The optimum hematocrit

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The hematocrit (Hct) determines the oxygen carrying capacity of blood. At the same time the Hct increases flow resistance by an exponential increase of blood viscosity. From this dual role of the Hct, the concept of an optimum Hct for tissue oxygenation has been derived. It has been investigated by different methods in vitro. Using the ratio Hct/viscosity, an optimum Hct of 50-60% was determined. Using the perfusion of an artificial microvascular network, we found a similar optimum Hct of 50-60%. In vivo, a deliberate Hct increase to supra-normal levels improves exercise capacity in athletes (Blood doping). Taken together, these data with normal red blood cells and healthy individuals suggest that the optimum Hct may be higher than the physiological Hct (35-40% in women, 39-50% in men). However, these findings are in contrast to clinical studies in patients. The correction of anemia in conditions such as chronic kidney disease, heart failure, coronary syndrome, oncology, acute gastrointestinal bleeding, critical care, or surgery has worse clinical outcomes with liberal compared to restrictive transfusion strategies. Actual guidelines, therefore, set a transfusion threshold as low as 7-8 g/dL hemoglobin (Hct 20-23.5%) and do not recommend a Hct normalisation. The discrepancy between the optimum Hct in health and disease may be caused by differences in hemorheology (red cell deformability, plasma viscosity) and the microcirculation (endothelial function, vasoconstriction).