"Rapid Capillary Electrophoretic Detection of Autologous Blood Transfusions"

Dr. C. Harrison (San Diego State University, USA)

Project Summary

The Harrison lab has been developing a capillary electrophoretic method for the detection of autologous blood transfusions. The method is capable of identifying transfused red blood cells by the difference in their mobilities as compared to non-transfused red blood cells. The development of the test for autologous blood transfusions has been conducted simulating transfusions by mixing aged and fresh blood samples in vials, this study aims to examine the capabilities of the test in detecting autologous transfusions that have taken place in human subjects. This will examine how long after a transfusion the detection can reliably be made. In addition, we seek to determine how extended periods of exercise may impact the reliability of the analysis.

Results and Conclusions

The work conducted by the Harrison research group at San Diego State University built on a prior WADA funded grant (09A23CH) to identify the efficacy of capillary electrophoresis (CE) at identifying autologous blood transfusions in endurance athletes. The process takes advantage of the changes in the physical characteristics of the erythrocytes while in storage, a change which is dominated by a reduction in the mean size of the erythrocytes. This change is important as endurance athletes have been shown to have a larger mean size for their erythrocytes than the average population, due to the higher rate of turnover of the cells, and the inherently larger size of new erythrocytes (reticulocytes).

The CE separation is based on the difference in mobilities of analytes in a buffer solution in a uniform electric field. The mobilities of the analytes, in this case the different erythrocytes, are a function of their charge to size ratio. Consequently, erythrocytes that have been stored will have a different mobility than those that have not been removed from the athlete's body. The CE separation had been previously shown to be able to identify mixtures of fresh and stored erythrocytes from endurance athletes, when mixed in a vial. The current project aimed to examine how effectively this mixed population could be identified when an actual autologous blood transfusion had taken place.

In the current study a small group of endurance athletes (cyclists) were recruited to evaluated both the impact of a prolonged period of exercise on the results of the erythrocyte separation, and to evaluate the efficacy of the test to identify actual instances of autologous blood doping. To this end the

tests revealed that prolonged exercise does not negatively influence the outcome of the analysis, specifically it does not result in false positive results for the test. The athlete volunteers for autologous blood transfusions were tested before and after the transfusions. These test results demonstrated variations in the results for each individual, yet each individual's blood profile varied between the pre and post transfusion periods, indicating that detection of an autologous blood transfusion could be possible.