

# BEYOND THE BASICS

## Drugs & Sports

### *What drugs are associated with sports?*

Androgenic-anabolic steroids (AAS), or anabolic steroids as they are popularly known, are a group of drugs that include synthetic testosterone and its many chemical variants. Steroid based drugs are synthesized for human and/or veterinary use and can be abused for the purpose of performance enhancement in sports or to improve physical appearance.<sup>1</sup> These drugs are associated primarily with sports because they are known to enhance physical strength, performance, stamina and recovery.<sup>1,2</sup>

Use of anabolic steroids by athletes began in the 1940s and 1950s, first by body-builders and weightlifters, and then by athletes in other sports. Use by non-athletes for body-image and other non-sport related purposes has been observed since the 1950s.<sup>1,3</sup>

Currently, AAS can be purchased illegally through gyms, competitions and mail order internet operations. These drugs are readily available due to illegal imports, thefts from pharmacies or veterinary clinics and production in illegal laboratories.<sup>3</sup>

While AAS are still the most widely abused class of performance enhancing drugs (PED), several additional classes of drugs and procedures are adopted for the purpose of increasing competitiveness in sport regardless of the inherent risks that may be associated with the practice:

- Tetrahydrogestrinone (THG) is an illicit designer androgen and progestin. Considered extremely potent, its overall safety has not been evaluated. It is presumed the negative effects resulting from use of THG are consistent with what could be expected from use of other AAS.<sup>4</sup>
- Erythropoietin (EPO) products are ergogenic due to their ability to increase the oxygen carrying capacity of blood.<sup>5,6</sup>
- Blood doping does not involve the use of drugs but is rather the intravenous administration of red blood cells or products containing red blood cells to increase oxygen carrying capacity.<sup>5</sup>
- Over-the-counter (OTC) products that claim to be precursors to human growth hormone (HGH) and to have the same metabolic effects are popular among body-builders due to the perception of the drugs' ability to enhance amino acid and glucose uptake in skeletal muscle.<sup>5</sup>
- Beta-blockers are used in certain sports, such as archery and shooting, to ensure a steady movement and ability to perform fine, accurate actions.<sup>5,6</sup>
- Diuretics are used by some athletes in events, such as boxing, to lose water weight, enabling them to compete in a lower weight class.<sup>5,6</sup>
- Local anesthetics have been used controversially in sport within specific restrictions to block pain so athletes can participate beyond their normal pain threshold.<sup>5</sup>
- Creatine, one of the most popular supplements, is used to produce small gains in short-term bursts of power and is also believed to promote the growth and strength of skeletal muscle.<sup>6</sup>
- Caffeine has been widely used in sport to increase energy and facilitate endurance.<sup>6</sup>
- Beta-2 agonists (such as salbutamol/Ventolin®) are abused to enhance oxygen capacity and exchange.<sup>6</sup>

### **Medical Use**

AAS were developed in the 1930s to treat hypogonadism and are currently used primarily to treat delayed puberty, some types of impotence, steroid hormone deficiency and loss of lean muscle mass resulting from diseases such as cancer and acquired immunodeficiency syndrome (AIDS). They can also be used to treat certain types of

anaemia, some breast cancers, osteoporosis and hereditary angioneurotic edema.<sup>1,2</sup>

The vast majority of alternative PEDs and approaches to gaining an edge in competition began with, and continue to have, legitimate medical purposes. These practices, when adopted for the purpose of sports competition, when not used under a physician's care, and when used

*Continued...*

more often than not in an inappropriate or contraindicated fashion, present risk to the health and well-being of the individual who is using them.<sup>5</sup>

### **Prevalence of Use**

Generally, it is presumed that individuals taking AAS are doing so to enhance their individual abilities with respect to sports competition; however, recent studies have questioned this presumption. Evidence is increasingly indicating that AAS use is associated with non-athletes and is instead linked to a broader spectrum of problem behaviours rather than efforts to achieve sporting success.<sup>7</sup>

Individuals with the behavioural syndrome muscle (or body) dysmorphia may be susceptible to the urge to use steroids. Rape victims and childhood victims of physical or sexual abuse are twice as likely to use anabolic steroids or other perceived muscle building substances than those who have not experienced physical/sexual violence. Adolescents engaged in other risk-related behaviours may also be at risk of initiating and/or continuing use of these drugs.<sup>3</sup>

In Manitoba, a 2007 survey of junior high and high school students revealed that a total of 1.3% of male students from Grade 7 to Senior 4 (Grade 12) used steroids in the previous year. Senior 3 (Grade 11) male students showed the highest prevalence of use among the group at 2.1%.<sup>8</sup> Female students from the same study displayed significantly lower use at 0.8%, with Grade 7 females demonstrating the highest prevalence at 1.2%.<sup>8</sup>

The National Institute on Drug Abuse (NIDA) Monitoring the Future Survey has found males consistently report higher rates of use than females. The 2008 survey saw a relatively stable reporting of use over grades 8, 10 and 12 from 2007 and 2008; however, these figures represent a significant decrease over use reported since 2001. The highest rates of use are among 12th graders, with 2.2% reporting a lifetime use.<sup>2</sup>

U.S. estimates of use among athletes is less than 6% based on surveys; however, anecdotal evidence suggests the prevalence in this population might actually be much higher.<sup>3</sup>

### **Pharmacokinetics**

Anabolic-androgenic steroid drugs are available in pill form, as an intramuscular injection or in the form of a cream, gel or a patch. Routes of administration will not generally differ in efficacy despite differences in pharmacokinetics.<sup>3</sup>

Doses taken by abusers may be as high as 10 to 100 times the dosage provided for medical indications.<sup>1,3</sup>

Androgenic-anabolic steroids are not typically used continuously. Users, who may or may not be athletes, will implement a “cycling” pattern whereby they take the drugs either orally or through injection over a period of weeks or months continuously, stop for a period of time, then resume the cycle again. It is believed by users this minimizes the risks associated with steroid use.<sup>2,3</sup>

Users are also known to combine several different types of steroids to maximize the effectiveness of the drugs. This “stacking” of a variety of steroids is believed by bodybuilders to create a synergistic effect. It can involve mixing two or more different anabolic steroids, using oral and/or injectable types, and sometimes may involve inclusion of steroids designated for veterinary use.<sup>2,3</sup>

“Pyramiding” – another technique for administering AAS – is the deliberate, slow escalation of the steroid exposure (quantity, dosage and frequency) to a peak and then tapering the cycle down over the course of six to 12 weeks.<sup>3</sup>

### **Pharmacodynamics**

Steroids bind to androgen and estrogen receptors on the surface of a cell. This AAS-receptor complex then diffuses into the cell nucleus to either alter gene expression or activate processes to send signals to other parts of the cell.<sup>2</sup>

Effects of AAS in the brain are significantly different from those of other drugs of abuse; specifically, AAS are not euphorogenic. However, long-term use of AAS can eventually affect brain pathways, such as the dopamine, serotonin and opioid systems.<sup>2</sup>

### **Effects of AAS Use**

When AAS are prescribed for legitimate medical purposes, at doses that are typically equivalent to 100 to 200 mg of testosterone over the course of a month, they can promote muscle development, physical vigour and feelings of well-being.<sup>1</sup>

However, anabolic steroids have been found to have detrimental effects on behaviour when used inappropriately. At high doses, individuals may experience euphoria, mania, hypomania, anxiety and depression, or they may become irritable and aggressive and commit aggressive acts, such as physical fighting, armed robbery, theft, vandalism or burglary.<sup>1,3</sup>

The physical manifestations specific to male users may include testicular atrophy, infertility, male pattern baldness, gynecomastia and increased risk for prostate cancer. Women who use AAS may experience reduction of body fat and breast size, coarseness of the skin, growth of body and facial hair, male-pattern baldness, changes or cessation of the menstrual cycle and enlargement of the clitoris. AAS may also cause deepening of a

*Continued...*

woman's voice, a permanent potential effect of AAS use. Both genders may experience acne, liver damage and cancer, increased potential for joint damage, and swelling of feet and ankles.<sup>1,3</sup>

Young people are at particular risk of significant consequences of AAS use because they are still developing. Consequently, adolescents who abuse AAS may experience stunted growth as a result of premature skeletal maturation and accelerated puberty changes.<sup>1,3</sup>

Effects of long term use of AAS are generally reported by physician case studies, and comprehensive studies have not been conducted. As a result, effects may only reflect a point-in-time and not capture the long-term implications if there is not sufficient follow-up. Animal studies that have been conducted suggested a higher frequency of early deaths among mice that were exposed to steroid doses equivalent to the doses taken by athletes.<sup>3</sup>

### **Toxic Effects**

Abuse of steroids can lead to serious health effects that may not always be reversible. Significant health concerns resulting from abuse of these drugs include liver damage, jaundice, fluid retention and increased blood pressure.<sup>2</sup>

Steroid use can contribute to cardiovascular diseases by increasing low-density lipoproteins (LDL) and decreasing high-density lipoproteins (HDL), thus increasing the risk of atherosclerosis and potentially contributing to heart attacks.<sup>3</sup>

Beyond significant health risks associated with steroid use, there are also risks of psychiatric dysfunction, such as paranoid jealousy, extreme irritability, delusions of invincibility and impaired judgment, all of which can lead to extremely aggressive behaviour.<sup>2</sup>

### **Tolerance and Dependence**

Animal studies have demonstrated laboratory animals will self-administer AAS when provided with the opportunity to do so. While the research is not conclusive with human subjects, some studies suggest long-term users may experience difficulty in stopping use and will continue use despite negative effects on physical health or in relationships. Along with a willingness to spend excessive amounts of money on the drugs, this suggests a potential for developing dependence with AAS.<sup>1,2</sup>

There is no evidence to suggest increased tolerance to the use of AAS.<sup>1</sup>

### **Withdrawal**

Users of AAS can experience withdrawal symptoms after discontinuation of use. Effects of abstinence can include mood swings, fatigue, restlessness, loss of appetite, insomnia, reduced libido and steroid cravings. The symptom of greatest concern is depression, which can lead to suicide attempts.<sup>2</sup>

### **Illegal Production**

Some steroids are made in illegal laboratories so there are no regulations that ensure their purity and strength. Users cannot be certain about the quality of the drugs, the chemicals used to manufacture the drugs or the concentration of the drug present in its final form, making it extremely difficult to predict toxicity and the potential consequences of use.<sup>3</sup>

### **Legal Issues**

In Canada, anabolic steroids are regulated under the *Controlled Drug and Substances Act*, Schedule IV. Trafficking, possession for the purpose of trafficking or export, and production and import offences are punishable on summary conviction by imprisonment for up to one year or on indictment by imprisonment for up to three years.<sup>1</sup>

### **Risks & Other Harms**

Individuals who inject AAS expose themselves to additional risks, including contracting human immunodeficiency virus (HIV), hepatitis B and C and other blood-borne viruses.

As is the case in any abuse of either licit or illicit drugs, there are potential adverse consequences related to the law, a person's financial situation, family relationships, and generally putting oneself at risk by participating in unsafe behaviours while under the influence of the drug.<sup>9</sup>

### **Pregnancy**

A study in 2003 of sheep treated prenatally with testosterone documented changes in the external genitalia of female lambs as a result of the testosterone treatment. In addition, the study also demonstrated that prenatal testosterone treatment led to growth delays in both male and female offspring and subsequent catch-up growth of the female lambs. The investigators considered these responses may have contributed to the development of adult reproductive, metabolic and behavioural deficits that were observed throughout the study period.<sup>10</sup>

## Interventions

Good patient-doctor communication is an essential risk management approach for all licit and illicit drug use. A comprehensive medical history puts physicians in the best position to determine appropriate medical interventions and recommendations for appropriate support programs.<sup>1</sup>

Anecdotal evidence of effective treatment of AAS abuse suggests that supportive therapy combined with presentation of information about potential withdrawal symptoms is generally adequate. If necessary, medications can be administered to manage symptoms and, eventually, to restore the hormonal system to a more balanced state. Hospitalization may be required in certain cases.<sup>2</sup>

**Remember:** A person's experience with any drug can vary. Here are a few of the many things that may affect the experience: the amount and strength of the drug taken, the setting, a person's mood and expectations before taking the drug, gender, overall health, past experience with that drug and whether more than one drug is being used at the same time. Using alcohol and other drugs at the same time can also be dangerous.

## Substance Use & Mental Health

- Substance use and mental health problems can often occur together. This is commonly referred to as a co-occurring disorder.
- Substance use may increase the risk of mental health problems.
- People with mental health problems are at higher risk of developing substance abuse problems:
  - Sometimes they use alcohol and other drugs in an attempt to relieve themselves from mental health symptoms.
  - For most people alcohol and other substance use only covers up the symptoms and may make them worse.

### Sources

1. Health Canada. *Straight Facts about Drugs and Drug Abuse*, 2000. Available at [http://www.hc-sc.gc.ca/hc-ps/alt\\_formats/hecs-sesc/pdf/pubs/adp-apd/straight\\_facts-faits\\_mefaits/facts-faits-eng.pdf](http://www.hc-sc.gc.ca/hc-ps/alt_formats/hecs-sesc/pdf/pubs/adp-apd/straight_facts-faits_mefaits/facts-faits-eng.pdf) (accessed May 2010).
2. National Institute on Drug Abuse (NIDA). *Info Facts, Steroids (Anabolic-Androgenic)*, 2009.
3. National Institute on Drug Abuse (NIDA). *Research Report – Anabolic Steroid Abuse*, 2006.
4. Death, A. K., McGrath, K. C., Kazlauskas, R. & Handelsman, D. J. "Tetrahydrogestrinone is a potent androgen and progestin," *J Clin Endocrinol Metab*, Vol. 89, No. 5, 2004, p. 2498-500.
5. Carpenter, P. "Performance-enhancing drugs in sport," *Endocrinology & Metabolism Clinics of North America*, 2007, p. 481-495.
6. Ambrose, P. J. "Drug use in sports: a veritable arena for pharmacists: drugs used in sports," *Medscape Today*, 2004. Available at [http://www.medscape.com/viewarticle/487473\\_6](http://www.medscape.com/viewarticle/487473_6) (accessed June 2010).
7. Harmer, P. A. "Anabolic-androgenic steroid use among young male and female athletes: is the game to blame?" *J Sports Med.*, Vol. 44, 2010, p. 26-31.
8. Friesen, K., Lemaire, J. & Patton, D. *Alcohol and Other Drugs: Students in Manitoba 2007*. Report prepared for the Addictions Foundation of Manitoba, 2008.
9. Addictions Foundation of Manitoba (AFM). *Fast Facts on Drugs*, 2004.
10. Manikkam, M., Crespi, E., Doop, D., et al. "Fetal programming: prenatal testosterone excess leads to fetal growth retardation and postnatal catch-up growth in sheep," *Endocrinology*, Vol. 145, No. 2, 2004, p. 790-8.

The Addictions Foundation of Manitoba (AFM) offers a broad range of prevention and treatment services for alcohol, other drugs and gambling. These are designed to meet the needs of all Manitobans and include harm reduction and abstinence-based programs.

For more information, contact your local AFM office or visit our website: [www.afm.mb.ca](http://www.afm.mb.ca).

**AFM Disclaimer:** This information is not intended as a substitute for professional advice. Every effort has been made to ensure that the information was accurate at the time of publication.

**Permission to reproduce is granted by AFM.** If you wish to order multiple copies of this or other topics in *The Beyond the Basics Series*, please contact AFM Library at 204-944-6233 or [library@afm.mb.ca](mailto:library@afm.mb.ca).