Medicina Sportiva
The Journal of Romanian Sport Medicine Society
Vol. IX, No. 1 – 2013 **15.03.2013**

EDITORIAL STAFF

Assoc. Prof. Mirela Maria Vasilescu - *Editor-in-Chief*
Professor Ligia Rusu - *Managing Editor*
Assoc. Prof. Anca Ionescu - *Scientific Editor*

EDITORIAL BOARD
Apostol Adela - Bucharest, Romania
Atanasescu Renee - Bucharest, Romania
Busneag Răzvan - Bucharest, Romania
Cosma Germina - Craiova, Romania
Duma Eugen –Cluj Napoca, Romania
Georgescu Mariana - Bucharest, Romania
Panait Gabriel - Bucharest, Romania
Popescu Alin - Bucharest, Romania
Serbescu Ioan - Timisoara, Romania
Siirghi Brandusa - Bucharest, Romania

SCIENTIFIC REVIEW BOARD
Avramescu Taina Elena - University of Craiova, Romania
Berteanu Mihai - University of Medicine and Pharmacy Bucharest, Rehabilitation Department, Romania
Bas Aslan Ummuhan – Pamukkale University, Denzli, Turkey
Branzaniuc Klara – University of Medicine, Tg Mures, Anatomy Department, Romania
Cavlak Ugur - Pamukkale University, School of Physical Therapy and Rehabilitation, Denzli, Turkey
Derevenco Petru - Romanian Academy of Medical Sciences, Romania
Dikic Nenad - Anti-Doping Agency of Serbia, Sports Academy, Beograd, Serbia
Dimitrova Diana – Sports Medicine Department, National Sports Academy, Sofia, Bulgaria
Donatelli Robert - National Director of Specific Rehabilitation and Performance Enhancement Programs – Las Vegas, Nevada, USA
Drosescu Paula – University A.I.Cuza, Faculty of Physical Education and Sport, Iasi, Romania
Emin Ergen – University of Medicine, Ankara, EFSMA Executive Board, FIMS Executive Board, Turkey
Gamze Ekici - Ahi Evran University, School of Physical Therapy and Rehabilitation, Kirsehie, Turkey
Georgescu Luminita - University of Pitesti, Romania
Nastsis Konstantinos - Aristotle University of Thessaloniki, Greece
Nestianu Valeriu - University of Medicine and Pharmacy Craiova, National Academy of Medical Sciences member, Romania
Nica Adriana – University of Medicine and Pharmacy, Bucharest, Romania
Oravitan Mihaela – West University of Timisoara, Romania
Popescu Roxana - University of Medicine and Pharmacy Craiova, Romania

ISSN 1841-0162
***Publisher "Universitaria"*, Brestei 156, 200177, Craiova, Romania**

Editorial Office Address: University of Craiova, Physical Education and Sports Faculty, Brestei 156, 200177, Craiova, Romania

Site adress:
http://www.medicinasportiva.ro

Technical editor
Eng. Aurora Beldiman (University of Craiova)

Medicina Sportiva (2013), vol. IX, no 1, 2009-2020
Romanian Sports Medicine Society

Anabolic androgenic steroids and doping in sport

Filomena Mazzeo, Antonio Ascione
Department of Institutional and Territorial Systems Studies, University Parthenope, Naples, Italy

Abstract. Anabolic steroids, technically known as anabolic-androgenic steroids (AAS), are synthetic derivatives of testosterone, modified to enhance its anabolic actions (promotion of protein synthesis and muscle growth). They are used by athletes (weightlifters, shot, hammer, discus or javelin throwers, rugby and American football players, swimmers and runners) to increase muscular mass and athletic performance and by bodybuilders to improve size and cosmetic appearance. AAS were the first identified doping agents that have ergogenic effects and are on the International Olympic Committee's list of banned substances.
The most popular AS used as doping substances are: *oximetolone, oxandrolone, testosterone undecanoate, nandrolone decanoate, nandrolone undercanoate, methandrostenolone.* To reach high dosages and rapid effects, steroid users practice a method known as "staking" which consist in the intake of two or more steroids in high dosages. Another method, called "pyramiding" provides a progressive increase of steroids dosage. The pyramid protocol is alternated with drug-free, process defined as "cycle". AAS abuse causes significant side effect: infertility, azoospermia, testicular atrophy, and gynecomastia in men and in women may develop excessive body hair growth, menstrual irregularity, hypertrophy of sebaceous glands, acne. Other side effects are: premature cease of growth caused by premature epiphysis closure; Alteration of cardiovascular function; increase of platelet aggregation and plasmatic levels of low density lipoproteins (LDL); liver damage; euphoria, aggressiveness and psychosis. Their action in central neuron system involves the dopaminergic neurotransmission and produces amphetamine-like activity. Therefore, the use of AAS should be banned from the sport, making a work of supervision and accountability of the sports centers and authorities in this field.
Key words: *anabolic androgenic steroid; doping; endocrinology; testosterone*.

Generality information about doping

Sports are a considerable importance both for the physiological end ethic benefits, not only by improving the performance conditions of an athlete but also for the positive influence on the character and personality of a person (1,2).

In addition, sports activity, at any level, remains a competition and emulation in respect of the other competitors and towards ourselves (3).

Therefore, since the ancient times, were researched illicit systems that could artificially improve the athletic performance, in addition to training and physical preparation; in ancient Greece for example, during the carrying out of the Olympic Games, the athletes used to assume an infusion of herbs and mushrooms in order to increase their performance (4).

More recently, at the early nineties, marathon runners assumed alcohol during the race and the American athletes began the use pharmacological practices by assuming a stimulant of popular diffusion called strychnine (5,6).

With the years gone by and the pharmacological progress, the use of drugs by athletes became more intense reaching a point of international phenomenon known as "*doping"*.

The word *doping* has an uncertain etymology. Probably, it originates from the English verb *to dope* which means "administer stimulants" and the subject *dope* by the mean of "stimulant substance" (4).

Many athletes use drugs especially AAS and in sports medicine, *doping* is "the assumption of substances or the recourse at particular methods which are able to artificially increase

an athlete's performance during a sports competition, contrary to sports morals and despite physical and psychological health" (6).
Drugs, substances biologically and pharmacologically active and medical practices, which their application is considered doping, are divided, in compliance with the provisions of the Strasbourg Convention and under the indications of the International Olympic Committee (IOC) and other international organizations responsible in the sports sector, in classes, according to their chemical and pharmacological character and their corresponding effect (4,7)
WADA significantly modified the Prohibited List of the IOC Medical Commission, binding from the end of 2003 (Table I). Since that moment the list has been regularly updated, and all changes, based mainly on scientific research, have been preceded by numerous consultations with representatives of the sport and medicine. By publishing a new version of the Prohibited List every year (Table II) and by enlisting numerous examples of prohibited substances WADA fulfilled partly the need of publishing a complete list of prohibited substances. In spite of the examples of prohibited substances or methods in particular groups, some additional substances, which are not located on the list but are characterized by "a similar chemical structure or similar biological effect(s)", can be considered as doping (7).
The empowerment effect and the sense of euphoria, induced by the use of doping substances, are related biological and/or organic malfunctions and alterations, which may not always be reversible (5-6). For such reason, doping should be considered not only an offense towards sports, but also a crime against health (6). Therefore, in Italy the necessity of updated rules for the protection of health in sports activities and for the fight against doping, it has been configured in the recent Law 14.12.2000 n* 376 through which, having become doping a criminal offence, the ordinary Judiciary at work in a territory that was once prerogative of Sports Justice (6). The first paragraph of the Article 9 of this Law includes the definition of the crime of Doping, which is committed by "whoever procures to others, administers, assumes or encourages by any mean the use of drugs or substances pharmacologically active including substances of hematologic and endocrinology nature, that are considered doping substances, that are not legitimated by pathologic conditions and are able to modify the psychophysical or biological conditions of the human organism, in order to affect the agonistic performance of an athlete, or are intended to modify the results of anti-doping test on the use of such drugs or substances" (6-7).

Table I. Prohibited classes of substances and prohibited methods, for the years 2001-2002 publisched by the IOC Medical Commission (Olympic Movement Anti-Doping Code, 2001).

I.	**Prohibited classes of substance**
A.	Stimulants
B.	Narcotics
C.	Anabolic agents
D.	Diuretics
E.	Peptide hormones, mimetics and analogues
II.	**Prohibited methods**
A.	Blood doping
B.	Administering artificial oxygen carriers or plasma expanders
C.	Pharmacological, chemical and physical manipulation
III.	**Classes of prohibited substances in certain circumstance**
A.	Alcohol
B.	Cannabinoides
C.	Local anaesthetics
D.	Glucocorticosteroids
E.	Beta-blockers

Table II. The WADA prohibeted list for 2010.

Substances and methods prohibited at all times (in- and out-of-competition)*
S1. Anabolic agents
S2. Peptide hormones, growth factors and related substances
S3. Beta-2 agonists
S4. Hormone antagonists and modulators
S5. Diuretics and other masking agents
M1. Enhancement of oxygen transfer
M2. Chemical and physical manipulation
M3. Gene doping
Substances and methods prohibited in competition
In addition to the categories S1 to S5 and M1 to M3 defined above, the following categories are prohibited in competition:
S6. Stimulants
S7. Narcotics
S8. Cannabinoids
S9. Glucocorticosteroids
Substances prohibited in particular sports
P1. Alcohol
P2. Beta-blockers

Epidemiologic notes

The restless evolution and multiplication of doping methods and substances, the fear by athletes of harsh sports and legal sanctions as well as the inadequacy of the identification techniques for illegal substances, contribute to make a not accurate evaluation of the prevalence of the Doping Phenomenon (6).

To estimate the use of prohibited drugs and other forms of doping in sports fields, in 1998 the National Italian Olympic Committee (CONI) and the National Research Council (CNR), appointed an independent committee designed to conduct a survey to ascertain the knowledge and opinions of the Italian athletes on doping practices (8). 1015 athletes and 216 sports professionals where interviewed during the survey. In total, 30% of athletes, coaches and sports managers and 21% of doctors stated that the athletic performance can be improved by using drugs or other doping techniques. In particular, more than 10% of athletes expressed the opinion that amphetamines and anabolic steroids are frequently used in national and international level.

Moreover, the percentage of athletes and sports professionals that retain harmful the use of doping methods and prohibited drugs was higher than the percentage that considered their use effective (8) (Table III).

A current meta-analysis, which concentrates and summarize the results of over 29 epidemiological researches, estimated the prevalence of doping from 3% to 5% in children, up to 15%-25% in adults that practice a sport at a competitive level (9).

A study conducted in Norway from 1977 to 1995 on 15208 athletes has demonstrated that, despite the low prevalence in registered athletes or athletes affiliated with sports societies (1,2% to 1,4%), the use of doping substances can assume worrying values in non professional athletes or amateurs (20 to 24%) (10). These results seem to be due to the difficulty to submit targeted control athletes who do not participate in official competitions. To finish, still remain obscure data on the prevalence of doping in East European athletes before the fall of the Berlin Wall.