There have been many recent reports of serious psychological changes in anabolic steroid users. Doug Williamson reviews the literature and considers the implications for drug policy.

Use of anabolic steroids has for some time been widespread among competitive sportsmen and women, who self-administer doses of up to 100 times the recommended therapeutic dose, and use combinations of multiple oral and injectable preparations (a practice known as 'stacking'). Often these are preparations intended for veterinary use, or of questionable origin, purity or authenticity. They are taken in 'cycles' of 6-12 weeks. Given the rewards of success in sport, it is almost understandable that competitive athletes should resort to drug use, despite the potential risks of adverse cardiovascular, endocrine and hepatic effects. It is more difficult to comprehend that most recent epidemiological evidence indicates that the use of anabolic steroids is increasing, and is spreading from competitive to non-competitive, recreational sport and exercise. In 1987 it was estimated that one million Americans were using anabolic steroids to improve their physique. Since then, several surveys have confirmed the spread of use of these drugs among young people. In one 1988 survey of 3403 male high school students from across the USA the rate of current or previous anabolic steroid use was nearly 7% (Buckley et al., 1988). In another, over a thousand male students in three American colleges were surveyed, and 2% reported anabolic steroid use (Pope et al., 1988). In a third survey of over a thousand high school students conducted the following year, 3% of students (5.0% of males, 1.4% of females) reported anabolic steroid use (Windsor and Dumitru, 1989).

In the context of this epidemic of anabolic steroid use in the USA, and following numerous reports in the popular press of aggressive acts committed by anabolic steroid users, psychiatrists have been increasingly asked to comment on the state of mind of individuals who claimed that they had committed violent crimes because they were taking anabolic steroids. In
the first recorded use of this so-called 'steroid defence', a 23 year-old body-builder was found guilty of the murder of a hitchhiker whom he had tied between two posts and beaten to death. The judge in this case was said to have rejected the death penalty in favour of a prison sentence after hearing psychiatric testimony that the accused was suffering from a mental illness at the time of the offence, caused by anabolic steroid use (Moss, 1988).

Recent evidence from the UK suggests that anabolic steroid use may be as widespread here as it appears to be in the US, and presumably elsewhere. Surveys of needle-exchange services in Wales have und that anabolic steroid users are frequent users of e service. The author conducted a survey of students attending a College of Technology in Scotland and found that 1 % of females and over 4% of males admitted to use of anabolic steroids 0 993). A recent survey funded by the Department of Health has found evidence of widespread anabolic steroid use in gymnasia and sports clubs all over the UK (Korkia and Stimson, 1993). It is perhaps time for us to consider the following questions: Do anabolic steroids cause aggression; can anabolic steroids cause mental illness; and what are the implications of these reports for drug policy?

AGGRESSION

In animals, there is clear evidence for a link between natural testosterone levels and aggressiop, but attempts to demonstrate a similar link in human'~ have not proved conclusive. Attention has therefore turned to the behavioural effects of androgenic drugs, suc as anabolic steroids. Three recent studies have looked at anabolic steroid users for evidence of an increase in aggressive behaviour. In the first (Bahrke et at., 1990), a comparison of 30 male current anabolic steroid users, 23 previous users and 40 nonusers failed to demonstrate any significant difference between the three groups with regard to aggression/hostility. In the second (Choi et al., 1990), three anabolic steroid users and three non-user controls were monitored over several months of training incorporating two cycles of drug use. Levels of aggression in the steroid users were higher at all times than in the controls, and also increased significantly during periods of anabolic steroid use. In the third (Yates et al., 1992), psychological testing showed higher ratings of aggression in 12 weightlifters who were either currently using anabolic steroids or had used them within the last year, compared to 25 weightlifters who reported no previous anabolic steroid use.

In addition to these studies, there have been sever, alreports of violent behaviour among anabolic steroid users. In one such case, a man deliberately drove a car into a tree at 40 miles
per hour, and in another a second man had smashed the windscreen of a car because its occupant had left the indicator flashing (Pope and Katz, 1988). In three more serious cases, a 32-year-old prison security officer became grandiose and paranoid whilst taking methandrostenolone and shot a shop assistant in the spine leaving her permanently paraplegic, a 23-year-old construction worker who was taking a combination of methandrostenolone, oxymethalone and testosterone in preparation for a body-building contest became irritable and grandiose and violently murdered a hitchhiker, and a 24-year-old teacher taking methandrostenolone, oxandrolone, stanazolol and testosterone broke off his engagement to be married and later set off a homemade explosive device under the car of his fiancée, who fortunately came to no harm. All three men in these cases had no previous history of psychiatric illness or any criminal record. It was argued that each man was suffering from a form of mental illness called ‘organic mood syndrome, manic type’ at the time of their offence, and that this illness had been brought on by their use of anabolic steroids. All three men reverted to their previous personalities during imprisonment (Pope and Katz, 1990). In another case, a man with a history of ‘casual drunken violence’ assaulted his wife with far greater severity than ever before while taking oral methandrostenolone and intramuscular nandrolone decanoate, resulting in her death from a brain haemorrhage (Connacher and Workman, 1989). A further report describes attempted murder by a male body-builder who was using several different anabolic steroids who followed a woman home and attempted to strangle her before stamping on her face (Choi et al., 1990).

Although these reports and studies suggest a link between anabolic steroid use and aggressive behaviour, a causal relationship has not yet been clearly established. It may be that people who are potentially more aggressive would be more likely to use anabolic steroids. Alternatively, anabolic steroid users may take the drugs with an expectation that they will cause aggression, seeing this as desirable for competition or training. Placebo-controlled trials, in which the active drug and an inactive placebo are administered to two matched groups of subjects, with neither the subjects nor the investigator knowing who received drug and who received placebo until the end of the study, are needed to provide conclusive results. Such studies are fraught with difficulty; it is potentially hazardous to use anabolic steroids in trials in the massive dosages which are taken by athletes, and trials with smaller doses may not provide a valid comparison with anabolic steroid use 'on the streets'. In the only study of this nature to date (Su et al., 1993), volunteers given varying doses of a form of testosterone showed significant and dose-related increases in both positive mood effects (euphoria, energy and sexual arousal) and negative mood effects (irritability, mood swings, violent feelings and hostility). Currently, therefore, it appears that, despite numerous reports of violent behaviour among anabolic steroid users, there is little scientific evidence that use of anabolic steroids actually causes aggression, and further studies are needed to test the relationship further.
MENTAL ILLNESS

There have been numerous reports of mental illness occurring in association with anabolic steroid use. A 17-year-old male with no previous psychiatric history developed a schizophrenia-like illness characterised by paranoid ideas and hallucinations 6 months after commencing regular use of an unknown dose of methandienone (methandrostenolone) obtained on the blackmarket. The illness subsided after discontinuation of the drug (Annitto and Layman, 1980).

A 27-year-old man with a history of mood swings developed symptoms of mania (elation, insomnia, increased energy and pressure of thoughts) a few days after commencing a self-administered course of oxandrolone. His symptoms disappeared with a few days of stopping the drug, only to reappear a week later after recommencing it (Freinhar and Alvarez, 1985).

A 40-year-old man prescribed methyltestosterone for impotence developed severe depression with psychotic symptoms within 2 weeks of starting the drug (Pope and Katz, 1988). These subsided with a small dose of an antidepressant but he rapidly developed insomnia, hyperactivity and grandiose ideas which resolved when the antidepressant was discontinued. A 22-year-old man taking methandrostenolone experienced depression, insomnia, anxiety and fluctuations in mood after discontinuing the drug. During a subsequent course, he developed symptoms of mania and grandiose delusions which required treatment with antipsychotic medication.

A 20-year-old man who took a 5-week course of an intramuscular anabolic steroid preparation in an attempt to gain a place on an American football team became depressed and irritable, and his behaviour became uncharacteristically irrational, finally culminating in an attempt to rob a department store (Dalby, 1992).

In a study of 41 anabolic steroid users recruited from gyms in the Boston and Santa Monica areas, a high proportion reported symptoms of mental illness. During periods of anabolic steroid use, five subjects experienced psychotic symptoms and four other subjects experienced milder symptoms. Five subjects reported a manic episode and nine subjects a serious mood disorder. During withdrawal from steroids, five subjects experienced a major depression. No psychiatric symptoms were reported outside periods of steroid use (Pope and Katz, 1988).
There is also increasing evidence that the anabolic steroid use of some individuals is motivated more by avoidance of unpleasant withdrawal effects on stopping the drug than by positive effects on exercise and physique. This may represent a form of addiction (Brower et al., 1991).

It appears, therefore, that anabolic steroids could precipitate a psychiatric illness in certain predisposed individuals: it has not yet been clearly established that they cause psychiatric illness.

**DRUG POLICY**

The issue of anabolic steroid use as a form of ‘cheating’ is really a matter for the legislative and governing bodies of sport and is not within the scope of this discussion. However, steroid use does carry with it the risk of serious psychological side effects, what action, if any, should be taken to minimise a potentially serious public health problem? Should more be done to inform target groups of potential psychological effects? Should perpetrators of violent crimes be routinely drug tested? When considering any possible drug policy implications of the reports discussed it is important to keep two things in mind. First, there is at present very little firm scientific evidence of psychological side effects on which to base any decisions. Second, there is now clear evidence that anabolic steroid use is far more widespread than we previously realised, and any reported effects may actually be rare relative to the large numbers of individuals using anabolic steroids. It may therefore be prudent, before considering any policy changes, to make sure that (1) there is clear scientific evidence for these adverse effects, and (2) there is also evidence that the effects are common enough to warrant changes that may affect the majority of users. Clearly then, the most important single change in policy needed is greater support and encouragement for research into this contentious area.

What is proven is that there are serious risks involved in taking other drugs in error in the belief that they are anabolic steroids, or in taking prescribable drugs such as insulin or diuretics which can have fatal metabolic consequences without medical supervision. There are also proven risks associated with poor technique in injecting intramuscular preparations of anabolic steroids, and the risk of infection with hepatitis B or HIV through sharing of needles or drug vials. It is
towards these areas where there are proven risks to health that the dissemination of information should currently be targeted.

There has been much recent debate about whether anabolic steroids should be added to the list of 'controlled' substances, which would make possession of them an offence punishable by law. At present, it is not illegal to possess anabolic steroids for one's own personal use, although, as prescription-only drugs, it is illegal to supply them to another person. It is my impression that most anabolic steroid supply in this country is by a large number of small-scale distributors, for whom profit is not the primary motive. My concern would be that legislation may frighten off many of these small-scale distributors, and that, far from reducing the scale of the problem, organised crime may step in to fill the gap in the market, bringing with them their association with other criminal activities and their trade in other drugs of abuse. It is of note that a high proportion of anabolic steroid users in American studies, where legislation has already been introduced in many states, admit to use of other drugs such as cocaine and speed (Pope and Katz, 1988). In addition, I fear that if we legislate before we really know what the risks to health of anabolic steroids are, we will reduce greatly the willingness of anabolic steroid users to participate in surveys and studies, and may lose the opportunity to ever find out.

CONCLUSION

At present, little has been scientifically proven about the psychological changes which may be associated with anabolic steroid use. There have been sufficient reports to warrant further study, however, and greater energy and resources should be directed towards this aim. It is too early to make major drug policy decisions about anabolic steroid use outside sport, and attention should currently be concentrated on the proven risks to health associated with taking unprescribed medication or the with incorrect use of potentially infected needles. Legislation introduced on the basis of anecdotal, and sometimes hysterical, reports, may criminalise anabolic steroid use, and preclude further study.

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REFERENCES


**FURTHER READING**