Prevalence and Correlates of Anabolic-Androgenic Steroid Use Among Sultan Qaboos University Students: Cross-sectional Study

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Abstract

Objectives: Despite the serious side-effects associated with anabolic-androgenic steroids (AAS), their widespread misuse to enhance physical performance and appearance remains a global concern, particularly among young adults. This study aimed to assess prevalence of AAS use among a cohort of university students and associated sociodemographic and academic factors.

Methods: This cross-sectional study was conducted January 2024 to March 2025 at Sultan Qaboos University (SQU) in Muscat, Oman. Data were collected using a self-administered questionnaire adapted from previous research, which included questions on exercise habits, use of nutritional supplements, and consumption of narcotic or psychiatric drugs.

Results: A total of 592 SQU students participated in the study, with 63.0% being male and a mean age of 20.16 ± 1.72 years. Only 11 students (1.9%) reported a history of AAS use, all of whom were male (100%), resulting in a significant association between AAS use and gender (P = 0.009). In addition, low grade point average (GPA) was significantly associated with AAS use (P <0.001), with most users having a GPA below 2 (54.5%). No other associations were found between AAS use and other demographic or academic factors.

Conclusions: This study provides insight into the prevalence and correlates of AAS use among Omani university students. Although the overall prevalence in the study population was low, the findings highlight significant gender and academic differences. These results underscore the importance of continued monitoring and initiatives to raise awareness of the potential hazards of AAS use in this population.

Keywords: Performance-Enhancing Substances; Anabolic Androgenic Steroids; Prevalence; Risk Factors;Young Adults; Students; Oman.

Introduction

Anabolic-androgenic steroids (AAS) are synthetic derivatives of testosterone, a hormone essential for various physiological functions.[1] Although AAS were originally developed to treat medical conditions related to testosterone deficiency, such as delayed puberty and impotence, they are frequently used outside these therapeutic applications.[2] The muscle-building and strength-enhancing properties of these drugs have led to widespread non-medical use, particularly among professional and amateur athletes and individuals seeking to enhance their physical performance and appearance.[3–5] More recently, attention has also focused on the relationship between AAS use and body image, eating behaviors, and physical activity, suggesting that motivations for AAS use may extend beyond athletic performance and include concerns related to muscularity and physical appearance.[16]

A meta-analysis of 187 original studies by Sagoe et al. estimated the global lifetime prevalence of AAS use to be 3.3% (95% confidence interval: 2.8–3.8%).[6] Although prevalence estimates vary considerably across populations and study settings, the continued use of AAS represents an important public health concern.[7] AAS may temporarily enhance muscularity and physical performance; however, non-medical use has been associated

with a broad range of adverse health effects, including cardiovascular toxicity, impaired spermatogenesis, hypogonadism, liver injury, dyslipidemia, hypertension, and psychological complications.[8–12] Recent evidence further emphasizes the multisystem nature of AAS-related harm.[8,11,12]

Despite these risks, evidence from the Arabian Gulf region indicates that AAS use remains present, particularly among individuals engaged in gym-based physical activity. [13, 28, 29] Recent studies from Saudi Arabia have documented AAS use among gym users and examined their knowledge, attitudes, and practices regarding AAS and its potential health consequences. [28, 29] These findings are particularly relevant to neighboring Gulf countries such as Oman, where the available evidence remains limited. University students represent an important population in which to explore this issue, as young adults may be exposed to body-image concerns and gym culture. [15–17] Recent evidence further supports the importance of body image and physical activity-related factors in understanding AAS use among young adults. [16]

However, despite increasing evidence from other countries and the Gulf region, there is limited published evidence on the prevalence and correlates of AAS use among university students in Oman. Understanding the extent and characteristics of AAS use in this population is important for identifying potential areas for health education and prevention. This study therefore aimed to assess the prevalence and associated factors of AAS use among students at Sultan Qaboos University (SQU) in Muscat, Oman. Findings from this research may support the development of future awareness and prevention initiatives targeting university students.

Methods

This cross-sectional study was conducted from January 2024 to March 2025 to investigate the prevalence of anabolic-androgenic steroid (AAS) use among students at Sultan Qaboos University (SQU) and its associations with selected academic and sociodemographic characteristics. The study targeted healthy students aged 18–26 years who were able and willing to provide informed consent to participate in the research. Individuals who reported using AAS for medical reasons were excluded. A total of 500 students were recruited from the university population of approximately 18,000 students. The required sample size was calculated using a 95% confidence level and a 5% margin of error, yielding an optimal sample size of 377. To account for an anticipated non-response rate of 25% ($377 \times 0.25 = 95$), the required sample size was adjusted to 472 and subsequently rounded up to 500.

Data were collected using a self-administered questionnaire adapted from a previous study conducted in Riyadh, Saudi Arabia, and further refined following a comprehensive review of the relevant literature. [5] The questionnaire included basic demographic information and assessed various aspects related to participants' health and lifestyle, including exercise habits, nutritional supplement use, and the consumption of narcotic or psychiatric drugs. For the analysis presented in Table 2, selected sociodemographic characteristics (age, sex, and marital status) and academic characteristics (college type and GPA) were examined based on their availability in the questionnaire and their potential relevance to AAS use among university students. Previous studies have reported differences in AAS use according to demographic characteristics, particularly sex and age, while academic characteristics may provide additional context when examining AAS use among university students. Prior to the main data collection, the questionnaire was pilot-tested among 30 participants from the target population to assess the clarity, comprehensibility, and applicability of the questions. Feedback from the pilot testing was considered in making the final revisions to the questionnaire before its use in the main study.

Students from all SQU colleges were invited to participate, with researchers available to provide assistance during completion of the questionnaire. Contact details were provided for further inquiries. To ensure privacy and minimize potential peer influence, respondents were instructed not to discuss the questionnaire items with one another. A convenience sampling approach was used, whereby students who were available and willing to participate were recruited. When initial participant recruitment was insufficient to reach the target sample after one-month, printed versions of the questionnaire were distributed in student hostels and libraries to facilitate further recruitment. This approach also relied on the availability and willingness of students to participate and therefore remained a convenience sampling method.

Collected data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS), Version 22.0 (IBM Corp., Armonk, NY). Following data cleaning, descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summaries the sociodemographic and academic characteristics of the sample. Associations between AAS use and categorical sociodemographic and academic variables were assessed using Fisher's exact test because of the small number of participants reporting AAS use ($n=11$) and the resulting small expected cell frequencies. A two-sided p-value of <0.05 was considered statistically significant. Given the small number of AAS users, the analytical findings were considered exploratory and were interpreted with caution because of the limited statistical power to detect true associations.

Participants were informed of the study objectives before enrolment. Ethical approval to conduct the study was obtained from the Medical Research Ethics Committee (MREC), College of Medicine and Health Sciences, Sultan Qaboos University.

Results

A total of 592 SQU students participated in the study. The mean age was 20.16 ± 1.72 years. Of the participants, 373 (63.0%) were male and 219 (37.0%) were female. Most students were single (n = 583; 98.5%), while a small proportion were engaged (n = 7; 1.2%), married (n = 1; 0.2%), or divorced (n = 1; 0.2%). Slightly more students were enrolled in scientific colleges rather than humanities colleges (56.3% vs. 43.8%). Regarding academic performance, 57.4% had a grade point average (GPA) between 2 and 3. In terms of living arrangements, 51.5% lived with their families, 42.4% with friends, and 6.1% alone [Table 1].

Table 1: Academic and sociodemographic characteristics of Sultan Qaboos University students (N = 592).

Characteristic	n (%)
Age in years	
Mean ± SD	20.16 ± 1.72
Gender	
Male	373 (63.0)
Female	219 (37.0)
Marital status	
Single	583 (98.5)
Engaged	7 (1.2)
Married	1 (0.2)
Divorced	1 (0.2)
College type	
Scientific	333 (56.3)
Humanities	259 (43.8)
GPA	
<2	45 (7.6)
2–3	340 (57.4)
>3	207 (35.0)
Living circumstances	
With family	305 (51.5)
With friends	251 (42.4)
Alone	36 (6.1)

SD = standard deviation; GPA = grade point average.

A total of 11 students (1.9%) reported using AAS, all of whom were male, resulting in a statistically significant difference between genders ($P = 0.009$). Among AAS users, 54.5% were from scientific colleges and 45.5% from humanities colleges, with no significant association between AAS use and college type ($P = 1.000$). Most AAS users (90.9%) were single, with one person being engaged ($P = 0.156$). There was no association between AAS use and living arrangements ($P = 0.387$), with 36.4% of AAS users living with family, 54.5% with friends, and 9.1% alone. However, low GPA was significantly associated with AAS use ($P < 0.001$), with most users having a GPA below 2 (54.5%) or between 2 and 3 (45.5%) and none reporting a GPA above 3. No significant association was found between AAS use and disease status ($P = 0.356$) [Table 2].

Table 2: Characteristics of anabolic-androgenic steroid users and associations with selected factors (n = 11).

Characteristic	n (%)	*p*-value
Gender		0.009
Male	11 (100)	
Female	0 (0)	
Marital status		0.156
Single	10 (90.9)	
Engaged	1 (9.1)	
Married	0 (0)	
Divorced	0 (0)	
College type		1.000
Scientific	6 (54.5)	
Humanities	5 (45.5)	
GPA		0.000
<2	6 (54.5)	

2–3	5 (45.5)	
>3	0 (0)	
Living circumstances		0.387
With family	4 (36.4)	
With friends	6 (54.5)	
Alone	1 (9.1)	
Disease status		0.356
Diseased	1 (9.1)	
Non-diseased	10 (90.9)	

AAS = anabolic-androgenic steroids; GPA = grade point average.

Discussion

The use of AAS among university students remains a growing public health concern, with physical, psychological, and academic implications.[18,19] Understanding prevalence patterns and determinants of AAS use across different populations is critical to guide prevention and educational strategies tailored to specific settings. The current study provides data on AAS use among SQU students, including associations with demographic and academic factors. To the best of the authors' knowledge, there is very limited existing national evidence on this topic.

Overall, 1.9% of SQU students in this study reported using AAS, indicating a relatively low prevalence compared with several international and regional studies. For instance, a study among California community college student-athletes reported a prevalence of 3.3%.[20] In the Gulf region, substantially higher rates have been documented among gym-goers, reaching 22% and 22.7% in the United Arab Emirates and Kuwait, respectively.[21,22] More recent evidence from Saudi Arabia has also demonstrated ongoing AAS use among gym participants, although prevalence estimates vary according to the study population and setting.[13,28,29] In other Middle Eastern settings, a 2024 study among physical education university students in Palestine reported current AAS use in 2.9% of participants,[18] while a study among university students in Isfahan, Iran, reported an 8.3% lifetime prevalence, with 5.6% reporting current use.[15] A study among Jordanian collegiate students and athletes also reported AAS use.[14] In the United States, 8.7% of non-athlete college students at the University of Nebraska-Lincoln reported AAS use.[23] Compared with these studies, the prevalence observed among SQU students was lower. However, direct comparisons should be made cautiously because the studies differed substantially in population characteristics, recruitment settings, definitions of AAS use, and study methodology. The lower prevalence observed in the present university-based population may partly reflect differences between general university students and populations with greater exposure to gym-based or athletic environments.

In this study, AAS use was exclusively reported among males. This is consistent with global evidence showing higher prevalence rates among men compared to women. Irving *et al.* reported AAS use among 5.4% of male and 3.9% of female middle and high school students in Minnesota.[24] Similarly, among California community college students, AAS use was 4.2% in males and 1.2% in females.[20] A global meta-analysis similarly confirmed this significant gender disparity (6.4% vs. 1.6%; P <0.001).[6] These findings suggest that AAS use may be influenced by social and cultural expectations, body image ideals, and disparities in access. However, given that only 11 students reported AAS use, this observed pattern should be interpreted cautiously, as the small number of positive cases limits the precision and statistical power of comparisons between groups.

Age is another determinant of AAS use, with adolescents and young adults consistently shown to have higher prevalence rates.[25] Research from high-school populations have reported prevalence rates ranging from 0.5% to 2.9% among girls and 4% to 12% among boys, with initiation of use occurring at approximately 17 years of age in around two-thirds of users.[26,27] These trends highlight the importance of early prevention, particularly within secondary and tertiary education settings, before usage patterns become established. Awareness programs focusing on the health risks and legal implications of AAS use could therefore help reduce experimentation at younger ages.

The observed association between AAS use and lower GPA warrants cautious consideration. Several behavioral, psychological, and lifestyle factors may potentially contribute to this relationship. Students who place greater emphasis on muscularity, physical appearance, or gym-based activities may devote substantial time and attention to exercise and body-related goals, potentially competing with academic responsibilities and study time. Previous research among young adults has linked muscularity-oriented concerns with disordered eating and other body-focused behaviours, while studies of university men have described the gym as an environment in which body achievement may become an important aspect of identity and social experience.15,17 In addition, AAS use may occur in the context of broader psychological or behavioral difficulties, although such mechanisms were not directly assessed in the present study.18,19 Conversely, academic difficulties or stress may precede AAS use, with some students potentially turning to appearance- or performance-enhancing practices as part of coping with

dissatisfaction or other pressures. However, these explanations remain speculative, as the cross-sectional design does not establish the temporal direction of the association, and the very small number of AAS users (n=11) substantially limits the statistical power of this finding. Therefore, the observed association between AAS use and GPA should be regarded as exploratory and requires confirmation in larger studies specifically designed to examine the underlying behavioral and psychological factors.

Several factors may contribute to the relatively low prevalence of AAS use observed among SQU students in this study. As in other Gulf countries, Oman's strong Islamic values and conservative cultural norms discourage substance use, including the use of performance-enhancing drugs, which may contribute to societal stigma and lower acceptance of such behaviours.[28,29] Additionally, legal regulations prohibiting the possession of monitored and prescription-only medications without medical authorisation may act as a deterrent due to the risk of legal consequences, such as financial penalties or imprisonment.[30] University authorities and family supervision may further limit opportunities for AAS acquisition or use among university students.

Limited awareness and exposure may also play a role. Unlike dedicated athletes or frequent gym-goers who may have greater access to AAS and related information, university students outside of sports disciplines may have fewer opportunities to obtain or learn about these substances, reducing their likelihood of use. Nevertheless, the possibility of under-reporting cannot be excluded. Given the cultural stigma surrounding AAS use in Oman, some participants may have been reluctant to disclose their experiences, leading to an underestimation of the true prevalence of AAS use.

This study has certain limitations that should be taken into account when interpreting the results. First, the cross-sectional design does not allow for determination of causal relationships between AAS use and associated factors. Second, as the findings were based on self-reported data, the possibility of reporting bias cannot be excluded, particularly given legal and cultural sensitivities surrounding perceptions of AAS use in Oman. Third, because the study was conducted at a single university institution, the results may not be generalisable to students enrolled in other universities or regions. Fourth, a convenience sampling approach was used, whereby students who were available and willing to participate were recruited. Although students from all SQU colleges were invited to participate, recruitment depended on students' availability and willingness to participate, and printed questionnaires were subsequently distributed in student hostels and libraries when the initial recruitment was insufficient. This approach may have introduced selection bias, and the sample may not be representative of the wider SQU student population. Therefore, the generalisability of the findings to the broader SQU and Omani student populations is limited. Finally, the very small number of AAS users identified in this study (n=11) substantially limited the statistical power to detect true associations and precluded reliable assessment of potential predictors or patterns of AAS use. Therefore, the observed analytical findings, including the association with GPA, should be interpreted with extreme caution and considered exploratory rather than definitive. These findings should not be interpreted as evidence of a causal or established relationship between AAS use and academic performance.

Nevertheless, the findings provide useful insight into AAS use among university students in Oman. Although overall prevalence of AAS use was low, maintaining awareness and preventive efforts within the SQU setting remains important. Targeted educational and awareness initiatives addressing the health risks and legal implications of AAS use may help maintain low usage rates. Future research involving larger and more diverse student populations, as well as research into students' perceptions and motivations related to AAS use, would further enhance understanding of this issue and guide preventive strategies.

Conclusion

There is a low prevalence of AAS use among SQU students compared to international studies. Nonetheless, associations observed with male gender and academic performance should be interpreted cautiously given the very small number of AAS users and the limited statistical power of the study. These findings are exploratory and require confirmation in larger studies. These findings underscore the importance of continued monitoring and targeted educational initiatives to raise awareness of potential health risks and reinforce preventive measures.

Disclosure

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