



Impact of Drugs on Sports Performance

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ABSTRACT

Today, there are as many performance enhancing drugs (PEDs) as there are sports, and it's a big job trying to keep up with them all. In 1999, an independent international organization, the World Anti-Doping Agency (WADA), was established. More than 192 banned drugs and "performance enhancing methods" (such as blood doping) are registered by WADA. Some of the most popular PEDs include anabolic steroids, human growth hormone, erythropoietin (EPO), beta blockers, stimulants, and diuretics. Medical experts see significant dangers in the use - and particularly the blatant overuse - of anabolic steroids. Amphetamines can damage the liver, kidneys, and cardiovascular system and cause hallucinations and violent behavior. If the EPO levels are too high, the body will produce too many red blood cells which can thicken the blood, leading to clotting, heart attack and stroke.

Keywords: Anabolic Steroids, Human Growth Hormone, Erythropoietin (EPO), Beta Blockers, Stimulants, and Diuretics.

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INTRODUCTION

Modern sport is beset with suspicions that many top athletes' resort to drugs - doping - to improve their performance, but this is not a new phenomenon. Its origins can be traced back to the ancient Olympic Games, where competitors drank "magic" potions or ate special foods to gain an advantage over their rivals. The desire to win, driven by economic incentives such as large awards and sponsorship deals, or social pressures such as national gold medal expectations, ensures that there is a constant market for drugs, which will improve performance [1].

Today, there are as many performance enhancing drugs (PEDs) as there are sports, and it's a big job trying to keep up with them all. In 1999, an independent international organization, the World Anti-Doping Agency (WADA), was established. More than 192 banned drugs and "performance enhancing methods" (such as blood doping) are registered by WADA, a list that is constantly updated as new drugs appear. A substance may be considered for inclusion on the Prohibited List of the World Anti-Doping Code if it meets two of the following three criteria: 1) It improves or is likely to improve performance.

2) It is or is potentially harmful to health of the athlete.

3) It violates the spirit of the sport.

WADA makes a final decision on whether a substance or method is included on the prohibited list. Both the creation of these drugs and the methods used to detect them involve sophisticated science, with each side (the makers and the testers) constantly innovating to try and stay ahead of the game. While cycling, athletics, weightlifting and swimming have been regularly associated with athletes using PEDs, no sport is immune. From archery to yachting and all sports in between, athletes have sought out drugs to improve their performance or hasten recovery from injury.

TYPES OF PERFORMANCE ENHANCING DRUGS [2]

Some of the most popular PEDs include anabolic steroids, human growth hormone, erythropoietin (EPO), beta blockers, stimulants, and diuretics to name a few. Although such drugs get a lot of publicity, they may not be well understood.

STIMULANTS

Stimulants are drugs that directly affect the central nervous system. They work to speed up parts of the brain and body, increasing the user's heart rate, blood pressure, metabolism, and body temperature. They

are used by athletes to reduce fatigue to increase alertness, competitiveness and aggressiveness. The most common stimulants detected in doping tests are amphetamines, cocaine, ecstasy, and methylphenidate (Ritalin). The actual effects vary depending on the drug and how it is ingested - drugs that are snorted or injected will produce more immediate results than those taken in pill form. Nicotine and caffeine are also frequently used as stimulants, but they are not prohibited in sports. However, both substances are currently on WADA's monitoring program for 2015. WADA is observing them in order to detect possible patterns of misuse in sport.

HEALTH RISKS

Amphetamines can damage the liver, kidneys, and cardiovascular system and cause hallucinations and violent behaviour, while long-term use can alter brain structures involved in memory and emotions.

ANABOLIC STEROIDS

Anabolic steroids are drugs derived from testosterone, a hormone that is produced in the testes of men and, to a much lesser extent, in the ovaries of women. Testosterone is partially responsible for the developmental changes that occur during puberty and adolescence and also participates in the control of the accumulation and breakdown of major biochemical components of all tissues, including muscles. Athletes who use anabolic steroids claim that in addition to increasing muscle mass, they reduce body fat and recovery time after injury. But androgenic (masculinizing) side effects - like increased body hair and deepening of the voice - aren't always desirable, especially in women. To counteract these side effects, scientists have developed steroids that retain their anabolic effects but have a weaker androgenic effect.

HEALTH RISKS

Medical experts see significant dangers in the use - and in particular the blatant overuse - of anabolic steroids. Some of the effects are minor or only last while you are taking the medicine; others are more serious and long term. For example, anabolic steroids can cause high blood pressure, acne, abnormal liver function, alterations in the menstrual cycle in women, decreased sperm production and impotence in men, kidney and heart disease. They can also make men and women more aggressive.

HUMAN GROWTH HORMONE [3] [1]

Human growth hormone (HGH; also called somatotropin or somatotrophic hormone) is a naturally occurring hormone produced in the human body. It promotes physical development - especially bone growth - during adolescence. It stimulates the synthesis of collagen, which is needed to strengthen cartilage, bones, tendons and ligaments, and also stimulates the liver to produce growth factors.

In adults, HGH increases the number of red blood cells, stimulates heart function, and makes more energy available by stimulating the breakdown of fat. Other effects attributed to HGH include increasing muscle mass and strength as well as tissue repair (recovery). However, as HGH is often used in conjunction with other PEDs, its direct role in these benefits is not proven. Still, it's pretty easy to see why athletes think it will improve their performance.

HEALTH RISKS

If you believe all of the hype - mostly from drug manufacturers - HGH is a wonder drug that will remove wrinkles, reverse the aging process, restore vitality, and improve sleep. However, there are some health risks.

For example, too much HGH before or during puberty can lead to gigantism, which is excessive growth in size and other physical attributes. After puberty, swollen HGH levels can cause acromegaly, a condition characterized by excessive growth of the head, feet, and hands. The lips, nose, tongue, jaw and forehead increase in size and the fingers and toes widen and take the shape of a spade. Organs and digestive system can also increase in size, which can eventually lead to heart failure. People with acromegaly often die before the age of 40. Excessive use of HGH in adults can also lead to diabetes; muscle, joint and bone pain; osteoarthritis; cardiac limitations; hypertension; and increased abnormal symptoms of cardiovascular disease.

BLOOD DOPING

Blood doping is the use of various methods and substances to increase the mass of a person's red blood cells. Higher levels of red blood cells in the blood cause more oxygen to be transported to the muscles, resulting in increased endurance and performance. There are three main types of blood doping:

- erythropoietin (EPO)
- synthetic oxygen carriers
- blood transfusions

ERYTHROPOIETIN (EPO) [1]

Erythropoietin, better known as EPO, has long been the drug of choice for endurance athletes. Produced naturally by the kidneys, EPO is also available in pharmaceutical form. EPO stimulates the production of red blood cells in the bone marrow and regulates the concentration of red blood cells and haemoglobin in the blood. This is useful for athletes because red blood cells carry oxygen to cells, including muscle cells,

allowing them to function more efficiently. EPO is a peptide hormone and can be produced synthetically using recombinant DNA technology. By injecting EPO, athletes aim to increase their concentration of red blood cells and, therefore, their aerobic capacity. EPO can also improve the body's ability to buffer lactic acid.

HEALTH RISKS [1]

If the EPO levels are too high, the body will produce too many red blood cells which can thicken the blood, leading to clotting, heart attack and stroke. In fact, EPO has been implicated in the deaths of many athletes, primarily cyclists. Repeated doses of EPO can also stimulate the development of antibodies to EPO, which can lead to anaemia. The long-term health risks of prolonged EPO use are still unclear

SYNTHETIC OXYGEN CARRIERS [4]

Synthetic oxygen transporters (SOCs) are proteins or purified chemicals that have this ability to transport oxygen. They are still under development and have not been approved for use outside of South Africa and Russia. SOCs have been developed for use in crisis situations where blood transfusions are not possible or blood products are not available.

There are several types of SOC available. Two of the most common types include hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs). Like red blood cells, they work to supply this oxygen to the muscles, thus increasing aerobic capacity and endurance. However, they also have additional advantages. HBOCs are not only excellent for tissue oxygenation, they can also increase blood serum iron, ferritin, and naturally occurring EPO. They can also increase the production of CO₂ and slow down the production of lactic acid.

HEALTH RISKS

The health risks associated with the use of SOCs are similar to those of EPO - increased risk of heart attack, stroke, and pulmonary embolism. HBOCs have not been deemed safe for human use.

BLOOD TRANSFUSIONS

Blood transfusion is an effective and relatively simple method for athletes to increase the number of red blood cells in their blood, thereby improving their aerobic capacity and endurance. Blood transfusions can be classified as autologous, when the athlete receives pre-prepared doses of their own blood, or allogeneic, when the transfused blood comes from someone else. Athletes who choose to use this method typically begin having blood drawn several weeks before a competition, building up a blood supply of between 450 millilitres and 1,800 millilitres. Plasma is returned to the body during weaning while the corpuscular components - primarily red blood cells (RBCs) - are stored. These can then be injected back into the patient directly before or during a high endurance event.

HEALTH RISKS

The risks of using blood transfusions to increase red blood cells are similar to the risks of using EPO and SOC: thickening of the blood leading to clotting, heart attack and stroke. Another risk concerns the process itself. Since transfusions involve several stages - blood collection, storage and reuse - there are many possibilities for something to go wrong. Contamination of blood or material, infection and improper administration of blood products, which could easily lead to serious health problems or even death.

BETA BLOCKERS

Beta blockers work to block the effects of adrenaline. They work to slow the heart rate, thereby reducing blood pressure, anxiety and muscle tremors, and improving the ability to concentrate. This makes them especially useful for athletes playing sports that require a steady hand like shooting, archery, darts, billiards, and even golf. Beta-blockers are prohibited by several sports (darts, racing) during competition, but others (archery, shooting) prohibit their use at any time.

There are over 20 types of beta blockers available. They can be taken orally, by injection or (in the treatment of glaucoma) as eye drops. Some common beta blockers include:

- Propranolol
- Metoprolol
- Atenolol
- Bisoprolol
- Esmolol.

HEALTH RISKS

When used for a legitimate medical reason, for example to treat heart disease, anxiety related to high blood pressure, and under the direction of a trained professional, beta blockers have a good safety record. When used without a legitimate health reason, side effects can include reduced circulation to the hands and feet, dizziness, fatigue, dry mouth, and drowsiness. More serious side effects (although rare) can include impotence, asthma attack, memory loss, or heart failure.

DIURETICS

Diuretics work to promote urine production. While raising your hand for a toilet break might not be considered professional in modern sport, athletes use diuretics to help with weight loss (water loss through urination leads to overall body weight loss). This is especially useful in sports where weight is critical such as boxing, rowing or horse racing. An added benefit of all of these toilet breaks is that other drugs in the system could also be "flushed" out of the body more quickly. The increase in urine volume also facilitates the dilution of doping agents and their metabolites. All classes of diuretics are considered "masking agents" by WADA and are prohibited both in and out of competition. Diuretics have been banned in sport since 1988.

There are over 20 diuretics banned by the IOC and WADA. Some examples include:

- Hydrochlorothiazide
- Desmopressin
- Probenecid
- Amiloride
- Metolazone

HEALTH RISKS

When used to treat legitimate medical conditions such as heart failure, high blood pressure, kidney and liver problems, and glaucoma, and under the supervision of a qualified physician, the use of diuretics is recommended.

However, since diuretics promote frequent urination, when used without medical supervision, they can lead to dehydration, dizziness, muscle cramps, and constipation. Other side effects include fatigue, fever, rash, and loss of appetite. More serious effects include disturbances of the heart's normal rhythms and electrolyte abnormalities, which can affect kidney function.

CONCLUSION

All doping drugs have immediate or short-term side effects, but scientists are always researching what long-term effects they can have on the body. Some studies have found evidence of early mortality from cancer or heart attack in previous long-term PED users. The 2013 study, which was conducted in mice, found that muscles can retain some of the benefits gained from using anabolic steroids for years or even decades after taking the drugs. On January 1, 2015, WADA introduced tougher punishments for doping, including increasing the bans from two to four years. There are also tougher punishments for coaches, coaches, and administrators who have assisted athletes with doping.

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