PREVALENCE OF ANDROGENIC-ANABOLIC STEROID USE IN ADOLESCENTS IN TWO REGIONS OF SOUTH AFRICA

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Objective. To determine the prevalence of androgenic-anabolic steroid (AAS) use among schoolchildren in two geographically separate regions of South Africa.

Design. Self-reported questionnaire.

Population. Standard 10 schoolchildren (16 - 18 years) were selected, 1 136 from region A and 1 411 from region B.

Results. The prevalence of AAS use in the overall population was 14.4/1 000. There were significant differences in prevalence of AAS use between the two regions (5.9/1 000 v. 22.7/1 000; $P < 0.0005$). There was significantly higher use in males (28.2/1 000) compared with females (0.7/1 000) ($P < 0.005$). Gymnasia were the most common source of AAS. Although there were regional differences in general knowledge about AAS, general knowledge scores were low across all the groups. Male sports participants who used AAS experienced significantly higher pressure to perform than their non-user counterparts in both regions.

Conclusions. Regional differences in AAS use and general knowledge about AAS need to be considered before a meaningful programme can be implemented to reduce the use of AAS by South African schoolchildren.

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Androgenic-anabolic steroids (AAS) are widely used by sports participants, with the primary goal of improving the user's muscle size and strength.[1-4] Users of AAS range from elite sports participants to recreational body-builders.[5,6] Studies have also shown that AAS are used by schoolchildren.[7-11] This has caused concern because of the undesirable effects of AAS,[12,13] particularly in growing children.[14,15] In addition, it has been shown that adolescent users of AAS are more likely to use other drugs and share needles.[16,17] The sharing of contaminated needles may potentially spread the human immunodeficiency virus.[18]

Before 1990 most prevalence studies of AAS use were conducted in North America;[9] now the problem has become international. In South Africa studies have shown that AAS are used by sports participants,[19] bodybuilders[20] and adolescents.[21] AAS were recently reclassified as schedule 5 drugs in South Africa. Infringements involving these drugs carry a severe penalty of up to 10 years' imprisonment (South African Parliament, Act 101 of 1965). Despite this, anecdotal reports of AAS use by schoolchildren persist. In particular, there are anecdotal reports that AAS use by schoolchildren is more prevalent in certain geographical regions.

This prompted us to conduct a study to determine the prevalence of AAS use in schoolchildren in South Africa. The specific aims of this study were to assess the prevalence of AAS among senior schoolchildren (16 - 18 years) in two geographically distinct regions with a similar degree of urbanisation. Another aim of this study was to compare general knowledge about AAS and pressure to perform in sport between AAS users and non-users in these two regions. Furthermore, the study attempted to identify the most common source from which schoolchildren obtained AAS. Answers to all these questions are essential before a relevant programme can be developed by any government structure or sports administration to reduce AAS use by schoolchildren.

METHODS

Two geographical regions with a similar degree of urbanisation were selected for the study. Region A was defined as all the matriculants (age range 16 - 18 years) attending 41 schools represented by the Cape and Parow school boards of the Cape Education Authority (5 005 pupils).[21] Region B was defined as all matriculants attending schools falling under the East, West, North, Central, Northwest and Northeast Johannesburg school boards in Gauteng Province. Thirty-three schools were represented in this region.

A single-step, stratified cluster sample design was used in each region to select sample schools. Each all-girls' school was paired with an all-boys' school because they had fewer pupils than mixed (boys and girls) schools in the area. Each mixed school and paired school then formed the cluster unit, stratified according to the language medium of instruction (English or Afrikaans). The assumptions and limitations of this sample design have been discussed in detail.[22]

The questionnaire was evaluated in a pilot study and problematic questions were identified and modified. The questionnaire was translated into Afrikaans and then translated back into English to compare with the original. The bilingual nature of the questionnaire allowed pupils to answer questions in their home language. All matric pupils in the selected schools, 1 361 in region A and 1 411 in region B, were asked to

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complete the questionnaire under examination conditions during normal school hours.

Pupils were not allowed to communicate while they were completing the questionnaire. To ensure pupil anonymity, questionnaires were numbered and coded for school and region only after they had been completed and handed in. The sample was divided into the following subgroups: region, male, female, English-speaking, Afrikaans-speaking, sport participant and non-participant in sport. Sport participants were further subdivided according to the type of sport and whether the sport was organised at school or elsewhere.

Level of proficiency in sport was categorised into 'first-team' and 'other team' representation. Those pupils who reported having used AAS were analysed as a subgroup. They were required to answer questions as to their motives for using AAS, the sports for which they used AAS, and any effects they had experienced after using AAS. In addition, all pupils answered eight general knowledge questions about AAS. The general knowledge score was determined for each pupil by totalling the correct answers. A pressure score for each pupil was calculated by totalling all the positive answers to eight questions asking about the source of pressure for them to perform in sport.

Data are expressed as absolute values, percentages and means (standard deviation) (SD). The Yates χ^2 statistic was used to detect significant differences between groups. A two-sample *t*-test was used to test for differences in pressure and knowledge scores between groups. Statistical significance between groups was accepted at $P < 0.05$.

RESULTS

Population characteristics

The general characteristics of the total study population, as well as the characteristics of the sub-populations in each of the regions, are shown in Table I. The total population (male 50.4%, female 49.6%) and each regional population (region A — male 50.2%, female 49.8%; region B — male 50.5%, female 49.5%) was stratified for gender. The overall frequency of sport participation in the total population was 91.9%; in region A it was 90.3% and in region B, 93.5%. The sport participation pattern with regard to gender was similar for regions A and B (Table I). Slightly higher frequencies of sport participation were observed in male (94.1%) compared with female subjects (89.8%), a trend that was evident in both regions A and B.

Level of sport participation and how this relates to gender is depicted in Table I. In males, the frequency of participation in the first team (56.4%) was similar to the frequency of participation in other teams (43.6%) (Table I). This trend was evident in regions A and B. In females, the frequency of participation in the first team (34.7%) was lower than the frequency of participation in other teams (65.3%) (Table I), a trend evident in regions A and B.

Table I. Characteristics of the study population

	Region A (N = 1 361)*	Region B (N = 1 411)†	Total (N = 2 772)‡
Gender			
Total	1 361	1 411	2 772
Males	683 (50.2%)	713 (50.5%)	1 396 (50.4%)
Females	678 (49.8%)	698 (49.5%)	1 376 (49.6%)
Sport participation			
Total	1 229 (90.3%)	1 319 (93.5%)	2 548 (91.9%)
Males	639 (94.2%)	656 (93.9%)	1 295 (94.1%)
Females	590 (86.3%)	663 (92.9%)	1 253 (89.8%)
Level of sport participation			
Males			
First team	354 (55.4%)	377 (57.5%)	731 (56.4%)
Other teams	285 (44.6%)	279 (42.5%)	564 (43.6%)
Females			
First team	189 (32.0%)	246 (37.1%)	435 (34.7%)
Other teams	401 (68.0%)	417 (62.9%)	818 (65.3%)

*Data incomplete for 51 respondents.
†Data incomplete for 64 respondents.
‡Data incomplete for 115 respondents.

Prevalence of AAS use

Prevalence of AAS use in the study population and sub-populations is shown in Table II. A total of 40 respondents from the total study population (N = 2 772) indicated that they used AAS. The prevalence of AAS use in the overall population was, therefore, 14.4 per 1 000 respondents. In the total population there was a significantly higher prevalence of use in male (28.2/1 000) compared with female (0.7/1 000) respondents ($P < 0.005$). In the total population there was a significantly higher prevalence of AAS use in male sport participants (30.1/1 000) compared with female sport participants (0.8/1 000) ($P < 0.005$) (Table II). In the total population there was also a significantly higher prevalence of use in male first-team participants (38.3/1 000) compared with male participants in other teams (19.5/1 000) ($P < 0.05$).

Table II. Prevalence of AAS use (users per 1 000) in the study population and subgroups

	Region A	Region B	Total
All subjects	5.9	22.7*	14.4
Gender			
Males	11.8	44.4*	28.2
Females	0.0†	1.4†	0.7†
Sport participation			
Males	12.5	47.3*	30.1
Females	0.0†	1.5†	0.8†
Level of sport participation (males)			
First team	11.3	63.7*‡	38.3‡
Other teams	14.0	25.1	19.5

*Significantly higher in region B compared with A ($P < 0.0005$).
†Significantly lower in females compared with males ($P < 0.005$).
‡Significantly higher in first team participants than other team participants ($P < 0.05$).

Prevalence of use in region B was significantly higher ($P < 0.0005$) than in region A for all subjects (B 22.7/1 000, A 5.9/1 000), for males (B 44.4/1 000, A 11.8/1 000), for male sport participants (B 47.3/1 000, A 12.5/1 000), and for male first-team sport participants (B 63.7/1 000, A 11.3/1 000) (Table II).

Characteristics of the AAS user group

The AAS were obtained from a variety of sources (Table III). Respondents frequently indicated that they obtained AAS from more than one source. Common sources of AAS in this study population were gymnasium friends (25.0%), gymnasium instructors/owners (22.5%), team friends (20.0%) and school friends (20.0%). Less commonly, AAS were obtained from veterinary surgeons (15.0%), coaches (15.0%), family doctors (7.5%), pharmacists (7.5%) and parents (2.5%).

Table III. Sources of AAS in the user group ($N = 40$)

Source of AAS	No.	%
Gymnasium friend	10	25.0
Gymnasium instructor/owner	9	22.5
Team friend	8	20.0
School friend	8	20.0
Veterinary surgeon	6	15.0
Coach	6	15.0
Family doctor	3	7.5
Pharmacist	3	7.5
Parent/s	1	2.5

The main sport for which AAS were taken was body building (27.5%), followed by rugby (12.5%), karate (12.5%), weight lifting (12.5%) and tennis (12.5%). Other sports for which AAS were taken were basketball (7.5%), athletics (5.0%), field hockey (2.5%) and swimming (2.5%).

The subjective effects on sports performance identified by users of AAS are depicted in Table IV. The most frequently reported effects on sports performance were increased strength (80.0%), improved size/appearance (67.5%), improved sports performance (62.5%), improved endurance (45.0%), and improved speed (42.5%).

Table IV. Subjective effects on sports performance reported by users of AAS ($N = 40$)

Subjective effects	No.	%
Increased strength	32	80.0
Improved size/appearance	27	67.5
Improved sports performance	25	62.5
Improved endurance	18	45.0
Improved speed	17	42.5
Less prone to injury	15	37.5
Improved resistance to fatigue	15	37.5
Improved concentration	5	12.5

Negative side-effects experienced by the user group are depicted in Table V. The most common negative side-effects reported by users of AAS were increased aggression (57.5%), increased sex drive (55.0%) and increased appetite (47.5%).

Table V. Subjective negative side-effects reported by users of AAS ($N = 40$)

Negative side-effects	No.	%
Increased aggression	23	57.5
Increased sex drive	22	55.0
Increased appetite	19	47.5
Nosebleeds	14	35.0
Headaches	14	35.0
Increased acne	13	32.5
Increased hair growth	13	32.5
Deepening of voice	12	30.0
Pins and needles	9	22.5
Nightmares	8	20.0
Arrested growth	6	15.0

Table VI depicts scores achieved by the subgroups in regions A and B in response to a questionnaire designed to test their knowledge on AAS. There was a significant difference ($P < 0.0005$) in the scores achieved by respondents (mean (SD)) in region B compared with region A for male sport participants who are non-users of AAS (A 2.10 (1.71), B 2.95 (1.57); female non-users of AAS (A 1.89 (1.59), B 2.34 (1.54)); all male non-users of AAS (A 2.09 (1.71), B 2.88 (1.59)); all non-user sport participants (A 2.03 (1.65), B 2.65 (1.57)); and all non-users not participating in sport (A 1.46 (1.63), B 2.16 (1.58)). Knowledge scores were significantly ($P < 0.005$) lower in female compared with male non-users of AAS in both region A (females 1.89 (1.59), males 2.09 (1.71)) and region B (females 2.34 (1.54), males 2.88 (1.59)). Furthermore, knowledge scores were also significantly higher ($P < 0.05$) in non-user sport participants than among non-users who did not participate in sport in both region A (participants 2.03 (1.65), non-participants 1.46 (1.63)),

Table VI. AAS test scores (mean (SD)) achieved by subgroups of the study population in regions A and B (maximum score for the test is 8)

	Region A	Region B
Male sports participants		
Users of AAS	2.38 (1.69)	3.20 (1.89)
Non-users of AAS	2.10 (1.71)	2.95 (1.57)*
Gender (non-users of AAS)		
Females	1.89 (1.59)†	2.34 (1.54)*†
Males	2.09 (1.71)	2.88 (1.59)*
All non-users of AAS		
Sports participants	2.03 (1.65)‡	2.65 (1.57)*‡
Non-participants	1.46 (1.63)	2.16 (1.58)*

*Significantly higher in region B compared with A ($P < 0.0005$).
†Significantly lower in females compared with males ($P < 0.005$).
‡Significantly higher in sports participants compared with non-participants ($P < 0.05$).

and region B (participants 2.65 (1.57), non-participants 2.16 (1.58)).

There was a significantly higher ($P < 0.005$) pressure score in all male sport participants who were AAS users compared with non-users in both region A (users 3.75 (1.39), non-users 1.62 (1.82)) and region B (users 2.65 (2.03); non-users 1.69 (1.89)). Among first-team male sport participants, there was a significantly higher pressure score ($P < 0.05$) for AAS users than non-users in region B (users 2.88 (2.07), non-users 2.03 (1.90)). A similar trend ($P < 0.10$) was observed in region A.

Table VII. Pressure to perform in sport (pressure score) (mean (SD)) in subgroups of the study population in regions A and B (maximum pressure score is 8)

	Region A	Region B
All male sports participants		
Users of AAS	3.75 (1.39)†	2.65 (2.03)†
Non-users of AAS	1.62 (1.82)	1.69 (1.89)
First-team male sports participants		
Users of AAS	3.75 (1.39)‡	2.88 (2.07)*
Non-users of AAS	1.94 (1.93)	2.03 (1.90)

Significantly higher in users compared with non-users (* = $P < 0.05$; † = $P < 0.01$).
Trend to be significantly higher in users compared with non-users (‡ = $P < 0.10$).

Discussion

The primary aim of this study was to determine the prevalence of AAS use by schoolchildren in two different geographical regions of South Africa, using a self-reported questionnaire. Data obtained from self-reported questionnaires are always open to criticism because the responses are difficult to validate. Being aware of this potential problem, we thoroughly tested the questionnaire in pilot studies and adjusted any questions which were misinterpreted or ambiguous. The schoolchildren completed the questionnaires in a controlled environment under examination-type conditions. We therefore believe that the risk of inaccurate information was minimised and that our method of data gathering was valid,[23] even though the participants possibly under-reported their use of AAS.[24]

The first finding of the study was that 14.4/1 000 (1.44%) pupils in the combined study regions used AAS. This prevalence is approximately half the prevalence determined in surveys conducted in the 1990s in the USA among schoolchildren of similar age (25 - 29/1 000),[9] and much lower than the 33/1 000 Canadian[10] and 58/1 000 Swedish[25] schoolchildren in this age group.

The study also showed that there were regional differences in AAS use (5.9/1 000 v. 22.7/1 000). The reason for these regional differences in prevalence are not clear because the regions, although geographically distinct, were similar in degree of urbanisation. In addition, the types of sporting activities the children were exposed to in the different regions were similar. These regional differences in the prevalence of AAS use are interesting and provide a useful model for trying to identify those factors which determine whether or not a community will have a high rate of AAS use. Although regional prevalence data were not reported in the Canadian study, there were regional differences in children's attitudes to AAS use.[10] The factors which determine why AAS use and attitudes to AAS use differ regionally need to be identified before any meaningful strategy can be developed to reduce the risk of AAS use in a specific population.[26]

When the AAS users in this study were analysed, it was found that the prevalence of use was higher in sport participants, particularly high achievers in sport, than in those who did no sport. This corresponds with findings in other countries,[9,10,27] and explains the positive relationship between AAS use and pressure to perform in sport. Theoretically, pressure to perform in sport is something that can be controlled. However, the source of the pressure (individuals, coaches, parents, peers, etc.) first has to be identified. Intervention programmes can then specifically target the groups which impose pressure on schoolchildren to perform in sport.

Gymnasia were the most common source of AAS supply in both regions in this study (Table III). This is cause for concern because young AAS users, who are often trying to improve their body size (Table IV),[27] are at risk of being influenced by more experienced body builders who train in the gymnasia and who use AAS.[9,20] In the gymnasium environment young AAS users will be more likely to heed the advice of their suppliers than that of medical professionals who could provide them with more factual information. Gymnasia are, therefore, areas that will need to be targeted for intervention programmes.

General knowledge scores for AAS in South African schoolchildren were very low, suggesting that there was lack of knowledge regarding the potential side-effects of AAS use, as was the case with American schoolchildren.[27] Although there were regional differences in general knowledge of AAS in this study, there were no differences in general knowledge scores between users and non-users (Table VI). It is, however, reasonable to assume that a potential user of AAS who has an understanding of its possible side-effects, coupled with increased knowledge about other strategies such as training and nutrition, will be less likely to use AAS than an individual who does not have this information.[28]

In conclusion, this study shows that there are regional differences in the prevalence of AAS use among schoolchildren in South Africa. Although the combined prevalence of use is lower than reported values in other countries, the problem is serious and needs to be addressed. Regional differences in AAS use need to be considered when intervention programmes are developed.

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