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## The mysterious world of doping

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### Abstract

Over time, the norms and principles of sport have not been fulfilled as they should be in their ideal genesis. Hence, doping is today, more than ever, a very investigated and commented topic. Although current, this problem is not recent and has extended over the last decades. However, because it is somewhat "settled" there is the idea that there is a universal definition of doping, which does not correspond to the truth.

The purpose of this article is to find the best definition for the understanding of doping, as well as to describe some cases where this was and is used. It is also the purpose of this investigation to identify in detail the substances that are classified as doping between athletes and the forms of control and combat by international organizations to fight against doping.

The methodology used for the elaboration and enrichment of this work was a bibliographical research, through scientific articles, using reliable sources and the most recent possible, in the databases: ACM Digital Library, ACS - Physics Institute, B-ON Library and Google Scholar.

On the basis of this article it was possible to conclude that the use of drugs in sport has been increasing, and some of these prohibited and illicit substances cannot be detected in the tests that are done before the tests. Some sportspeople have consumed a lot of illegal substances, leading many of them to death, with many reasons being pointed out: improvement of physical performance, pressure to which they are exposed in the face of supporters and sponsors, personal fulfillment or family influence, among others. Decision to consume illicit substances easier. Often even these are provided by the sponsors or clubs who want to reach a certain level that leverages the economic and financial gains.

**Keywords:** Fraud, corruption, doping

### 1. Introduction

The ideal of sport in its genesis is that victory takes place within the rules, regardless of their evolution, with the objective of guaranteeing equal opportunities and countering the occurrence of fraud and violence. All these values and principles establish a school of virtues, preparation for life and formation of a moral respect for the dignity of each other (Martínó, 2017)<sup>[9]</sup>.

According to Silva (2012)<sup>[11]</sup>, sports and doping have been linked to the achievement of great performances in the most diverse modalities, and the phenomenon has been excessively studied in its different perspectives, both physiologically and sociologically. Every four years there has been a repeat of the fact that another Olympic Games has passed, and more athletes have been caught (Silva, 2012)<sup>[11]</sup>.

The high competition sport is understood according to José Teotónio Lima, as a cultural matrix of systemic perspective in order to frame the sports career of the high-performance athletes in a humanized, value-creating course (Lima, 2002).

According to Dumas, in Silva (2012)<sup>[11]</sup>, all definitions of doping have gaps and reflect some divergences: a precise definition is not absolutely true. The important thing is to understand the problem. We cannot be content with the concept of those who dock and who know very well what they are looking for in such a practice: better preparation, better performance, faster recovery, thanks to artificial means, more or less effective and sometimes dangerous (Gordillo, 2000). Par Dumas, m Silva (2012)<sup>[11]</sup>, all lead to doping in a cruel way: doping is really a sport cancer, a cancer that reached Elite Athletes and Doping to contaminate the student media that, if it is can cause great damage to the manufacturing means, if any director happens to demand an artificial increase in income (Gordillo, 2000).

## 2. Theoretical framework

### 2.1. The History of Doping

According to Ana Sofia Tavares (2016), the word Doping comes from the term "dop" and is associated with an alcoholic beverage, used by warriors to increase their powers in battle.

In the Roman period continued to elevate the prestige of the sport, but with more violence, in which the gladiator fights and the horse races stood out. At this point, doping was passed by horses, and a mixture of water, honey and oats (called mead) was administered to the horses to run faster (Tavares, 2008).

Already in the nineteenth century, the way of life that was lived, made sport resurface through community celebrations, where they danced, and made sack races, rooster fighting, pig picking and even boxing and football, which involved a large number of players (Tavares, 2008).

With the increase of industrialization, people migrated from the fields to the city, and began to live better and to have more rigid working hours, which led to a change in sports activities. However, technological development and electric light has given rise to new sports (tennis, golf and cricket) which has led to the professionalism and commercialization of sport and with consequent pressure on athletes, their income, which again, leads to doping, through the use of strychnine, caffeine, cocaine and alcohol (Tavares, 2008).

In 1886, the first fatality described in history was due to the use of drugs that improve physical performance: in the Tour de France of cycling, the English cyclist Linton dies under the effect of stress and speed ball (cocaine plus heroin) (Tavares, 2008).

The term became current and in the early twentieth century, referring today appears to be linked to illegal drugs (Tavares, 2008). During the twentieth century, sport has already played as important a role as in the Greco-Roman period. In 1904, the first scare occurred in the modern Olympics, when marathon runner Thomas Hicks almost died due to the administration of brandy and strychnine. In 1919, the Japanese pharmacist Ogata, synthesized amphetamine, and as a consequence, sports doping grew, especially in cycling. The synthesis of amphetamines replaced strychnine (Tavares, 2008).

During World War II, from 1939 to 1945, soldiers were given amphetamines in their survival kits, to withstand night flights between London and Berlin. After the war, many soldiers were addicted to these pills and when they returned home, many of them continued their sporting practices, especially football players. Such phenomenon led to the spread of amphetamines use among athletes (Tavares, 2008).

Doping tests were used for the first time during the Winter Olympic Games in Grenoble, France, and in 1968 at the Olympic Games in Mexico. However, the control was very small and without any punishment. Participating countries claimed the short time between games and the law, and many threatened not to attend the Games and other countries expressed their intention to leave the Olympic Village (Tavares, 2008).

A year before, the death of cyclist Tommy Simpson on the Tour de France for abusive use of amphetamines forced the IOC to take strict measures and in 1972 at the Olympic Games in Munich the "formal" tests for the detection of drugs and / or stimulant drugs in biological samples. However, only in 1976, at the Olympic Games in Montreal, the detection of exogenous anabolic steroids was initiated by the radioimmunoassay technique (RIA) (Tavares, 2008).

In the XXI century Portugal approved in 2007 the International Convention against Doping and its Annexes I and II (Decree-No 4-A / 2007, of March 20) (Tavares, 2008), evolving from Law No. 374/79 of 8 of September. In this way doping is being tackled not only ethically, socially and culturally but effectively through regulation, but it is important to note that in any fraudulent process the actor is always one step ahead of the detection process. That is why everyone's attention is necessary and through denunciation, fact finding or other forms we must collectively contribute to eradicate this malady that affects the sporting truth and the purity of a competition.

Doping according to Marivoet (1998) consists of the ethical principles of modern sport that are based on equal opportunities in the face of a competition based on confrontation and cooperation, where a code of loyalty is imprinted with each other and the recognition of normative instances and disciplines that oversee and regulate competitive frameworks (Martínó, 2017)<sup>[9]</sup>. In sport, justice must predominate, where athletes beyond race and social class face the same weapons, and nothing is a given and the best is the one that shows their supremacy through their abilities (Martínó, 2017)<sup>[9]</sup>.

The definition of doping varies according to the various institutions and even according to the different states and, for that reason, their combat becomes so difficult (Vieira, 2018)<sup>[14]</sup>.

In 1967, Dr. René Guillet created a definition for doping very close to the current one: those substances which appear on an official list of doping agents, irrespective of medical reasons or not, voluntary or involuntary, of their absorption and whether or not they have been prescribed by a physician (Martínó, 2017)<sup>[9]</sup>.

The European Council defined doping as the administration to an individual, or the use, by himself and by any means whatsoever, of a substance foreign to the organism, with the sole purpose of artificially and unfairly increasing his income during participation in a competition. Certain psychological processes, created for the same purpose, can also be considered as doping. This same definition was adopted in the Portuguese legislation, in the decree of law n° 374/79 of 8 of September. However, the definition did not include injured or sick athletes, so the following was added: When the athlete or athlete is injured or ill, only a physician can treat him or someone else's responsibility. Also, only the doctor has the authority to authorize or not the participation of the athlete, injured or sick and under treatment, in a competition. In the case of a medical prescription, an agent or substance (whatever its nature, dosage, preparation or route of administration) can be artificially and unfairly modified by the practitioner during the period of the sporting events, it is forbidden to him, at that time, the competition for having to consider himself doped. For physicians dealing with the treatment of athletes, amateurs or professionals, a list (pharmacological preparations, not fixed, dynamic, easy to malleability) should be established which, although clinically prescribed, prohibits participation in sporting events during the period of treatment. Currently this definition of doping applies not only in Portuguese legislation, but also in the International Olympic Committee (Martínó, 2017)<sup>[9]</sup>.

In view of the definition of doping and its historical evolution, it can be accepted that a substance or a method can be considered as doping, and at least two of the following criteria must be met:

- Have the potential to improve, or improve effectively, sports performance;
- Constitute a risk to the health of the athlete;
- Its use violates the sporting spirit.

The International Olympic Committee (IOC) divided the prohibited substances into five classes: class A (stimulants), class B (narcotics), class C (anabolic substances), class D (diuretics) and class E (peptide hormones, mimetic and related substances) (Silva, 2012)<sup>[11]</sup>.

**Table 1:** Different classes of doping and their effects and risks

Classes	Examples of prohibited substances	Risks and effects of use	Comments
Class A (stimulants)	amineptine, amiphenazole, amphetamines, bromantan, caffeine, carphedon, cocaine, ephedrine, fencamfamin, formoterol, mesocarb, pentetrazol, pipradrol, salbutamol, salmeterol, terbutaline and related substances.	<p>The use of stimulants and amines:</p> <ol style="list-style-type: none"> <li>1. It can cause, in competitions, influencing the production of stimuli and impulses to reach the maximum performance, sometimes in an extreme way, entails a total imbalance of the indispensable mechanisms of biological regulation and in extreme cases can cause the death of the athlete (WEINECK, 2005).</li> <li>2. Involves the death of doped athletes, as they do not have self-protection mechanisms and are related to unfavorable climatic conditions during the doping stage, such as strong heat, high relative humidity, low atmospheric oxygen pressure or deficient ingestion of liquids (WEINECK, 2005).</li> <li>3. The use of stimulant substances can lead to a circulatory collapse in the cardiovascular system.</li> <li>4. Cardiovascular side effects manifest themselves with headaches, a very high resting heart rate and a constant increase in blood pressure (WEINECK, 2005).</li> </ol> <p>One of the most common substances in the stimulant group is amphetamine, which can be ingested in pill form or injected. Generally, amphetamines are used by:</p> <ol style="list-style-type: none"> <li>a) People who want to lose weight</li> <li>b) By physicians to control hyperactivity or narcolepsy symptoms (sleep disorders)</li> <li>c) For sportsmen who wish to support greater physical effort</li> <li>d) For students to stay awake for long periods.</li> </ol> <p>The use of amphetamines can make the user unable to think about their physical and psychological condition, causing a dietary deficiency, heartbeats in alternating rhythms and, in case of high doses, fever and seizures.</p> <p>Another widely used stimulant is caffeine, which at the 1984 Olympic Games was first considered a dopant, where a concentration greater than 12 micrograms / ml is considered illegal by doping rules. Caffeine can be consumed orally, in the form of a tablet or liquid (WEINECK, 2005).</p> <p>One of the effects of caffeine occurs on the central nervous system because it improves the performance of all cognitive functions and decreases fatigue, drowsiness or even pain perception, but depending on the dosage, it can present the following side effects:</p> <ol style="list-style-type: none"> <li>a) Heart rate changes</li> <li>b) Difficulty concentrating,</li> <li>c) Restlessness,</li> <li>d) Insomnia,</li> <li>e) Muscle tremor</li> <li>f) Among others.</li> </ol> <p>Caffeine also acts on the cardiovascular system and the muscular system (WEINECK, 2005). This substance is found in several products, like mate, chocolate, coffee, teas, soft drinks and guarana.</p>	<p>When stimulating amines are ingested over a long period, a severe physical and psychological dependence develops, with characteristic symptoms. On the one hand, abstinence manifestations occur at the end of the substance's effect, through depression, states of anxiety, apathy and exhaustion (WEINECK, 2005).</p>
Class B (narcotics)	buprenorphine, dextromoramide, diamorphine (heroin), methadone, morphine, pentazocine, pethidine and related substances	<p>The main effect of the use of narcotics and analgesics is:</p> <ol style="list-style-type: none"> <li>a) Decrease or even elimination of pain, as they act on the central nervous system.</li> <li>b) Another effect verified is the change of state of humor, installing euphoria (WEINECK, 2005).</li> </ol> <p>As pain serves as a protective mechanism for our body, limiting some movement as a result of injury, the use of narcotics or analgesics, by suppressing pain, can cause more serious injuries such as rupture of ligaments, muscles or bone fractures (WEINECK, 2005).</p> <p>The use of such substances can lead to a physical and psychological dependence, and increasing doses are necessary to obtain the same result. Dependence causes the following</p>	

		<p>withdrawal effects:</p> <ol style="list-style-type: none"> <li>Anxiety,</li> <li>Aggressiveness</li> <li>Restlessness</li> <li>Excitation state,</li> <li>Insomnia</li> <li>Depression</li> <li>Chills,</li> <li>Diarrhea,</li> <li>Vomiting,</li> <li>Among others (WEINECK, 2005).</li> </ol> <p>Other side effects seen with the use of narcotics are: urinary retention, dry mouth, sedation, disorientation, increased intracranial pressure, among others.</p>	
Class C (anabolic substances)	<p>This class is subdivided into two groups: anabolic steroids and beta-2 agonists. The first subgroup has the following examples: clostecol, methenolone, nandrolone, oxandrolone, stanozolol, androstenediol, androstenedione, testosterone and related substances. The second subgroup has the following examples: terbutaline, bambuterol, clenbuterol, fenoterol, reproterol, salbutamol and related substances.</p>	<p>Anabolic or simply anabolic steroids are male sex hormones, androgens. They are similar to testosterone, presenting androgenic and anabolic effects (WEINECK, 2005).</p> <p>They are androgenic effects: greater libido, greater body hairiness, greater aggressiveness, penis growth, more serious voice, among others.</p> <p>The anabolic effects are the stimulus of protein synthesis, causing the following: greater skeletal muscle mass, decrease of body fat, higher concentration of hemoglobin, among others (WEINECK, 2005). Anabolic only reach their maximum potential when associated with training and a protein diet, otherwise there is no increase in muscle tissue (WEINECK, 2005).</p> <p>The consequences of the use of anabolic substances can affect several systems of the human body, such as:</p> <ol style="list-style-type: none"> <li>The central nervous system</li> <li>male and female reproductive systems</li> <li>The skeletal muscle system</li> <li>The cardiovascular system</li> <li>The hepatic system</li> <li>The renal system (WEINECK, 2005).</li> </ol> <p>According to the report, there are a number of side effects, such as: aggressiveness, hyperactivity, irritability, panic disorders, depression, libido and appetite altered, euphoria, testicular atrophy, impotence, feminization with gynecomastia, hair loss, masculinization, breast tenderness, menstrual irregularities, increased tenderness of muscles and tendons, increased blood pressure and cholesterol, sodium and water retention, hepatitis, elevated creatinine, thyroid, acne, insulin resistance, glucose intolerance, among others.</p> <p>The lesions of tendons and ligaments that intensify with the use of anabolic substances are due to the fact that they have slower metabolism, taking time to adapt to the rapid increase in muscle strength (WEINECK, 2005).</p>	
Class D (diuretics)	<p>Acetazolamide, bumetanide, chlorthalidone, ethacrynic acid, furosemide, hydrochlorothiazide, mannitol, mersalil, spironolactone, triamterene and related substances.</p>	<p>These banned substances are used by athletes wishing to reduce their body mass in sports that set a weight limit for each category, such as boxing and mixed martial arts (MMA). They are also used to camouflage the use of other banned substances as it increases urine flow and elimination of these substances.</p> <p>The side effects of using diuretics are:</p> <ol style="list-style-type: none"> <li>Dehydration</li> <li>cramp</li> <li>Myalgia's</li> <li>Risk of cardiac arrhythmias.</li> </ol>	
Class E (peptide hormones, mimetic and related substances)	<p>Coronelonadotropin (hCG), pituitary and synthetic gonadotropin (LH), corticotrophin (ACTH, tetracosactide), growth hormone (hGH), somatomedin C (IGF-I), erythropoietin (EPO) (WEINECK, 2005).</p>	<p>HGH is the growth and development hormone of the individual. The concentration is high in children and decreases as the age advances, being almost nil in the old age. The highest values of HGH are achieved in sleep and after sports (WEINECK, 2005).</p> <p>This hormone is widely used by athletes to increase strength and muscle mass, improving performance capacity, since it is still not detectable in doping, but to achieve such results high dosages are necessary which can lead to the following side effects:</p> <ol style="list-style-type: none"> <li>Weight gain;</li> <li>Hypertension;</li> <li>Among others (WEINECK, 2005).</li> </ol>	

Source: Adapted from Silva, 2012 <sup>[11]</sup>.

The author Ribeiro (2015) <sup>[10]</sup> uses the definition of the International Olympic Committee (IOC) to define doping as the use of any endogenous or exogenous substance in abnormal amounts or routes with the intention of increasing the athlete's performance in a competition. This definition has undergone changes and is currently considered doping not only the use of substances, but also the use of methods capable of increasing the performance of athletes. In addition, it is still considered doping, according to the World Anti-Doping Agency (WADA), the violation of one or more of the following rules:

- a) Presence of a prohibited substance, its metabolites or markers in a sample of blood or urine;
- b) Use or attempted use of a prohibited substance or method;
- c) Refusal or failure to take samples after notification;
- d) Violation or attempt to change the sample or part of the sample for doping control;
- e) Possession of a prohibited substance or prohibited method;
- f) Trafficking or attempted trafficking in any prohibited substance or prohibited method;
- g) Compliance (World Anti-Doping Agency, 2015) <sup>[15]</sup>.

Through the analysis of statistical data on doping control issued by the Administration and Anti-Doping Management System (ADAMS) and published on the official WADA website since 2003, author Ribeiro (2015) <sup>[10]</sup> verified that anabolic agents always represented the largest number positive cases in relation to the other categories. The author also evaluated the most recent statistical data for the year 2013, and again verified that anabolic agents and stimulants are the classes of drugs most used as doping agents by the world athletes (World Anti-Doping Agency, 2013). Still based on the statistical data, it is evident that the sports that contribute most to the increase of these numbers are cycling, athletics, soccer, weightlifting and bodybuilding (Ribeiro, 2015) <sup>[10]</sup>.

In Portugal, according to the statistics of the Portuguese Anti-Doping Authority (ADoP), it can be seen that in the positive cases of 2013, the majority resulted in the detection of cannabinoids (25.0%), stimulants (25.0%), and anabolic agents (25.0%). Diuretics and other masking agents (12.5%), peptide hormones (4.2%), hormonal modulators (4.2%) and beta-2 agonists (4.2%) occupy a secondary plane within the substances detected.

However, the most recent statistics, for the year 2014, have some changes. When compared to year 2013, there was a percentage decrease in cases of cannabinoid detection (15%), stimulants (15%), anabolic agents (15%) and absence of hormone detection cases. The author Ribeiro (2015) <sup>[10]</sup> also affirms that the decrease of the percentage in some of the substances may possibly be explained by a greater effectiveness of the National Anti-Doping Plan, characterized by the performance of out-of-competition controls at times considered to be at greater risk.

## 2.2. Fighting Doping in Sports

In the Olympic Games of 1960, in Rome, the death of a Danish cyclist, Knut Enemar Jesen, by the abusive use of amphetamines occurred. The goal of the athlete would be to improve the times in the performance of their tests (Kayser *et al.*, 2007; Lippi *et al.*, 2008; Mazzoni *et al.*, 2011). After this and many other similar events, anti-doping measures were implemented. Some sports federations (International Football Federation, International Cyclist Union and International Modern Pentathlon Union) have begun to organize the first lists of illicit substances for their respective sports (Mazzoni *et al.*, 2011 cited by Ribeiro, 2015) <sup>[10]</sup>. On the other hand, the International Olympic Committee (IOC) has begun to worry about the control of doping and to improve methods of detecting banned substances in sport (Bella *et al.*, 2009; Kayser *et al.*, 2007). Subsequently, the IOC Medical Commission issued the first list of banned substances for the 1968 Olympic Games in Grenoble (Winter Games) and Mexico (Summer Games) (Mazzoni *et al.*, 2011; Thieme, 2010).

In 1999, the World Anti-Doping Agency (WADA) was created linked to the IOC with the following objectives:

1. Combat World Doping;
2. Formulate means of research for the detection of prohibited substances and methods;
3. Unify all rules and irregularities (Bella *et al.*, 2009, Kayser *et al.*, 2007).

WADA is an international and independent organization created in 1999 by the sports movement and various government entities to promote, coordinate and control the fight against illicit drug use in sport. Based on this objective, they have developed the World Anti-Doping Code (CODE), a universal document that establishes anti-doping rules and programs to ensure that all athletes, regardless of their sport or the country in which they compete, benefit from the same anti-doping policies and procedures (World Anti-Doping Agency, 2015) <sup>[15]</sup>. CODE acts in conjunction with five international directives:

1. List of prohibited substances and methods (identifies all prohibited methods and substances);
2. International standard for tests and investigations (it consists of an effective planning in order to maintain the integrity and the identity of the samples from the notification of the athlete to the transport of the samples for analysis);
3. International standard for laboratories (guarantees that the results of the anti-doping tests are valid, uniform and made in accredited laboratories);
4. International standard for authorization of therapeutic use (rules the use of prescription medication in the same way in all countries and sports);
5. International Standard for the Protection of Private Information (Ensures that all parties involved in the fight against doping adhere to privacy standards when using or obtaining information regarding athletes) (World Anti-Doping Agency, 2015) <sup>[15]</sup>.

**Table 2:** Prohibited substances and methods

General substances	Type	Chemical substances
<ul style="list-style-type: none"> <li>▪ S0 - Substances not approved;</li> <li>▪ S1 - Anabolic agents;</li> <li>▪ S2 - Hormones, Growth Factors;</li> <li>▪ S3 - <math>\beta</math>-2 agonists;</li> <li>▪ S4 - Metabolic hormones and modelers;</li> <li>▪ S5 - Diuretics and agents.</li> </ul>	Prohibited substances during and outside competitions (World Anti-Doping Agency, 2015) <sup>[15]</sup>	<p>Particularly cycling is a sport of great resistance and therefore banned substances / substances not officially approved are many. Usually the majority of sports are as follows:</p> <ol style="list-style-type: none"> <li>1. <b>Erythropoietin (EPO):</b> It is an endogenous hormone of glycoprotein nature, produced in the kidneys (90%) and in the liver (10%). EPO production appears when the number of red blood cells is below normal or when the oxygen rate is below the limit (Martínó, 2017)<sup>[9]</sup>. The use of EPO by athletes is due to the fact that it is responsible for the production of red blood cells, increasing the oxygenation of the tissues, and consequently increase the resistance and decrease the recovery time. Side Effects: Increased blood viscosity, which results in an increased risk of potentially fatal diseases such as heart disease, acute myocardial infarction, and cerebral or pulmonary embolism. Prolonged use of EPO may cause medium erythroid aplasia by anti-erythropoietin antibodies, resulting in severe anemia (Martínó, 2017)<sup>[9]</sup>.</li> <li>2. <b>Stimulants:</b> All stimulants are included, with effect on the central nervous system, increasing the stimulation of the metabolic and cardiac system. Examples are amphetamines, cocaine, ephedrine and caffeine (Martínó, 2017)<sup>[9]</sup>. The use of these stimulants aim to achieve the same effect of adrenaline (Martínó, 2017; Docherty, 2008)<sup>[9]</sup>. And they aim to reduce fatigue, increase alertness and strength. They are usually administered on competition days and during training, so that they are more intense (Thieme, 2010). Side Effects: Anxiety, irritability, nervousness, agitation, chest pain, respiratory failure, increased blood pressure, rupture or spasms of cerebral blood vessels, gastrointestinal problems (use of cocaine) (Avois <i>et al.</i>, 2006; Benzaquen, 2001). Inhibiting the signs of fatigue and heat leads the athlete to exceed their physical limits, increasing the probability of accidents involving third parties and until the death of the athlete. The doses administered depend on the desired effect and the effort to be performed, and at high doses, the probability of behavioral changes increases, such as aggressiveness, decreased alertness, euphoria and decreased sense of responsibility. With prolonged use, memory loss, lack of energy and lack of concentration, physical and psychic dependence, and in the absence of regular use of the substance, abstinence syndrome (ADOP, 2016) can occur.</li> </ol>
<ul style="list-style-type: none"> <li>▪ S6 - Stimulants;</li> <li>▪ S7 - Narcotics;</li> <li>▪ S8 - Cannabinoids;</li> <li>▪ S9 - Glucocorticoids.</li> </ul>	Categories of Prohibited Substances in Competition (World Anti-Doping Agency, 2015) <sup>[15]</sup>	
<ul style="list-style-type: none"> <li>▪ P1 - Alcohol;</li> <li>▪ P2 - <math>\beta</math>-blockers.</li> </ul>	Substances prohibited in private sports (World Anti-Doping Agency, 2015) <sup>[15]</sup>	
<ul style="list-style-type: none"> <li>▪ M1 - Handling of blood and its constituents;</li> <li>▪ M2 - Chemical or physical manipulation;</li> <li>▪ M3 - Genetic Doping.</li> </ul>	Prohibited Methods (World Anti-Doping Agency, 2015) <sup>[15]</sup>	

Source: Adapted from Martínó, 2017<sup>[9]</sup>.

### 2.3. Doping in cycling

Doping in addition to interfering with the competitive environment also has negative consequences both at the individual level and potential health problems due to the use of certain substances and at the aggregate level, such as reputation issues of a particular modality and the loss of credibility in the professional athletes, resulting in a great social loss, exemplified by the case of cycling, which lost credibility after the various doping scandals throughout its history. To the extent that, cycling is one of the most well-known modalities in the doping universe (Fairbanks, 2018)<sup>[4]</sup>. In 1968, the International Olympic Committee decides to carry out doping controls for the first time in the Olympic Games, also Portugal at the request of the Director General of Sports, conducts the first doping control. This event, took place during the return to Portugal by bicycle. In the late 1960s and throughout the 1970s, the vast majority of doping controls were conducted on cycling and in accordance with the regulations of the Union Cycliste Internationale. The controls performed in 1969 and 1984 resulted in 11% of positive tests (Martínó, 2017)<sup>[9]</sup>.

Over time, it's not just talent, dedication, training and healthy eating. Most professional cyclists apart from the pressure from the public and sponsors to get good results, also have deals with the media, which for exclusivity or publicity privileges, cover up doping cases (Fairbanks, 2018)<sup>[4]</sup>.

In cycling cases of doping are caused by chemical substances or even mechanical fraud. In recent years, a type of doping that does not cause physical damage, which is mechanical doping, has emerged in cycling. This doping consists of a motor hidden in the frame of the bicycle, connected to the pedal, which increases speed up to 5km / h when actuated by

a button on the handlebar (Furtado, 2017)<sup>[5]</sup>.

This mechanism, which increases the speed of the bicycle has already been identified in world events and at the Olympic Games (Furtado, 2017)<sup>[5]</sup>.

One of the most media-laden cases of non-mechanical doping is that of the American Lance Armstrong, considered a true legend, for having won one of the world's most prestigious cycling competitions seven times in a row, Tour De France (1999 and 2005) (Fairbanks, 2018)<sup>[4]</sup>.

Floyd Landis was the first athlete to lose the 2006 Tour de France title when a test tested positive for synthetic testosterone at a particular stage of the competition. Landis then denounced the doping scheme experienced by the US Postal cycling team, led by Lance Armstrong during the years 1998 to 2005. Floyd detailed the functioning of the blood transfusion mechanism and drug use that improved the performance of athletes belonging to the team that composed the great doping scheme experienced during that period. Although Floyd does not present evidence, US authorities have taken the case forward and the Food and Drug Administration (FDA) opens an investigation for the team and consequently for Lance Armstrong (Fairbanks, 2018)<sup>[4]</sup>.

Two years after the complaint, the US Anti-Doping Agency concluded the investigations and Armstrong took up the use of Erythropoietin (EPO) and lost all titles obtained, as well as being withdrawn from competitive cycling by the International Cycling Union (Fairbanks, 2018)<sup>[4]</sup>.

The institution noted that, along with its manager Johan Bruyneel, Armstrong led the most sophisticated, professionalized and assertive doping program sport has ever experienced (Fairbanks, 2018)<sup>[4]</sup>.

### 3. Conclusions

There are already many entities concerned with the control of doping and to categorize this phenomenon in detail in order to combat it. However, it would be interesting in future studies to understand how these control processes are actually applied, as well as the effectiveness / viability they have in practice.

Concluding the use of drugs in sport has been increasing, and some still cannot see in the tests that are done before the tests. And some of the sports people have consumed a lot of illegal substances, leading many of them to certain death, one of the factors being the pressure that they are exposed making the decision to consume illicit substances easier.

However, the author (WEINECK, 2005) classified the various types of illicit substances into four classes, and in class A are the stimulants and in this are inserted the amineptin and caffeine, where they are the most known and the most commonly mentioned. In Class B we have the narcotics where morphine and diamorphine are inserted. Class C contains anabolic steroids such as testosterone which is actually the most commonly referred to and best known in this class. Class D includes the diuretics in which bumetanide is inserted; finally, in class E, we find the peptide hormones, mimetic and related substances in which the growth hormones (hGH) are inserted, which are undoubtedly also one of the most talked about and used in this class.

In addition to the use of prohibited substances, cycling doping has advanced to mechanical doping and it would be interesting to investigate whether other modalities use alternative methods using technologies or other more advanced forms in the face of technical progress, or substances not yet prohibited and why escape the practice of fraud in the form of doping.

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