PROJECT REVIEW

"*Determination of red blood cell deformability in athletes during the course of the year: Considering gender, ethnic and training conditions*"

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Project overview

Performance-enhancing aids are not new to athletes. Owing to fame, honor and economic benefits arising from success in competitions, there is rather a long history of cheating in sports. After the usage of erythropoietin could effectively been proven, lots of athletes turned to an older doping procedure: autologous blood doping to increase the number of circulating red blood cells (RBCs). This increases the oxygen delivery through the blood to the working muscle which profoundly enhances an athletes´ performance. The International Olympic Committee (IOC) forbade blood boosting after the 1984 Olympics, despite the fact that no methods had been devised for unequivocal detection. Valid and established methods for the detection of autologous blood doping are still missing but our recent findings indicate that the RBC flexibility represents a useful marker to detect blood doping. The deformability is an essential feature enabling RBCs to access and transit the capillary bed and to deliver oxygen to the muscle cells due to the fact that the vessel diameter of the capillary is smaller than the resting cell diameter.

The aim of the presented study is the investigation of RBCs flexibility in male and female endurance athletes and male and female non-athletes during a one-year period. Thereby, a variety of parameters, known to influence RBC deformability like L-arginine and NO levels, are planned to be investigated. Also, the influence of the female hormone cycle on the RBC deformability should be investigated. Furthermore, the influence of competition and training periods and the influence of the ethnic background on RBCs flexibility will be evaluated. The findings obtained with this study will serve as a basis for further investigations and the development of a routinely applicable detection method to detect autologous blood doping

Results and Conclusions

Autologous blood doping is the practice of boosting the number of red blood cells (RBC) in order to improve aerobic capacity and thus athletic performance and endurance. RBC deformability, the ability of RBC to change their shape under a given level of applied shear stress, is an important cell property to ensure oxygen and nutrient supply to the working tissue in the microcirculation. Thus, RBC deformability may also determine performance capacity. Hypothermic blood storage decreases RBC deformability, thus,

monitoring RBC deformability of elite athletes during the course of the year may be suitable to detect for autologous blood doping.

But first it was necessary to test for factors that possibly influence deformability in endurance athletes. Among these were age, ethnicity, gender, estrogen levels and training volume.

The major results revealed increasing RBC deformability from pre-puberty to adulthood. Further, female athletes who used hormonal contraceptives and who thus showed reduced estrogen levels showed reduced RBC deformability compared to female athletes without hormonal contraception (-HC). An acute response of RBC deformability to increasing estrogen levels was not detected concluding a chronic impact of estrogen on RBC deformability. Both, male and female athletes (-HC) showed higher deformability values compared to respective non-athlete control groups, indicating a correlation of endurance exercise and RBC deformability. RBC deformability did not differ between male athletes and female athletes – HC but deformability values were significantly higher in male athletes compared to female athletes + HC. Female Asian and black athletes (all – HC) showed reduced RBC deformability compared to white female athletes – HC. Also, male Asian and black athletes showed reduced RBC deformability compared to white male athletes.

The recent data indicated that RBC deformability is influenced by some variables such as gender or ethnicity. According to the recent data it is suggested to monitor individual RBC deformability values longitudinally to detect abnormalities possibly occurring after autologous blood doping.