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ORIGINAL PAPER

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Prevalence, Attitude, Knowledge, and Practice of Anabolic Androgenic Steroid (AAS) Use Among Gym Participants

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ABSTRACT

Background: Anabolic steroids (AS) are synthetic testosterone derivatives that last longer than physiological androgens in the body. Anabolic-androgenic steroid (AAS) abuse is spreading among athletes. The aim of this study is to assess the knowledge, attitudes, and practices of gym participants in Saudi Arabia. **Methods:** A cross-sectional survey was carried out among gym users from February 2017 to May 2017. The questionnaire included information on demographics related to the use of AAS and lifestyle habits. Any willing male gym participant could be included. **Results:** A total of 4860 male gym participants with a mean age of 28.6 ± 6.2 years were included. A majority were single, with a bachelor's degree or higher. Moreover, 9.8% of the participants used AAS, of which 76.7% reported improved fitness. Friends were the main source of AAS-related information, but only 38.0% of AAS users sought medical consults. The oral route was most common, and testosterone enanthate was the AAS most used. **Conclusion:** Also, 9.8% of gym participants used AAS and were more likely to be involved in risky habits, such as smoking and growth hormone abuse. They were less aware of potential complications of AAS, with gym trainers being the predominant source of AAS substances. **Keywords:** Anabolic Androgenic Steroids, AAS, Gym participants, testosterone, growth, hormone.

3000 years ago (2), and many athletes have been using AAS for the same purpose since 1950 (3).

Exercise has many benefits to help people live longer and healthier lives, as it also has an effect on the overall appearance of the body. Inactivity is described as a “silent killer,” and has been identified as the fourth leading risk factor for global mortality (6% of deaths) after high blood pressure (13%) and tobacco use (9%) (4). Regular exercise reduces coronary heart disease and stroke risk, hypertension, diabetes, colon cancer, breast cancer, and depression (4).

In the past decade, AAS abuse has been increasing and spreading among professionals, as well as youths taking part in daily sporting events (5). AAS is often associated with some serious adverse effects, which are generally dose-related (6). These complications include risk of sudden death, chronic damage to vital organs (7), myocardial infarction, atrial fibrillation (8), and effects on kidney function (9). A recent study showed that bodybuilders who used AAS for years developed proteinuria and a severe reduction in kidney function (10).

There are numerous reports of hepatic dysfunction and a marked elevation in serum levels of aminotransferases (10, 11). Additionally, AAS use has been associated with psychiatric complications including violent behavior and suicide (12, 13). Over the last few years, there has been a noticeable increase in the number of gyms in Saudi Arabia, which is associated with positive changes in people's attitudes towards exercise and bodybuilding. However, there are very few studies on gym participants' habits and knowledge about this substance. Our primary goal was to assess the prevalence of AAS abuse among gym participants; we also assessed AAS-related knowledge and attitudes among users.

1. INTRODUCTION

Anabolic androgenic steroids (AASs) are synthetic drugs with testosterone-like hormones that have anabolic and androgenic properties (1). The anabolic properties are the dominant effect of AAS drugs, while the androgenic properties are weaker. The first time athletes used an exogenous substance to improve their performance was over

Baseline characteristics	
Mean age (years)	27.6 ± 7.2
Mean BMI (kg/m ²)	26.0 ± 4.1
Married (%)	38.4
High school graduate or less (%)	26.2
Low income (%)	49.9
Working in the medical fields (%)	27.6
Living in Central region of Saudi (%)	44.1
Living in Eastern region of Saudi (%)	16.1
Living in Western region of Saudi (%)	22.3
Living in North region of Saudi (%)	7.3
Living in Southern region of Saudi (%)	10.2
Active smokers (%)	30.0
Passive smokers (%)	22.2
Gym/Physical activities and related data	
Participated in the gym for health reasons	20.4
Participated in the gym for social reasons	9.2
Participated in the gym for personal reasons	70.4
Duration of gym participation (months)	30.1 ± 31.9
Average weekly gym training (hours)	7.3 ± 4.6
Use of multivitamin/mineral supplements (%)	58.9
Use of growth hormone (%)	7.4
Participants who believed that it was legal to use AAS (%)	53.5
Participated in walking-related exercise (%)	33.7
Participated in running-related exercise (%)	15.5
Participated in swimming-related exercise (%)	21.0
Participated in soccer-related exercise (%)	29.8
Knowledge about potential AAS complications	
AAS can cause acne (%)	39.0
AAS can improve vision (%)	7.0
AAS can cause hair loss (%)	32.5
AAS can cause infertility (%)	57.3
AAS can increase risk of cardiovascular diseases (%)	45.1

Table 1. Baseline characteristics for the cohort

2. METHODS

We conducted a cross-sectional study from February 2017 to May 2017 to evaluate the prevalence of AAS abuse. The study was explained to all participants before answering the questionnaire. Any male gym participant willing to take part was included in this study. We excluded incomplete responses. A total of 4860 gym participants from more than 60 sports centers in the 5 major geographic sectors of Saudi Arabia were included to evaluate AS users.

The questionnaire was distributed to gym participants by a group of medical students who explained the questionnaire and collected the responses, with an informed written consent form for all participants. The 26 questions and answers were all in Arabic. The questionnaire consisted of single-response questions and 1 multiple-response question. We collected socioeconomic data, with participants reporting their weight and height, which we used to calculate body mass index (BMI). Data were collected about AAS use, the type and route of the substance, and awareness about potential complications. We considered those with monthly incomes of less than 5000 Saudi Arabia riyals as having a low income.

There were 4 questions related to knowledge and attitudes

Anabolic Androgenic Steroid (AAS) data	
AAS use (%)	9.8
Plan to use AAS in the future (%)	6.8
Friend as a source of information about AAS (%)	41.5
Gym trainer as a source of information about AAS (%)	23.7
Social media as a source of information about AAS (%)	34.8
Gym trainer provided participant with AAS substance (%)	43.3
Participant buys the AAS from online sites (%)	39.7
Participant buys the AAS from local drug stores (%)	17.0
AAS usage during the 1 st gym year (%)	34.0
AAS usage during the 2 nd gym year (%)	26.3
Participant seeks or plans to consult a medical provider about AAS (%)	38.0
Any fitness improvement experienced by the participant from AAS usage (%)	76.7
Participant advised other gym trainees to use AAS (%)	52.7
Complications experienced by the AAS users after quitting	
AAS can cause depression after quitting (%)	52.5
AAS can cause muscle wasting after quitting (%)	59.3
Fitness will decrease after quitting AAS (%)	54.4
AAS can cause infertility after quitting (%)	24.5
AAS Type and route of Administration (Among users only)	
Testosterone Enanthate (%)	31.0
Dianabol (%)	30.8
Deca durabolin (%)	28.6
Sustanon (%)	20.0
Winstrol (%)	16.7
Participant uses other types of AAS not listed above (%)	37.3
Participant does not know the type of AAS being used (%)	24.8
Oral administration of AAS (%)	43.6
Injectable administration of AAS (%)	22.0
Both oral and injectable administration of AAS (%)	34.4

Table 2. Anabolic Androgenic Steroid (AAS) data

towards AAS and another 7 questions to assess related habits. When a questionnaire was returned, it was checked by the data collectors for missing answers, and the participant was invited to complete them as necessary. One question had a list of 5 undesirable effects associated with AAS use except 1 on vision improvement, which was used to test knowledge about AAS side effects.

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Version 22, IBM Corporation, Armonk, NY, USA). Data are presented as the mean ± standard deviations. The means and differences between subjects were compared with an independent t-test for quantitative data or a chi-squared test for qualitative data. We considered $p \leq 0.05$ as statistically significant. The Ethics Review Committee of the College of Medicine, Taif University, approved this study.

3. RESULTS

The participants in our study had a mean age of 28.6 ± 6.2 years and mean BMI of 26.0 ± 4.1 . The majority were single, had a bachelor's degree or higher, and lived in the central region of Saudi Arabia. Almost half were low income, believed that AAS use was legal, and were either active or passive smokers. A quarter worked in the medical field (Table 1).

Personal interest was the reported reason for joining a

gym with the goal of extended attendance. More than half reported using multivitamins or mineral supplements, while less than 10% used growth hormone. Walking was the most common form of physical activity, which was followed by soccer (Table 1).

As such, 9.8% of the participants used AAS, while 6.8% planned to use it in the future. Gym friends were the main source of AAS-related information, followed by social media, while gym trainers were the main source of the substance: most trainees starting using it during the first 2 years of gym enrollment. Less than a third of AAS users sought medical consultation. More than two-thirds experienced improvement in fitness following AAS use, and half of them advised other gym participants to use it as well (Table 2).

After quitting AAS, more than half reported depression, muscle wasting, and decline in fitness. Approximately one-quarter reported a history of infertility due to past AAS usage. Most AAS was testosterone enanthate, followed by dianabol. Twenty-five percent did not know what type of AAS they were using. As stated earlier, the oral route was the most common for AAS substances (Table 2).

Compared to non-AAS users, AAS users were older ($p = 0.002$), had a higher BMI ($p = 0.018$), were more likely to be married ($p < 0.001$), had comparable levels of education ($p = 0.439$), reported higher incomes ($p = 0.002$), and were less likely to work in the medical field ($p < 0.001$). They were also more likely to live in the central and eastern regions of Saudi Arabia to be active smokers ($p < 0.001$), engage in a longer duration of gym participation ($p < 0.001$), use multivitamins and growth hormone (both $p < 0.001$), know that it was illegal ($p < 0.001$), and participated in walking and swimming ($p < 0.001$) (Table 3).

Overall, there was substantial awareness about the potential complications of AAS usage. Non-users were more likely than AAS users to attend the gym for health reasons and to be aware of infertility and cardiovascular complications of AAS abuse.

4. DISCUSSION

The prevalence of AAS users among gym enthusiasts in Saudi Arabia was 9.8%, which is consistent with other studies in Iran (13%) (13) and Sweden (9.3%) (14). However, other studies in the Middle East showed a higher prevalence of AAS abuse in the UAE (22%) (15), Kuwait (22.7%) (1), and Jordan (26%) (16). There was a much higher prevalence of AAS abuse reported in the United Kingdom (69.9%) (16) and the United States (79.6%) (17). A possible explanation for this difference might be factors such as sample sizes, the number and distribution of gyms in our study, and self-reported drug abuse; as such, abusers might feel shame or embarrassment in acknowledging their AAS use. The other explanation is that 20.4% of participants attended gyms for positive health reasons.

In our study, 7.4% of participants used growth hormone, while in a study done in the United States, the use of growth

Baseline characteristics	AAS users	Non-AAS users	P value
Participant number (%)	474 (9.8)	4386 (90.2)	n/a
Mean age (years)	28.6 ± 6.6	27.5 ± 7.25	0.002
Mean BMI (kg/m ²)	26.4 ± 3.9	25.9 ± 4.1	0.018
Married (%)	46.4	37.5	< 0.001
High school graduate or less (%)	27.6	26	0.439
Low income (%)	42.6	50.7	0.002
Working in medical fields (%)	19.2	28.5	< 0.001
Living in Central region of Saudi (%)	54.2	42.9	< 0.001
Living in Eastern region of Saudi (%)	23.0	16.2	
Living in Western region of Saudi (%)	14.8	22.2	
Living in North region of Saudi (%)	5.7	7.5	
Living in Southern region of Saudi (%)	2.3	11.1	
Active smokers (%)	39.2	28.9	< 0.001
Passive smokers (%)	21.9	22.2	
Gym/Physical activities related data			
Participated in gym for health reasons	16.5	20.8	< 0.001
Participated in gym for social reasons	12.9	8.8	
Participated in gym for personal reasons	70.6	70.4	
Duration of gym participation (months)	44.4 ± 37.8	28.5 ± 30.8	< 0.001
Average weekly gym training (hours)	7.4 ± 4.6	7.3 ± 4.6	0.685
Use of multivitamin/mineral supplements (%)	75.9	57	< 0.001
Use of growth hormone (%)	34.8	4.5	< 0.001
Participants who believed it was legal to use AAS (%)	35.2	47.7	< 0.001
Participated in walking-related exercise (%)	39.1	33.1	< 0.001
Participated in running-related exercise (%)	15.6	15.5	
Participated in swimming-related exercise (%)	23.8	20.7	
Participated in soccer-related exercise (%)	21.5	30.6	
Knowledge about potential AAS complications			
AAS can cause acne (%)	48.5	37.9	< 0.001
AAS can improve vision (%)	7.0	7.0	
AAS can cause hair loss (%)	38.4	31.8	
AAS can cause infertility (%)	39.5	59.2	
AAS can increase risk of cardiovascular disease (%)	33.5	46.3	

Table 3. Groups based on AAS usage

hormone was estimated to be 24% (17), which reflects many types of substance abuse not limited to AAS. In our study, as stated, the main provider of AAS substances was gym trainers (43.3%), which was also seen in other studies in Kuwait (62.1%) (1) and Jordan as well (42.9%) (16). There are questions regarding the quality, purity, and doses of AAS used by trainees, with the increased risk of AAS-related complications.

Our results suggest that smoking was moderately higher (39.2%) in AAS users compared to previous studies in Kuwait (70.5%) (1) and Sweden (50%) (14). A possible explanation might be that AAS users tend to have more unhealthy life-

styles than non-users. Multivitamin/mineral consumption (75.9%) was significantly higher than another study in the United Arab Emirates (UAE) (44%) (15). This may be the essential role of vitamins and minerals in hormone metabolism and bodybuilding. Other sports are important for building muscle mass, which was reflected in the survey. In total, 31.1% of participants engaged in running, and 52.1% engaged in soccer, which was higher than in an Irish study, in which only 3.7% engaged in running and 7.4% engaged in soccer (18). This reflected cultural preferences.

Surprisingly, all AAS users had inadequate knowledge about the harmful effects in our study, which was significantly observed in previous studies (15-17). We found that the most common type of AAS was testosterone enanthate (31.0%), followed by dianabol (30.8%). Percentages were more than twice as high as in another study (18, 19). However, a study in the United States demonstrated that 85% of AAS abusers used testosterone (17).

One limitation of the study may be that the data was self-reported. The strengths included a large sample size and a high number of gyms surveyed.

5. CONCLUSION

Overall, 9.8% of the included gym participants used AAS and were more likely to be involved in risky habits, e.g., smoking and growth hormone abuse. They were less aware of the potential complications of AAS, as gym trainers promoted these substances for trainees.

- **Authors contributions:** S. Althobiti and N. Alqurashi contributions to the conception and design. S. Althobiti, A. Alotaibi, and T. Alharthi did acquisition of data. A. Alotaibi, T. Alharthi and K. Alswat did the analysis and interpretation of data. A. Alotaibi and S. Althobiti drafted the article and revising it critically for important intellectual content. S. Althobiti, N. Alqurashi, T. Alharthi and K. Alswat approved the final version to be published.
- **Conflict of interest:** none declared.

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