

Il doping nello sport e i suoi sviluppi nel nostro tempo

Doping in sport and its developments in our age

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Abstract

Man has always tried to improve his physical performance. Doping is an ancient phenomenon. It exists not only in professional sport, but also affects amateur athletes. Furthermore, it involves athletes' friends and relatives, medical staff, managers, chemists, biologists and pharmacists, pharmaceutical industries, clandestine laboratories and criminal organizations. Over time, doping has shown a great ability to discover and always use new substances and appropriated the new scientific discoveries. Unfortunately, new discoveries for the human health are been used in distorted way by the athletes. In fact, the athletes may be able to use gene therapy to re-engineer their bodies for better performances. Drug dependence depends on several factors: the socio-environmental context of the subject and what effects have the substance in the body. Moreover, the drug dependence could be connected to the indirect gratification. WADA, in 2004, drew up a Code that is constantly emended. The Code explains not only "what is" doping but it contains sanctions too. Others instruments used to contrast doping are the accredited laboratories, the biological passport and the Anti-Doping Administration & Management System (ADAMS), a Web-based database management system that simplifies the daily activities of all stakeholders and athletes involved in the anti-doping system.

L'uomo ha sempre cercato di accrescere le proprie performance fisiche. Il doping, infatti, inteso come l'assunzione di sostanze in grado di modificare artificialmente la prestazione, è un fenomeno che ha origini antichissime. Il doping, nel corso degli anni ha inglobato nella propria trappola gli atleti e tutto l'universo di relazioni che ruotano intorno ad essi: amici e parenti, staff medico, farmacisti, biologi, chimici, case farmaceutiche. Nel corso del tempo, inoltre, il doping ha dimostrato una grande capacità di scoprire e utilizzare le nuove sostanze sempre e si è appropriato delle nuove scoperte scientifiche. Purtroppo, queste ultime sono state usate in modo distorto dagli atleti. Infatti gli atleti possono utilizzare la terapia genica a riprogettare i loro corpi per prestazioni migliori. La dipendenza da farmaci nello sport, dipende da diversi fattori: il contesto socio-ambientale del soggetto e quali effetti hanno la sostanza nel corpo. Inoltre la dipendenza potrebbe essere collegata alla gratificazione indiretta. La WADA, nel 2004, ha elaborato un codice che viene continuamente emendato. Il Codice spiega non solo "ciò che è" doping ma contiene le sanzioni. Altri strumenti utilizzati per contrastare il doping sono i laboratori accreditati, il passaporto biologico e l'ADAMS (Anti-Doping Administration & Management System) un sistema di gestione di database che semplifica le attività quotidiane di tutte le parti interessate e gli atleti coinvolti nel sistema anti-doping.

Keywords

Doping, Drugs, Sport, Gene Doping, WADA

Doping, Farmaci, Sport, Doping Genetico, WADA

Introduction¹

Man has always tried to improve his physical performance by any method: legal or illegal, healthy or harmful to health (Mazzeo et al., 2016; Santamaria et al., 2013; Sjöqvist et al., 2008; Calatayud et al., 2007). The reasons of these attempts are various and they are changed over time: from to get best results in the hunting to obtain profit. In fact, best performances mean, great earnings (Lippi et al., 2009). Therefore, drug abuse is one of the biggest problems in sports. In elite athletes, it involves the repeated and excessive use of substances to realize a certain effect (Mazzeo, 2017; Sjöqvist et al., 2008). Furthermore, the desire to enhance their physical abilities did not even spare the disabled athletes (Mazzeo et al., 2015; Montesano et al., 2013). Doping is an ancient phenomenon. Probably would have the same age of sport as from the moment when the man began to practice physical activity in competition with other men, he sought to improve own performance by taking mixtures of various types of plant origin (Calatayud et al., 2007). In fact, it seems that the term doping is derived from an ancient African dialect “doop” as meaning a mixture or a potion. Greek wrestlers and the Roman gladiators attempted to improve their own performance by eating specific part of animal’s meat (Dilger et al., 2007). Doping exists not only in professional sport, but also affects amateur athletes who are making increasing use of performance-enhancing drugs (Mazzeo, 2017). Doping is thus increasingly a matter that concerns the whole society (Lippi et al., 2008; Anti Doping Convention, 1989). Furthermore, it involves athletes’ friends and relatives, medical staff, managers, chemists, biologists and pharmacists, pharmaceutical industries, clandestine laboratories and criminal organizations (Marclay et al., 2013; Esseiva et al., 2007).

In the beginning of the 20th century, in the search for substances able to make it stronger than others, the athlete was matched and complicity in different professionals: coaches, managers, doctors and pharmacists, nutritionist, equally interested in increasing their power, in a general and economic perspective. In the last quarter of the twentieth century, the use of doping in sport activities has become massive and systematic (Mazzeo et al., 2015). With the advent of sponsors and mass media, the success in major sports competitions (Olympics, World Championships, and so on) has been playing an increasingly significant social and economic goal, such as to encourage the use of all means, legal and illegal to catch up.

Doping poses a threat to sport worldwide. It undermines the principle of open and fair competition (Mottram, 2005). It is a factor that discourages the practice of sport in general and puts the professional under unreasonable pressure. It seriously affects the image of the industry and represents a serious threat to individual health (Anti Doping Convention, 1989; Mazzeo et al., 2016). Unfortunately, in the past and for a long time, doping was underestimated and public institutions considered it as a problem exclusively of sports organizations that alone had to vanquish a phenomenon in continuous expansion (Møller, Di Meo, 2014).

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1. A brief history

Over time, doping has shown a great ability to discover and always use new substances and appropriated the new scientific discoveries (Anti Doping Convention, 1989).

Botrè (Botrè, 2008) distinguishes three main periods about the evolution of substances to identify (Table 1).

		Period	Substances to identify
Origin	early 1970s	1970	Stimulants, narcotics, drugs of abuse
Synthetic anabolic androgenic steroids (AAS)		Mid 1970 – 2000	Synthetic anabolic androgenic steroids, beta-blockers, diuretic, cannabinoids, glucocorticoids, human chorionic gonadotropin, endogenous testosterone and/or precursor, erythropoietin and analogs
Protein Chemistry and Molecular biology Age		2000-present	Designer steroids, hormone and hormone receptors modulators
		2003-present	Blood doping
		2005-present	Peptide hormones
Gene Doping Age		2008 - present	No substances but cells, genes, genetics elements, modulation of gene expression

Table 1 - Evolution of substances to identify.

The first one –the early age- includes “in competition drugs”; the second period – the androgenic anabolic steroids age – includes “in and out competition drugs”. The third age - protein chemistry and molecular biology age- includes the newly discovered in genetic engineering used for the treatment of diseases too. Now, in the “gene doping age”, the new frontier of doping is the use of cells, genes, genetic elements, or the modulation of gene expression with the aim to increase the performance and not easy to detect (Botrè, 2008; Mazzeo, Volpe, 2017). This last period includes the blood doping. Indeed, the blood transfusion and administration can boost the capacity to transport the oxygen to the muscles. Already in the early 1900s it was realized that the use of substances to increase physical performance, not only falsified the results of competitive sport but it was also very dangerous for the health (Calatayud et al., 2007). For this reason, in 1928 the International Association

of Athletics Federations became the first International Sport Federation (IF) to ban the use of stimulating substances. Only after the death of a cyclist at the Olympic Games in Rome in 1960 urged the relevant authorities to introduce the first anti-doping test.

After eight years, during the Olympic Games of Mexico City, there was a pilot project with the aim to analyze the efficacy of anti-doping tests and thanks to their success, the first official anti-doping screening started in 1972 during the Summer Olympic Games of Munich (Botrè, 2008). At beginning, the tests were sporadic and not completely reliable. But in 1999, thanks to the creation of the World Anti Doping Agency (WADA), it finally created an organization with the sole purpose to fight this “cancer” of sport and consequently the situation of tests is changed (Dvorak et al., 2014; Valkenburg et al., 2014). One of most important WADA function was to harmonize the Olympic anti-doping code and develop a single and complete code applicable and acceptable for all the stakeholders. The world anti-doping code developed by WADA introduced several international standards (ISs) with the main goal to harmonize the anti-doping disciplines from each country (Mazzeo et al., 2016). The Agency has compiled a list of banned substances and practices that is constantly updated. Now, WADA, for example, has identified more than two hundred banned substances currently divided into 10 classes (including the class S0) and three methods (Strano Rossi, 2011; Badoud, 2011). (Table 2)

Substances and methods prohibited (in and out competition)

S1 Anabolic agents
 S2 Peptide hormones, growth factors, related substances and mimetics
 S3 Beta- 2 agonists
 S4 Hormone and metabolic modulators
 S5 Diuretics and masking agents
 M1 Manipulation of blood and blood components
 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,
 S6 Stimulants
 S7 Narcotics
 S8 Cannabinoids
 S9 Glucocorticosteroids

Substances prohibited in particular sport

P1 Alcohol
 P2 Beta-blockers

Table 2 Wada 2017 Prohibited List

2. The last doping’s frontier: the use of genes

The discovery of the complete human genome with approximately 30.000 different genes leads to new possibilities for diagnosis and prevention of a wide variety of diseases. In addition, this knowledge may be used for the design of a new therapeutics use, including gene therapy, based on the DNA sequence informations (Doessing et al., 2005; Mazzeo, 2017).

Gene therapy may be defined as the transfer of genetic material to human cells for the treatment or prevention of a disease or disorders. Its principle is based on the delivery to a cell, of a therapeutic gene which may compensate an absent or abnormal gene (Unal et al., Mazzeo, Volpe, 2017). This material can be encapsulated into a virus, such as adenovirus or retrovirus, or into a lipid, such as a liposome. The viruses are crippled so that they are no longer pathogenic. The encapsulated genetic material is mostly referred to as a vector and is introduced into the body by direct injection into the target organ or administered by aerosol for lung delivery (Lippi et al., 2009; Doessing et al., 2005). Also, it is possible to isolate cells from a patient and treat these cells with the vector in the laboratory and then re-implant these into the patient. Gene therapy is currently an experimental therapy and its use is strictly regulated (Gaffney et al., 2007; Beerens et al., 2003).

Unfortunately these new important discoveries for the human health are been used in distorted way by the athletes. In fact, the athletes may be able to use gene therapy to re-engineer their bodies for better performances. They know that any physiologic process involved in producing a motor action or assisting the implementation of a motor movement could be a candidate for gene doping (Oliveira et al., 2011).

Gene doping is defined, for the first time in the 2003, in the IOC List of Prohibited Substances and Methods, as the “Gene or cell doping is defined as the non-therapeutic use of genes, genetic elements and /or cells that have the capacity to enhance athletic performance” (World Anti- Doping Agency, 2010; Santamaria et al., 2013; Gaffney et al., 2007).

The goals of gene doping include the injection of novel genes of the modulation of existing genes too; however, the gene doper introduces the gene products for the enhancement of physiologic parameters expedient to the athlete’s competitive tasks, rather than the treatment of a medical illness (Gaffney, 2007; Keying, 2008; Doessing 2005).

Now, in the 2013 WADA Prohibited List, gene doping, is “the transfer of polymers or nucleic acid analogues” and “the use of normal or genetically modified cells” (World Anti- Doping Agency, 2013).

Growth hormone (*GH*) has a multitude of effects on the body associated with growth. It has a well-documented stimulatory effect on carbohydrate and fatty acid metabolism, and a possible anabolic effect on muscle proteins (Doessing et al., 2005).

Doessing and Kjaer (2005) also suggest a role for GH as an anabolic agent in connective tissue in human skeletal muscle and tendon (Gaffney et al., 2007). Recombinant GH, is already being used as a doping agent in sports. Insulin-like growth factor 1 is a protein that stimulates cellular proliferation, somatic growth and differentiation (Doessing et al., 2005) (Table 3)

Gene/Product	System/ target tissue	Gene product properties	Physiologic response	Sport
ACE	Skeletal muscles	Peptidyl dipeptidase	ACE-I seems to correlate with endurance ACE-D involved in sprint and powers	Endurance
ACTN2,3	Muscular system	Actin-binding proteins related to dystrophin	Involved in fast twitch muscles	Endurance and sprint

Endorphins, Enkephalins	Central and peripheral nervous systems	Widely active peptides	Pain modulation. Increases risk of overuse of musculoskeletal and cardiovascular system. Increase stress and pressure on heart	Endurance
EPO	Hematopoietic system	Glycoprotein hormone	Increases RBC mass and oxygen delivery	Endurance
HGH	Endocrine and muscular system	191-amino acid protein	Increases muscle size, power, and recovery	Entrengh
HIF	Hematologic and immune systems	Multisubunit protein	Regulates transcription at hypoxia response element	Endurance aerobic
IGF-1	Endocrine/metabolic/skeletal muscle	70-amino acid protein	Increases muscle size, power, and recovery	Entrengh
Interleukin-15	Skeletal muscle	cytokine with strong antitumor properties	Myoblast proliferation and muscle-specific myosin heavy chain (MCH) expression	Strength
Myostatin.	Muscular system	2-subunit protein	A negative muscle mass regulator. Damage of tendons ligament and bone	Entrengh
PPAR- δ	Skeletal muscle and adipose tissue	Nuclear hormone receptor protein	Promotes fat metabolism and increases number of slow twitch fibers	Speed and endurance
VEGF	Vascular endothelium and angiogenesis	Glycosylated disulfide-bonded homodimers	Induces development of new blood vessels	Endurance
<i>Abbreviation:</i> ACE, angiotensin-converting enzyme; ACTN3, actinin binding protein 3; EPO, erythropoetin; HGH, human growth factor; HIF, hypoxia inducible factor; IGF-I, insulin-like growth factor; PPAR-delta, peroxisome proliferators-activated receptor (delta); VEGF, vascular endothelial growth factor. (Gaffney, Parisotto, 2007)				

TABLE 3- Genes for sports doping and physiologic response.(Santamaria et al., 2013)

3. Drug addiction

The athlete using drugs or nutritional supplements practice mainly sport where appearance is a significant aspect as in body building (Mazzeo et al., 2013). These substances are more and more used by athletes not only in competitive sports, but also in fitness and recreational sports. It is important to ask why athletes dope. One thing is certain the substances that give pleasant sensations or help the subject in his activity will bring him to repeat the consumption. But, not all people develop drug dependence. It depends on several factors: the socio-environmental context of the subject and what effects have the substance in the body.

Moreover, the drug dependence could be connected to the indirect gratification. It consists in all situations in which the person has a social, economical or psychological benefit thanks to use drugs. For example: we can see direct gratification in the winning of a competition and indirect gratification in the money that the athlete receives after. If all the gratifications are connected to use of drug, maybe he will use drug in the future.

A lots of researches focused their attention on subject's personality. It is demonstrate that people with an ego orientation have a low self-esteem, are aware that only with their own abilities fail in their main purpose: to beat the others. They also hate the defeat and, therefore, looking for the victory in any way (Serpelloni et al., 2006). Perhaps, an ego oriented person probably will use drugs because he doesn't want to improve himself but only give the appearance of improvement; and this result will get it only through the use of performance-enhancing drugs (Duda et al., 1995; Duda, Nicholls, 1992). Kahneman and Tversky (Tversky, 1974; Kahneman, 1979) give us others reasons that push people to resort to doping. Indeed, they identify four factors: the effect of formulation, the principle of utility, the heuristic of the accessibility and the representativeness heuristic.

The first factor - the effect of formulation - consists in the way in which the message is transmitted. With this effect, there is an alteration in communication between advantage and disadvantage. Applied to doping, it means that the athlete will underline the enormous benefits arising from the use of performance-enhancing drugs compared to low risk.

With the second factor – principle of utility – the athlete focuses his attention only on the advantages linked to the use of abovementioned drugs and he doesn't prefer thinking to negative consequences.

The heuristic of accessibility teach us that if an athlete does not think of negative consequences, it is due to ignorance about them. Indeed, he tends to overlook the possibility that an event occurs because, for example, he has never seen before the above-mentioned consequences. Finally, with the last one heuristic, we understand that the only aim of an athlete is to become like his idol, at any cost (Santamaria, Mazzeo, 2014).

Moreover, many substances have various gratifications' effects, such as stimulants, anabolic, narcotics and cannabinoids stimulants are used to increase the concentration, alertness and safety. They also increase the aggressiveness and the sense of competitiveness (Stella et al., 2005). To anabolic are recognized for the following effects: euphoria, sense of wellbeing, glee, increased motivation and self-esteem. Moreover, the athlete doesn't get bored during the training (Mazzeo, Ascione, 2013).

Narcotics have a calming effect on the psyche as well as beta-blockers reduce the anxiety and stress. Corticosteroids have, instead, a stimulating effect like alcohol. Moreover, other effects include euphoria, increased sociability and sense of wellbeing.

Cannabinoids, such as cannabis, hashish and marijuana, cause changes in mood and perception, euphoria, happiness, relaxation and deep sleep and reducing anxiety (Mazzeo, 2017). They are considered drugs to use social-recreational (Stella et al., 1999).

4. Legal instruments against doping

In accordance with the WADA Code doping is the presence of a prohibited substance or its metabolites or markers' banned; the use or the attempted use of a prohibited substances or a prohibited method. The refusing or the failing, without compelling justification, to submit to sample collection; the violation of applicable requirements regarding athlete availability for out-of-competition testing; the tampering or the attempting to tamper with any part of doping control; the possession of prohibited substances and prohibited methods; the trafficking or the attempted trafficking in any prohibited substance or prohibited methods; the administration or the attempted administration to any athlete of any prohibited methods or prohibited substances, or the assisting, the encouraging, the aiding, the abetting, the covering up or any other type of complicity involving an anti-doping rule violation or any attempted anti-doping rule violation (Mazzeo, Volpe, 2017).

WADA, in 2004, drew up a Code that is constantly emended. The Code explains not only “*what is*” doping but it contains sanctions too. Others instruments used to contrast doping are the accredited laboratories, the biological passport and the ADAMS (Overbye et al., 2013).

The laboratories have an important role in the discovery of new substances; most of them are included in the WADA List. They also determine the quantitative of those substances, carry out anti-doping tests, and determine cases, criteria and methodologies of anti-doping tests too. Currently, there are 34 laboratories in the World (Table 4) (Valkenburg et al., 2014).

State	City	Note
AUSTRALIA	Sydney	
AUSTRIA	Seibersdorf	
BELGIUM	Ghent	
BRAZIL	Rio de Janeiro	
CANADA	Montreal	
PEOPLE'S REPUBLIC OF CHINA	Beijing	

COLOMBIA	Bogota	
CUBA	Havana	
FINLAND	Helsinki	
FRANCE	Paris	
GERMANY	Cologne	
	Kreischa	
GREAT BRITAIN	London	
GREECE	Athens	
INDIA	New Delhi	
ITALY	Roma	
JAPAN	Tokyo	
KAZAKHSTAN	Almaty	suspended from conducting anti-doping testing for a maximum period of four months effective as of 24, June 2016. That suspension was further extended on 24 October 2016 for a period of six months following the laboratory's failure to address the required non-conformities identified in the External Quality Assessment Scheme (EQAS) program and any additional non-conformities identified during WADA's site visits during the suspension period. If the laboratory satisfies the Disciplinary Committee in meeting these requirements, the laboratory may apply for reinstatement prior to the expiry of the six month suspension period.
KOREA	Seoul	
MEXICO	Mexico	
NORWAY	Oslo	
POLAND	Warsaw	
PORTUGAL	Lisbon	suspended from conducting anti-doping testing for an undetermined period effective as of 15, April 2016.
QATAR	Doha	
REPUBLIC OF SOUTH AFRICA	Bloemfontein	suspended from conducting anti-doping effective as of 3, May 2016. The laboratory will not be allowed to carry out anti-doping analyses on samples until further notice.
ROMANIA	Bucharest	
SPAIN	Barcelona	
	Madrid	suspended from conducting anti-doping testing for an undetermined period effective as of 6, June 2016.
SWEDEN	Stockholm	
SWITZERLAND	Lausanne	
THAILAND	Bangkok	
TURKEY	Ankara	
UNITED STATES	Los Angeles	
	Salt Lake City	

Table 4- 2017 WADA Accredited Laboratory

The Biological Passport is a tool for indirect detection of the presence of a doping substance in biological samples of an athlete. With it, in fact, the changes of certain bio-markers of doping are recorded and monitored. If the data, combined with the personal data localization in a given period, exceeded a certain range, the athlete would assume the banned substances (WADA, 2015). The Anti-Doping Administration and Management System (ADAMS) is an on-line database system where are recorded all data: laboratory results, therapeutic use exemptions (TUEs) and information on anti-doping rule violations. It allows the sharing of information amongst the organizations and promotes efficiency, transparency and effectiveness in all anti-doping activities (Møller et al., 2014).

Doping in Italy is taken into attention from the sports law and the State law. The sports law tends to ensure the fairness in competitive sports, while the State wants to protect the health of the community. In fact, the Italian Constitution, at the art. 32, establishes the protection of the health as a fundamental right of the individual and collective interest. This right is also protected by the art.2 of the Constitution that ensures that the Republic recognizes and guarantees the fundamental human rights both as in individual and in social formations in which the man develops his personality.

The importance of the right to the health is also underlined by the fact that it cannot be undermined by individuals and by public authorities or by other private entities. This right does not mean only to take care of illness but it also means ensuring better living and working conditions.

This provision requires the State to create more and better health conditions and places it in a "debit" position to the citizens who have a real personal right to the protection of their health.

In 2000 Italy has issued the Law no. 376 that is a concrete response to the fight against doping. Thanks to it, the Italian State aligned itself to the most European and extra European countries engaged in the same direction. The law establishes the National Committee for the supervision and control of doping and for the protection of health in sports. Experts of various fields (medical, legal, political, sports) compose this Commission, which is established within the Ministry of Health. It suggests the classes of drugs, determines cases, criteria and methods of doping controls and identify the competitions for the tests.

In addition, it prepares research programs on drugs, identifies forms of cooperation with the National Health Service for this purpose, maintains work relationships with international entities, and promotes information campaigns and prevention of doping. Moreover, the Commission concludes agreements with the Anti-doping laboratories accredited by the IOC or not accredited by the IOC Anti-Doping Laboratory and coordinated by the Regions.

Currently, following a reorganization of the governing entities, the Commission has become Section for the supervision and control of doping and for the protection of health in sport within the newly established Sanitary Technical Committee.

Today's approach to anti-doping is mostly centered on the judicial process, despite pursuing a further goal in the detection, reduction, solving and/or prevention of doping (WADA, 2009).

In Italy law 376/2000 establishes three distinct types of doping offenses. The first two concern both athletes and their support personnel for procuring, administering, assuming or even encouraging the use of doping substances or methods, with the aim of improving an athlete's competitive performance or to modify the results of an anti-doping test (article 9, sections 1 and 2). The third offense is the most innovative, as it tackles illegal suppliers who

trade in doping substances outside the official distribution channels (article 9, section 7). Imprisonment from three months to three years and a fine from €2,580 to €51,645 are the sanctions foreseen for the first two offenses; imprisonment from two to six years and a fine from €5,164 to €77,468 are foreseen for the third offense (Arioli, Bellini, 2005; Fabri et al., 2003).

5. Conclusion

Unfortunately, today, despite the technological advancement that characterizes the field of scientific research, the analytical methods are not sufficiently reliable for the search of the entire group of substances included in the anti doping lists.

Professional athletes must serve as role models and spokesmen for drug-free sport and lifestyle (Baron et al., 2007; Gomez, 2005).

Even in the case in which the substances are identified, there are cases of dispute and the few economic resources are used for further study on the same samples to athletes rather than new research. In addition, it is impossible to anticipate the moves of the opponent and this, therefore, is not easy to understand what new substances will be taken and what new methods will be adopted (Ministero della Salute, 2013).

According to art. 4 of Law 376/2000, one or more laboratories accredited by the IOC or by another international organization analyse the samples of controlled athletes. The reason of this choice is to guarantee the reliability and impartiality of the controls (Mazzeo, 2017). After the establishment of WADA, this entity was incorporated into the system of accreditation. This is to ensure maximum harmonization of techniques and methods of analysis followed by those laboratories. In Italy, there is only one accredited laboratory, in Rome: the Anti-doping Laboratory of “Acquacetosa”.

Close collaboration among the laboratories themselves would enable them to keep up to date and exchange new techniques. Closer ties with the pharmaceutical industry and those involved in basic research are also vital if they are able to anticipate new tendencies and forms of doping by means of a sort of scientific “vigil”. The instrumentation and measurements industry would be also able to give them the benefit of recent progress in their domain (de M rode, 1999).

In addition, professional athletes are frequently the role models of adolescent and young adult populations, who often mimic their behaviours, including the abuse of drugs.

Continuing, updates educational programs developed for these at-risk populations by national Olympic organizations and athletic federations are important first steps to curb and to control these dangerous behaviours (Baron et al., 2007).

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