Foot-strike Hemolysis: A Systematic Review of Long-Distance Runners

Nick Lowe, B.S.[1], Austin Gartner, B.S.[1], Nicholas Dombrowski, ATC[1], Vafa Behzadpour, M.D.[2], Rosey Zackula, M.A.[2]
[1]University of Kansas School of Medicine-Kansas City, Kansas City, KS
[2]University of Kansas School of Medicine-Wichita, Wichita, KS, Department of Orthopedic Surgery

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Introduction. Endurance athletes are subject to rigorous physiological demands, leading to a multitude of effects on the human body. In endurance runners, sports-related anemia has been described as commonplace, due to hemodilution, metabolic injury, and direct mechanical injury to red blood cells (RBCs), known as foot-strike hemolysis. This phenomenon has been theorized to contribute to anemia in long-distance runners.

Methods. A systematic review of literature was performed following PRISMA guidelines by three independent authors. The review was registered with PROSPERO and no similar meta-analyses or systematic reviews were identified. Nine studies containing a total of 267 runners met all inclusion criteria. Most runners included in the study were male (n = 236/267), with mean age of 38 years. The runners' average best marathon time was 220 minutes. Three studies examined races of marathon distance (42.2 km), three examined races between 42.2 km – 160 km, and two studies examined a one-day and six-day ultra-marathon race, respectively. The average distance ran was 54.4 km.

Results. Reticulocyte count showed a 16% increase between pre- and post-race measurements, while haptoglobin levels decreased by 21%. Hemoglobin, hematocrit, and RBC count values remained within accepted normal limits.

Conclusions. This systematic review has demonstrated an appreciable change in both reticulocyte count and haptoglobin levels in runners following a race of at least marathon distance, indicative of hemolysis. Appreciable changes in hemoglobin and hematocrit were not identified, which may be attributable to dehydration and subsequent hemoconcentration, advances in shoe technology, or physiological adaptations in endurance athletes.