BLOOD DOPING: MORE BLOOD, MORE MEDALS

(1) You've probably heard of athletes that drug dope. This means that they take performance enhancing drugs, usually anabolic steroids, that give them an advantage over their competitors during athletic competitions; however, this is not the only way to cheat. Besides drug doping, there is also blood doping. During blood doping, the number of red blood cells in an athlete is artificially increased beyond what their body is capable of producing on its own. This is primarily done by either taking drugs to produce more red blood cells or by receiving blood transfusions that immediately increase the number of red blood cells.

(2) Hemoglobin on red blood cells carry oxygen to all the cells of the body including the muscle cells. Having more red blood cells improves athletic performance because it increases VO_2 max. This means that muscles are able to increase their rate of oxygen use, which gives them longer endurance at high levels of performance before they become fatigued and resort to anaerobic respiration. The athletes most likely to blood dope are the ones involved in endurance sports like long distance running, cycling and skiing. There are different ways of increasing red blood cell count and some are legal and some, like blood doping, are illegal.

(3) Unlike blood doping, high altitude training is a permitted method of increasing red blood cell count. During high altitude training, an athlete trains for several weeks or months at a high altitude which stimulates the production of more red blood cells. This effect can begin to be seen at 1500m (4921ft) above sea level but the most dramatic effect happens at 2500m (8202ft) above sea level. It is widely acknowledged that Kenyans and Ethiopians are the best long distance runners and it is not surprising that many of them live and train in elevations of 3000m or more.

(4) At higher altitudes, the atmosphere is thinner than at sea level. This means that there is less oxygen in the air. This creates a condition of hypoxia (lack of oxygen) in the body which causes HIF1 (hypoxia inducible factor 1) to activate. Active HIF1 stimulates the production of a hormone called EPO (erythropoietin) from the kidneys. EPO travels through the blood stream to the bone marrow

and causes it to make more red blood cells. This production of more red blood cells is called erythropoiesis. Though HIF1 and EPO are natural substances produced by the body, synthetic forms have been developed for use as therapeutic drugs and these drugs can be misused for blood doping.

(5) Synthetic HIF was initially produced to treat chronic kidney disease. As a performance enhancing drug, HIF is used to make the kidneys produce more natural EPO which will cause erythropoiesis. Synthetic EPO was first produced to counteract the side effects of the radiation and chemotherapy used on cancer patients. Synthetic EPO became popular for blood doping in the 1990s and its detection was difficult until 2000, when tests were developed to detect it; however, a difficulty still remains since synthetic EPO lasts for a very short period of time in the body while the effects of EPO, elevated red blood cell count, can last for a long time. Red blood cells survive for 120 days in the blood once created.

(6) Blood transfusions, where extra blood is pumped directly into an athlete, were widely used before EPO became the standard blood doping method, but transfusions have become popular again since tests for EPO have been developed. A blood transfusion gives an immediate boost to red blood cell count without the need for drugs or the need to wait for erythropoiesis. If the blood donor is the same as the recipient, the transfusion is called autologous. In his method, the athlete has his or her own blood drawn to be stored for later use in an autologous transfusion before a competition. If the blood donor is different

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from the recipient, the transfusion is called homologous. A test for detecting homologous transfusions became used at the 2004 Sydney Olympic games because differences between donor and recipient antigens (unique proteins) on the surface of the red blood cells could be detected. Autologous transfusions are much more difficult to detect because all the red blood cells are from the same person.

(7) The World Anti-Doping Agency has been implementing athlete biological passports to overcome the multiple techniques of cheating in sports. In this method, an athlete's baseline biological profile (e.g. amount of natural hormones and blood count etc.) is recorded through obtaining blood and urine samples and this baseline is compared to an athlete's levels before a race or competition. If their race levels are way beyond their normal biological range, they can be accused of doping without need for further proof. This method by-passes the need to find a new detection technique for every new method of cheating that arises.

(8) Though blood doping provides a performance advantage, it also has negative health consequences. All those extra red blood cells thicken the blood and this puts an athlete at risk of blood clots, strokes and heart attacks.

Article Questions

1) What is blood doping?

2) How does blood doping provide an performance enhancing advantage?

3) What is one legal way for athletes to increase their red blood cell count?

4) What does EPO stand for and what does it do?

5) What makes detecting synthetic EPO difficult?

6) What is the difference between an autologous and a homologous blood transfusion?

7) How is the athlete biological passport supposed to help catch cheaters?