The Doping Debate: Can science stamp out doping in South African sport

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Abstract

This essay sets out the contributing factors to doping in South Africa, and the challenges faced by scientists who wish to stamp it out. The number of cases in South Africa of athletes doping has more than doubled from 2009 to 2010. The number of adolescent athletes using drugs is increasing, and these are school and university students who are unaware of the strengths and side-effects of the performance enhancing drugs they are offered or buy at local chemists. The production of scientific tests to detect the use of drug enhancements or blood doping can take up to 20 years. However, science is also on the side of the athletes, creating new drugs that are able to cheat the screen detectors. It is estimated that 120 new drugs are formed a year. Anti-doping scientists cannot keep up or predict what new drug will be developed next. Athletes have also found ways to cheat the testing system by working in teams, warning each other about unannounced tests, changing ticket destinations at the last minute and skipping certain races. They dope regularly and at night to reduce variation in their system. Clean urine samples and dilatants are used to taint the laboratory results. Serious health defects might create a general fear amongst athletes and reduce the use of doping, but as with other risks that the law warns us against, people refuse to co-operate. The longer it takes to stamp out doping in sport, the harder it will become to detect the drug use by everyday citizens – bus drivers, lawyers and teachers – because masking our physical conditions will only develop as a phenomenon. South Africa is a drug-dependent country; we are a 'quick-fix, get-rich, more-is-better' society where dishonesty and manipulation are means used by people to reach the top. Therefore, every citizen is culpable for creating this type of atmosphere.

INTRODUCTION

Doping has become a serious problem in the world of sport and South Africa is no exception. Statistics show that the demand for harmful substances has been growing rapidly –there was a 100% increase in positive tests for doping from 2009 to 2011 (Nkosi,). Shuaib Manjra, chairman of the South African Institute for Drug Free Sport, said, "Our SA doping control stats clearly show the use of performance enhancing drugs is on the increase among adolescent athletes and among the adult population". These athletes are uneducated about the legality and form of harmful drugs they are injecting (Mjikeliso,).

This essay shows that the rapid rate at which different drugs are developing means that our medical researchers and doctors cannot stay up-to-date with effective, legalised, appropriate testing methods in order to successfully stamp out doping in South Africa. In addition, cheating athletes have access to the same science as the sports' bodies trying to prevent doping and stay ahead of scientific developments. Lastly, science cannot respond to all the social factors that contribute to a culture of doping in sport.

BODY

Doping in sport is the deliberate use of an illegal substance (drug enhancements) or method (blood doping) which is prohibited according to the list published by the International Olympic Committee. This ban protects athletes from the unfair advantage gained by those who use substances or illegal methods to enhance their performance, and protects them against the harmful side-effects which some forms of doping can produce (Technische Universität München, .).

There are four common forms of drug enhancement for which tests have been produced. Stimulants, such as amphetamines, increase wakefulness and focus by reducing fatigue and appetite (Wikipedia contributors,). Anabolic steroids, such as nandrolone, are used in the treatment of postmenstrual women with osteoporosis, and so aid muscle growth, increase the level of red-blood cell production and bone density (Wikipedia contributors,). Diuretics, in addition to helping an

athlete lose weight, are also used as masking agents which serve as protection against the detection of another banned substance. Both erythropoietin (EPO), and the third generation EPO, known as continuous erythropoiesis activator (CERA), are blood doping agents (Wikipedia contributors,). They are hormones found naturally in the body, released by the kidneys to stimulate the production of red blood cells, increasing the amount of oxygen sent to the muscles and buffering lactic acid (Kitchen,). Additional doses boost athletes' endurance and encourage a quicker recovery.

Drug screenings may involve the testing of urine, hair follicles, blood or saliva. The South African Institute for Drug-free Sport (.) found 29 athletes, in all sport codes, guilty of illegal drug use in 2012. The most commonly used drugs were methylhexaneamine, cannaboids and nandrolone. The sports codes with the highest number of doping violations were athletics (9) and rugby (7).

Blood doping increases the amount of haemoglobin (an oxygen-carrying agent) in the blood, which is beneficial because the body uses up to 20 times the rate of oxygen during strenuous exercise compared to when at rest (Schwartz,). Blood doping is achieved by athletes using someone else's or even their own blood. Homologous transfusion, where one to four units of blood from someone of the same blood type are transfused increases the amount of haemoglobin in the recipient's bloodstream. Autologous transfusion, on the other hand, involves athletes withdrawing their own blood, with high levels of haemoglobin, storing it and then re-infusing it before competition. Haemoglobin-based oxygen carriers (HBOCs) are red-blood cells substitutes but diffuse oxygen better, increase carbon dioxide and lower lactic acid production (Wikipedia contributors,).

Scientists have developed tests to detect the use of the above mentioned blood doping methods. Detecting for homologous blood doping uses flow cytometry to determine whether blood from more than one person is present by examining the antigens on the surface of the red-blood cell (Wikipedia contributors,). This process took 20 years to develop. Autologous blood doping can be detected by using the optimised CO-rebreathing method, using a spirometer (Wikipedia contributors,), hemoximeter (OSM-3, Radiometer) and a CO-tester (Wikipedia contributors,). This test measures the difference in carboxy haemoglobin concentration (HbCO) before and after breathing (Wikipedia contributors,). The World Anti-Doping Agency (WADA) is leading the development of 'biological passports', which will keep a record of athlete's blood and biological variables over time (Kelland,).

However, despite these advanced testing methods and the best efforts of many within the sports community, it seems athletes, and those who benefit from their success, will always find a way to cheat the system. Because there are scientists on both sides of the doping battle, athletes have the advantage of knowledge of and access to the latest technology. This on-going situation, in which athletes remain one step ahead of the drug monitoring process, is very real in South Africa. With reference to Lance Armstrong, it has been shown possible to cheat the testing system for over a decade (Honan,).

But how do athletes practically beat the system? They dope regularly so that variation is not easily picked up; they use small amounts of the enhancing substance and dose at night to extend the period in order to pass a test in the morning. As became clear in the Lance Armstrong investigation, athletes also work in groups to avoid tests, making last-minute travel changes, skipping certain races and alerting each other about unannounced tests through text messages (Honan,).

Substances such as detox drinks, shampoos, concentrated synthetic urine substitute and even saliva neutralizing gum have been marketed to beat doping tests (Honan,). Athletes smuggle clean urine samples in a balloon or condom and dilute samples using aspirin, salt, vinegar, bleach, visine, nitrites or chromates, all substances known to interfere with commonly used drug screening technology.

Even today, more advanced doping drugs are being manufactured and released on the market for which scientists have not yet formulated tests. Candidates for new forms of doping for the next Olympics are under development. Four are described here. The first includes the manipulation of

genes to block naturally occurring muscle-growth inhibitors. Secondly, pills have been created that have the same effect and benefits as EPO, causing the body to function as if under low-oxygen conditions thus making it produce more red-blood cells and improving muscle endurance. When oxygen levels are back to normal, the hypoxia-inducible factor (HIF) breaks down and cell formatting stops. However, using an HIF stabiliser ensures that blood production does not stop. The use of vascular endothelial growth factor (VEGF), injected in the heart or limbs, causes blood vessels to grow which, in theory, reduces the energy used to transport oxygen and nutrients between organs and tissues of the body and therefore allows more energy to be expended on athletic performance. Lastly, the beta-endorphin gene, when inserted into the spinal fluid of rats, causes the body to release its own painkilling endorphins by blocking pain signals before they reach the brain, without the side effects of sleepiness and cloudiness produced by other painkilling drugs (Feeley,).

CONCLUSION

It is clear that there is a standoff between the athletes using advanced medical research and technology to cheat the testing system for doping and WADA and the South African Institute for Drug-free Sport. This is due to the fact that the solutions to the problem are not clear. Legality is not enough to encourage people to do the right thing, new technology is constantly being produced and is accessed by both parties. So what can be done to change this situation?

While science is not able to defeat doping on its own, scientists are responsible for determining the biological effects of doping substances or doping methods and calculating the likelihood of a manipulation.

Perhaps a terrible scenario with an athlete who was harmed badly from doping would scare athletes from using drug enhancements. Health risks are increasing with an increase in effectiveness. The risks of taking HIF stabilisers are unknown; unregulated VEGF may promote the growth of tumour cells and metastasis. Raising an athlete's pain threshold in turns leads them to ignore signs of overexertion and injury. However, this undoubtedly will not prevent athletes from using these drugs, just as citizens do not always drive slowly or give up smoking because they know the dangers (Feeley,).

There are the social, economic and political issues involved in the business of sport, the unethical behaviour of athletes, coaches, administrators and doping testing centres who will not abide by the law due to their lack of integrity, their greed for money and status. It must also be remembered that South Africa is a drug-dependent country. We live in this new ‘quick-fix, get-rich, more-is-better’ age and therefore doesn't this make each individual culpable for creating a dishonest, materialistic environment in which cheating is used as a means of reaching the top?

How does one change this culture? With the help of government funding (for research, education, anti-doping activities and international co-operation), raising awareness through workshops about prohibited substances and methods, doping control procedures and relevant aspects of the code of WADA and campaigns aiming to sensitise the public about unethical behaviour and health consequences, progress can be made.

But does the longer it takes to efficiently stamp out doping and the more acceptable it becomes in sport, mean that it becomes acceptable elsewhere? The more common the masking of physical conditions becomes, the more the public is put in danger. Where can the line be drawn between a world of sport and games and the real world, where the implications of this behaviour amongst bus drivers, teachers, lawyers and politicians could result in economic and social chaos?

This essay has shown that doping in sport is a serious issue, fuelled by the interests of many people, with consequences for the morality and health of sportsmen and women, and which cannot be resolved by scientists in isolation from society as a whole.

GLOSSARY

Anabolic steroids are a group of powerful compounds related chemically to the male sex hormone testosterone. Anabolic means it stimulates protein synthesis.

Buffering of acid minimises the change in the acidity of a solution when an alkali is added to the solution.

Cannaboids are a group of substances that naturally occur in the nervous and immune systems of animals.

CO-oximeter is a device that with arterial blood gases measures the oxygen carrying state of haemoglobin in a blood specimen (Wikipedia contributors,).

Flow cytometry is a laser based, biophysical technology employed in cell counting, sorting, biomarker detection and protein engineering, by suspending cells in a stream of fluid and passing them by an electronic detection apparatus. It physically sorts particles based on their properties, so as to purify populations of interest (Wikipedia contributors).

Haemoglobin based oxygen carriers (HBOCs) use modified forms of haemoglobin that are sturdier than the naturally-occurring molecule. They are smaller than RBCs, so they can fit into spaces that RBCs cannot.

Hemoximetry is the monitoring of haemoglobin and oxygen saturation.

Hypoxia-inducible factors (HIFs) are transcription factors (controlling the flow of genetic information in cells) that respond to changes in available oxygen in the cellular environment, specifically, to decreases in oxygen, or hypoxia (Wikipedia contributors).

International Olympic Committee is a Swiss non-profit, non-governmental organisation which organises the modern Olympic Games and Youth Olympic Games, held in summer and winter, every four years.

Methylhexaneamine is a well-known organic compound, marked under many names as a dietary supplement.

Nandrolone is an anabolic steroid that may be present naturally in the human body (Wikipedia contributors,).

Osteoporosis is a disease of the bones that leads to an increased risk of fracture.

Spirometer is an apparatus for measuring the volume of air inspired and expired by the lungs (Wikipedia contributors,).

World Anti-Doping Agency (WADA) was established in 1999 as an international agency responsible for the promotion, coordination and monitoring of the international fight against doping in sport.