**SIDE EFFECTS**
The main side effects of blood doping include:
- Formation of blood clots
- Overload of the circulatory system
- Kidney damage from allergic reactions
- Transmission of infectious diseases e.g. HIV
- Rash
- Fever
- Jaundice (potentially life-threatening)

The side effects of artificial oxygen carriers vary significantly and they include:
- Fever
- Reduced platelet counts
- Hypertension
- Vasoconstriction
- Impaired oxygen delivery to tissues
- Kidney damage
- Iron overload
- Allergic reactions
- High body temperature
- Diarrhea
- Kidney, liver and lung toxicity
- Blood infections
- Embolism
- Thrombosis

**WHEN IS MANIPULATION OF BLOOD AND BLOOD COMPONENTS PROHIBITED?**
Manipulation of blood and blood components is prohibited in-competition and out-of-competition under M1 of the List of Prohibited Substance and Methods.
Manipulation of blood and blood components is the misuse of certain techniques and/or substances administered for non-medical reasons to increase one’s red blood cell mass, thereby increasing the blood’s oxygen-carrying capacity. These include blood doping, namely blood transfusions and erythropoietin (EPO) and the use of artificial oxygen carriers. The goal is to increase the number of red blood cells (RBCs) which are responsible for delivering oxygen to the tissues in the body and/or to increase oxygen delivery to the muscles, particularly in conditions of demanding physical exercise.

Transfusion is the transfer of blood into a person’s vein. Blood may be withdrawn from an athlete several weeks before a competition and re-infused or donated blood may be infused a few days before competition. Transfusions may be autologous or homologous. Autologous blood doping is the removal of one’s own blood, storing it (refrigerating or freezing) until needed by which time the body would have compensated for the blood volume loss and once the blood is returned to the body this will result in a raised blood volume. Homologous blood doping is the transfusion of blood that has been taken from another person with the same blood type.

EPO is a peptide hormone that is produced naturally by the human body. EPO is released from the kidneys and causes more red blood cells to be produced in the body’s bone marrow. The additional red blood cells result in the presence of additional hemoglobin molecules, which aid in the delivery of oxygen to the body’s tissues. Artificial oxygen carriers, such as haemoglobin based oxygen carriers (HBOCs) or perfluorocarbons (PFCs), are purified proteins or chemicals having the ability to carry oxygen and aid the transport of oxygen throughout the body.

WHAT IS MANIPULATION OF BLOOD AND BLOOD COMPONENTS?

Cheating using manipulation of blood and blood components

Oxygen transport enhancing agents, EPO and both homologous and autologous red blood cell transfusions have been used by some athletes for enhancing performance, especially in endurance sports such as long distance running, cycling, skiing or swimming.

Research has shown that blood doping increases the RBC count of an athlete, increasing oxygen delivering to the muscles resulting in a higher aerobic capacity and thus overall performance. Artificial oxygen carriers having the ability to carry oxygen prolong endurance by increasing blood oxygenation.