Small amplitude oscillation (SAOS) technique to characterize blood of species with different RBC aggregability

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Small amplitude oscillation (SAOS) technique is used to characterize the shear stiffness of viscoelastic materials. In blood, it reflects the forces between blood cells and between blood cells and surrounding plasma. We analyzed blood of species with high (horse), medium (man), and low (sheep) erythrocyte (RBC) aggregability and compared the results to dynamic viscosity data obtained in rotational shear flow. Amplitude and frequency sweep tests (linear viscoelastic mode, LVE) were performed from hematocrit (HCT) adjusted (40%, 50%, 60%) samples that were tested at 7°C, 22°C, and 37°C. Storage modulus (G’) increased with HCT and decreased with temperature in each species, but the gradient of this increase was species-specific. The lower dependency of G’ on the equine HCT value could be a benefit during physical performance when high numbers of RBCs are released from the spleen. In sheep, an HCT-threshold must be overcome before the desired quasi-static condition was achieved, suggesting that the binding forces within blood are rather weak. This was confirmed by the reduced shear thinning of sheep blood. Human blood was the easiest to measure. The frequencies for tests under LVE were in a narrow range around the resting heart rate of the species. In horse, time-dependent influences concurred at frequencies lower than 3 rad.s⁻¹ due to sedimentation of RBC aggregates. In conclusion, blood is a fragile suspension that shows its best stability around the heart rate of the species.