

Prevalence of performance-enhancing substance use by Johannesburg male adolescents involved in competitive high school sports.

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Objective: Goals for winning in sports can overshadow the virtues of fair play, friendship and unity among competitors. Adolescent athletes are using substances to achieve these goals, often at the expense of their health. The objectives of this study were to investigate the prevalence of performance enhancing substance (PES) use in South African male adolescents and to determine which substances are regularly used. Moreover, the study investigated whether the subjects were using legal or illegal substances, and also determined the reasons for using these in sports. **Design:** The study used a cross-sectional study design, using a self-administered questionnaire adapted from a previous South African study that investigated doping in elite athletes. The questionnaire included questions on high school sport participation, nutritional supplements and doping substances used to enhance performance. The sample of subjects was obtained from male adolescent high school athletes involved in regular competitive sports at the 1st and 2nd sports team levels. **Results:** The results indicated that the prevalence of PES use in this sample was reasonably low (30/100). The subjects indicated a variety of substances used for performance enhancement, including banned substances, (namely, growth hormone (5/100), anabolic androgenic steroids (4/100)), and adrenaline/ephedrine (4/100), and permissible supplements, (namely, creatine (32/100), vitamins (61/100), protein (61/100), caffeine (57/100) and carbohydrates (54/100)). **Conclusion:** The findings indicate that the use of banned substances for performance enhancement is present. A holistic approach to educational interventions and behaviour change may help to reduce the prevalence of banned substance use in adolescents.

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INTRODUCTION

Adolescent and youth sports seem to have progressively developed in South Africa to the point where young athletes are considering doping and performance enhancing substance (PES) use (16, 28). Just as the competitive nature of professional adult sports has led to athletes to do whatever it takes to give them an edge in competition, this approach seems to have filtered into adolescent sports, where winning in competition is all that matters (34). Substances that offer to boost muscle mass, strength and stamina beyond an adolescent's usual limits can be attractive.

However, using illegal substances such as anabolic androgenic steroids (AAS) can have serious harmful effects, including anti-social behaviour and dependencies on illegal drugs (6). A longitudinal study by van den Berg (31) found that 1.5% of a moderate sized sample of adolescents (n=2516) used AAS to improve their performance in sports. Another study by Laure et al. (18) showed that one percent of eleven year old athletes could be engaged in doping practices. Both of these studies highlight the need for intervention in a group of athletes that may be prone to risk at a vital stage in their growth and development. Many adolescents are involved in potentially

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dangerous behaviour, experimenting during a period of their lives where they are trying to deal with the tasks of adolescent development. Tasks of adolescent development include discovering sexual characteristics and identity, becoming free from family, gaining a sense of accomplishment and self esteem, and discovering a group of individuals they can identify with (30). For example, Calfee and Fadale (5) argued that up to a third of non-athletic high school students use AAS to enhance their body image. The motives for using PES in sport may be different, but mixtures of the mentioned challenges exist for most of those taking prohibited PES (5, 6). Thus, the complexity and pressures of this period may contribute to adolescent athletes' consideration to use these substances. Doping in adolescent sport seems to be common and is one of the main problems facing authorities internationally (6, 27).

The concern about doping in sports is however not a recent one because it has been noted that since the 3rd century B.C., athletes have used substances to improve their athletic performances (29). Rituals of consuming animal and plant products were perceived by athletes to promise success in competition, which exercise alone could not guarantee (14). Some of these perceived enhancements included improvements in vigour, intellect, body image, health, strength, power and confidence (7). These perceived benefits could also possibly be part of the underlying rationale behind adolescent athletes using PES in modern times. Thus, the aim of this paper is to determine to what extent male high school adolescent athletes in Johannesburg were using PES and what common nutritional and prohibited substances were prevalent.

MATERIAL AND METHODS

The study was a cross-sectional survey design, using a questionnaire that was adapted from a study by Coopoo and Jakoet (8) which had investigated the abuse of substances in South African elite athletes. A pilot study was done which found the questionnaire to be reliable (83%). Validation of the questionnaire was done by experts in the areas of exercise science and sports medicine. The questionnaire elicited responses on the prevalence of PES use and what substances were commonly used. The sources of information on the use of PES were also investigated in the study. The Gauteng Provincial Department of Education gave consent for the study, and ethical clearance was given by the University of the Witwatersrand, Johannesburg, South Africa. Permission was also given by headmasters of the high schools. Informed consent was given by parents/guardians, enabling the subjects that completed the minor assent forms to participate in the study. The sample size, based on a previous South African study done by Lambert et al. (16), was

determined to be 117 with 80% power and 95% confidence. The authors allowed for non-response by inflating the required sample size to 123. A representative sample of adolescent high school athletes from Johannesburg boys' high schools were thus invited to volunteer in this study. Inclusion criteria were participation in competitive 1st and 2nd team high school sports, male and aged between 15 and 18 years. Completed questionnaires were collected by the researcher and the data was analysed using the Epi Info (TM) 3.5.1 statistical software package for descriptive statistics.

RESULTS

The sample size (n=100) was representative of male adolescent athletes in Johannesburg boys' high schools and the response rate was 81%. The majority of the subjects (78/100) were 17 to 18 years old, and these ages reflect the normal distribution of ages for the grades mentioned. Sixty-seven percent of the subjects were in Grade 11, which reflects the general distribution of 1st and 2nd sports teams at most Johannesburg boys' high schools. The majority of the subjects played rugby (42/100), while the rest were involved in hockey (15/100), water polo (6/100), football (5/100), and swimming (5/100), cricket (5/100), golf (5/100), athletics (4/100), rowing (4/100), basketball (3/100), rock climbing (1/100), wushu martial arts (1/100), squash (1/100), and cycling (1/100). Two subjects (2/100) did not indicate what their high school sport was.

A number of subjects (30/100) indicated regular PES use, whereas the majority (64/100) did not, while some (6/100) did not respond. Figure 1 displays the common substances used, which included the use of the banned substance growth hormone (5/100). Moreover, of those that indicated PES use (30/100), a number of them (37/100) indicated that their coaching staff were aware that they were using PES regularly, whereas other coaches (40/100) were not conscious of this, and a few (23/100) were unsure of their coach's awareness.

The subjects were also questioned on their reasons for using PES (Figure 2). Most of the subjects (17/100) reported that they felt it helped to improve their performance in sports.

Table 1 demonstrates that the internet was the main source of information (74/100) on PES use in sports, possibly because the high schools in the study have access to this resource and its use as a means of finding out information is encouraged.

Some of the other mentioned sources of information were from personal trainers (33/100), information brochures (31/100), newspapers (31/100), the pharmacist (24/100), and a combination of television and their school (23/100).

Use of performance enhancing substances by adolescents

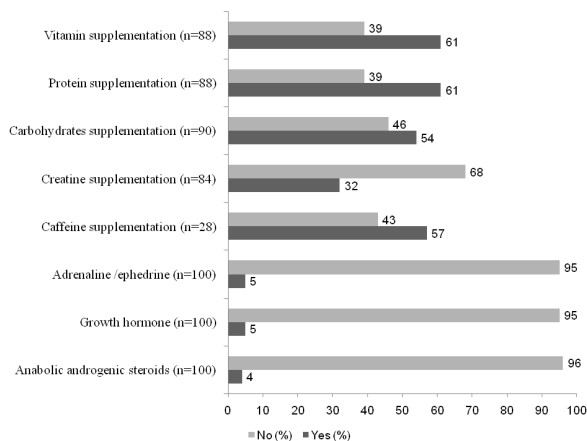


Figure 1: Prevalence and common substances used to enhance performance (n=100)

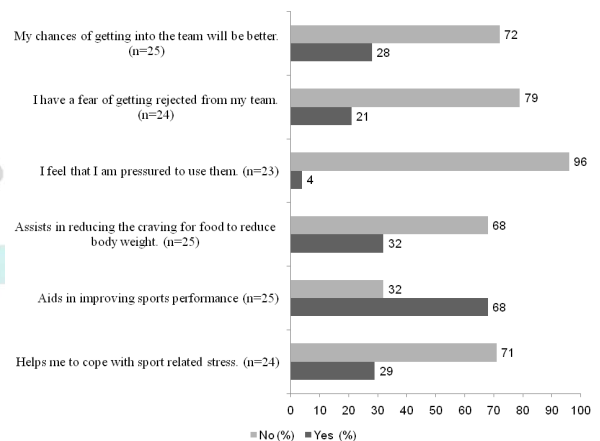


Figure 2: Reasons for using performance enhancing substances (n=30)

DISCUSSION

Success is fundamental to any sport, but it seems that adolescent athletes are now employing every possible means available in an attempt to excel in competition. Sadly, these athletes may sometimes see the use of prohibited PES as an option to achieve excellence in sport, but this often occurs at the expense of psychosocial and physiological drawbacks (12). Performance enhancing substances can be defined as “any substance taken in non-pharmacologic doses specifically for the purposes of improving sports performance” (2). These substances can be bought from pharmacies, health clubs, supermarket stores, the internet and elsewhere, but it is the prohibited substances being sold to adolescent athletes which has created concern. Most of these substances have been banned because of their ill effects on health or the unfair advantage created in sports, nevertheless, their use in sports has become more common (6). The majority of the subjects that indicated PES use (17/100) said that they used them to help improve performance output in sport. This, as well as the fact that one of the subjects felt pressured to perform well, could be substantial enough for deciding to use PES. Whether the products are banned or not may not be as important as winning. Winning may carry with it the reward of scholarships or honorary status among peers and teaching staff. An alternative to this viewpoint may be that adolescents considering using legitimate PES products could be doing so because consuming a well balanced diet and the optimal amount of nutrients is sometimes impossible to achieve, and thus leads to reduced physical performance.

A variety of reasons for not eating a well balanced diet may exist, but some of the common ones can include having a heavy training schedule and demanding

academic requirements. Thus, those adolescent athletes experiencing this norm may have decided to use dietary supplements to ensure that the recommended nutritional needs are met on a daily basis (20). With respect to the use of regular nutritional supplements in this study, a prevalence of creatine (32/100), vitamin (61/100), protein (61/100), caffeine (57/100) and carbohydrate (54/100) supplements were indicated by the subjects. Athletes generally use nutritional supplements for a variety of reasons including improving performance, recovering quicker from exercise, influencing body composition and decreasing sickness and the risk of infection (19). It could be speculated that the majority of these adolescent athletes are consuming nutritional supplements on a regular basis specifically for these reasons.

A few of the subjects (7/100) indicated that they took PES to assist them in coping with the stresses of sports. Even though this is a reasonably small number, it is vital to note that these adolescents have to deal with stress from sports at a high school level. Carbohydrate (CHO) supplements can be used to cope with these stresses. Noakes (26) showed that CHO loading can be used as a method of increasing CHO stores in the body. Our results show that 54 of the subjects use CHO as a nutritional substance. Doing so would give these athletes the advantage of having an increased threshold against fatigue, allowing them the advantage of recovering quicker recovery from exercise (25). Furthermore, the use of protein supplementation was used by the majority of the subjects (61/100). When taken in moderation, protein supplements can be an essential part of adolescent athletes’ diet (22). However, there are known side effects of using excess supplementation. Some of these can include dehydration, muscle cramps, gastro-

Table 1: Sources of information used by male high school athletes on performance enhancing substance use (n=100)

Sources of information	Yes (%)	No (%)
Media, paper and electronic sources		
Magazines (n=88)	72	28
The internet (n=93)	74	26
Books (n=83)	16	84
Journals (n=80)	9	91
Television and School (n=65)	23	77
Information Brochures (n=80)	31	69
Newspapers (n=82)	29	71
Professional sources		
Biokineticist (n=87)	16	84
Coach (n=94)	40	60
Personal trainer (n=89)	33	67
Physician (n=87)	10	90
Pharmacist (n=89)	24	76
Other sources		
Sibling (n=85)	19	81
Parent (n=89)	33	67
Friend (n=96)	66	34

intestinal pain and renal damage (22). Awareness of the side effects of using supplements is important for these athletes, especially in the case of the more common supplements like creatine.

The adolescent athletes that indicated using creatine in this study (32/100) should be made aware of the side effects if excess amounts or incorrect doses are used. Even though creatine use is popular, its use in athletes younger than 18 may not be safe until proven otherwise (21). Coaches, however, may be advocating the use of this product in their teams because of a belief in its supposed ergogenic effects. On the contrary, the same effects can be achieved with a well-balanced diet and periodized training programmes (15). The coaching staff in high schools clearly have a key role to play in directing the decisions made by their athletes; young athletes generally have much respect for their coaches. Fortunately, a relatively small number (38/100) of the subjects received their information about PES from coaches. Thus, the potential for receiving high-quality guidance from high school coaches is better than from other sources. For example, a number of subjects in the sample (64/100) received information about PES from friends. However, adolescents may fail to offer mature leadership and decision making skills to their peers, especially when there are a constellation of factors influencing the development of individuals during this period. Arguably, adult perspective and experience in the area of optimal food and physical training may aid in producing the professional and elite athletic superstars of the future. Improving nutritional education may assist coaches in helping their athletes make healthy choices. This may prove important since

there have been traces of banned substances found in South African nutritional supplements (32).

The investigation done by van Der Merwe and Grobbelaar (32) showed that 40% of nutritional supplements bought in Bloemfontein, South Africa, contained prohormones and stimulants that have been banned by The World Anti-Doping Agency (WADA). Their findings showed that unintentional doping through the use of nutritional supplements is a reality for South African athletes (32). This is a key issue in the fight against doping in adolescent sports. Popular brand names and products will always be favored by the population at large because of the products' involvement in sponsorship and advertising; however, the risk of contamination may be evident. The exact reason for the contamination of these products is unknown, but it does appear to be either intentional or indirectly related to poor manufacturing. This is an unethical practice and should be addressed by the anti-doping authorities. Consequently, as is shown in this study, adolescent athletes are clearly using PES products and thus need to be even more attentive to nutritional supplements that could potentially contain prohibited substances, such as AAS, which would not be displayed on labels.

Anabolic androgenic steroids are synthetically produced compounds that are derivatives of the hormone testosterone, and which are also structurally linked to it (6). Athletes from a broad selection of explosive sports such as shot put, javelin, power lifting, and bodybuilding, have used AAS to boost their performance (6). Some of the subjects in our study (5/100) indicated that they took PES because they were afraid of being dropped from the team. Steroid use could be one of the options available to help them remain part of the team and decrease the chances of being replaced by a better athlete. The findings of this study also show that the use of AAS reported by the subjects (4/100) was similar to the current literature (4, 9, 11, 24, 33, 35), which indicated a prevalence of AAS use from 0.7% up to 12%. Thus, it appears that the use of AAS for the improvement of body composition and sports performance is still prevalent in South Africa and is a problem globally. A startling point to note is that athletes in high schools are using this harmful substance despite the known adverse effects (6, 23). A further finding of concern was that 37% of the coaches were aware that their athletes were using PES; some of which were prohibited. The morality of these coaches is questionable, and perhaps educating them on the harmful effects of all types of doping may help to deter such behaviour. Besides AAS, another used substance indicated by the subjects was growth hormone, the use of which coaches may also be aware of. Growth hormone seems attractive to adolescent

athletes because it has the potential to improve muscle strength and mass by aiding the production of protein and helping with lipolysis (1). Alarming, adolescent athletes have been known to take more than twenty times the therapeutic dose of growth hormone for improving their performances (17). The thought of using this product for increasing height and muscle mass may seem advantageous to adolescent athletes. However, side effects are detrimental, including acromegaly, which can lead to debilitating symptoms such as weakness, shortness of breath, myopathy, and a decreased tolerance for exercise (5). A comparatively small number (5/100) indicated growth hormone use in this study, however, it seems that the cost of using this substance far outweighs the benefits. One probable reason for using this product may be that the information obtained about it was not entirely reliable, so the costs could be easily overlooked by those adolescents buying them. For example, the results show that the majority of the subjects (69/100) attained their knowledge of these substances from the internet.

The internet can be a source of good and dependable information, but most of it is not reviewed and oftentimes prohibited products such as growth hormone, AAS and ephedrine can be purchased on the internet without the purchaser knowing all of the related adverse effects. For example, adolescent athletes using ephedrine for its potential benefits (3) need to be concerned about using this product and its derivatives. There have always been concerns regarding the safety of its use and several adverse effects have been reported, including arrhythmias, myocardial infarctions, stroke, unexpected fatality, and seizures (13). Although some of the subjects (4/100) indicated ephedrine use, the specific form or type utilized was not made clear. It is also of concern that the adolescent athletes using ephedrine might develop a dependency on it (10). This dependency could lead to further psychosocial problems, such as criminal and antisocial behaviour, of which one effect is premature death from violence. In comparison, education regarding the legal use of PES, the adverse effects of doping and the means of using legitimate methods in sport may help to reduce prohibited PES use and create an environment where fair play is encouraged. This can be enhanced through education about healthy behaviour strategies, so that the objectives focus on the way the game is played, where adolescents “play to play” (14) rather than play to win.

CONCLUSION

Founded on the results of this study, there appears to be evidence of both legal and illegal PES use in male adolescent athletes from Johannesburg boys’ high

schools. There was notable indication of the banned substance AAS (4/100) in the sample. It appears that some of the adolescent athletes in this study might be using prohibited PES because of the known performance enhancement offered by these substances. However, these effects may be overshadowed by long term harmful physiological and psychosocial, not to outweigh physical, effects on the athletes. Even those using legal nutritional supplements need to be made aware that these products could be contaminated with banned substances and have other possible effects. Furthermore, the findings of this study showed that some coaches were aware that their team members were using prohibited PES, which is unethical, thus the authors recommend that the following plan be implemented to discourage the use of prohibited PES in adolescent athletes:

- A programme of intervention should be implemented at the pre-adolescent stage in an attempt to provide meaningful education on the effects and side effects of using PES to coaches, students, parents/guardians and teaching staff.
- This programme should include relevant and recent literature about PES and be complemented with journal clubs, forums, discussions on scientific means for enhancing performance in sports.
- More focus should be given to finding out what the cause and scale of demand there is on adolescents to excel in sport in order create a plan to reduce this stress.
- The sale of PES products via the internet should be regulated and screened to decrease the likelihood of any athlete purchasing products that may have traces of banned substances in them.
- The optimisation of performance in sport can be enhanced by improved training methods, nutrition, psychology, and performance monitoring.
- Future studies may include some investigation into the prevalence of traditional South African medicinal use for performance enhancement in youth sport.
- Similar studies could be done in other parts of the country to obtain an indication of the general trend of PES use by male and female South African adolescent athletes.
- Intervention studies should be done to investigate the impact of educational strategies onto improving the anti-doping attitude in adolescent athletes.

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