

# Module 3. The fight against doping

## 3.1 The history of doping and its regulations

### 3.1.1 Introduction

The use of substances to improve performance has a long history in our culture. Everyone is aware of the concept of doping, and its presence always triggers an opinion. Unfortunately, stimulants, barbiturates, alcohol, morphine analgesics, and so on have been used since ancient times to increase performance, lessen fatigue, facilitate recovery, and even change motivation during wars and fights between humans (Kamienski, 2017).

In itself, the term doping has an unusual source. *Dop* comes from the Kaffir dialect of South Africa, where *dop* or *dog* refers to the use of stimulating liquor by members of the tribe during religious ceremonies. The Dutch colonists in South Africa adopted the term, and by 1865 it had spread to Amsterdam, where swimmers in a canal race were accused of taking it. In 1889, it appeared in an English dictionary in reference to a narcotic mixture of opium used for racehorses. The letter "e" (*doppe*) was added at that point. The drug acquired many meanings, and is even used for recreational drugs. However, doping most often refers to human drug use in athletic activities (Voy & Deeter, 1991).

In the sports world, those of us who work to guarantee athletes' health should know what leads a person to doping and the reasons that justify the fight against it. Recent advances in the development of doping strategies are not limited to the development of new compounds; the administration methods have also been optimized to avoid detection of substances administered. For example, anabolic steroids that are classically administered via intramuscular injection of esters, or taken orally, have become available as sublingual and regular tablets and, in particular, as transdermal gels, which offer the efficient application of low doses with good bioavailability and moderate detection windows (Thieme & Hemmersbach, 2010).

On the other hand, recent advances in genetic techniques are important for doping analysis, for example in understanding interindividual variations (pharmacogenomics of testosterone glucuronidation) or as a diagnostic tool (biomarkers from reporter genes) (Thieme & Hemmersbach, 2010). Additionally, the possible abuse of developments in the therapeutic treatment of genes has revealed a new potential for manipulation (genetic doping). The first attempts to detect this are in progress. The development of doping analysis in human sports is closely related to the abuse and detection of illegal compounds in animal sports (especially horseracing). Aspects such as the availability of

substances, the biochemical particularities of the species, and the specific regulation of the acceptance of medications define its specialty. In the same way, the application of inappropriate doses of anabolic compounds in body building, and its illegal use in food-producing animals are not completely comparable to sports situations, although they do allow a useful understanding of biotransformation, biochemistry, the appearance of secondary effects and the attempts to treat them. Analytically, the detection in urine (the main sample in doping controls), and the corresponding periods for detecting the relevant compounds, are governed mainly by their pharmacokinetics. Detailed knowledge of biotransformation and the kinetics of the excretion of prohibited compounds is, therefore, essential in doping control. Quite often, pharmacologically irrelevant terminal metabolites are examined in great detail to enable a long-term detection of steroid abuse.

### **3.1.2 The World Anti-Doping Agency**

The World Anti-Doping Agency (WADA) aims to ensure clean, doping-free competition, and defines the World Anti-Doping Code and the World Anti-Doping Program. It focuses on what constitutes doping and how to fight against it. The main purposes of this fight are, on the one hand, to protect the fundamental right of athletes to participate in athletic activities free of doping, and to promote health and therefore guarantee equity and equality during competitions for all the athletes in the world; and on the other hand, to ensure the effectiveness and execution of the doping detection, deterrence, and prevention programs.

#### **Definition of Doping**

Even though the definition of doping has changed over the years, its significance can be understood (pharmacologically) as the attempt to improve performance in a sport by administering illegal pharmaceutical products or applying prohibited methods (for example, blood transfusions). However, according to the Anti-Doping Code (2018) the idea of committing doping violations is, in reality, much wider and refers to other aspects.

Doping is defined as the occurrence of one or more of the anti-doping rule violations set forth in Articles 2.1 to 2.10 of the Code.

1. The presence of a prohibited substance or its metabolites or markers in an athlete's sample.
2. The use or attempted use by an athlete of a prohibited substance or a prohibited method.
3. Evading, refusing, or failing to submit to a sample collection.
4. Failure of the athlete to be located at pre-determined whereabouts.
5. Tampering or attempted tampering with any part of doping control.
6. Possession of a prohibited substance or a prohibited method.
7. Trafficking or attempted trafficking in any prohibited substance or prohibited method.

8. Administration or attempted administration and competition to an athlete of any prohibited substance or prohibited method, or administration or attempted administration to any athlete out-of-competition of any prohibited substance or any prohibited method that is prohibited out-of-competition.
9. Complicity. Assisting, encouraging, aiding, abetting, conspiring, covering up, or any other type of intentional complicity involving an anti-doping rule violation, or any attempted anti-doping rule violation or violation of Article 10.12.1 by another person.
10. Prohibited association (World Anti-Doping Code, 2015).

The details of this definition and its components are explicitly listed in the Anti-Doping Code, which can be found on the WADA website and at the Spanish Anti-Doping Agency (AEPSAD). The list of prohibited substances is updated annually and appears on the above websites in January and, shortly after, in the *Boletín Oficial del Estado* in Spain. It is each athlete's obligation to know the code and to stay current with the updates, and it is the duty of those of us who care for the athletes to facilitate this knowledge.

It should be noted that on a legal level in Spain, Article 361 bis of the Penal Code states:

1. Those who, without therapeutic justification, prescribe, provide, dispense, supply, administer, offer or make available to federated non-competitive sports people, non-federated sports people who play recreational sport or sports people who take part in competitions organized in Spain by sports entities, banned substances or pharmacological groups, as well as non-authorized methods, aimed at increasing their physical capacity or modifying the results of competitions, which, by their content, repetition of ingestion or other attendant circumstances, place the life or the health thereof in danger, shall be punished with prison sentences of six months to two years, a fine of six to eighteen months and special withdrawal of authorization for public employment or position, profession or office, from two to five years.<sup>1</sup>

Athletes, as individuals susceptible to illness, have different reasons for using medication. In this sense, four main reasons can be identified that are not necessarily considered doping. These are:

- The legitimate therapeutic use of prescription or self-administered medication.
- As an athletic performance-enhancing supplement or aid for treating sports injuries, during the recovery process, etc.
- For recreational or social use, either with legal or illegal substances or molecules.
- To improve performance itself (generally considered doping).

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<sup>1</sup> Article 361 bis Chapter III: Crimes Against Public Health. Penal Code. Added by Organic Law 7/2006. November 21, 2006.

- In each of the categories mentioned, there are medications that appear on the WADA list of prohibited substances. Inevitably, there is not always a clear distinction between these uses. It would be easy to restrict the use of medications in general during a competition; however, there are many circumstances in which it is advisable to take them for the athlete's health and well-being. It is therefore sensible for athletes to consider their needs carefully, together with all the consequences of their actions.

### 3.1.3 Legitimate use of drug therapy and therapeutic authorization

Just like any other person, an athlete can suffer an illness (major or minor) that requires therapy with medication. Examples include respiratory problems that require symptomatic treatment; a headache that requires an analgesic, anti-inflammatory drug, or other appropriate medication; or a bacterial infection that requires antibiotics to fight the bacteria. These pathologies are commonly observed in the sports world, just as in everyday life. In addition to the slight risk of side effects from the treatment, it is difficult to discern how it could affect an athlete's performance (in one way or another).

Less common but more serious medical conditions are asthma, epilepsy, and diabetes. In these situations, it would be inconceivable for an athlete to consider going without their regular treatment. It would even be unethical to allow them to put their health or life at risk by suggesting that certain doses of their medication would affect their physical performance.

If the medication or method an athlete requires to treat an illness or condition happens to fall under the Prohibited List, they should apply for authorization from the **Therapeutic Use Exemption Committee (TUEC)**. This organization considers each case and grants or denies the request on the basis of medical records, background, supplementary tests provided, the medication requested, its dose and duration, and the specialist report. It is important to understand that the committee does not judge treatments, only whether or not it is justifiable to authorize the requested prohibited substances. If the substance being requested is not permitted, it is because although the treatment improves or prevents symptoms, it probably produces an enhancement of performance that is greater than would be expected when the athlete returns to their normal state of health. Substances are also rejected when there is a reasonable therapeutic alternative to the use of the otherwise prohibited substance or method. The TUEC therefore needs to know the criteria the physician considers appropriate for justifying why the prohibited substance is better and necessary for the athlete than other non-prohibited alternatives, if they exist. The physician requesting authorization should also do so with the utmost care, since they are responsible for justifying the prohibited treatment. It is common for the TUEC to see multiple, unnecessary applications for products that are permitted, and others that are incomplete and require corrections (Drobnic, Blanco-Alfaro, April 2018).

For many illnesses that are typical in any population, such as respiratory problems, minor allergic reactions, or gastrointestinal disorders, it is possible to obtain medications without visiting a physician and without a prescription, both in pharmacies and in stores with OTC (over-the-counter) products. Athletes should thoroughly analyze the package insert for any medication or substance they are taking in order to guarantee that it does not contain a prohibited substance. For example, psychomotor stimulants such as caffeine, and sympathomimetic drugs like ephedrine, pseudoephedrine, phenylpropanolamine, and phenylephrine. Although OTC medications have low dosage levels, the sophisticated methods used for urine analysis are perfectly capable of detecting these medications or their metabolites.

WADA introduced urine cut-off levels for these over-the-counter medications at the end of the 1990s. If these medications are detected in urine samples in concentrations lower than the threshold levels, the athlete will not be sanctioned or warned. Even so, athletes should be cautious with some OTC medications due to their concentration and release methods; if they are not careful, a pharmacokinetic effect can play a nasty trick on them (Drobnic, Blanco-Alfaro, April 2018). In this sense, when discussing the nature of any pharmacological treatment with a physician, it is important to avoid a prescription for prohibited substances whenever possible. Just as with any medical condition, a decision should be made on whether the athlete is able to compete while under treatment.

### **Useful Advice on Doping**

- Athletes should tell any professional who treats them that they are athletes in order to prevent doping with prohibited substances or methods.
- They should not be forced to compete when dealing with an injury or illness, since they are putting their health at risk for a one-off performance.
- The physician that requests therapeutic authorization must provide suitable proof of the need for the prohibited substance, the dose required, and the treatment period.
- Regarding the consumption of vitamins, minerals, or other aids to improve athletic performance:
  - Vitamin and mineral supplements can be necessary to complement the diets of athletes who perform a lot of physical activity.
  - All nutritional aids in the diet should be prescribed and evaluated by a professional.
  - If the athlete belongs to a club or federation, their specialist physician should be an expert, and should supervise the administration of these compounds.
  - Substances that advertise fast improvements in performance or are of uncertain origin should not be bought or taken.

- **A specialist physician should always be consulted about the advantage of adding nutritional supplements to the diet.**

### **Continuing Performance**

Athletes suffer injuries to the musculoskeletal system that affect muscles, ligaments, and tendons. Medication is typically indicated to alleviate pain or the inflammatory process. This allows the athlete to continue their training and even compete during the injury recovery period. From an ethical perspective, the experience of the professional who treats the athlete and evaluates the progress of their process is fundamental. Whether or not an athlete should be given treatment to lessen pain in order to complete an exercise or competition can be questionable, even keeping in mind that the healing process should not be obstructed. Although the use of analgesics in these circumstances is unlikely to give athletes an unfair advantage, the expertise of the professional should be questioned if it negatively affects the injury process.

Doping regulations restrict the type of analgesics that can be used, and control the administration methods of medications such as glucocorticosteroids. Table 1 shows the presence of analgesics as adverse results in doping controls from 2003 to 2016 (current data is found in Drobic & Galilea 2018). Their presence is fairly stable, in between 4% and 8% of the results. It should be understood that an adverse result is not necessarily doping, and is not always sanctionable. It could be due to the absence of therapeutic authorization (as occurs in some cases); it might be the result of an abnormal response of the body in special situations; or it could be a specific idiosyncrasy of the individual under assessment.

**Table 1. Data on adverse results (random results) in anti-doping controls from 2003 to 2016 in olympic and non-olympic sports**

	Total checks	Total Olympic	Total Non-Olympic	Ratio Ol./Non-Ol.	Total Adverse R	Adverse R Olympic	Adverse R Non-Olympic
<b>2003*</b>	151,210	113,562	37,648	67%	2,447	1,710	737
					<b>1.62%</b>	<b>1.51%</b>	<b>1.96%</b>
<b>2004</b>	169,187	128,591	40,596	68%	2,909	2,145	764
					<b>1.72%</b>	<b>1.67%</b>	<b>1.88%</b>
<b>2005</b>	183,337	139,836	43,501	69%	3,909	2,958	951
					<b>2.13%</b>	<b>2.12%</b>	<b>2.19%</b>
<b>2006</b>	198,143	156,866	41,277	74%	3,887	2,915	972
					<b>1.96%</b>	<b>1.86%</b>	<b>2.35%</b>
<b>2007</b>	223,898	174,483	49,415	72%	4,402	3,375	1,027
					<b>1.97%</b>	<b>1.93%</b>	<b>2.08%</b>
<b>2008</b>	274,615	202,067	72,548	64%	2,956	1,974	982
					<b>1.08%</b>	<b>0.98%</b>	<b>1.35%</b>
<b>2009</b>	277,928	187,029	90,899	51%	3,091	1,674	1,417
					<b>1.11%</b>	<b>0.90%</b>	<b>1.56%</b>
<b>2010</b>	258,267	180,584	77,683	57%	2,790	1,624	1,166
					<b>1.08%</b>	<b>0.90%</b>	<b>1.50%</b>
<b>2011</b>	243,193	167,820	75,373	55%	2,885	1,762	1,123
					<b>1.19%</b>	<b>1.05%</b>	<b>1.49%</b>
<b>2012</b>	267,645	184,955	82,690	55%	3,190	1,831	1,359
					<b>1.19%</b>	<b>0.99%</b>	<b>1.64%</b>
<b>2013</b>	269,878	176,502	93,376	47%	3,529	1,710	1,819
					<b>1.31%</b>	<b>0.97%</b>	<b>1.95%</b>
<b>2014</b>	283,304	186,739	96,565	48%	3,153	1,440	1,713
					<b>1.11%</b>	<b>0.77%</b>	<b>1.77%</b>
<b>2015</b>	303,369	196,581	106,788	46%	3,809	1,634	2,175
					<b>1.26%</b>	<b>0.83%</b>	<b>2.04%</b>
<b>2016</b>	300,565	193,345	107,220	45%	4,822	1,927	2,895
					<b>1.60%</b>	<b>1.00%</b>	<b>2.70%</b>

Source: Modified from Drobnic (2018).

**Table 2. Adverse Analytical Findings (AAF) and Atypical Findings (ATF)**

Year	AAF+ATF	S6		S8		S3		S9		S5		S2		S4		Other	
		Anabolic Agents	Stimulants	Cannabinoids	Beta Agonists	GCs	Masking Agents	Pept. H.	Hormones & SM								
2003*	2716	872 32.1%	516 19.0%	378 13.9%	297 10.9%	286 10.5%	142 5.2%	79 2.9%			64 2.4%						
2004	3305	1191 36.0%	382 11.6%	518 15.7%	381 11.5%	548 16.6%	157 4.8%	78 2.4%			50 1.5%						
2005	4298	1864 43.4%	509 11.8%	503 11.7%	609 14.2%	325 7.6%	246 5.7%	162 3.8%			80 1.9%						
2006	4332	1966 45.4%	490 11.3%	553 12.8%	631 14.6%	282 6.5%	290 6.7%	42 1.0%			78 1.8%						
2007	4850	2322 47.9%	793 16.4%	576 11.9%	399 8.2%	288 5.9%	359 7.4%	41 0.8%			72 1.5%						
2008	5523	3259 59.0%	472 8.5%	496 9.0%	350 6.3%	316 5.7%	436 7.9%	106 1.9%			88 1.6%						
2009	5084	3297 64.9%	325 6.4%	399 7.8%	303 6.0%	265 5.2%	273 5.4%	100 2.0%			122 2.4%						
2010	5546	3374 60.8%	574 10.3%	533 9.6%	209 3.8%	234 4.2%	396 7.1%	86 1.6%			140 2.5%						
2011	5600	3325 59.4%	718 12.8%	445 7.9%	225 4.0%	274 4.9%	368 6.6%	125 2.2%			120 2.1%						
2012	4500	2279 50.6%	697 15.5%	406 9.0%	131 2.9%	365 8.1%	322 7.2%	181 4.0%			119 2.6%						
2013	5271	3320 63.0%	530 10.1%	188 3.6%	138 2.6%	330 6.3%	393 7.5%	202 3.8%			170 3.2%						
2014	3079	1479 48.0%	474 15.4%	73 2.4%	122 4.0%	252 8.2%	389 12.6%	91 3.0%			199 6.5%						
2015	3432	1728 50.3%	528 15.4%	127 3.7%	115 3.4%	215 6.3%	428 12.5%	98 2.9%			193 5.6%						
2016	4234	1404 40.9%	568 16.6%	110 3.2%	172 5.0%	184 5.4%	499 14.5%	109 3.2%	721 17.0%		67 2.0%						

Atypical findings could correspond to multiple medications taken by the same athlete, as in the case of longitudinal studies of testosterone.

GCs: Glucocorticoids

Pept. H.: Peptide hormones.

SM: sample manipulation.

The initials S1 to S9 represent the categories of classes of substances according to the Anti-Doping Code.

As sports physicians, we should be aware that there is a great dependence on sophisticated dietary and training programs to support the exercise process. However, if these are not accompanied by top quality in other performance areas (athletic ability, technique, tactics, rest, training quality, good nutrition, etc.), they can contribute very little. On the other hand, it is also important to note that some of the so-called vitamin preparations and nutritional supplements can contain prohibited substances that are added voluntarily or involuntarily by the providers. There is no legal requirement for the manufacturers to list all the contents of these food supplements, so to avoid conflict with anti-doping regulations, it is better to avoid them.

### 3.1.4 Recreational and social use

Many cultures throughout time have used substances for social or recreational purposes. These range from caffeine, which is a common component of beverages frequently consumed in many societies, to socially-accepted drugs like alcohol and marijuana, to hard and addictive drugs such as narcotic analgesics based on opium, heroin and morphine, and psychomotor stimulants like cocaine.

The use of these substances, particularly in Western cultures, has grown in recent years and is reflected in the increased number of positive results in tests by WADA-accredited laboratories, especially for marijuana (Table 5). Cannabis use had an elevated presence until 2012, when education and controls were introduced. Although these substances can be taken in a social or recreational environment, they do potentially improve performance, hence their inclusion in WADA regulations.

Amphetamines, cocaine, and narcotic analgesics are completely prohibited. Caffeine is prohibited, but only if the urine concentration is above 12 micrograms per milliliter, which permits normal consumption of caffeinated beverages. Alcohol and marijuana are only banned in certain sports. At the same time, some substances are only subject to a monitoring process during certain seasons, which is why it is advisable to check the Code every year.

### **Improvements in Performance**

The deliberate and illegitimate use of substances in an event to obtain an unfair advantage over other competitors is the most serious threat to the credibility of competitive sports, and has become the subject of doping control rules. It would be appropriate to provide a definition of medication that improves performance, but unfortunately, an exact definition is extremely difficult to formulate for several reasons (Mottram, 2003).

1. A specific medication can be considered performance-enhancing in one sport, but detrimental in another sport. For example, substances with a sedative effect, such as alcohol and beta blockers, would be considered useful in events based on accuracy, such as shooting or archery, where a reduced heart rate and steady posture are important. However, they would be counterproductive, if not dangerous, in the majority of other sports.
2. If we define the substances that improve performance by the fact that they are “synthetic” or “unnatural” to the body, this would exclude testosterone and other peptide hormones of natural origin that are used for illicit purposes. Blood doping would also be excluded. This is the method by which competitors store quantities of their own or another person’s blood in a frozen state, which is then reinfused before a competition in an attempt to increase the capacity for oxygen transportation.
3. In general, substances used in special diets, such as vitamin and molecular supplements or performance-enhancing compounds are not classified. These are used to supplement the diet or to facilitate recovery; however, some of these natural substances, such as creatine, L-carnitine, or leucine, have been used with the expectation that they would improve performance. And we know that, for example, the first does have an ergogenic effect *per se*, and the latter really does help the tissue recovery process while being considered nutritional elements.

4. Perhaps the greatest difficulty in precisely defining improved performance from medications lies in the prescription and use of those substances that are perceived as possessing performance-enhancing properties, but which are utilized with legitimate therapeutic purposes. This problem is easily illustrated with athletes that suffer from asthma. One of the most important classes of drugs used to treat asthma is the group of bronchodilators, many of which are sympathomimetic and therefore subject to anti-doping control. Since asthma attacks are frequently associated with hyperventilation during exercise (and even stress), of which competitive exercise is an extreme case, this obviously produces serious problems for asthmatic athletes if they want to avoid violating the doping control rules. The sympathomimetic bronchodilators Salbutamol, Formoterol, and Salmeterol are permitted under the doping control regulations. If a different drug is desired, an authorization request must be submitted.

### **The ethical dilemma – Arguments for the presence of doping**

- The simple desire to be the best, regardless of rules or ethical considerations.
- The pressure from the media to win.
- The belief, which is difficult to eradicate and is increasingly present, that doping is necessary for success.
- The public expectations surrounding national competitiveness which lead to unethical practices being tolerated by national and international organizations.
- The pressure from certain athletic federations and sponsors.
- The enormous economic rewards for winners, or the resources associated with the athletes' performance by governments and sponsors.
- Training models from childhood that emphasize winning as the only objective.
- The competitive character of each athlete and their dependence when faced with extreme or limiting situations such as an injury, the aging process, or simply the presence of better competitors.
- The unfailing ability of the medical profession to cure and improve performance, reliably or in the time desired.
- The belief in artificial performance-enhancing products, in other words, a magic pill or supplement.
- An excessive competition calendar that is difficult to complete satisfactorily.

For most people, many of the above circumstances merge into each other on the majority of occasions (Mottram, 2003).

### 3.1.5 Doping control

It is very important for a team sports physician to know what the doping control regulations are, and what they cover. There is a specific doping control protocol that not only refers to documentation compliance, but also guarantees the transparency and legality of sample collection, in order to assure the athlete that the analysis of his sample will be completely clean and free from any external tampering.

There is a guide for how an anti-doping control test is carried out on the AEPSAD (Spanish Anti-Doping Agency for Health Protection in Sport) and WADA websites. The FC Barcelona and CAR guides are also included, for practical orientation. Basic recommendations that all sports physicians should know and practice are presented in Table 3.

**Table 3: Practical recommendations for completing a doping control test**

<p>The athlete should go to the test with a witness.</p> <p>Request the credentials of the person responsible for the test.</p> <p>If the athlete needs a drink, they should only do so from bottled and sealed products, never from ones which are already open.</p> <p>Check that all urine sample containers are sealed.</p> <p>Choose between at least two containers.</p> <p>Only the athletes themselves should handle the urine sample.</p> <p>Never lose sight of the urine sample.</p> <p>Ensure that the urine containers are leak-proof.</p> <p>Ensure that the pH and density are evaluated in the residual sample, not the sample to be sealed and analyzed.</p>
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