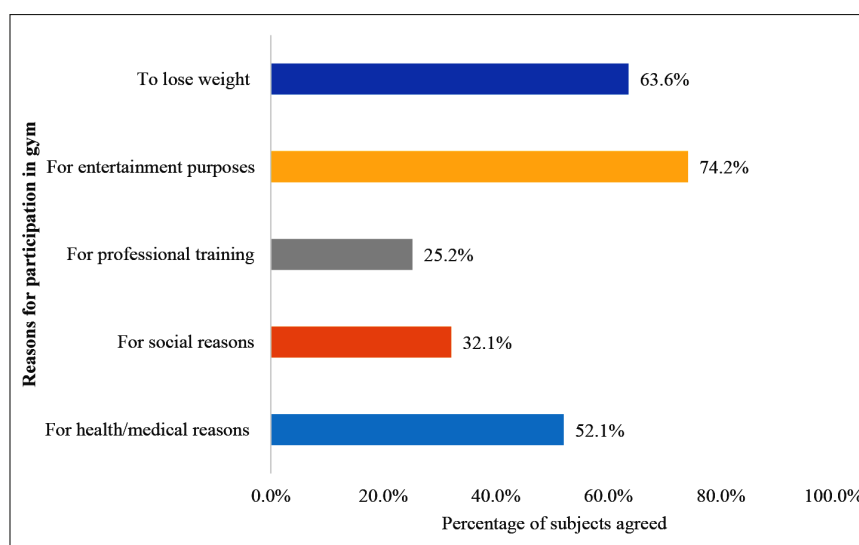


Figure 1. Reasons for participation in the gym as reported by the study participants (n=365).

Table III. Participants' knowledge about anabolic-androgenic steroids and their complications (n=365).

Statements	Correct answer	Percentage of participants answered correctly n (%)
Anabolic-androgenic steroids can cause depression	True	146 (40.0)
Anabolic-androgenic steroids can cause an increase in body weight	True	218 (59.7)
Anabolic-androgenic steroids can cause aggressive behavior	True	167 (45.8)
Anabolic-androgenic steroids can cause an increase in blood pressure	True	200 (54.8)
Anabolic-androgenic steroids can cause acne	True	175 (47.9)
Anabolic-androgenic steroids can cause an increase in cholesterol level	True	134 (36.7)
Anabolic-androgenic steroids can cause liver damage	True	190 (52.1)
Anabolic-androgenic steroids can cause gynecomastia	True	229 (62.7)
Anabolic-androgenic steroids can cause cancer	True	112 (30.7)
Anabolic-androgenic steroids can cause a decrease in sexual function	True	227 (62.2)
Anabolic-androgenic steroids can cause heart disease	True	195 (53.4)
Anabolic-androgenic steroids can cause stunting in growth	True	76 (20.8)
Anabolic-androgenic steroids can cause hair loss	True	3 (0.8)
Anabolic-androgenic steroids can cause infertility	True	190 (52.1)
Anabolic-androgenic steroids can cause suicidal thoughts	True	64 (17.5)
Knowledge score out of 15 [median (IQR)]		7.0 (7.0)

IQR: Interquartile range.

Regression revealed that being a male was associated with 3.35 times higher usage of AAS compared to females (OR=3.351, $p=0.008$). None of the other sociodemographic factors were found to have a significant effect on participants' AAS utilization ($p>0.05$).

Discussion

Anabolic androgenic steroids' use has been growing worldwide over the years in athletes and non-athletes, with higher prevalence in the Middle East region (21.7%), while global rates are much lower, according to a very recent me-

ta-analysis¹⁶. The picture in Jordan corresponds to that of the region. A 2008 study¹⁷ showed that the prevalence of AAS abuse was 4.2% among college students and as high as 26% among athletes. Jordan Anti-Doping Organization (JADO) adopted the World Anti-Doping Agency's (WADA) list, which prohibited the use of AAS at all times (in and out of competition)¹⁸. However, possession of AAS without prescription in Jordan is currently unregulated, and new legislation attempts to limit the supply of AAS rather than ban their use¹⁹. This study aimed to re-evaluate the prevalence of AAS use, focusing on gym attendants and assessing knowledge, attitudes, and practices regarding AAS use.

Table IV. Perception towards the use of anabolic-androgenic steroids (n=365).

Statements	Agree n (%)	Neutral n (%)	Disagree n (%)
Anabolic-androgenic steroids use can make your muscles bigger	277 (75.9)	70 (19.2)	18 (4.9)
Anabolic-androgenic steroids use can make your muscles stronger	199 (54.5)	94 (25.8)	72 (19.7)
Anabolic-androgenic steroids use can make anyone a stronger athlete	145 (39.7)	117 (32.1)	103 (28.3)
Anabolic-androgenic steroids use to make people look better	164 (44.9)	101 (27.7)	100 (27.4)
Anabolic-androgenic steroids are easy to obtain	201 (55.1)	116 (31.8)	48 (13.1)
Anabolic-androgenic steroids are safe to be used	62 (17.0)	114 (31.2)	189 (51.8)
People who sell anabolic-androgenic steroids should be punished	135 (37.0)	153 (41.9)	77 (21.1)
People who use anabolic-androgenic steroids should be punished	100 (27.4)	162 (44.40)	103 (28.3)

Table V. The experience of anabolic androgenic steroids by the study participants (among users) (n=54).

Parameters	N (%)
Types of anabolic-androgenic steroids used	
• Testosterone Enanthate® (Testosterone Enanthate)	38 (70.4)
• Dianabol® (methandrostenolone)	30 (55.6)
• Deca durabolin® (Nandrolone Decanoate)	39 (72.2)
• Sustanon® (Testosterone Propionate)	20 (37.0)
• Winstrol® (Stanozole)	31 (57.4)
• I do not know	8 (14.8)
Route of administration of anabolic-androgenic steroid	
• Oral administration	10 (18.5)
• Injectable administration	10 (18.5)
• Both oral and injectable administration	34 (63.0)
From where was the anabolic androgenic steroid obtained?	
• From friends	17 (31.5)
• From gym trainer	38 (70.4)
• From online sites	16 (29.6)
• From local drug stores	33 (61.1)
• From Fitness stores	15 (27.8)
• From healthcare professionals	7 (13.0)
Reasons for using anabolic androgenic steroid	
• Increase in lean body mass	52 (96.3)
• Increase in muscle mass	51 (94.4)
• Decrease in body fat percent	33 (61.1)
• Increase muscle strength & power	45 (83.3)
• Enhance recovery between workouts	29 (53.7)
• Enhance recovery from injury	51 (94.4)
• Increase in bone mineral density	10 (18.5)
• Reduced muscle damage	39 (72.2)
• Increase in pain tolerance	18 (33.3)
Have you ever experienced any side effects after using anabolic-androgenic steroids?	
• No	18 (33.3)
• Yes	36 (66.7)

Most current study participants were young males with low incomes and unemployed. They mostly performed resistance training and attended commercial gyms for entertainment purposes and/or weight loss. Similar to previous studies^{13,20,21}, their knowledge about the adverse effects of AAS was insufficient, both in Saudi Arabia, and United Arab Emirates (UAE). While in Russia, the level of awareness about side effects was high²², especially among users, but the later study had a larger sample size, including athletes and non-athletes, and almost double the prevalence of AAS use compared to our study.

Interestingly, drivers behind attending the gym were entertainment purposes, losing weight, and other health-related purposes. This is slightly different from the most common motives observed in countries like Germany and Norway^{23,24}, where being a role model for their children, the organization's reputation for achieving health benefits

and improving physical appearance was the primary basis for joining^{23,24}. These motivational differences could be attributed to different social/cultural factors.

In Jordanian gymgoers, the prevalence of AAS use was alarming (14.8%) but relatively lower than that of 2008 (26%), as well as that of other countries like Russia (30.1%)²², Saudi Arabia (29.3%)^{13,20}, and UAE (22%)²¹, but comparable to that among fitness centers' users of Germany (13.5%)²⁵. Studies^{26,27} from Western Europe and the United Kingdom (UK) reported a prevalence of AAS use among male fitness center visitors of about 5-10%, and a study²⁸ of AAS use among Portuguese gym users showed a prevalence of about 11%.

A more recent analysis²⁹ in the UK, using the Delphi method, showed a much higher rate, with a range of 328,000 and 687,000 (central value 447,000) in men aged 15-64 years who have recently used AAS regarding reasonable estimate.

Table VI. Assessment of factors associated with the use of anabolic androgenic steroids among the study participants (n=365).

Parameters	Use of anabolic androgenic steroids [0: No, 1: Yes]			
	OR	p-value [#]	OR	p-value [§]
Age (years)	1.0500.004 [^]	1.026	0.355	
Gender				
• Female	Reference 3.635	0.004 [^]	3.351	0.008*
• Male				
Educational level				
• University students or below	Reference 1.317	0.359	---	---
• University graduate or above				
Monthly income				
• ≤ 400 JD/month	Reference 2.686	0.001 [^]	1.811	0.100
• > 400 JD/month				
Marital status				
• Married	Reference 0.495	0.030 [^]	0.514	0.417
• Others (Single, divorced, or widowed)				
Do you have children?				
• No	Reference 1.729	0.099 [^]	0.574	0.499
• Yes				
Place of residence				
• Center of Jordan	Reference 1.346	0.356	---	---
• Others (north or south of Jordan)				
Do you have a health-related degree?				
• No	Reference 0.995	0.989	---	---
• Yes				
Do you suffer from chronic diseases?				
• No	Reference 0.960	0.942	---	---
• Yes				
Presence of a Trainer in the Gym				
• No	Reference 1.175	0.800	---	---
• Yes				

[#]Using simple logistic regression, [§]Using multiple logistic regression, [^]Eligible for entry in multiple logistic regression, *Significant at 0.05 significance level.

On the contrary, AAS use in Jordan was strikingly higher than in other countries, including India (2.9%)³⁰ and Sweden (3%)³¹, in addition to Brazil (current users 3.4%)¹². In Poland, a nationwide study³² showed that AAS use differed between recreational athletes (1-23%) vs. professional athletes (7-30%), especially in males.

Most participants thought that AAS use increases muscle size and strength, similar to the global motives behind the abuse of these agents. The majority used Nandrolone and testosterone, with gym trainers and local drug stores being the major sources of these drugs. The main motive behind the use was to increase lean body weight muscle mass and hasten recovery from muscle injury. More than two-thirds of participants experienced side effects, and being a male was associated with more likelihood of use. These results

were aligned with previous international studies, as reported in a scoping review from the Eastern Mediterranean Region³³.

The current study revisited the prevalence of AAS abuse in the Jordanian population since 2008, specifically among gym attendants, and was the first study to assess knowledge, attitudes, and practices regarding AAS use in Jordan. Nevertheless, the study has some limitations: (1) the sample size was less than required, which might have hindered finding statistically significant differences between users and non-users of AAS, (2) the use of a self-administered questionnaire which could have introduced self-reporting bias, (3) results cannot be generalized to the country or the region since it involved participants mainly from the center of Jordan, (4) no objective measures to confirm the use/non-use were done such

as blood tests or AAS level analysis, (5) no data about the actual side effects of the AAS reported by participants nor on dosage or frequency of AAS use among study participants.

Findings from this study reported a relatively high prevalence of AAS use among gymgoers. This study provides a scheme to examine the prevalence of AAS abuse among gym users and their knowledge, perception, and practices towards using these AAS. Also, results from this study would help policymakers get more insights into AAS use among gym goers, therefore helping enforce regulations regarding prohibiting their use without a prescription.

Conclusions

Results from this study indicated a relatively high prevalence of AAS use among gymgoers. Therefore, future efforts should prompt JADO or similar organizations to enforce their regulations regarding prohibiting their use without a prescription, and unlawful use should be criminalized. More awareness campaigns about the consequences of illicit utilization of AAS should be implemented in educational institutions, such as high schools and colleges. Future epidemiologic studies are recommended to provide stronger evidence about the correlation between AAS use and serious side effects to be included in these awareness campaigns.

Conflict of Interest

The Authors declare that they have no conflict of interests.

Funding

This research received no external funding.

Authors' Contribution

NI and RA contributed to the design and conception of the study, the acquisition of the data and its analysis and interpretation, the drafting of the article and critically revising, and the final approval of the version to be published. HA and AK contributed to analyzing and interpreting the data, drafting the article, critically revising, and final approval of the version to be published.

Ethics Approval

The study was performed after obtaining approval from the Research and Ethics Committee at Applied Science Private University (Approval number 2022-PHA-29).

Informed Consent

Electronic consent was obtained at the beginning of the questionnaire by selecting "agree to participate". Once the consent was given, participants were allowed to fill out the study questionnaire.

References

- 1) Mazzeo F. Anabolic steroid use in sports and in physical activity: overview and analysis. *Sport Mont* 2018; 16: 113-118.
- 2) Goldman A, Basaria S. Adverse health effects of androgen use. *Mol Cell Endocrinol* 2018; 464: 46-55.
- 3) Boyadjiev N, Georgieva K, Massaldjieva R, Gueorguiev S. Reversible hypogonadism and azoospermia as a result of anabolic-androgenic steroid use in a body builder with personality disorder: A case report. *J Sports Med Phys Fitness* 2000; 40: 271.
- 4) Tan KA, Turner KJ, Saunders PT, Verhoeven G, De Gendt K, Atanassova N, Sharpe RM. Androgen regulation of stage-dependent cyclin D2 expression in Sertoli cells suggests a role in modulating androgen action on spermatogenesis. *Biol Reprod* 2005; 72: 1151-1160.
- 5) Tan KA, De Gendt K, Atanassova N, Walker M, Sharpe RM, Saunders PT, Denolet E, Verhoeven G. The role of androgens in Sertoli cell proliferation and functional maturation: studies in mice with total or Sertoli cell-selective ablation of the androgen receptor. *Endocrinology* 2005; 146: 2674-2683.
- 6) 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: 341-375.
- 7) Pope HG, Jr., Khalsa JH, Bhasin S. Body Image Disorders and Abuse of Anabolic-Androgenic Steroids Among Men. *JAMA* 2017; 317: 23-24.
- 8) Kanayama G, Pope HG, Jr. History and epidemiology of anabolic androgens in athletes and non-athletes. *Mol Cell Endocrinol* 2018; 464: 4-13.
- 9) de Ronde W, Smit DL. Anabolic androgenic steroid abuse in young males. *Endocr Connect* 2020; 9: R102-R111.
- 10) Hussain B, Khalily MT, Rehman AU, Masud M, Arouj K. Prevalence of anabolic androgenic steroids usage among Pakistani athletes and its psychological/legal consequences. *Shield Res J Phys Edu Sports Sci* 2019; 13.
- 11) Thiblin I, Runeson B, Rajs J. Anabolic Androgenic Steroids and Suicide. *Ann Clin Psychiatry* 1999; 11: 223-231.
- 12) Pereira E, Moysés SJ, Ignácio SA, Mendes DK, Silva DSD, Carneiro E, Hardy AMTG, Rosa EAR, Bettega PVC, Johann ACRB. Prevalence and

- profile of users and non-users of anabolic steroids among resistance training practitioners. *BMC Public Health* 2019; 19: 1-8.
- 13) Alharbi FF, Gamaledin I, Alharbi SF, Almodayer O, Allohidan F, Alghobain M, Arafah A, Al-Surimi K. Knowledge, attitudes and use of anabolic-androgenic steroids among male gym users: A community based survey in Riyadh, Saudi Arabia. *Saudi Pharm J* 2019; 27: 254-263.
 - 14) Al-Harbi FF, Gamaledin I, Alsubaie EG, Al-Surimi KM. 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.
 - 15) WMA. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA* 2013; 310: 2191-2194.
 - 16) Reyes-Vallejo L. Current use and abuse of anabolic steroids. *Actas Urol Esp* 2020; 44: 309-313.
 - 17) 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: 661-665.
 - 18) Marinelli S, Basile G, Vari MR, Napoletano G, Negro F, Tini A. The evolution of European legislation on doping. New challenges in the age of NPS. *Eur Rev Med Pharmacol Sci* 2022; 26: 6405-6417.
 - 19) Tahtamouni L. Use of Anabolic Androgenic Steroids in Jordan : Mini Review. *Jordan J Biol Sci* 2013; 6: 1-4.
 - 20) Albaker W, Alkhars A, Elamin Y, Jatou N, Boumarah D, Al-Hariri M. Anabolic-Androgenic Steroid Abuse among Gym Users, Eastern Province, Saudi Arabia. *Medicina (Kaunas, Lithuania)* 2021; 57: 703.
 - 21) Al-Falasi O, Al-Dahmani K, Al-Eisaei K, Al-Ameri S, Al-Maskari F, Nagelkerke N, Schneider J. Knowledge, Attitude and Practice of Anabolic Steroids Use Among Gym Users in Al-Ain District, United Arab Emirates. *Open Sports Med J* 2009; 2: 75-81.
 - 22) Lykhonosov M, Babenko A, Lykhonosov P. The awareness of the side effects of the use of AAS as a factor of the conscious rejection of their use: The price of a beautiful body. *Endocrine Abstracts* 2019; 63: P330.
 - 23) MacIntosh E, Law B. Should I stay or should I go? Exploring the decision to join, maintain, or cancel a fitness membership. *Manag Sport Leis* 2015; 20: 191-210.
 - 24) Riseth L, Nøst TH, Nilsen TIL, Steinsbekk A. Long-term members' use of fitness centers: A qualitative study. *BMC Sports Sci Med Rehabil* 2019; 11: 1-9.
 - 25) Striegel H, Simon P, Frisch S, Roecker K, Dietz K, Dickhuth HH, Ulrich R. Anabolic ergogenic substance users in fitness-sports: a distinct group supported by the health care system. *Drug Alcohol Depend* 2006; 81: 11-19.
 - 26) Kanayama G, Gruber AJ, Pope HG, Jr., Borowiecki JJ, Hudson JI. Over-the-counter drug use in gymnasiums: an underrecognized substance abuse problem? *Psychother Psychosom* 2001; 70: 137-140.
 - 27) Korkia P, Stimson GV. Indications of prevalence, practice and effects of anabolic steroid use in Great Britain. *Int J Sports Med* 1997; 18: 557-562.
 - 28) Silva PR, Machado LC Jr, Figueiredo VC, Cioffi AP, Prestes MC, Czepielewski MA. Prevalence of the use of anabolic agents among strength training apprentices in Porto Alegre, RS. *Arq Bras Endocrinol Metabol* 2007; 51: 104-110.
 - 29) Hope V, Bond V, Boardley I, Smith J, Campbell J, Bates G, Ralphs R, Hout M-C, McVeigh J. Anabolic androgenic steroid use population size estimation: a first stage study utilising a Delphi exercise. *Drugs Edu Prev Policy* 2022; 1-13.
 - 30) Maharaj VR, Dookie T, Mohammed S, Ince S, Marsang BL, Rambocas N, Chin M, McDougall L, Teelucksingh S. Knowledge, attitudes and practices of anabolic steroid usage among gym users in Trinidad. *West Indian Med J* 2000; 49: 55-58.
 - 31) Nilsson S, Baigi A, Marklund B, Fridlund B. The prevalence of the use of androgenic anabolic steroids by adolescents in a county of Sweden. *Eur J Public Health* 2001; 11: 195-197.
 - 32) Gwizdek K, Brzęk A, Bąk-Sosnowska M, Dittfeld A, Knapik A, Ziaja D. The use of steroids by gym athletes: an attempt to diagnose the problem scale and possible causes. *J Sports Med Phys Fitness* 2018; 58: 880-888.
 - 33) Hearne E, Wazaify M, Van Hout MC, Atkinson A, McVeigh J. Anabolic-Androgenic Steroid Use in the Eastern Mediterranean Region: a Scoping Review of Extant Empirical Literature. *Int J Ment Health Addict* 2021; 19: 1162-1189.