CHAPTER-II

REVIEW OF RELATED LITERATURE

Abuse of drugs in sports field is a widespread phenomenon which has been researching mainly in the form of scientific (biomedical) point of view. This phenomenon has evolved greatly in recent years, and greater understanding of it is essential for developing efficient prevention programs. In the psychosocial approach, attitudes are considered an index of doping behavior, relating the use of banned substances to greater leniency towards doping. The aim of this review is to gather and critically analyze the publications describing elite athletes’ attitudes, beliefs and knowledge of doping in sport, to better understand the foundations provided by the previous work, and to help develop practical strategies to efficiently combat doping.

DOING IN SPORT: A REVIEW OF ELITE ATHLETES’ ATTITUDES, BELIEFS, AND KNOWLEDGE.

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The literature search and review was done to collect the detail information on the terms “doping in sport”, “attitudes”, “beliefs”, “knowledge of drugs”, “performance-enhancing substances (PES)” and view of coaches on the matter and its present situation. The study focused on athletes, coaches and their attitudes towards matter, beliefs and knowledge of doping in sport. The psychosocial approaches are also key factors in the fight against doping; the initial reasons given for using banned substances included achievement of athletic success by improving performance, financial gain, improving recovery and prevention of nutritional deficiencies, as well as the idea that others use them, or the “false consensus effect”. Although most athletes acknowledge that doping is cheating, unhealthy and risky because of sanctions, its effectiveness is also widely recognized. There is a general belief about the inefficacy of anti-doping programs, and athletes criticize the way tests are carried out. Most athletes consider the severity of punishment is
appropriate or not severe enough. Anti-doping controls are less exhaustive in team sports. The use of banned substance also differs according to the demand of the specific sport. Coaches appear to be the main influence and source of information for athletes, whereas doctors and other specialists do not seem to act as principal advisors. With the time frame athletes are becoming increasingly familiar with anti-doping rules, but there is still a lack of knowledge that should be remedied using appropriate educational programs. There is also a lack of information on dietary supplements and the side effects of PES. Therefore, information and prevention are necessary, and should cater to the athletes and associated stakeholders. This will allow us to establish and maintain correct attitudes towards doping. Psychosocial programs must be carefully planned and developed, and should include middle- to long-term objectives (e.g. changing attitudes towards doping and the doping culture). Some institutions have developed or started prevention or educational programs without the necessary resources, while the majority of the budget is spent on anti-doping testing. Controls are obviously needed, as well as more efficient educational strategies. Encouragement to sporting institutions is essential to invest in educational programs aimed at discouraging the use of banned substances. Event organizers and sport federations should work together to adapt the rules of each competition to dis incentivize dopers. Current research methods are weak. The standard combination of qualitative and quantitative measurements are recommended, using interviews, questionnaires and, ideally, biomedical tests. Studies should also examine possible geographical and cultural differences in attitudes towards doping.

DOPING IN SPORTS AND ITS SPREAD TO AT-RISK POPULATIONS: AN INTERNATIONAL REVIEW

David a baron, David m martin, and Samir Abol Magd

The creed of the Olympics states: “The important thing in the games is not winning but taking part. The essential thing is not conquering, but fighting well”. As noble a goal as this is, it has little to do with the reality of the modern sports
world. Athletes are rewarded for winning at virtually every level of competition. Second place is viewed as the “first loser”. A coach’s job security is directly related to his team’s success, not that they are simply “fighting well”. Given this reality, it is not surprising that athletes and coaches will sacrifice and risk a great deal in order to obtain a competitive edge and enhance performance at all costs. Performance enhancement in Olympic and professional sport has now become a medical, ethical, and legal problem for modern athletes and athletic organizations. This is primarily due to the amount of money associated with winning in today’s sports industry. Multimillion dollar contracts, appearance fees, international endorsement and sports merchandising represent a billion dollar industry that offers today’s athletes, their sponsors and entourage previously unheard of financial gains. When Sports Illustrated interviewed a cohort of elite Olympic athletes, one of the questions was: “If you were given a performance enhancing substance and you would not be caught and win, would you take it?” 98% of the athletes responded “Yes”. The more chilling question was: “If you were given a performance enhancing substance and you would not be caught, win all competitions for 5 years, then die, would you take it?” More than 50% said “Yes”.

Athletic performance enhancement can be gained using various diets, training routines and hard work. However, it can and has been achieved since ancient competitions by using a wide variety of physiological, mechanical and pharmacological doping techniques. As prize money and endorsement rewards increased, so did the science and abuse of performance-enhancing techniques. Today no sport is spared the cloud of cheating using illegal performance enhancement. Driven by the millions of dollars now routinely available for winning a sporting event, unethical pharmacists, medical professionals, trainers and sports organizations have worked secretly, and at times without their athletes’ consent, to develop sophisticated doping programs where performance is optimized, often at the risk of the athletes’ health. Now, these same doping programs are moving out of the professional sports market to our youth and other at-risk populations at alarming rates.
There are several hundred forms of known and potentially more unknown doping substances and techniques abused by professional athletes worldwide. This review will provide a summary of the history of doping in sport, and focus on the most commonly abused substances: anabolic androgenic steroids, human growth hormone (HGH) and erythropoietin (EPO).

HISTORICAL OVERVIEW OF DOPING

Performance-enhancing drugs are not unique to modern athletic competition. Mushrooms, plants and mixtures of wine and herbs were used by ancient Greek Olympic athletes and Roman gladiators competing in Circus Maximus. Various plants were used for their stimulant effects in speed and endurance events as well as to mask pain, allowing injured athletes to continue competing.

In the 1904 Olympics, marathon runner Thomas Hicks used a mixture of brandy and strychnine and nearly died. Mixtures of strychnine, heroin, cocaine, and caffeine were used widely by athletes, and each coach or team developed its own unique secret formulae. This was common practice until heroin and cocaine became available only by prescription in the 1920s. During the 1930s, it was amphetamines that replaced strychnine as the stimulant of choice for athletes. In the 1950s, the Soviet Olympic team first used male hormones to increase strength and power. When the Berlin Wall fell, the East German government’s program of performance enhancement by meticulous administration of steroids and other drugs to young athletes was exposed. These well-documented and controlled hormonal doping experiments on adolescent athletes by the East German Sports Medical Service yielded a crop of gold medalists (mostly young females as they responded more dramatically to male hormones). These athletes suffered severe medical abnormalities, including premature death.

The world became acutely aware of the extent and benefits of doping in sport when Ben Johnson’s gold medal was stripped in the 1988 Seoul Olympics for using the steroid stanozolol. The International Olympic Committee (IOC) medical
commission had established a list of prohibited substances in 1967 and introduced anti-doping testing of athletes in the 1972 Munich Games. It was clear at this point that doping did work and, if gone undetected, would win gold medals. East German scientists from the state-run doping programs at Kreischa and Leipzig, who were disgraced in their own country, where now in demand in Asia, former Soviet Block nations and sports organizations worldwide that wanted to promote their status. Doping became so prevalent in Olympic sport that some argued that all records should be discarded or put on hold until all forms of doping could be detected and stopped. Through the 1980s and 1990s, clandestine doping programs spread from sport to sport guided by modern, albeit unethical, pharmacists and sports medicine professionals. In 1999, the IOC organized a World Conference on Doping in Sport in response to a shocking discovery of massive amounts of performance enhancing drugs and paraphernalia by French police at the 1998 Tour de France. It was at this meeting that an independent global agency was founded, the World Anti-Doping Agency (WADA). Its mission was to work independently of the IOC, sports organizations and governments to lead the fight against doping in sport.

Despite years of aggressive anti-doping testing by international sports federations such as those for cycling, athletics and soccer, steroid abuse scandals involving high profile athletes continue to be front page news across the globe. Professional sports in the United States are not subject to extensive anti-doping programs, as players’ unions and collective bargaining agreements prevented such extensive testing to be put into place. However, they did establish limited anti-doping programs, as the professional sports organizations recognized the potential of doping to harm athletes and their sport. In 1998, when Mark McGuire, an American baseball player, broke Roger Marris’ home run record, it was revealed that he had been taking a supplement containing a precursor to nandrolone, a steroid. At that time Major League Baseball did not ban steroids and did not believe that steroids were a problem within the league. However, subsequent government investigations and former players revealed that steroid abuse was a problem in the League, which resulted in a limited steroid testing program.
In 2003, another significant event in the understanding of the institutional nature of doping occurred. A syringe was anonymously sent to a WADA-accredited laboratory in Los Angeles that contained tetra hydro gastronome (THG), a “designer” steroid that was not known and not on the current WADA prohibited list, made specifically to avoid detection by modern anti-doping technologies. This led to a series of investigations resulting in the indictment and subsequent conviction of individuals running a performance-enhancing program for professional athletes at the BALCO pharmacy in San Francisco.

In May 2006, Spanish police arrested five people and seized a variety of banned performance-enhancing drugs and blood-doping supplies at a Madrid doping clinic. Here, professional athletes would receive medically-supervised injections of hormones and other performance-enhancing drug regimes. The 40-page police report included a clear paper trail of doping procedures on at least 50 professional cyclists. The report was given to the International Cycling Union, which led to the disqualification of 23 professional cyclists, virtually all the top contenders from the 2006 Tour de France. The final of the 2006 Tour was also tarnished, as the champion, Floyd Landis, was found to have a positive anti-doping test for steroids. Landis was stripped of the championship and discharged from his team. At this writing the result is being challenged by Landis and his legal and medical experts, claiming that the test was invalid since several errors were made in the collection, analysis and reporting of the results.

In a separate investigation in Paris in 2006, 23 individuals were sentenced to 4 years in jail for trafficking a cocktail of amphetamines and other performance-enhancing drugs known as “Belgium Pot” to professional cyclists. Making this problem even more complex, in the June 2006 issue of the Journal of Applied Physiology, an article from Stanford University reported that Viagra can be used to increase by approximately 45% the performance of cyclists in high altitudes, suggesting a whole new class of performance-enhancing drugs not restricted to cycling. In October of that same year, the cricket world was shocked to learn that
two Pakistani fast bowlers, Shoaib Akhtar and Mohammad Asif, tested positive for the steroid nandrolone.

This brief overview suggests not only the historical and institutional nature of doping by athletes, but also the international development of a clandestine and sophisticated distribution network of black market doping programs that follows the modern sports industry. Today perform-ance-enhancing programs and drugs are not the exclusive province of elite athletes, but have spread to health clubs, high schools and other at-risk populations, creating an over $1.4 billion US dollar industry that is growing daily as new compounds are synthesized and marketed.

KNOWN DOPING SUBSTANCES AND TECHNIQUES

There are literally hundreds of known doping substances and an equal number of designers, veterinary, and yet to be identified drugs and techniques abused in sports today. The 2006 WADA list of prohibited substances includes the following major categories: anabolic agents (i.e., exogenous anabolic androgenic steroids such as androstendiol, boldenose, closterbol and danazol; endogenous anabolic androgenic steroids such as dihydroxytestosterone and testosterone, and other anabolic agents such as clenbuterol and tibolone); hormones and related substances (i.e., EPO, HGH, insulin-like growth factors, mechno growth factors, gonadotropins, insulin and corticotrophins); beta-2 agonists (i.e., terbutaline, salbutamol, etc.); agents with anti-estrogenic activity (i.e., anastrozole, letrozole, clomiphene, etc.); diuretics (furosemide, hydrochlorothiazide, etc.) and other masking agents (such as epitestosterone, probenecid, plasma expanders, etc.); stimulants (amphetamines, ephedrine, cocaine, etc.); narcotics (morphine, oxycodone, etc.); cannabinoids (marijuana, hashish), and glucocorticosteroids (allowed externally but not internally). WADA also lists prohibited methods, including enhancement of oxygen transfer (blood doping, efaproxial, etc.), chemical and physical manipulation (tampering or substitution of sample) and gene doping.
In addition, WADA prohibits alcohol and beta-blockers (in specific sports: archery, billiard, etc.

Testing for the above list of compounds is technically challenging, expensive and only performed by about 35 WADA-accredited laboratories worldwide. Steroids are still the most detected performance-enhancing drugs by WADA laboratories. However, because of the limitations of laboratory technology and sophistication of doping athletes to avoid detection, they may not be the most abused.

**Anabolic androgenic steroids**

Anabolic androgenic steroids are naturally occurring male hormones involved in a wide range of physiological functions. Simply referred to as “steroids”, they fall into two categories: endogenous or naturally occurring, like testosterone, and exogenous or synthetic, like danazol.

In 1923 Bob Hoffman formed the famous York Barbell Company in the United States. A dominant figure in US weightlifting, he published the Strength and Health magazine and sold health and food supplements in his gym. As a weightlifting coach, his success led to him being named the head coach of the US Olympic weightlifting team. At the 1954 World Championships in Vienna, he met with a Soviet colleague who told him of a synthetic form of testosterone developed by the Nazis which produced dramatic improvements in strength and power. He and his colleagues contacted Ciba Pharmaceuticals in pursuit of synthetic testosterone. Ciba had conducted a number of studies on the use of synthetic testosterone in pain patients and the physically disabled. This resulted in the development of danazol, which rapidly became a doping substance abused by weightlifters.

Although steroids were first reported to be abused in Olympic sports in the 1950s, the abuse of steroids in young male non-Olympic athletes was not reported until the 1980s. As demand increased, trafficking steroids at schools and gyms became common and the use of steroids was seen in younger and younger
populations. Steroid sources included doctors, trainers, friends, the black market and foreign suppliers. In the United States, the Anabolic Steroid Enforcement Act of 1990 brought anabolic steroids under the record-keeping, reporting, security, prescribing, import and controls of the Controlled Substances Act. All manufacturers and distributors of steroids were required to register with the Drug Enforcement Agency. Other countries have similar laws on the manufacture and dispensing of steroids. However, the amount of illegal steroids entering the United States and distributed to athletic and at-risk populations has increased dramatically. It is now estimated to be an over 100 million US dollar black market for steroids in the US alone, with more than 80% manufactured in Mexico. Projecting these figures internationally suggests that the illegal steroid market alone approaches a billion US dollars annually, clearly making it a public health concern, especially for at-risk groups.

The serious side effects of steroids described in the medical literature include liver function abnormalities, liver and kidney tumors, endocrine and reproductive dysfunctions, testicular atrophy, lipid and cardiac effects and psychiatric symptoms. These consequences are exaggerated with the common doping practices using ten times or more the recommended medical dose, and multiple drugs or “stacking”, e.g., steroids and EPO or HGH. Added to this, a new problem has emerged with the manufacture of “counterfeit” drugs by unregulated pharmacies, which are tainted with impurities, contain no medication, or are potentially harmful. Now, more so than in the past, when an athlete buys performance-enhancing drugs from a friend or at the gym, he will never know exactly what is being bought or taken. Steroids are sold on the internet ranging in price from $50 to $200 per regime, depending upon the type of steroid and doping program selected. These black market steroids may or may not contain any medication at all or may contain harmful material. Testing for steroids in urine is available at a few commercial clinical laboratories in the United States and can be obtained in the price range of $100-$200/test, depending upon the number of steroids screened.
Human growth hormone (HGH and RHGH)

HGH is a naturally occurring hormone produced by the anterior pituitary gland and is one of the major hormones influencing growth and development. Harvey Cushing discovered the hormone in 1912 and isolated it from human and monkey cadaver brains in 1956. Two years later it was used to treat dwarfism in children by injection. The unfortunate development of Creutzfeldt-Jakob disease, a degenerative brain disorder, in boys who were treated with cadaver growth hormone led to the discontinuation of all products derived from the human pituitary gland. Because of this ban, the abuse of HGH was rare in sport until the middle to the end of the 1980s. In 1985 Genentech received approval from the US Food and Drug Administration (FDA) to market Protropin for children with growth hormone deficiency. This was the first recombinant DNA form of growth hormone (RHGH) that was safer than cadaver extracts used in the past. Recombinant DNA technology made the production of pharmaceutical grade growth hormone easier and cheaper. Genetically engineered RHGH is now marketed as Nutropin, Humatrope, Genotropin, Norditropin, Saizen, and Tev-Tropoin. Most human growth hormone used in medicine and diverted to sports doping is now obtained by recombinant technology, and is simply referred to as HGH (but it may also appear as RHGH or HGH). Unfortunately, cadaver extracts of pituitary HGH may still be in circulation. It has been reported that a Russian coach was arrested and, upon searching his apartment in Moscow, over 1000 cadaver pituitary glands were found preserved in a large container. Moreover, the problem of counterfeit drugs also exists with HGH: illegal pharmaceutical manufacturers are now flooding the black market with HGH vials of unknown quality and safety. It is estimated that an eight week performance enhancement regime of pharmaceutical grade RHGH will cost about $2000, well out of the range of an adolescent and the majority of weekend athletes. However, the increased trafficking of low cost counterfeit RHGH will create interest and experimentation in these at-risk populations. HGH is marketed on the internet in many forms: pills, drops and aerosol formulations; most are ineffective and shams. The normal route of administration of HGH is injection, posing an additional health
risk of infection from non-sterile counterfeit drugs and the risk of HIV and hepatitis transmission caused by shared needles.

Olympic, professional and weekend athletes abuse HGH because of unsubstantiated reports that it is as effective as anabolic steroids with fewer side effects. They often abuse HGH as a steroid substitute to prevent loss of muscle after discontinuing the use of steroids. Ben Johnson admitted to using HGH along with steroids during investigations after his disqualification in Seoul. According to some controlled scientific studies, HGH does not increase muscle strength. Nevertheless, the abuse of HGH in sports is escalating, with large caches of needles and vials of HGH being confiscated at sporting events worldwide. Six months prior to the 2000 Olympic Games, a pharmacy in Sydney was broken into and 1,575 multiple dose vials of HGH were taken while nothing else was touched. Also, on their way to Australia, the Chinese swimming team was detained, as needles, syringes, and vials of HGH were found by customs officials in their baggage.

Using HGH may lead to life-threatening health conditions, especially since some estimates report that athletes who use HGH to enhance performance are taking 10 times the therapeutic dosage. Some reported side effects of HGH are abnormal bone growth, hypertension, cardiovascular disease, cardio myopathy, glucose intolerance, colonic polyps, decreased life span, and cancer.

Since HGH is a naturally-produced hormone and RHGH is similar in structure, testing for doping with RHGH has been a technical challenge only recently solved by WADA certified laboratories. Routine blood tests for HGH available at clinical laboratories will not differentiate HGH from RHGH and are of no value in determining if an adolescent or weekend athlete is doping.

**Erythropoietin (EPO)**

EPO is a naturally occurring hormone produced by the kidney that stimulates red blood cell production in the bone marrow in response to low circulating oxygen levels. It was not until 1977 that it was identified and extracted
from human urine. This was concurrent with the development of recombinant DNA technology, and in 1989 Epogen was released in the United States and approved for the treatment of anemia. Procrit was licensed in 1991 for the treatment of chemotherapy-induced anemia. European formulations include Aranesp, Eprex and NeoRecorman.

EPO abuse in sport was believed to start as soon as the drug was available as a replacement for the older, more complex and dangerous doping technique referred to as “blood doping”. In this technique an athlete donates his own blood several months before a competition, stores it and transfuses it back into himself prior to competing. This technique is fraught with problems and health risk. EPO accomplishes this same effect by increasing red blood cells, which results in more oxygen in circulation. It was in 1998 at the Tour de France that French customs arrested Willy Voet, a physiotherapist of the Festina cycling team, for the illegal possession of needles, syringes and over 400 bottles containing EPO, HGH, steroids, amphetamines, narcotics and stimulants.

EPO used for medical treatments can cost thousands of US dollars a month and is administered by intravenous or subcutaneous injection. As with steroids and HGH, doping with EPO is often injected in supernormal doses that could cause increased blood viscosity, deep vein and coronary thromboses, cerebral thromboses, pulmonary embolism, arrhythmias, stroke and death. It has been estimated that 20 European cyclists have died since 1987 due to abuse of EPO, making it one of the most deadly doping agents. The genetically engineered form of EPO is indistinguishable from naturally occurring EPO, making routine blood testing useless to determine if an athlete is doping. At the 2000 Olympic Games in Sydney, the Australian WADA-certified laboratory first launched a sophisticated anti-doping test for EPO that required both urine and a blood sample. Over 300 tests were performed for EPO for the first time in Olympic history and no positives were reported. This could be due to the fact that the technology for the test was new and questions still existed about the assay.
OTHER AT-RISK POPULATIONS FOR DOPING

Given the above history and current state of knowledge, it is not difficult to understand why there would be over a million abusers of steroids in the United States youth alone. Unlike professional athletes, these at-risk users will not have fame and fortune as a result of using steroids, only the side effects.

Pioneering studies in this area were done by Buckley et al in the early 1980s, when they interviewed 3403 male high school seniors nationwide. Their results reported in 1988 indicated that 6.6% of respondents had used steroids and more than two-thirds of the group started using steroids when they were 16 years old or younger. Twenty percent reported that health professionals were the primary source for obtaining steroids and 38% used injectable steroids. Pope et al studied 1,010 college men for use of steroids and also reported their findings in 1988. The study found that only 2% of the respondents reported using steroids. The authors qualified their finding as potentially underestimating the true prevalence of steroid abuse. However, it is interesting to note that this study found that 25% of those reporting using steroids were not athletes. They abused steroids to improve personal appearance, a problem that continues today and is fueled by the media and “anti-aging” marketing. A review of published reports concluded that 3-12% of high school students used steroids, and of the group of abusers about half were adolescent females.

Contrary to popular belief and supported by Pope’s early findings, steroid abuse is not exclusively related to performance enhancement. Durant reported in 1993 that steroid abuse in ninth graders was associated with use of cocaine, injected drugs, alcohol, marijuana, cigarettes and smokeless tobacco. They then reviewed the 1991 Centers for Disease Control and Prevention Youth Risk Behavior Survey of over 12,272 male and female public and private high school students, and confirmed the earlier finding that there is an association between steroid abuse and multiple drug abuse. In a later review of the 1997 Centers for Disease Control and Prevention Youth Risk Behavior Survey of 16,262 high school students, Miller
reported no significant correlation in male or female steroid-abusing high school students with physical activity, nor were athletic participation or strength conditioning alone associated with lifetime steroid abuse. Rather, they found that athletic participation was less of a factor than behavior problems such as substance abuse, fighting, binge drinking, tobacco use and high risk sexual behavior. They suggested steroid abuse may be part of a much larger syndrome of problem behaviors. In 2002, Irving confirmed Miller’s report that physical activity was not associated with steroid abuse. This group shed light on the fact that male and female adolescent steroid abuse may also be associated with unhealthy attitudes and behaviors to lose, gain or control weight and body shape. Clancy and Yates reported that steroid abusers may have a unique set of clinical differences and are distinct from other drug abusers Bahrke et al associated a number of personal high-risk behaviors and other factors with a partially developed profile of an adolescent anabolic steroid abuser.

What has become evident is that not only high school and weekend athletes are potential steroid abusers. Steroid abuse may also include a wider population of non-athletes who have behavioral problems and may experiment with these now easily available performance-enhancing drugs. Their motivation may not be athletic enhancement, but rather cosmetic and body shaping purposes. To maintain youthful appearances, weekend athletes may experiment with hormones encouraged by “anti-aging” marketing, while adolescent females desirous of the long, lean female media images of “adult women” may use steroids and HGH to reduce fat and increase muscle tone

DISCUSSION

Modern sports and the media’s misplaced fixation on fame, fortune and winning at all costs have unintentionally created a growing market for doping substances. These substances, once only abused by elite athletes, are clearly spreading into our schools and health clubs worldwide. They are being accepted by
a whole new generation of young customers who see reports daily in the newspapers of sports icons accused of abusing drugs only to continue playing, breaking records and claiming fortunes. These same performance-enhancing drugs are also abused by adolescents and weekend athletes and non-athletes who have wider behavioral and health risk problems. In addition, these drugs are now being abused by male and female adolescents for cosmetic purposes in an attempt to achieve the “cut” and sexy look promoted by the media. Continuing educational programs developed for these at-risk populations by national Olympic organizations and athletic federations are important first steps to curb these dangerous behaviors. Testing for performance-enhancing drugs in high schools as a means of early detection, intervention and prevention is now being launched in New Jersey, with other states following their lead. Medical professionals, teachers, coaches and sports organizations must all be made aware of this continuing problem in our adolescent and at-risk populations and contribute to its solution by open, honest discussion. Most importantly, professional athletes must serve as role models and spokesmen for drug-free sport and lifestyle. This position must be actively supported by the media, owners of teams and international sports federations by providing consistent leadership and advocacy of anti-doping programs in sport, regardless of costs and consequences. Accepting the magnitude of doping in at-risk populations and developing education, prevention and treatment programs is the only way we can prevent the continuing spread of the abuse of doping in sport and its spread into the most fragile groups in our society, our youth and at-risk populations.
HORMONAL DOPING AND ANDROGENIZATION OF ATHLETES: A SECRET PROGRAM OF THE GERMAN DEMOCRATIC REPUBLIC GOVERNMENT.

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Several classified documents saved after the collapse of the German Democratic Republic (GDR) in 1990 describe the promotion by the government of the use of drugs, notably androgenic steroids, in high-performance sports (doping). Top-secret doctoral theses, scientific reports, progress reports of grants, proceedings from symposia of experts, and reports of physicians and scientists who served as unofficial collaborators for the Ministry for State Security (“Stasi”) reveal that from 1966 on, hundreds of physicians and scientists, including top-ranking professors, performed doping research and administered prescription drugs as well as unapproved experimental drug preparations. Several thousand athletes were treated with androgens every year, including minors of each sex. Special emphasis was placed on administering androgens to women and adolescent girls because this practice proved to be particularly effective for sports performance. Damaging side effects were recorded, some of which required surgical or medical intervention. In addition, several prominent scientists and sports physicians of the GDR contributed to the development of methods of drug administration that would evade detection by international doping controls.

Anabolic steroids

The use of anabolic steroids by athletes is controversial. On the one hand, many athletes believe that steroids improve athletic performance and thus provide an advantage to those who use them. On the other hand, the medical and scientific communities believe that inadequate scientific data exist to support the claim that anabolic steroids can improve athletic performance while overwhelming scientific data demonstrate their deleterious effects. Therefore, a large information and credibility gap concerning anabolic steroids exists between the athletes and the medical and scientific communities. We believe that this gap can be closed if both groups are better informed about anabolic steroids. We provide a detailed review of
the literature on anabolic steroids that provides to the reader the information needed to make an informed decision on the relative risks and benefits of anabolic steroids to the athlete.

ANABOLIC STEROID USE AMONG SUBSTANCE ABUSERS IN TREATMENT.

Background:

Increasing illicit use of anabolic steroids in adolescent and young adult populations has been reported. To determine the scope of this problem and its relationship to psychoactive substance abuse, we evaluated the prevalence of anabolic steroid use among individuals seeking inpatient treatment for substance abuse.

METHOD:

A randomized mail survey of 175 inpatient substance abuse treatment directors elicited information regarding the prevalence of anabolic steroid use for inpatients treated in 1989 and the first half of 1990. Additionally, directors were surveyed for experience with DSM-III-R psychoactive substance dependence criteria for anabolic steroid use.

RESULTS:

Only 19% of centers responding had treated at least one individual using anabolic steroids. Facilities encountering anabolic steroid users reported a prevalence of less than 1% among all admissions. Anabolic steroid users were seen more commonly in privately funded facilities. Directors reported a majority of anabolic steroid users had at least three DSM-III-R psychoactive substance dependence criteria for anabolic steroid use. Treatment directors rarely found anabolic steroid use acknowledged as a problem by users and rarely found anabolic steroid use a primary reason for treatment.

CONCLUSION:

Users of illicit anabolic steroids may have significant clinical differences compared with users of other psychoactive substances of abuse and dependence.
Physiological and Psychological Effects of Testosterone on Sport Performance: A Critical Review of Literature

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Introduction

The emergence of testosterone (Te) use in sports has increased drastically since its inception, spawning a “cat and mouse game” between athletes and regulating bodies. Once a means for detection is developed, scientists are developing new forms or compounds of Te which are undetected by current testing or mask increased Te in some way to make the testing inefficient.

Athletes that can improve their level of play through supra physiological doses of Te are willing to risk getting caught because they believe the pros outweigh the cons. If an athlete can avoid getting caught using Te, the benefits to their performance can include notoriety, increased individual and possibly team success, and increased salaries.

The endocrinology of Te release is based on homeostatic regulations. A human will release Te based on the need to grow as during infancy and puberty, and based on exercise demands explained in the proceeding research. Increasing the amount of Te in the body will have an increased effect on the already potent and beneficial outcomes of natural Te.

As you will see in this review, the effects of Te use in athletes can improve their physical strength, stature, and possibly performance. Much research has
proven the effects of Te doping on an individual, whether they are an athlete or not; although, these benefits do not ensure success in certain sports. This review will discuss the endocrinology and origins of Te, the physiology behind how Te works the effects, the relationships of these effects to sports, the ethics of Te use in sports, and the relationship between Te and sports related skills.

LITERATURE REVIEW

History of Use Drugs in Sports

Athletes have used many different performances enhancing drugs (PED), dating back to the 19 century in Olympic and professional sports. Even today with the detection tests that have been developed, there are still instances of athletes testing positive in Olympic, professional, collegiate, and even high school sports. A 2002 review on the History of doping by Yesalis and Bahrke highlighted the use of Te as an anabolic steroid. The authors suggested that the age of anabolic use began with Charles Edouard Brown-Sequard, who self administered injections that contained blood of the testicular veins, semen, and juice extracted from a testicle of a dog or guinea pig. Brown-Sequard described the effects as improvements in physical and mental energy. After Brown-Sequard had taken a month off of the injections, he returned to a prior state of weakness. Even though many attribute his benefits as the placebo effect, Brown-Sequard established the value of hormone replacement or supplementation therapy. This report spawned experiments throughout the Western world involving testicular extracts.

The use of these testicular extracts in athletics came soon after Brown-Sequard’s report. In an 1896 paper by Zoth, he states that “The training of athletes offers an opportunity for further research in this area and for a practical assessment of our experimental results.” This served as a prophecy of the future of anabolic steroids in the 20 Century as transplantation of human and animal testicular material became popular to cure or “rejuvenate”. In 1935 this practice ceased as scientists were able to isolate, chemically characterize, and synthesize the hormone
Te and reveal the basic nature of its anabolic effects. Shortly after, oral and injectable Te was available to the medical community.

In 1936 it was rumored that the Germans supplemented Te before the 1936 Olympics, although no proof was found due to the lack of research on Te having an ergogenic effect on humans. Wade alleged that during World War II, German soldiers took Te before battle to increase aggressiveness. This claim has yet to be documented and contradicts the belief that the Nazis were opposed to organism-altering drugs. In the 1950s, reports of West Coast bodybuilders using Te for better physique surfaced. Since then, bodybuilding has had strong ties to TE and anabolic use.

The first reports of Te use in sports came from the reports that the Soviet weightlifting team had used anabolic steroids in the 1950s. Dr. John Ziegler claimed that the Soviet counterpart actually told him they were taking Te. Dr. Ziegler then experimented with Te on himself and a few other weightlifters at the York Barbell Club. After some of the weightlifters Dr. Ziegler were working with achieved championship status, news of the efficiency of this Te usage spread to other strength-intensive sports in the 1960s. Because anabolic use became so prevalent, urine testing was initiated in the Olympics in 1968. By 1969 athletes were openly praising the effects of Te and anabolic steroids publicly.

The use of Te and anabolic steroids became widespread in Olympic and professional sports at 1970s and 1980s, so much that the NFL adapted urine testing in 1987. In 1990, the Anabolic Steroid Act was published and usage required a prescription from a physician. This act and the Dietary Supplement Health and Education Act in 1994 have deterred athletes from illegal anabolic steroids to legal nutritional supplements.

In Bowers’ article, he points out that “the availability of numerous synthetic steroids and recombinant peptide hormones has made testing an analytical challenge.” Due to testing, scientists searched for new compounds and synthetics
that can go undetected and still bring forth the same results. A very popular example of this was the case of the Bay Area Laboratory Co-Operative (BALCO). BALCO had developed a cream which contained both Te and epitestosterone; a ratio of the two hormones was used in testing. The administration of both of these hormones caused inefficient data and results in the drug testing procedures of that time. The discovery of these compounds and their use in baseball led to the January 2005 changes in MLB’s steroid testing and sanctions policy. As new testing has been developed, the International Olympic Committee and all professional sports leagues have issued banned substance lists and adopted the most recent testing procedures to ensure fair play among the athletes.

**Physiological Effects Related to Sports**

In 2006, Giannoulis investigated the effects of growth hormone and/or Te in healthy elderly men. This six month double-blind study consisted of men ages 65-80 grouped into 4 areas: Placebo GH and Te, GH and placebo Te, placebo GH and Te, or GH and Te. The results of this study were administration of both GH and Te in older men had more positive effects than the other groups, including increased lean body mass (P = 0.008), muscle size (P = 0.006), and aerobic capacity (P < 0.001). Notably, lean body mass did increase with GH administration only as compared to placebo group.

In 2009, Sattler et al. performed a similar investigation to Giannolis, testing the effects of GH and Te administration on elderly men. The sample size in this study was 122, significantly higher than Giannolis, and the methods were slightly different. All subjects received administration of Te on two tiers, one getting 5g/day, and the other getting 10g/day. The subjects again were placed into three tiers for each initial group (six total). The three tiers received administration of GH at 0g/day, 3g/day, and 5g/day. Sattler investigated the effects of administration on body composition, muscle strength, aerobic capacity, and hormone assays. The results of this study showed increases in lean body mass (P < 0.008), maximal muscle strength (P < 0.008), and aerobic endurance (P < 0.008), and total fat mass
decreased for all groups ($P = 0.0002$). Sattler’s conclusions are that supplemental Te produced significant gains in total and appendicular lean mass, muscle strength, and aerobic endurance with significant reductions in whole-body and trunk fat. Outcomes appeared to be further enhanced with GH supplementation. These conclusions back Giannolis’ findings in 2006 regarding GH and Te supplementation in older men.

In 1996, Bhasin experimented with the effects of just Te supplementation in normal men. There were 43 normal men that took part in the study, and were assigned to one of four groups: placebo with no exercise, Te with no exercise, placebo plus exercise, and Te plus exercise. The subjects received injections of either 600mg of Te or placebo weekly for 10 weeks. Subjects in the exercise group took part in a normal routine three times per week, and all were measured for fat-free mass, muscle size, and strength before and after the 10 weeks. In the two no-exercise groups, the group receiving doses of Te showed increases in muscular size and strength ($P<0.05$). The Te and exercise group showed increases in fat-free mass, muscle size and strength in comparison to all other groups ($P<0.05$). Bhasin concluded that supraphysiologic doses of Te, especially when combined with strength training, increase fat-free mass, muscle size, and strength in normal

In 2002, Bhasin, Woodhouse, and Storer backed Bhasin by publishing a review on the proof of the effect of Te on skeletal muscle. The authors report that abuse of Te by those who use Te supplementation, are based on the assertion that it will help increase muscle mass and improve skeletal muscle performance, effects that will translate into improvements in athletic performance. Among other effects of Te listed in this review that are not pertinent to sports, Bhasin, Woodhouse, and Storer do highlight body composition, muscle strength, fat metabolism, and athletic performance which will be discussed in a later section.

Three different studies, not including Bhasin were mentioned as to the effects of Te on muscular strength and body composition. Collectively the data from the studies conclude that supraphysiological doses of Te produce increases in
fat-free mass and strength in men. The authors also report that strength training in conjunction with Te supplementation may augment the effects of androgen on the muscle.

Long term studies of Te supplementation report a consistency in the reduction of fat mass, and epidemiological studies have shown serum Te levels are lower in middle-aged men with visceral obesity. Research shows there is an inverse relationship between serum Te levels and visceral fat in men and that Te is important in fat metabolism and regional fat distribution in men. Kadi backed these results and reported “testosterone administration in sports provides an unfair muscular advantage over non-drug users. The long-term consequences of the heavy recruitment of satellite cells on their proliferative potential and the regenerative capacity of skeletal muscle are unknown”

In 2006, Cardinale and Stone studied the effect of Te on explosive performance, an attribute that can be utilized in many sports. Seventy elite athletes (22 women and 48 men) in track and field (sprinters), handball, volleyball, and soccer competing at national and international levels participated in the study. The idea was to compare resting Te levels and vertical jumping ability in elite men and women athletes. The results showed that resting Te levels in women were roughly 90% lower than men (P<0.001), and men’s vertical jump was 16% higher than women (P<0.001). It was noted that when maximal lower body strength is adjusted for fat-free mass or body mass, women are as strong as men. Therefore the positive relationship identified between Te levels and vertical-jumping ability (P<0.001) supports the idea that Te plays an important role in neuromuscular function, in this case power movements. This article gives yet another positive effect and another reason behind athlete’s use of Te supplementation. Meinhardt supported the results of Cardinale and Stone in regards to body composition and physical performance, but the participants of this study included 96 recreationally trained athletes of both sexes.
Haddad meta-analysis that assessed the effect of testosterone use on cardiovascular events and risk factors in men reported that any available evidence weakly supports the conclusion that Te use in men is not associated with cardiovascular effects. Therefore, users of Te should be cautioned on the possible long-term cardiovascular risks that may be linked to, and not yet observed, this supplementation. Also Basaria supports Haddad et al. by reporting that the application of a testosterone gel was associated with an increased risk of cardiovascular adverse events in his study.

**Psychological Effects Related to Sports**

For many years it has been accepted that along with the physiological effects of testosterone, there are obvious psychological effects that explain moods and behaviors in human users. The notion of “roid rage” has given an excuse to certain behaviors and crimes of those who ironically have been supplementing with Te or other steroids. As you will see, the research has caused quite a controversy.

In 1994, Bjorkqvist, Nygren, Bjorklund, and Bjorkqvist experimented with Te intake and its effects on aggression. In this double-blind study, 27 men were either given 40mg of Te, a placebo, or nothing every day for one week. The results revealed a significant placebo effect. At the end of the week, the placebo group scored higher than the Te and the control group on self-animated anger, irritation, impulsivity, and frustration (P<0.01). An explanation behind this may be the lack of natural Te in the Te group due to homeostatic suppression of release. The authors further point out that these results suggest that androgen use causes expectations, rather than actual increases in aggressiveness.

In 1996, another double-blind 10-week study was conducted, this time they increased the dosage of Te to 600mg per week and included exercise into specific groups. Forty-three men ages 19-40 were assigned into four different groups: placebo no exercise, Te no exercise, placebo plus exercise, and Te plus exercise. The Multi-Dimensional Anger Inventory, which includes five different dimensions
of anger (inward anger, outward anger, anger arousal, hostile outlook, and anger eliciting situations), and a Mood Inventory were completed at the end of the study. At the conclusion, no differences were observed between exercising and non-exercising and between placebo and Te treated subjects. These findings back Bjorkqvist in that supraphysiological doses of testosterone, when administered to normal men in a controlled setting, do not increase angry behavior.

In 2000, Pope, Kouri, and Hudson performed a similar study with somewhat different results conflicting the previous two articles. This study consisted of 56 men in a randomized, placebo controlled experiment. All subjects were given doses rising to 600 mg/wk and placebo for six weeks, separated by six weeks of no treatment. Psychiatric measures included Young Mania Rating Scale, the Point Subtraction Aggression Paradigm, the Aggression Questionnaire of Buss and Perry, the Symptom Checklist-90-R, daily diaries of manic and depressive symptoms, and similar weekly diaries completed by a significant other who knew the participant well. Results showed that testosterone treatment significantly increased manic scores on the Young Mania Rating Scale (P=0.002), manic scores on daily diaries (P=0.003), and aggressive responses on the Point Subtraction Aggression Paradigm (P=0.03). Pope et al. did point out that the effects, were not uniform across individuals; most showed little psychological change, and a few developed prominent effects.

O’Connor, Archer, Hair, and Wu experimented with the effects of Te on cognitive function in men. This study consisted of a single-blind placebo-controlled design involving 30 healthy men and seven hypogonadal men. The healthy men were placed into two groups, one receiving 200mg Te weekly for eight weeks, the other receiving 200mg sodium chloride weekly for eight weeks. The hypogonadal group received the physiological replacement dose of 200 mg of Te bi-weekly for eight weeks. All groups underwent a battery of neurophysiological tests and had Te measured at start, four weeks, and eight weeks into testing. Results showed that at week four, the Te group showed decreases in spatial abilities.
compared to placebo (P<0.01) and performed significantly better than the placebo group in the measure of verbal fluency (P<0.01). No significant changes were found on any other tests. These results suggest that Te supplementation inhibits spatial ability and increases verbal fluency.

O’Connor, Archer, Hair, and Wu again experimented with the effects of Te in 2004, this time studying mood, aggression, and sexual behavior in young men. This double-blind placebo-controlled study grouped 28 men into one of two treatment groups which varied the timing of Te injection. The injection consisted of 1000mg of Te undecanoate, which was a new, long-acting concentration. Mood, self and partner-reported physical and verbal aggression, anger, hostility, irritability, assertiveness, self-esteem, and sexual function were assessed. The results of this research stated that increased circulating Te was associated with significant increases in anger-hostility from baseline (P<0.05), and Te treatment did not increase aggressive behavior or induce any changes in non-aggressive or sexual behavior (P<0.05). These results suggest that supraphysiologic-induced elevation of circulating Te, to the range likely to be used in hormonal male contraception, has limited psychological effects.
CONCLUSION

Te use in sport has given researchers plenty of targeted substance matter and fueled much controversy for over a century. The history of Te started with self-administration of gonadal material by researcher Charles Edouard Brown-Sequard and has been linked to Nazi soldier’s use during wartime to increase aggressiveness, and of course has become extremely popular in bodybuilding and sports.

Abundant research has shown the physiological effects of Te use: increased muscle size and strength, aerobic endurance, decreased fat mass, faster recovery from high exertion exercise, and increased muscular power. These effects can translate individually or in combinations to assist athletes in nearly every sport. The issue researchers have had was the amount of a dosage that should be used and how frequently a dose should be taken. Increased doses have shown better potential in enhancing these pre-mentioned effects, but the extent of any damage done to the body from long-term usage has yet to be solidified. Whether the pros outweigh the cons is an individual decision that may be based on individual morals, goals, fears, or ambitions.

Athletes seek advantages for performance enhancement. The term “performance enhancement” includes items such as equipment, sneakers, coaches, technology, pharmacology, endocrinology, and nutrition. Stronger, bigger, faster muscles promote confidence in physical ability which may contribute to changes in mood, including aggression, anger, and frustration. Exaggerated psychological effects of Te use were further highlighted in Sports Illustrated by Lyle Alzado, attributing the aggressive level of play and (his) brain tumors to steroid use. The extent is unclear as to how Te affects coordination, reaction, intelligence, manipulation and spontaneity, adaptation, and injury prevention. Future Te research may investigate safety considerations and the performance advantages and disadvantages of long term use.
APPLICATIONS IN SPORT

Over a century of Te supplementation/administration research has shown the effectiveness in humans. Positive effects can directly translate to improving or enhancing the physical requirements necessary for the successful participation in sports. The inclusion of Te administration into any training program should give the user a definitive edge over an athlete who is not administering Te. Performance may be affected to benefit the user at the risk of the consequences of being caught using this banned substance. Furthermore, there are known and unknown as well as short and long term risks of receiving Te to raise Te to normal levels as well as taking superphysiological amounts of Te. Athletes need to consult their physician if they are thinking about taking Te in any capacity and also need to consider the unknown and known health risks and the possibility of being banned from their sport for life.

Doping knowledge, attitudes, and practices of Ugandan athletes: a cross-sectional study

Background

Peninnah Aligawesa Kabenge et al., (2015) Despite the development of advanced drug testing systems, both deliberate and inadvertent doping in sports is increasing in elite, amateur and school sports. As a result, alternative approaches that seek to influence an athlete’s attitudes are needed to address the growing doping concerns that threaten both the health and well being of the athlete as well as the legitimacy of the sport. Therefore, the current study set out to establish the doping attitudes, knowledge and practices of professional Ugandan athletes, gathering information that may guide the design of more efficient doping prevention programs.

Methods

This was a cross-sectional study of 384 professional Ugandan athletes from four contact team sports (basketball, football, handball and rugby) and two
individual sports (athletics and cycling). An Interviewer administered questionnaire used contained; questions about the doping behavior, the performance enhancement attitude scale (PEAS), and doping use belief (DUB) statements.

Results

Approximately 60 % of the athletes reported familiarity with information on doping and that most of this information came from fellow colleagues (41.9 %), individual or team coaches (29.7 %) or the media (15.6 %). However, nearly 80 % of these athletes could not correctly define doping. The overall mean PEAS score, a measure of doping attitudes, for all study participants was 39.8 ± 14.8. Female athletes (PEAS: 41.1 ± 15.1), athletes with a prior doping history (PEAS: 44.1 ± 15.6) and athletes from the sport of athletics (PEAS: 56.6 ± 17.4) had higher mean PEAS scores than their respective counterparts. Regarding doping behaviors/practices, 9.3 % of the study participants had been offered a doping agent at some point, although only 3.9 % of the athletes acknowledged recent use.

Conclusions

The confessed use of doping agents in this study was low, which may suggest that fewer athletes use doping agents in Uganda. However, there is still an urgent need for educational anti-doping programs to address the knowledge gaps observed amongst athletes in this study. Modifying the existing Physical education curriculum for inclusion of more content about doping in sport could provide the basis for doping prevention programs amongst amateur athletes in Ugandan primary and secondary schools.

Background

N. Toumanis Despite the development of advanced drug testing systems, both deliberate and inadvertent doping in sports is increasing in elite, amateur and school sports. According to the 2013 World Anti-doping Agency (WADA) report, the
number of abnormal test findings recorded by anti-doping authorities worldwide have increased by more than 20% since 2012. One biochemical analysis of 7,289 blood samples collected globally from 2,737 track and field athletes both out of and during competition from 2001 to 2011 found a 14% mean period prevalence of blood doping, with a range of 1% to 48%, depending on the nationality of the athletes. In the general population, a meta-analysis of studies done in the African region for the period between 1970–2013, found a 2.4% lifetime prevalence of anabolic-androgenic steroid use.

Therefore, in a bid to deter athletes from using banned performance enhancing drugs/methods, athletes have been subjected to impromptu in- and out-of-competition screening tests for these substances over time, and those athletes who test positive are given heavy punishments or fines. However, despite the rigorous testing procedures, the decades of doping scandals that have nonetheless prevailed have shown that the tests are no guarantee of a drug-free race. It is difficult to name a tour de France, an Olympic competition or even a Commonwealth competition in recent years that has gone unmarred by doping accusations. Ewen Callaway, in a Nature feature article, appropriately termed it “an endless cycle,” where anti-doping agencies try to thwart one cheating strategy while another emerges.

Although anti-doping control testing is obviously necessary, other programs aimed at discouraging athletes to use banned substances are sorely needed. Support for such programs was reinforced in a speech by the president of the International Olympic Committee, Thomas Bach, who remarked that “there should be a change in emphasis from fighting against drugs in sport, to protecting a clean athlete”. In principle, most of these parallel programs focus on influencing athletes’ attitudes and beliefs toward the use of performance enhancing substances. In one such approach, the psychosocial approach, attitudes are considered an index of doping behavior, and a greater leniency towards doping is linked to the use of banned...
substances. In a meta-analysis by N toumanis on personal and psychosocial predictors of doping use in physical activity settings, a positive attitude towards doping was one of the strongest positive correlates to doping intentions and behaviors. Therefore, a greater understanding of an athlete’s knowledge of, attitudes toward, and practices in doping is crucial for developing efficient prevention programs. However, despite the potency of such information in designing national anti-doping programs, there is still a paucity of data on doping in the majority of sub-Saharan countries, including Uganda. In a necessary bid to provide an impetus on which Uganda’s’ anti-doping programs could be based, this study set out to determine the knowledge, attitudes and practices of Ugandan athletes towards doping.

Several studies of a similar nature have been conducted in other parts of the world, where athletes have access to more advanced training facilities, more resources to acquire more sophisticated doping substances/methods, and a greater access to databases of knowledge on doping and its consequences. Because the issue of doping is complex, and is presumably predicted by a variety of situational and personal factors, results from the above studies cannot entirely be extrapolated to athletes in the Sub-Saharan region, where training facilities are poor, resources to access the most potent and least detectable doping substances/methods are lacking, and where ready access to databases with information about doping is still low.

Methods

Study design

This was a cross sectional study involving 384 professional Ugandan athletes from six sporting disciplines; four contact sports (basketball, football, handball, and rugby) in the major national league and two endurance sports (athletics and cycling).
The Uganda Olympic Committee (UOC) in conjunction with the Regional anti-doping agency (RADO) for the East African region lead, and coordinate the doping prevention efforts in the country. In the current study, we only enrolled athletes over 18 years of age who were currently playing at a professional level for a club. Participants who had retired from a sport or those who had not participated in a competitive game or competition in the past year were excluded. Of the 384 athletes who were approached to participate in the study, 360 consented and gave complete responses, resulting in a response rate of 93.75 % for the current study. The mean age of the athletes was 24 years. The majority of the interviewed athletes (Table ) were male (60.6 %), and most had at least attained tertiary education, which is equivalent to a diploma and above, from a vocational school, college or university. Fifty nine participants (16.3 %) were rugby players, 61 (16.9 %) participants played basketball, 60 (16.6 %) were cyclists, 59 (16.3 %) participants played hand ball, 61 (16.9 %) participants were footballers, and 61 (16.9 %) participants were track and field athletes’. The study sample size was estimated using the Kish and Leslie formula for cross-sectional studies to give a power of 80 %. Stratified random sampling was used in the recruitment of study participants. Independent variables for the study included the following: demographic characteristics of the participants (age, sex, marital status, level of education, and occupation) and the type of sport. The dependent variables were the following: the athletes’ knowledge of doping, doping beliefs, doping attitudes and doping practices.

The number of abnormal test findings recorded by anti-doping authorities worldwide increased by more than 20% last year, according to a report by the World Anti-Doping Agency.

There were 5,962 adverse or atypical test results across all sports, compared with 4,723 in 2012.

The number of tests carried out rose by only 0.8% in the same period.
Sprinters Tyson Gay and Asafa Powell and tennis player Marin Cilic were among those to fail drug tests in 2013.

<table>
<thead>
<tr>
<th>Olympic sports: most adverse test results</th>
<th>Percentage of adverse results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weightlifting</td>
<td>3.4</td>
</tr>
<tr>
<td>Wrestling</td>
<td>2.3</td>
</tr>
<tr>
<td>Equestrian</td>
<td>2.3</td>
</tr>
<tr>
<td>Judo</td>
<td>1.5</td>
</tr>
<tr>
<td>Boxing</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Among the findings contained in the report were:

- In total, 269,878 samples were analyzed across 35 Olympic and 58 non-Olympic sports, compared with 267,645 in 2012
- Adverse or atypical findings were returned for 5,962 samples, or in 2.21% of cases
- Olympic sports accounted for 65.4% of the tests conducted, but only 57.8% of the abnormal results
- Among Olympic sports, football, athletics and cycling conducted the most tests, but weightlifting and wrestling had the highest rate of adverse findings
- Adverse test results were recorded in sports as diverse as chess, bridge and boccia

Adverse findings are those that detect the presence of a prohibited substance. Atypical findings are those that necessitate further investigation by anti-doping authorities.

Atypical findings may correspond to multiple analyses performed on the same athlete.

<table>
<thead>
<tr>
<th>Olympic sports: fewest abnormal test results</th>
<th>Percentage of adverse results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bobsleigh</td>
<td>0.1</td>
</tr>
<tr>
<td>Field hockey</td>
<td>0.1</td>
</tr>
</tbody>
</table>
The increase comes in a year in which sports such as football and tennis stepped up their use of the athlete biological passport program, which allows authorities to collect and compare biological data and spot discrepancies over time that suggest possible doping.

Other sports, such as cycling, have stiffened the ‘whereabouts rule’ that requires athletes to provide the authorities with regular information about their location and possible windows for testing.

However, British 800m runner Jenny Meadows says drug-takers in sport are still getting away with it.

“People are still taking drugs and always will,” she said. “The margin of error between coming first and third is so tiny that people will always looks for ways to break that down.

“You look at Tyson Gay and Justin Gatlin lining up in the 100m (both men have served bans from athletics after failing drugs tests). It makes you feel sick because they are still getting sponsorship and prize money. It’s not fair on the rest of us.

“I do think the sport is being cleaned up and these figures send out a message of ‘we’ll find you eventually’ but unfortunately there are always sophisticated ways to cheat the system.” The report also reveals which national anti-doping authorities test their athletes most frequently. Russia and China lead the way, each testing more than 10,000 samples in 2013. UK Anti-Doping, the body responsible for testing British athletes, analyzed nearly 5,000 samples.
<table>
<thead>
<tr>
<th>Country</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>13,364</td>
</tr>
<tr>
<td>USA</td>
<td>7,144</td>
</tr>
<tr>
<td>UK</td>
<td>4,848</td>
</tr>
<tr>
<td>Jamaica</td>
<td>294</td>
</tr>
<tr>
<td>Ukraine</td>
<td>9</td>
</tr>
</tbody>
</table>

By contrast, the Jamaican Anti-Doping Commission, which was strongly rebuked by Wada for its lax approach, conducted just 294 tests, fewer than Hong Kong.

The national anti-doping body in Ukraine, two of whose athletes failed drug tests at the 2013 World Athletics Championships in Moscow, carried out just nine tests in 2013, according to Wada’s report.

Andy Parkinson, chief executive of UK Anti-Doping, says testing in Britain is getting more sophisticated, but that it remains a major challenge to make sure sport is drug-free.

“The more sophisticated tests become, the more chance you will have of catching a cheat,” said Parkinson.

“But although the analytical side of anti-doping and the science is getting better, at the same time you’ve got the industry and black market trying to design drugs that bypass the testing. So analysis is improving but so are the illicit substances.

“It is a big task to try and stay one step ahead, and also frustrating - but even more frustrating for the clean athletes.”

Football was responsible for more than 28,000 tests, more than any other sport. Of those, 140 adverse samples were recorded, a ratio of 0.5%.

**Andy Parkinson, chief executive of UK Anti-Doping**
“Elite athletes are under a great deal of pressure and their entourage is under a great deal of pressure and, as in any walk of life, there will always be someone who crosses the line”

Cyclists were also subject to frequent testing, with more than 22,000 samples analysed in 2013 - 1.2% of those tests resulted in adverse findings.

However, there were also widespread adverse findings in sports without the stigma of cycling. Rugby recorded a rate of 1.3% adverse results from just over 6,000 tests.

Paralympic sport boccia had one of the highest rates of adverse results, with 11.1%, although that figure is skewed by the relatively small number of participants in the sport.

Of non-Olympic disciplines, chess recorded three adverse findings, while bridge returned one.

Parkinson added: “Elite athletes are under a great deal of pressure and their entourage is under a great deal of pressure and, as in any walk of life, there will always be someone who crosses the line.

“Our approach to serious dopers is that we are very firm and try and get the biggest sanction we can.”

Sir Craig Reedie, the president of Wada, has previously warned that doping represents the biggest threat to Olympic sport. In November, Wada approved stricter punishments for athletes found guilty of doping, doubling bans to four years.

**Sports doping: Racing just to keep up**

Anti-doping researchers are looking for new ways to catch cheaters. Can a biological passport help to save the sport?
Cyclist Borut Bozic drew his hands to his chest with a look of joy, disbelief and exhaustion after defeating some of the world’s best sprinters in the Swiss village of Tobel. His stage victory at the week-long Tour de Suisse last month netted the 30-year-old Slovenian a €4,000 (US$5,600) bonus and probably helped to secure his spot in this month’s Tour de France, cycling’s most prestigious race.

His stage win also automatically earned Bozic a trip to a cramped medical trailer. Inside, he and three other riders each filled two small jars with urine. The containers were sealed, anonymized and sent to the Swiss Laboratory for Doping Analyses in Lausanne, where technicians would test them for traces of steroids, stimulants & a potent blood-boosting drug erythropoietin (EPO).

Such tests have become as much a part of professional cycle racing as carbon-fibre bicycles, but decades of doping scandals show that they are no guarantee of a drug-free race. It is tough to name a Tour de France win in recent years that has gone unmarred by doping accusations. Last year’s winner, Alberto Contador, tested positive for the banned drug clenbuterol. He has successfully argued that it came from contaminated meat, but an arbitration hearing could still erase his victory. And last year, it was revealed that seven-time Tour de France...
winner Lance Armstrong has been the focus of a US Justice Department investigation into doping — although he has never been disciplined and maintains that he never doped. Confronted with increasingly sophisticated dopers, anti-doping scientists face a daunting game of catch-up. “This is an endless whirl,” says Martial Saugy, the director of the Lausanne laboratory.

In hopes of slowing the whirl, Saugy’s team has pioneered a new kind of anti-doping test: the biological passport. Instead of scouring an athlete’s urine for traces of drugs or their breakdown products — as the Lausanne lab would do for Božič’s sample — the passport builds up a profile of an individual over time and tries to detect biochemical changes that might indicate doping.

Since 2008, Saugy’s laboratory and the International Cycling Union (UCI), cycling’s international federation based in Aigle, Switzerland, have created biological passports for hundreds of professional cyclists, some containing data from dozens of blood draws. Other sports are looking to follow suit. Some researchers say that the passport offers the best line of defence against EPO use, which has bedevilled inspectors for the past two decades; and biological passports to detect steroid and growth-factor doping are in the works. The technology may see its Olympic debut at the games in London next year. Still, critics — and some athletes — say that it is no match for determined dopers.

“The biological passport is a joke,” said Floyd Landis, a former US pro cyclist, to sport-news website ESPN.com in May 2010. After losing a costly four-year battle to overturn his conviction for using steroids during the 2006 Tour de France, Landis admitted to doping for much of his career and said that pro cyclists knew how to defeat the biological passport before it was introduced. But the passport has already led to convictions, and perhaps briefly shifted the advantage back to the testers. “I think we are forcing people to decrease their doping habits,” says Saugy.
Sport: a picture-based brief implicit association test for measuring athletes’ attitudes

Background

Philipp Heck and Matthias Ziegler (2014) Doping attitude is a key variable in predicting athletes’ intention to use forbidden performance enhancing drugs. Indirect reaction-time based attitude tests, such as the implicit association test, conceal the ultimate goal of measurement from the participant better than questionnaires. Indirect tests are especially useful when socially sensitive constructs such as attitudes towards doping need to be described. The present study serves the development and validation of a novel picture-based brief implicit association test (BIAT) for testing athletes’ attitudes towards doping in sport. It shall provide the basis for a transnationally compatible research instrument able to harmonize anti-doping research efforts

Herbal supplements in sports: use and abuse

Abstract

Caprino L, Braganò MC, Botrè F. The use of natural supplements, included herbal supplements, by athletes has become an habit which often lacks any valid scientific rationale. It appears evident that this habit may entail health risks (including more or less serious adverse effects), consequent either:

1) To the pharmacodynamic effects of the drugs at high doses; or

2) To the occurrence of accumulation especially when their administration is not justified by a reduced synthesis or an increased demand; or

3) To the occurrence of intolerance; or, finally,

4) To the presence of unlabelled ingredients. The abuse of this kind of products always entails risks to the consumer, not only to the elite athlete, that can incur an adverse analytical finding on the occasion of anti-doping tests, but also to the amateur sportsman, for the possible occurrence of adverse drug reactions (ADR).

Spanish cycling team managers’ opinion and experience regarding doping
Summary

Jaime Morente-Sánchez et al., (2013) The aim of this study was to determine and compare the opinions and experiences regarding doping of a sample of Spanish cycling team managers considering his previous experience as cyclists and their academic level of training. A total of 87 cycling team managers (the highest level) participated in the study. Regarding his previous cycling experience, 40 subjects were cyclists “professionals”, 29 had been cycling to category “Amateur” while 18 had no experience as cyclists. In relation to their previous academic level of training, 15 subjects had a degree in Sport Sciences, 36 had prior federal certification and 36 had no prior technical or academic training, but had previously been professional cyclists. Cross-sectional descriptive design was carried out by means of a specific questionnaire comprised of seven open-ended questions. Although there were differences between analyzed and compared groups, in general, the most mentioned word associated with doping was “cheating”, the most often mentioned doping agents were “managers” and “laboratories”, the highlighted difference between cycling and other sports was “discriminatory treatment” and the main reason for using doping practices was the search for “athletic success”. Most participants recognized that they have been suggested to dope and also know similar cases. The main proposals of solution to eradicate doping were “prevention since early ages “ and “increase the number of controls”. This study shows that Spanish cycling team managers recognize the existence of the phenomenon of doping. The comparison among analyzed groups shows interesting data about different issues such as responsible agents of doping and reasons for initiation in doping. It was observed a recognized and close coexistence with doping for the total sample, especially from the perspective of former professional cyclists. These results support the idea that, apart from maintaining doping controls and make them more efficient, educational programs since earlier ages are needed.
References:

1) P.J. Vanni, M.S., NSCA-CPT, MusclePharm Sports Science Center Research Institute Director, Distance Learning Faculty member, Department of Sports Exercise Science, United States Sports Academy (2015).


4) Ralf Brand (Email) author, Philipp Heck and Matthias Ziegler Published: 30 January 2014.