

**ASPECTS OF DOPING AND PROHIBITED DRUGS**

Mayank Tripathi, Rajendra Kr Songara\*, Priyank Sharma, Vipin Mishra and Manju Bala

School of Pharmaceutical Sciences, Jaipur National University, Jaipur, Rajasthan, India.

Received: 3 January 2011; Revised: 12 April 2011; Accepted: 1 May 2011; Available online: 5 May 2011

**ABSTRACT**

The International Olympic Committee (IOC) Medical Code states "Doping contravenes the ethics of both sport and medical science. Doping consists of the administration of substances belonging to prohibited classes of pharmacological agents or the use of various prohibited methods or both". International Pharmaceutical Federation approved a Statement of Standards for the role of the pharmacist in the fight against doping in sport. This document outlines recommendations for governments, pharmaceutical associations, pharmacists, and pharmaceutical manufacturers regarding their role in doping control.

**Keywords:** Doping, Prohibited drug, OTC, Regulatory.

**INTRODUCTION**

Misuse of drugs in sport is not new. Athletes have always expressed a need for speed, but some interpret this pharmacologically. The first documented report was in 1865, in swimming, when an unnamed drug was used to enhance performance in a canal race in Amsterdam. In 1955, 20% of cyclists in a French cycle race tested positive for drugs. Stimulants and anabolic steroids are the most common drugs implicated. In 1967, a British Cyclist died under the influence of Amphetamine during the 1967 Tour de France<sup>1</sup>. In a study in West Glamorgan, 38.8% of body builders admitted to taking anabolic steroids to enhance their physique and performance. Similarly, in an American study, 54% of male body builders were abusing anabolic steroids. Of the 671 cases of drug abuse logged by the UK Drug Testing Programme, 273 involved stimulants while anabolic agents were implicated in 169 cases.

A leading UK track athlete, of Lucozade fame, was allegedly reported to be getting more a fizz from the anabolic steroid, Nandrolone and a top US Sprinter, who attributed his astronomically high testosterone, levels to "pleasing his wife" the night before drug test was banned.

Doping-control (DC) procedures, particularly as used at the 1996 Olympic Games, are described, and the role of pharmacists in DC is discussed. DC procedures must be strict and precisely followed to avoid contamination of samples, the appearance of bias, and breaches in security and confidentiality. The process of selecting athletes for testing can be random, nonrandom, or a combination of the two. Escorts are used to notify athletes of their selection, verify their identity, and accompany them to the DC station. When urine specimens are obtained for DC, the voiding process must be directly observed. The specimen is checked for pH and specific gravity and then processed for shipping to a laboratory to be analyzed for banned substances. Medication histories are also obtained, giving

**\*Corresponding Author:**

Rajendra Kumar Songara  
School of Pharmaceutical Sciences, Jaipur National University,  
Jaipur, Rajasthan, India.  
Contact no: +91-9887863372, Email: rajendrasongara25@gmail.com

athletes the opportunity to declare any substance that has been taken for legitimate medical purposes. Laboratory analysis involves screening and confirmation phases. During the Atlanta Games, roughly 50 pharmacists participated in the DC program as escorts or technical officers. It is logical to involve pharmacists in DC programs because they can develop and conduct drug-testing protocols; educate athletes, coaches, and trainers about drug use and abuse; and help ensure the safe and effective use of medications. Sophisticated doping-control procedures have been developed for athletic competitions, and pharmacists have much to offer DC programs.<sup>2</sup>

The World Anti-Doping Agency (WADA) was formed in 1999, as a result of an increasing awareness internationally of the need to intensify efforts to fight doping in sports. The WADA has taken over responsibility for international doping control from the International Olympic Committee. A new World Anti-Doping Code, created by the WADA, became effective globally in January 2004. This Code contains, among other things, lists of prohibited substances and prohibited methods. The intention is that the Code will encourage harmonisation and co-ordination and make national and international antidoping programmes more effective in terms of detection, dissuasion and prevention.

**HOW DO ATHLETES OBTAIN DRUGS**

Athletes may obtain drugs through three main networks: their physician, the black market and the proximity network. Many GPs prescribe drugs unwittingly, for what they trust is a genuine complaint. Many drugs in particular the high-tech agents are purchased on the black market. The proximity network is the term used to describe acquisition of drugs from people within a close network e.g. coaches, teammates and commonly relatives.

**THE ROLE OF PRESCRIBER AND PHARMACIST**

1. Control of International and Non-International drug abuse in sport requires the co-operation of athletes and prescribes. Athletes suffer the same cross section of

- ailments as other patients and many sportsmen avoid all medicines because of concern about failing doping tests.
2. A balance is needed to have a range of drugs available to manage a variety of common disorders while maintaining a level playing field. Prescribers should be aware of prohibited medicines and routes of administration compatible with sports.
  3. The Community Pharmacist also has an important role to play in advising on appropriate use of medicines in sport. In addition to prescribed medicines, many OTC preparations also contain prohibited substances. For example, many cold and hay fever remedies contain Sympathomimetics and analgesics may contain Opioids and Caffeine. It is noteworthy, that because OTC preparations are widely used for minor ailments, their abuse is more difficult to control.
  4. There is a need for provision of up to date information and advice to prescribe on drugs in sport. Different sports may have different regulations and drugs banned by one sports organization may be allowed by another. Where there is any doubt, as the compatibility of a drug in sport, athletes should be recommended to check with their governing body.

## DRUGS ALLOWED BY THE INTERNATIONAL OLYMPIC COMMITTEE (IOC)

Drugs permitted for use in sport by the IOC are:

- Anesthetics (local, intra-articular)
- Beta Agonists (inhaled Salbutamol, Terbutaline, Salmeterol)
- Analgesics e.g. Paracetamol, Aspirin, Codeine
- Corticosteroids (inhalers, topical, intra-articular)
- Antacids (simple) H<sub>2</sub> antagonists (Cimetidine, Ranitidine)
- Antibiotics
- Anti diarrheas (Diphenoxylate, Loperamide, Electrolyte Replacement Agents)
- Proton Pump Inhibitors
- Anti- Emetics (Metoclopramide, Domperidone)
- Sodium Cromoglycate Antihistamines

## PROHIBITED USE OF DRUGS ACCORDING TO INTERNATIONAL OLYMPIC COMMITTEE

### Stimulants

Stimulants are the most common group of drugs abused in sport. They stimulate the nervous system and increase cardiovascular activity, reducing tiredness and muscle fatigue and enhancing aggression, stamina and competitiveness. Amphetamines are the most potent. They are highly addictive and adverse effects include anxiety, arrhythmias, hypertension, stroke and death. Indeed attributed to a number of sports fatalities.<sup>3,4</sup>

### Narcotics

Narcotics do not have significant performance enhancing potential and may even impair performance. Nevertheless they have been used to reduce pain and enable athletes to continue despite injury e.g. leg cramps in long distance events. They are also highly addictive. Their prohibition is based mainly on their reputation as illegal drugs. Banned substances include Morphine, Methadone and Pethidine. In 1992, Codeine and Dihydro Codeine were removed from the banned list and more recently Dextro propoxyphene was also permitted by the IOC.

### Anabolic agents

Two groups of drugs fall into the category, the Anabolic Androgenic Steroids and the Beta2 Agonists.

**Anabolic Androgenic Steroids:** Anabolic steroids include Nandrolone, Oxandrolone, Stanozolol, Testosterone, Metenolone, Dehydroepiandrosterone (DHEA) and related substances. Over 100 different anabolic steroids are available. Testosterone is responsible for stimulating development of male sexual characteristics (Androgenic Effects) and the buildup of muscle tissue (Anabolic Effects). Manufactures of anabolic aim to minimize the Androgenic and maximize the anabolic effects. They improve performance by increasing muscle size and strength, allow athletes to train harder and longer, with improved recovery from training sessions and promote increased aggressions and competitiveness.<sup>5,6</sup>

Anabolic steroids are known as "Training Drugs" as they are often taken during training prior to competition and then are often taken during training prior to competition and then stopped for several weeks before a competition to reduce the likelihood of positive testing. The presence of Testosterone (T) to Epitestosterone (E) in the urine in a ratio is due to an underlying physiological or pathological disorder. Side effects of anabolic steroid abuse include: Hypogonadism, Gynaecomastia, Acne, Alopecia, Stunted growth in teenage athletes, male and female infertility, Aggression, Homeostasis, Cardiovascular diseases and Death.<sup>6,7</sup>

**Beta-2-agonists:** Beta-2-agonists are not anabolic steroids; however they do not have potent anabolic effects. Drugs such as Salbutamol and Clenbuterol, when taken orally, increase muscle mass improving muscular strength. Clenbuterol ("Angels Dust"), only available as a veterinary medicine, is also widely abused in the cattle industry. Salbutamol, Salmeterol and Terbutaline are permitted by inhalation, with written in advance of competition; the same applies to inhaled steroids. Asthmatics may be treated with therapeutic dose of Theophylline, Sodium Cromoglycate, and Anticholinergics without prior medical notice.<sup>8</sup>

**Diuretics:** Diuretics e.g. Furosemide, Bumetanide, Chlorthalidone, Triameterene, Hydrochlorothiazide tend to be abused by those competing in weight lifting, boxing, wrestling and horse racing, to achieve rapid weight loss. Anti diuretics use prior to weigh-in has been associated with serious adverse effects, such as profound hypotension and in one case pulmonary embolism. They are also used to enhance exertion of prohibited drugs to mask their presence in the urine by producing a significant dilution.

**Peptide Hormone:** Peptide hormones are the so-called sports designer drugs and are increasingly abused by athletes. Their attraction is that although they are synthetically produced, they are indistinguishable from the body's natural hormones and cannot be detected by current IOC testing methods.<sup>9</sup> Human Chorionic Gonadotropin (HCG) is used to stimulate the production of endogenous testosterone. Human growth hormone (HGH), a particularly expensive drug, is also thought to have an anabolic effect. Side effects associated with its abuse include Acromegaly, Gigantism and Metabolic disturbances. Creutzfeldt-Jacobs Disease has been associated with some eastern European supplies of HGH. A detection method for HGH is currently under development. Insulin is also being abused, with potentially fatal consequences. Some athletes are putting their lives at risk at taking Erythropoietin (EPO). EPO stimulates red blood cells production from the bone marrow.

Synthetically prepared EPO (Eprex) is used medically to increase the haematocrit of patients with severe anemia associated with chronic renal failure. It increases hemoglobin levels thereby increasing Packed Cell Volume (PCV) and improving oxygenation of the blood. Eprex is being used in sport to enhance oxygen delivery to working muscles and improve athletic endurance. Abuse of EPO can increase the haematocrit in endurance athletes to very high levels. The viscosity of the blood is greatly increased which can lead to poor circulation, Thromboses lesions and Myocardial infarction. It is thought that the high incidence of sudden death in some endurance athletes is due to abuse of EPO now considered to be perhaps the most deadly of the ergogenic drugs available.<sup>8,10</sup>

### PROHIBITED METHODS ACCORDING TO IOP BLOOD DOPING

Blood doping is also used to improve the oxygen capacity of the athlete's blood. It constitutes the administration of blood and red blood cells, usually preceded by withdrawal of the blood from the athletes who continues to train in a blood depleted state. The athlete's blood is stored and later rein fused, thereby boosting the PCV. Again this method is difficult to detect. Due to the difficulties associated with appropriate storage and rein fusion of blood, this method is being superseded by administration of EPO'S.

#### Pharmacological, Chemical and Physical Manipulation

The drug testing procedure may be manipulated by pharmacological, chemical and physical means and such procedures are also banned. A number of methods are used for tampering with the integrity and validity of urine samples collected for testing. Physical procedures include Cathetersation and Instillation of clean urine into the bladder, followed by simulation of voiding. Pharmacological means include the use of Probenecid to inhibit renal excretion of steroids. Epitestosterone is also added to the urine to reduce the T/E ratio.<sup>7,10</sup>

#### Nutritional Supplements

Many athletes use ergogenic nutritional aids to benefit performance without damaging their eligibility for competition or indeed Carnitine, Chromium Picolinate and Creatine.<sup>11</sup> Many products are promoted as natural anabolic steroids, and advertised in lifestyle magazines, health food stores and more recently on the internet. In addition, purified amino acids are taken as a rich protein source. Some products may also be harmful. Excessive intake of protein may cause liver and kidney damage. Hypervitaminosis is not uncommon. Creatine is currently in vogue and actively promoted by coaches, but again there is limited evidence of improved performance. Chromium Picolinate is a food supplement claimed to accelerate lean body, mass and concurrent loss of body fat. It is particularly popular with metabolism of Serotonin, Dopamine, and Noradrenalin metabolism.<sup>6,7</sup>

### REFERENCES

1. Drugs in sports part one; Sports Drugs website. <http://www.sports-drugs.com/drugs-in-sport.htm> Accessed on 8 December 2010.
2. Drugs in sports part two; Sports Drugs website. <http://www.sports-drugs.com/drugs-in-sport-two.htm> Accessed on 8 December 2010.
3. Williams D A et al. Foye's Principles Of Medicinal Chemistry, Indian Edition, B I Publications Pvt Ltd, Delhi, 5<sup>th</sup> Ed, 2005, pp 708-09.

### RECOMMENDATION OF INTERNATIONAL PHARMACEUTICAL FEDERATION (FIP) TO GOVERNMENT

- Put in place effective enforcement measures to detect and prevent the illegal supply by fitness clubs and others, including supply via the internet, of drugs used to improve performance in sports.
- Provide adequate financial support to the World Anti-Doping Agency (WADA) and ensures its authority in relation to, its independence from, sports associations.
- Through independent national agencies and by causing the services of IOC accredited laboratories for testing for drugs, ensure strict application of the legislation, the control procedure and the analytical methods, harmonized at international level.

### RECOMMENDATIONS OF FIP TO PHARMACEUTICAL ASSOCIATIONS

- Request the bodies responsible for national administration of individual sports to ensure that their affiliated bodies advise individual participants that, when they present a prescription for dispensing or they wish to purchase a non-prescription medicine, they should inform the pharmacist that they participate in competitive sport.
- Participative, in co-operation with national Anti-Doping Agencies, National Olympics Committees and appropriate Governments Departments, in awareness campaigns on the dangers of doping.
- Promote the provision to pharmacists of educational materials on doping designed to meet the needs of those involved in sports.
- To ensure that basic and continuing education of pharmacists includes information on substances and processes used for doping in sport and the associated health risks.
- Ensure that continuing material for pharmacist includes information on the WADA Code.<sup>12</sup>

### CONCLUSION

The use of performance enhancing drugs in sport contravenes the spirit of fair competition and can also be detrimental to an athlete's health. Many feel that a drug must be taken to level the playing and for some "*it is just one step from the belief that drugs can aid performance to the expectation that athletes must take drugs if they want to win medals*". However, where some athletes deliberately take drugs to seek an advantage, others may inadvertently take a prohibited substance due to lack of awareness.

Nevertheless, drugs doping is here to stay and effective doping control methods must be in place, supported by education, of athletes and health care professionals, quality research and international collaboration.

4. Gennaro A R; Remington: The Science & Practice Of Pharmacy, Vol-II, Indian Edition, 20<sup>th</sup> Edition, pp 1181-82
5. Hardman J G et al. Goodman & Gilman's The Pharmacological Basis Of Therapeutics, International Edition, 10<sup>th</sup> Ed, pp 1635-46
6. Katzung B G, Basic and Clinical Pharmacology, International Edition, 10<sup>th</sup> Ed, pp 674-78.
7. Rang H P, Dale M M et al. Pharmacology, Elsevier

- Publication, New Delhi, 5<sup>th</sup> Ed, 2003, pp 436-37.
8. FIP statement of professional standards the role of the pharmacist in the fight against doping in sport, International Pharmaceutical Federation Website, [http://www.fip.org/www/uploads/database\\_file.php?id=208&table\\_id=](http://www.fip.org/www/uploads/database_file.php?id=208&table_id=); Accessed on 12 December 2010.
  9. Ambrose P J; Doping control in sports--a perspective from the 1996 Olympic Games. *American Journal of Health-System Pharmacy*, 1997; 54: (9) 1053-1057.
  10. Franke W W, Berendonk B; Hormonal doping and androgenisation of athletes: a secret program of the German Democratic Republic government. *Clin Chem* 1997; 43(7): 1262-1279.
  11. Greenhaff P; Creatine supplementation: recent developments. *Br J Sports Med* 1996; 30: 276-277.
  12. John Hoberman, A Pharmacy on Wheels - The Tour De France Doping Scandal. <http://www.scribd.com/doc/34137589/Pharmacy-On-Wheels-The-Tour-de-France-Doping-Scandal>; Accessed on 12 December 2010.