How do red blood cell properties contribute to the exercise performance in camels (Camelus dromedarius)?

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We studied the influence of the camels´ rigid and spindle-shaped erythrocytes (RBC) on whole blood viscosity during exercise and determined the theoretical “optimal” hematocrit (opt.HCT). Blood of 11 Arabian camels (C. dromedarius) was collected before and after a 8 km run, as well as after a 30 min cool down period. Flow curves (11-500 s⁻¹, 37°C; Physica MCR301 rheometer, Anton Paar, Austria) and RBC aggregation (MA1, Myrenne, Germany) were analyzed. 51 samples with packed cell volume (PCV) values between 5% and 85% (RBC in autologous plasma) were used to determine the opt.HCT. Despite a gain in plasma volume of 1-2 L per camel, PCV remained unchanged (median: 31% (pre), 32.5% (end of race) and 31.5%, (cool down)), as did dynamic shear viscosity. Aggregation indices were low and remained unchanged. Camel blood showed low shear thinning. Opt.HCT ranged from 49% at 11 s⁻¹ to 31% at 500 s⁻¹. A strong correlation between WBV and aggregation index (M1) suggests some form of organization within the camel blood in relation to shear flow, despite the spindle-shape, bi-convex surface probably preventing substantial aggregation. Contrary to observations in humans and horses, opt.HCT decreased continuously with increasing shear rates (SR). Resting PCV equaled opt.HCT at high SR, suggesting that camels do not depend on a high circulating RBC count to perform. The lacking WBV-increase in camels in response to exercise could be a physiological buffer to offset the effects of dehydration.