

A Brief Review on Doping in Sports and Performance-Enhancing Drugs

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Abstract : Doping is a major issue in competitive sports and is favored by vast groups of athletes. The feeling of being higher-ranking than others and gaining fame has caused many athletes to misuse drugs. The definition of doping is to use prohibited substances and/or methods that help physical or mental performances or both. Doping counts as the illegal use of chemical substances or drugs, excessive amounts of physiological substances to increase the performance at or out of competition or even the use of inappropriate medications to treat an injury to gain the ability to participate in a competition. The International Olympic Committee (IOC) and World Anti-Doping Agency (WADA) have forbidden these substances to ensure fair and equal competition and also the health of the competitors. As of 2004 WADA has published an international list of illegal substances used for doping, which is updated annually. In the process of the Genome Project scientists have gained the ability to treat numerous diseases by gene therapy, which may result in bodily performance increase and therefore a potential opportunity to misuse by some athletes. Gene doping is defined as the non-therapeutic direct and indirect genetic modifications using genetic materials that can improve the performances in sports events. Biosynthetic drugs are a form of indirect genetic engineering. The method can be performed in three ways such as injecting the DNA directly into the muscle, inserting the genetically engineered cells, or transferring the DNA using a virus as a vector. Erythropoietin is a hormone majorly released by the kidney and in small amounts by the liver. Its function is to stimulate the erythropoiesis and therefore the more production of red blood cells (RBC) which causes an increase in Hemoglobin (Hb). During this process, the oxygen delivery to muscles will increase, which will improve athletic performance and postpone exhaustion. There are ways to increase the oxygen transferred to muscles such as blood transfusion, stimulating the production of red blood cells by using Erythropoietin (EPO), and also using allosteric effectors of Hemoglobin. EPO can either be injected as a protein or can be inserted into the cells as the gene which encodes EPO. Adeno-associated viruses have been employed to deliver the EPO gene to the cells. Employing the genes that naturally exist in the human body such as the EPO gene can reduce the risk of detecting gene doping. The first research about blood doping was conducted in 1947. The study has shown that an increase in hematocrit (HCT) up to 55% following homologous transfusion makes it more unchallenging for the body to perform the exercise at the altitude. Thereafter athletes' attraction to blood infusion escalated. Also, a study has demonstrated that by reinfusing their own blood 4 weeks after being drawn, three men have shown a rise in Hb level which improved the oxygen uptake, and a delay in exhaustion. The list of performance-enhancing drugs is published by WADA annually and includes the following drugs: anabolic agents, hormones, Beta-2 agonists, Beta-blockers, Diuretics, Stimulants, narcotics, cannabinoids, and corticosteroids.

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