Introduction

Anabolic-androgenic steroids (AAS) are testosterone derivatives that are used to treat various conditions such as reproductive system dysfunction, breast cancer and anaemia. It is well established that androgens play the central role in masculinization of the reproductive tract, genitalia and many other organ systems during the sexual differentiation process in the male.

AAS are one of the most widely abused drugs taken mostly by bodybuilder athletes in an attempt to enhance their performance and physical appearance. AAS have been used by athletes since the 1950s. It is estimated that one in five American athletes are using one form or another of AAS. Approximately one million Americans were using AAS in the 1980s. AAS drugs are taken in doses 10 to 100 x the recommended therapeutic dose for the purpose of physique enhancement.

The anabolic effects of AAS include increased muscle mass and bone density, decreased body fat, stimulation of erythropoiesis and an increase in heart and liver size. One of the most pronounced effects of AAS is the negative impact on the pituitary-gonadal axis. Serum FSH and LH are usually low resulting in a condition of impaired spermatogenesis including oligozoospermia to azoospermia, abnormalities of sperm motility and morphology. Some studies suggested that the AAS-induced endocrine imbalance is reversible while others reported conflicted results.

Other side effects of supraphysiological doses of AAS include acne, fluid retention, liver failure, decreased high-density lipoprotein, myocardial infarction and certain cancers. Psychological abnormalities like mood fluctuation, aggressive behaviour, violence and suicidal attempts were also observed with AAS abuse.

Abuse of AAS has spread from athletes to collegiate and high school students. Prevalence of AAS abuse in countries other than USA and some European countries such as Germany, Sweden and Poland has not been reported. The literature focusing on the non-therapeutic use of AAS tends to be aimed at athletes. This article investigates the extent of AAS abuse among Jordanian collegiate students and bodybuilders, who are the main target of such an abuse, and evaluates some risk factors associated with AAS abuse.

Methods

The university’s research committee approved of this study and gave its authorization. The study was divided into two parts, one focused on collegiate students and the other on bodybuilding gym attendants.

Selection of subjects

Collegiate students

All of the university students selected attended one university, The Hashemite University, Zarqa, Jordan. Jordan has 10 public universities. The Hashemite University is the fifth largest in terms of the number of enrolled students. Jordanian students are enrolled in public universities according to their achievement in a unified general examination regardless of their gender, ethnicity or area of residence. The distribution of The Hashemite University enrolled students (gender and area of residence) is comparable with the distribution of the Jordanian society (data not shown).

Athletes

All of the bodybuilding and weight lifting health clubs in four major Jordanian cities (Amman, Irbid, Zarqa and Aqaba) were
identified through the Jordanian telephone directory and each was assigned a number. Twenty-four health clubs were then randomly selected out of these. The health clubs were attended mainly by males. After consultation for participation in this study, only seven of them agreed to taking part in the study, while the rest declined the participation for various reasons.

**Questionnaire**

The questionnaire consisted of three sections. The first section asked for demographic information such as: age, year at school, area of residence of the subject, income source and amount. The second section investigated the subjects’ attitude towards the use of AAS, while the third section was concerned with the previous and current abuse of AAS and its side effects on the health of users. The lead author (L.H.T.) and a research assistant (N.H.M.) supervised the completion of the questionnaire, and the subjects were assured anonymity.

**Statistical analysis**

Descriptive statistics such as percentage, mean, range and standard error of the mean were used. Confidence intervals on proportions and the differences in proportions were also calculated. The Student’s t-test was used to test for significant differences between means. Statistical comparisons of users’ age, frequency of AAS abuse and the use of one type or more of AAS between low and high income athletes were performed by multivariate logistic regression. The same was done for unemployed and employed students. Data was analysed where applicable using STATISTICA 7 software for Windows. A significance level of \( P < 0.05 \) was considered acceptable.

**Results**

Five hundred and three collegiate students were offered the questionnaire, all of them completed and returned the questionnaire, giving a response rate of 100%. Also, the response rate from the health club users’ group was 100% (154/154); however, the numbers for different questions answered varied slightly because some participants failed to complete the whole questionnaire. The percentage of collegiate students who are currently using AAS (in the last 4 weeks) was 4.2% (95% CI = 2.7–6.3%), while it was 26.0% (95% CI = 19.3–32.9%) for the athletes using group.

The age of all of the collegiate students in the user group was 18- to 29-years-old, which is logical because the average age of Jordanian college students is 18- to 24-years-old. On the other hand, the age of the athletes users ranged from 18- to 45-years-old, with the majority (62.5%) being in the 18–29 group. The mean age of the collegiate student-abusers was 19.9 ± 0.3 (mean ± SEM) years, while it was 28.0 ± 1.0 for the athlete-abusers. Figure 1 summarizes the data about the age of first use of AAS for students and athletes.

The employment status of both groups (students and athletes) was also investigated. Of the using students, 9.5% (95% CI = 1.5–30.0%) were employed, in contrast to 5.2% (95% CI = 3.5–7.6%) of the non-using students who were employed (figure 2). The difference in the monthly income between non-using and using students who were employed (280.0 ± 20.4 and 157.1 ± 14.3 $, respectively) was insignificant \( (P > 0.05) \), which is mainly due to the fact that only two using students were employed. There was no reported difference among unemployed AAS users and those who were employed regarding their age, frequency of AAS use and the use of one type of AAS or more at a time \( (P > 0.05) \). On the other hand, 52.5% (95% CI = 43.5–61.6%) of the non-using athletes were employed, and 80% (95% CI = 65.0–89.8%) of the user athletes were employed (figure 2). The difference in monthly income between these two groups [employed athletes, non-users (322.3 ± 15.6 $) and users (483.9 ± 70.7 $)] was statistically significant \( (P < 0.05) \). Frequency of AAS use in the last 4 weeks and the age of the users tended to increase with increased income of athletes \( (P = 0.05) \), where 322 $ was set as the threshold income. In general, the level of education did not differ between the user and non-user athletes.

When non-users were asked if they knew where and how they could obtain the AAS, most of the students (67.4%) replied with a no answer, while the majority of the athletes (86.7%) confirmed that they did indeed know how and where to get AAS drugs. Figure 3 summarizes the most common sources for obtaining AAS. For collegiate students, a friend (most probably a user) is the major source for AAS (66.7%) (figure 3), while for athletes the sources were mainly a friend (35.7%) or a coach (42.9%) (figure 3).

The majority of the students (74.9%) who are not using any of the AAS drugs insisted on rejecting the use of these drugs even if they were provided with them and 20% of them were not sure. On the other hand, almost half (45.6%) of the athletes who are currently non-using, said that if they were given the drugs they would use them; the other half (44.7%) still would not use AAS.

The main reason for almost two-thirds (61.5%) of the athletes as to why to use AAS was to improve their athletic performance, while the other third abused AAS to enhance their physique \( (P < 0.05) \). On the other hand, the reasons for the use among students were divided between either improving their performance (44%) or their appearances (55.6%) \( (P > 0.05) \). The main motive for not using AAS in the students’
AAS abuse. Available literature about AAS tends to focus mainly on case reports, once again, because of the private and personal nature of such an abuse. Therefore, we must admit to certain study limitations such as the validity of self-report drug abuse; abusers of these drugs feel that their behaviour is disapproved of and so they might not disclose their abuse.\textsuperscript{23} The present study aimed at investigating the extent of AAS abuse among two Jordanian targeted groups; students and athletes. In addition, it was conducted to identify risk factors behind using such drugs and the attitudes of these two groups towards AAS.

Many of the studies related to prevalence of AAS abuse among athletes and adolescents come from the USA.\textsuperscript{5} The prevalence of AAS ranges from 3% to 12% among American high school students, while it is 1.7% for Australian high school male students.\textsuperscript{10} In the United Kingdom, the percentage of athletes admitting to be current AAS abusers ranges form 5% to 65.8%.\textsuperscript{3} In the present study, the prevalence of AAS abuse was 4.2% among collegiate students, which is not surprising for a country like Jordan in which the young generation is highly influenced by the western culture that pressures the youth to achieve the perfect body image and the ideal body weight. For the athletes, the prevalence was 26%. According to some coaches interviewed this percentage should be higher, which means that despite our maximum effort in validating the information given by participants, still some of them might have not disclosed their abuse.

There was a wide age range noted among athletes abusing AAS (18- to 45-years-old), with the majority (62.5%) being in the 18- to 29-year-old group (figure 1). One-third of the student–users started using the drugs before the age of 15 years, and half of them started between the ages of 15 and 18 years (figure 1). On the other hand, none of the athletes started before the age of 15 years, and more than half (57.1%) began abusing AAS when they were between 15- and 18-years-old (figure 1). This result is disturbing and is extremely dangerous as one of the side effects of AAS abuse at a young age is epiphyseal closure resulting in reduced adult height.\textsuperscript{22} Also, this information raises the concern of how these drugs are acquired at such a young age.\textsuperscript{24}

Two students in the users’ group were employed (figure 2) and this made it difficult to try to draw any conclusion about the effect of the employment status on AAS abuse among students. On the other hand, 80% of the AAS-using athletes were employed as compared with 52.5% of the non-using athletes who were employed (figure 2). The difference in the monthly income between these two groups was significant leading us to think that being able to afford these drugs is a major risk factor. When low and high income athletes were statistically compared, it was found that the frequency of AAS abuse increased with the increase of monthly income of abusers.

One of the risk factors for AAS abuse is the media and peer pressure regarding body image and achieving the ideal body size,\textsuperscript{11} which was confirmed by our data; the two main reasons behind abusing AAS for students and athletes were either improving their athletic performance (44.4 and 61.5%, respectively) or enhancing their physique (55.6 and 38.5%, respectively). The information gathered from this study indicated that despite the fact that AAS are prescription drugs,\textsuperscript{25} still abusers can easily acquire them. Moreover, it was found that if non-using athletes were provided with free drugs, almost half of them (45.6%) would most probably abuse AAS. In regards to non-using students, the knowledge of the adverse side effects of AAS and the religious belief had an impact on their decision as why not to abuse these drugs. The sources of AAS (friends or coaches) were convenient for abusers (figure 3); a coach being a source for AAS has been documented by others.\textsuperscript{24}

Generally, AAS abusers tend to be poly substance abusers, a behaviour known as stacking. The rationale is to activate more

### Discussion

AAS are testosterone derivatives, in addition to their androgenic activities; they have enhanced anabolic effects and prolonged biological availability.\textsuperscript{20} AAS are consumed by abusers at supraphysiological doses (10–100× the therapeutic dose), and since all major tissues in the body have androgen receptors, AAS abuse affects almost all body systems. AAS increase the risk of cardiovascular diseases and spermatogenesis impairment.\textsuperscript{4,21,22}

Conducting a study that aims at gathering data about AAS abuse proved to be difficult because of the secretive nature of

### Table 1 The most common AAS used by students and athletes (n=61)

<table>
<thead>
<tr>
<th>AAS brand name</th>
<th>AAS chemical name</th>
<th>Percentage of use</th>
<th>P-value\textsuperscript{a}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anapolon</td>
<td>Oxymetholone</td>
<td>18</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Andriol</td>
<td>Testosterone undecanoate</td>
<td>11.5</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Boldebal H</td>
<td>Boldenone undecylenate</td>
<td>13</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Deca 50/Deca-durabolin</td>
<td>Nandrolone decanoate</td>
<td>55.7</td>
<td></td>
</tr>
<tr>
<td>Dianabol</td>
<td>Methandrostenedione</td>
<td>47.6</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Primobolan</td>
<td>Methenolone acetate</td>
<td>16.4</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Primobolan depot</td>
<td>Methenolone enanthate</td>
<td>1.6</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Sustanon</td>
<td>Testosterone esters</td>
<td>22.9</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Stanazol</td>
<td>Stanozolol</td>
<td>11.5</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Testosterone</td>
<td>Testosterone cyclopentyl</td>
<td>16.4</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Propionate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testo LA</td>
<td>Nandrolone decanoate</td>
<td>1.6</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Tribolan</td>
<td>Methandri dipropionate</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>34.4</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a: P-value calculated in comparison to deca 50/deca-durabolin}
receptor sites and/or achieve synergistic effects with certain steroid combinations although there is no scientific support for stacking.\textsuperscript{25,26} In the current study, the majority (77\%) of the users used more than one steroid at any given time, deca 50/deca-durabolin (nandrolone decanoate) and diabolin (methandrosteneolone) being the two most common AAS (55.7 and 47.6\%, respectively) (table 1). The principle reasons bodybuilders stack these two drugs are related to their perception that these drugs have synergetic effects that will show results in a relatively short time of use (8–10 weeks).

Also, athlete abusers believe that deca 50 and diabolin have few of the commonly occurring side effects of AAS abuse.\textsuperscript{16} Some of the AAS (such as oxymetholone and stanozolol) abused by users in the current study are not sold in any pharmacy Jordan wide due to their link to liver cancer,\textsuperscript{27} and still users can acquire them from the black market.

AAS abusers suffered from a number of health-related problems, such as increased appetite (37.7\%), mood changes (36.1\%), fluid retention (25\%), headache (23\%), hair growth (21.1\%) and acne (21\%). All of these AAS-related symptoms have been documented by others.\textsuperscript{4,25,27} Data presented in the current work indicate that Jordanians, as represented by the two surveyed groups, do indeed abuse anabolic steroids and that being able to afford AAS is the main risk factor for such an abuse. Jordanian ministries and associations, such as the Ministry of Higher Education and/or The Higher Council for Youth, should be urged to conduct more comprehensive surveys to measure the prevalence of AAS abuse; such a task is beyond the scope of this article. The motives to AAS abuse have been found to enhance physical appearances and athletic performance; this in turn calls for new intervention measures that target those currently abusing AAS and who might be at risk of such abuse in an attempt to influence their perception and attitude towards the abuse of non-therapeutic drugs.

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Conflicts of interest: None declared.

Key points

- To our best knowledge, this is the first survey of AAS abuse among Jordanian collegiate students and athletes and the first to be conducted in an Arab country.
- The prevalence of AAS abuse among students (4.2\%) and athletes (26.0\%) is distressing, Jordan is a young country (90.0\% of the population are under the age of 49 years), and Jordanian adolescents represented by collegiate students and bodybuilding athletes do indeed abuse AAS.
- The results from this study lead us to call for the implementation of an educational programme that aims at educating the youth about the dangers of such abuse.
- Educators and mentors’ attention should be drawn to the fact of the presence of such abuse and of its adverse side effects of AAS abuse.

References


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