ERTHROPOIETIN
THE SUBSTANCE FOR THE ENDURANCE ATHLETE

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Athletes drug use conjures up a variety of perceptions and responses. This paper will explore what performance enhancing substances mean in elite and professional sports, with an emphasis on cycling. The history of all athletic competition relative to the use of "artificial" performance enhancers will be viewed from the experience of a World Class cyclist who holds 2 World Records. I will address who decides when, where, how and why drugs may or may not be used in athletic competition and explore the question is it unethical or immoral for an athlete to use any type of substance to enhance their performance? The major focus will be the drug Erthropoietin, commonly refereed to as EPO, a controversial performance enhancing substance. Drug testing of profession and elite athletes will also be explored. Why are drugs and drug testing important in athletic competitions, or are they? The literature review covered the history of the use of drugs to enhance sporting performance, the medical uses and benefits of EPO, and summarized the International Olympic Committee (IOC) and the Union Cycliste Internationale (UCI) rules of operation.

The use of drugs to enhance athletic performance is commonly known as doping. The word 'dope' comes from a South African language. Dope was a primitive alcoholic substance that was used as a stimulant in ceremonial dances. The term 'doping' is used in all of today's sports and refers to the use of banned substances or methods that may enhance athletic performance. In 1881 the term doping made its first appearance in the English dictionary, an indication that drugs have been evident throughout the history of sports.

In ancient Greece, the classic Greek 'lifestyle' was centered around a sports calendar. The participants in Greek sports were required to write poetry or display another artistic ability, in addition to performing physical feats. It was around 400 BC that sports achieved an elevated status in the social life of Greece, possible greater than its place in society today. Spectator sports were the order of the day, and rich prizes for winners led to the emergence of a class of highly paid athletes. A victory in the ancient Olympics was the equivalent of winning nearly half a million dollars(1). This was complemented by other forms of recognition including food, homes, even exemptions from taxation and armed service. Even in ancient times, commercialism and professionalism led to corruption. Cheating and bribery became inevitable. Athletes of that time were willing to try anything that might enhance their performance, like mushrooms and plant seeds.

The status of sports and the elevated position of athletes continued into the Roman period. The growth of sports as public entertainment was fostered with gladiatorial competitions and chariot races. To please the crowds the Romans constructed the Colosseum in 100 AD, where up to 60,000 spectators could view various sporting events and pageants. During this period, drug use was recorded. Chariot racers, for example, are said to have fed their horses a substance to make them run faster(2). The Gladiators were 'doped-up' to make their fights look more violent as well as bloody. This is what the paying spectator wanted, similar to today's pay-per view wrestling audience.

The Christian era signaled the decline of the ancient Roman games, leading eventually to a rule banning all forms of deadly sports. The banning of 'blood' sports diminished the public's interest in spectator sports. At this time society expounded that "physical development hindered intellectual development"(3) and religious festivals and celebrations became popular large group experiences.

Industrial Revolution brought many new contributions to society, including: technology, communication, transportation, and new political and economic institutions. This new era brought about the formation of athletic clubs and organized competitions. Rules of competition were developed, equipment was modified and standardized, and restriction were placed on time, space and number of players for specific games or sports(4).

In the mid 1800's large spectator sports replaced Christian eras festivals and religious celebrations and brought about the rise of commercialism and professionalism in organized sports. Crowds at major events grew from a few thousand during the middle of the nineteenth century to over 100,000 by the 1900s. Sporting facilities such as major stadiums were built and sporting events received greater coverage in newspapers and specialist magazines.

Around the turn of the century, sports in society were reassuming the place it once held in Greek and Roman societies. Soon the elite athlete returned to esteem in society. Sports were no longer an activity to be played solely during free time. Sports could now be a purpose in life, and the professional athlete was reborn. Continuing advances in

technology combined with social, economic and political developments influenced sports, during the twentieth century along with it the use of performance enhancing substances. Sporting activity gradually evolved into 'big business' providing a significant, world-wide source of entertainment, revenue and employment. Sports have developed into significant social institutions and to succeed in the sports world has become highly valued. This placed pressure on athletes to become not only successful, but to become the 'best.' Athletes became the 'best' with and without the use of performance enhancing substances. At this time drug use appeared to be commonly accepted within the international sporting community: athletes, coaches and administrators. Society was turning a blind eye or they simply joined in. While drug use was reported to be common at the 1952 Olympic Games, and to a lesser extent at the 1956 Olympics, countries eventually began to speak out against the harm that drugs were causing to individual athletes, to their sports and to their countries.

Early efforts at regulation began in the 1960's, with the first international anti-doping effort initiated by the Council of Europe, a group of twenty-one western European nations. They established a resolution against the use of doping substances in sports. The tide was beginning to turn in the world of athletics, from one of acceptance of doping, to a more positive anti-doping outlook; But drug use did not disappear from the scene. France was the first to enact national anti-doping legislation in 1963. Belgium followed the same path in 1965. The impact of anti-doping programs, until this time, was relatively small. It wasn't until the televised death of professional cyclist Tommy Simpson in the 1967 Tour de France that the International Olympic Committee (IOC)

became actively involved in international anti-doping. Simpson was thought to have used a controversial drug that both enhanced his performance and may have made him more susceptible to heart attacks. As a result, the IOC established a Medical Commission in 1967 and published their first list of doping classes(5). The first drug tests was conducted on athletes at the Mexico City Olympics in 1968. A schedule of banned substances was developed by the IOC. Drug testing programs became a more common feature only in high-level sporting competition.

Unfortunately, the fact that drug testing programs were in operation did not guarantee their effectiveness. Not only were positive drug tests limited because of inadequate technology, but athletes and their coaches and trainer learned quickly how to beat the system or the rules. This included attempts to substitute urine samples, and to stop the use of drugs in a sufficient amount of time before any trace of the drug could be detected.

In 1983, drug testing strategies took an important step forward. The introduction of gas chromatography and mass spectrometry allowed accurate results of even trace amounts of banned chemicals to be detected (6). The improved testing caused numerous athletes at the 1983 Pan American games to leave without competing. The IOC established a comprehensive set of operating procedures and standards for laboratories to ensure that drug testing is conducted in a uniform and effective manner.

In today's sports, the use of and the testing of banned substances is of major concern. IOC's banned substances also includes many performance enhancing substances. One of the latest and most important performance enhancing substances is EPO. EPO is a peptide protein hormone made and secreted by the kidneys that enhances the ability of muscles to perform effectively and efficiently. It stimulates the bone marrow to produce red blood cells which carry oxygen from our lungs to the rest of our body. Our body needs oxygen to function and to keep the Krebs cycle running aerobically. The Krebs cycle is a physiological/biochemical phenomenon in our bodies which provides our bodies with energy. The Krebs cycle, with oxygen can produce **36** adenosine triphosphate or (ATP.) When the Krebs cycle is anaerobic or without oxygen, the cycle will only produce 2 ATP's (7). Oxygen basically is what our body needs to run effectively. The body needs the ATP to activate the muscles or to contract. The more oxygen available the easier the Krebs cycle spins, creating more energy for endurance athletes.

Most of today's professional and elite endurance athletes, especially professional cyclists, uses EPO. About "99% of the peloton is doped" says the UCI(8). Peloton is a large group of bicyclists in a race(9). The use of EPO causes the athletes body to receive more oxygen than normal. EPO enhances the body's muscle performance, by improving oxygen transport. This enables muscles to rejuvenate much quicker, which means one can work a lot harder and a lot longer than ever before, increasing endurance. In fact, "it's not doping that makes champions; if there was no doping, the races would be 5

kilometers an hour slower, but the same guys would win," states Professional Cyclist Eddy Planckaert.

Athletes using EPO must also take other substances to reduce negative side effects. The normal day to day person's haematocrit (the red cells level of in blood) is around 36/ml. In a March 17th, 1999 interview Steven LeVine, a physician at Kaiser Oakland, said "the highest haematocrit count of an athlete that does not take any performance enhancing substances is about 45/ml." He stated "that man has to be an endurance athlete and has to live and train at high altitude in order to achieve that high of a haematocrit." The UCI and IOC legal haematocrit level for any athlete is 50. Most professional cyclists' haematocrit level is around 50, if not above. "To have that (50) as the limit they (the UCI) do cause a lot of problems, because the limit is too low. From 42 to 54 is normal, but they consider 52 too dangerous" says 1997 Tour de France winner, Bjarne Riis. Just think about your blood for a moment, you have a haematocrit count of 36. Your blood is flowing easily through your body and you are not thinking about it, which is normal. The use of artificial EPO causes the oxygen level in ones blood to thicken to "the consistency of yogurt" (10). If and when the blood becomes too thick it causes the blood to move too slowly to vital organs. Small capillaries can clot and blood clotting increases the risks of heart attacks and strokes. Endurance athletes are extremely vulnerable to these risks because their blood is normally thicker at the end of a race due to dehydration. Of great importance is determining the amount of EPO to administer. It is a very difficult process. Injecting even slightly too much can cause a significant damage to the athlete. "The misuse of EPO has apparently killed at least 18

Dutch and Belgian cyclists since 1987(11). One thing cyclists are told to do by their team physician is "riders using EPO have to take aspirin or a drink sodium (salt) water each evening before they go to bed, to prevent them from going to sleep forever"(12). How does an athlete learn about these important facts of the use, possible benefits and dangers of EPO?

One could advise athletes to read the instructions on the label before they inject themselves, but I do not think it is that simple! The athletes are not coming up with theories about pushing their bodies limits with performance enhancing substances, their physicians and support staff do! Alessandro Donati, the of Italian Olympic Committee states, "I would like to add that my objective is not to blame the athletes, but doctors, manager and directors who administrate the dope and corrupt the athletes"(13). Renal Specialists/Urologists made an artificial EPO hormone in the laboratory, to help ease the difficulties for those who are showing signs of kidney failure. Artificial EPO was designed to stimulate bone marrow to produce red blood cells so that patients do not have to go through the pain and risks of blood transfusions. Sports physicians, not athletes, came up with the idea that artificial EPO could also give endurance athletes an edge.

A professional team's doctor is analogous to a formula one race car's mechanical engineer. Both are paid large sums of money to ensure that their teams perform better. Each sport has rules, the physician and the engineer push the limits of or bends the rules, so that new rules have to be made. They push the rules as far as they can to secure a

victory, without being penalized. In their mind if their team wins, they have done an excellent job. When they win their fans are fooled and/or satisfied.

The rules and boundaries are stretched in most all competitions. The formula one engineer knows the rules, i.e. the size of the gas tank, in gallons, and the size of the engine, etc. However, the rules do not say anything about the diameter of tube from the gas tank to engine, yet. The engineer will often enlarge the diameter of the tube. When they do they change the volume of gasoline that the car will hold. The car will then be able to hold more fuel and race longer with out as many pit stops. The team physician, knows the rules and helps design performance enhancing substances or regimes that athletes can use while still testing negative on drug tests. EPO is similar to changing the diameter of the fuel hose. To a professional athlete sports is their life and livelihood. In every profession the edge of the rule is pushed which results in the making new rules.

Our society's experience with the Industrial Revolution has done nothing but let all of us pull and push, stretch, and fiddle with all rules. All events, interactions and relationships have rules. Rules bring meaning and structure to our lives. Most individuals do not want to watch or to participant in any event that have David and Goliath odds. Professional Sports can not survive without rules. Rules in sports are artificial ways to keep the athletes and the spectators involved and interested. Athletes and spectators only compete or watch athletic events if the outcome is close and seen to be fair. A goal of many professional athletes is to push the boundary or edge of a game and its rules without penalty.

Society today, sees and speaks about the use of drugs in sports as being unethical or immoral. I interpret society's views of unethical as the use of an advantage that is "unavailable to every one" and immoral as "I know this technology, substance, etc. it is not available to everyone yet, and I will use it to my advantage." But once everyone in society has equal access to the advantage, it becomes ethical and moral, and a new rule has been written. An example from professional cycling is in the final stage of the 1989 Tour de France, an American, Greg LeMond defeated Laurent Fignon of France by only 8 seconds in an event that covers a distance of over 2300 miles. This was the closest win in the history of the Tour de France, since its beginning in 1903. LeMond's was able to win with the use of specially designed handlebars. He used handlebars no one in the cycling world had seen or used before. These handlebars made it possible for front of the cyclists body to become more aerodynamic. LeMond won the race and the cycling society felt that he had an unfair advantage and that his behavior was unethical. However he was awarded the win because there was no rule specifically disallowing his handlebars. Today LeMond's handlebars are now known as time trial bars or tri-bars. Because in 1990 the use of his bars became ethical in time trials events by UCI. From 1990 to 1998 people have experimented with the length of tri-bars. In 1989, LeMond, extending his handlebars slightly. Other cyclist's have made handlebars that make them look like superman in flight. The 1999 UCI regulations for these types of handlebars now states: The overall length (forward projection) of the handlebars may not exceed a limit set 15 cm forward of the vertical line passing through the front wheel spindle(14). Are they ethical now because we changed the rule book?

"Since sports has existed there's always been somebody who has wanted to improve someone's performance and has used all the methods available to do so. The various governing bodies have not managed to sort our efficient controls"(15) states Moerno Argentin former World Champion, 4 time winner of Liege-Bastogne-Liege bicycle race and now the president of the Association of Professional Bicycling Teams. The IOC and UCI rule books tries to efficiently control the use of drugs, but they only state that one can not abuse the use of performance enhancing substances. This is at times, ambiguous and confusing:

> The International Cycling Union has created a drug test system (also known as an anti-doping exami-nation system) the purpose of which is to prevent drug abuse (also known as "doping") in world cycling. This system comprises the Anti-doping Examination (Drug Test) Regulations, the list of class-es of doping substances (doping agents) and methods, the list of international events at which drug tests are to be effected, the list of approved laboratories and the dissemination of information on and promotion of action aimed at dissuading the abusive use of drugs.
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> The UCI definition of drug abuse ("doping"), as that of the IOC Medical Commission, is based on the principle that the use of all substances belonging to the pharmaceutical categories mentioned in the Regulations shall be strictly forbidden(16).

The Webster's Ninth New Collegiate Dictionary defines 'abuse' as "1: improper use or treatment: misuse [drugs~]." So what does this all mean. To '99% of the peloton' it is okay to use performance enhancing substances, just do not abuse it, meaning avoid death.

The professional or elite athlete has the opportunity and ability to say 'No', but they do not. If one looks at the times of the Olympic Games or World Championship events, one would see that these event times are very close. A Gold Medalist will usually only win by a few tenths of a second or a second or two at the most.

Everyone is an athlete is some arena. The athlete that works hard and is dedicated to their sport, may reach the top of the pyramid, i.e. the gold medal. The problem with hard work and dedication is that there are several hundred to thousands of other athletes trying for the same title. The only way to get close to the top of the pyramid, in most sports, is to use performance enhancing substances/methods.

Changing athletes' behavior and attitudes towards performance enhancing substances is a very complicated task. One way of moving toward change in this area is to be truthful with society and the spectators of sports about the use of performance enhancing substances. Almost every one is aware that to become a professional, i.e., a physician one must prepare academically for years. Not every one knows what it takes to be a professional athlete, i.e., to be a become a professional cyclist you must ride hundreds of thousands of miles, at high speeds, most cyclists feel they must use performance enhancing substances. The only way to stop the use performance enhancing substances is by stepping up testing for detectable products and presently undetectable products. That will never happen in my opinion. In 1997 the United States Olympic Committee (USOC) gave a meager $50,000 to Dr. Allen Murray, president of California biotect company Glycozyme Inc. and Dr. John Pazur of University of Pennsylvania (17).

That is not even close to enough money to strengthen testing. What IOC needs is to pass laws or rules that will hold biotechnological companies that make these performance enhancing substances, responsible for educating the athletes and the public at large concerning the appropriate use and abuses of their products. They should also release information on tests that they use to see if the substances are working correctly. It would then be easier and cheaper to detect this substances at athletic events.

The UCI is trying to make each professional team list only one official team physician. The UCI wants to make sure that each team's physician is qualified in sports medicine. The physicians would be held responsible for their team following the rules of cycling related to performance enhancers and for safeguarding the health of their riders. A group of six physicians has already been set up to study and discuss the medical treatment required by riders to compete in this sport. The UCI will also re-examine the list of banned substances with a view of establishing a list that applies specifically to cycling. This of course will be done in consultation with the IOC. These six physicians will see if the team physician is pushing cyclists that are burned out with the duration of competitions and/or the length of races. Much is said about the cycling events calendar being overloaded. But in the eyes of the promoter a full calendar is a sign of increased revenue from a sport. The UCI states that money for anti-drug testing will increase next year, but so does inflation.

UCI and IOC could make strides toward stopping abuse of athletes and athletes abuse of drugs by having the sponsors of each event, team, country give a certain

percentage of their sponsorship funds toward anti-drug testing. Another way to try and stop this is by Drug-testing the athletes through out the year, not just so called random testing and/or the top three finishers of an competition. A more thoughtful way would be to crack down on the anti-doping laboratories. "In Rome, the anti-doping laboratory has temporarily been closed after it was discovered that 70 per cent of all the urine samples taken were never tested"(18). We all know if Italy can do that, then any one in world can do the same or has done the same. Replacement of urine testing with blood testing would also curb abuse. Blood testing is a lot harder to foil than urine testing.

Regulating a performance enhancing substance is difficult but we are able to do it if we are willing. There will always be loop-holes in any type of law or rule. There are only two things that we can do as a society in terms of ethical use of performance enhancing substances: one allow the use of performance enhancing substances in all athletic events and/or two, increase the funding for testing of performance enhancing substances by at least tenfold. I will leave you with a final thought about athletics, I believe, Competition is a measure of inequality, not of equality!

FOOTNOTES

(1) Australian Drug Foundation http://www.adf.org.au

(2) Australian Drug Foundation http://www.adf.org.au

(3) Australian Drug Foundation http://www.adf.org.au

(4) Australian Drug Foundation http://www.adf.org.au

(5) Australian Drug Foundation http://www.adf.org.au

(6) Australian Drug Foundation http://www.adf.org.au

(7) Fox, S. (1994) Human Physiology (4th ed.). Dubuque, Iowa: Wm. C. Brown Publishers. p 99

(8) Union Cycliste Internationale http://www.uci.ch

(9) Graham Watson. (1992) The Road to Hell. West Yorkshire, England: Springfield Books Limited. p 3

(10) Dickey, C. (1999) The Real Scandal. Newsweek February. p 51

(11) Dickey, C. (1999) The Real Scandal. Newsweek February. p 52

(12) Sutcliffe, A. (1996).EPO friend or foe?. Cycle Sport March. p 10

(13) Sutcliffe, A. (1997). Who is right on Drugs. Cycle Sport March. p 10

(14) Tarbert, J. (1999) United States Cycling Federation 1999 Rulebook. Colorado Spring, CO.: USA Cycling p 22

(15) Sutcliffe, A. (1998). Ex-pro pro dope. Cycle Sport April. p 10

(16) Union Cycliste Internationale http://www.uci.ch

(17) Sutcliffe, A. (1997). EPO test on back burner. Cycle Sport July. p 12

(18) Sutcliffe, A. (1998). Conconi faces toughest test. Cycle Sport December. p 8

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