

Ph.D. dissertation
*Comparative standardizing investigation of laboratory animals'
micro-rheological properties for experimental surgical research studies*
by Ferenc Kiss, M.D.

Department of Operative Techniques and Surgical Research, Institute of Surgery,
Medical and Health Science Center, University of Debrecen

Supervisor: Norbert Németh, M.D., Ph.D.

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Summary

In experimental surgical research, the hemorheological parameters (blood and plasma viscosity, red blood cell deformability, red blood cell aggregation) show significant, often signaling changes in several pathophysiological processes, which changes have big importance due to the evolving tissue microcirculatory disorders.

In the experimental models, the measurement results and their estimability and comparability are highly influenced by the not totally known race and barely known gender hemorheological differences of laboratory animal races as well as the effect of sampling, sample storage and handling on the micro-rheological parameters, which demonstrability depend also on the sensitivity of the special measurement device.

For securing proper estimable laboratory results we aimed to analyze the race and gender differences of the hemorheological parameters in two laboratory animal races -outbred rat and beagle dog-, furthermore to investigate the importance of the influencing effect of sample storage time and temperature and of the medium used for ektacytometric red blood cell deformability measurement and the sensitivity of the measurement-technical method.

We experienced significant hemorheological gender differences between the two races in red blood cell aggregation and deformability. In case of rats the females, in beagle dogs males had better red blood cell deformability while the red blood cell aggregation was increased in female rats and in male beagle dogs.

By the storage of CD rat and beagle dog blood samples the magnitude of micro-rheological parameter changes showed difference between the laboratory animal races. The red blood cell deformability measurements by room-temperature storage are stable within 4-6 hours, in case of rats the red blood cell aggregation measurements have to be possibly completed already within 1 hour.

We showed using slit-flow ektacytometric method that the red blood cell deformability values of Sprague-Dawley rat and beagle dog blood samples significantly differ from each other, using 15, 20 and 30 mPa.s viscosity polyvinyl-pyrrolidone (PVP) solutions for red blood cell deformability measurements. We got more sensitively and the most securely detectable race and gender differences by using 30 mPa.s viscosity solution. We could show the largest magnitude of changes in the deformability of the heat-treated, rigid red blood cells in the rat.

As conclusion we can say, that for securing properly extrapolable data it is necessary to plan properly the experimental model, standardize the measurement method for the actual laboratory animal race. The experienced race and gender differences, so the measurement alterations deriving from fault sample handling and not properly standardized methods can reach or mask the magnitude of the real differences between the experimental groups.

Keywords: hemorheology, red blood cell deformability, red blood cell aggregation, experimental surgical research, hemorheological interspecies and gender differences
(haemorheologia, vörösvérsejt deformabilitás, vörösvérsejt aggregatio, kísérletes sebészeti kutatás, faji- és nemi haemorheológiai különbségek)