Mid Atlantic Regional Chapter
of the
American College of Sports Medicine

Annual Scientific Meeting, November 1st – 2nd, 2019
Conference Proceedings
International Journal of Exercise Science, Volume 9, Issue 8

Changes in Circulating Angiogenic Cell Number and Function During and After an Ultramarathon

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Circulating angiogenic cells (CACs) have been identified as having an important role in vascular health and function. Typical bouts of aerobic exercise (≤60min) can increase the number and function of certain CACs; however, less is known about the effects of prolonged endurance exercise on CAC number and function. **PURPOSE**: To distinguish the effects of normal (10km) and extreme (50km) distances of running on CAC number and function. **METHODS**: Blood samples were obtained from seven ultramarathon participants (age 39±2 years) at four timepoints: before the race (0km), after 10km, upon race completion (50km), and 24 hours after race completion (24hrs). Peripheral blood mononuclear cells (PBMCs) were isolated from blood samples and cultured to generate conditioned cell culture medium (CM). Human umbilical vein endothelial cells (HUVECs) were then incubated in the resulting CM to assess the paracrine effects of CACs on endothelial cell proliferation at each time point. Specific CAC subtypes (CD34+, CD31+, CD3+, and CD3+/CD31+ cells) were enumerated at each timepoint by flow cytometry analysis. **RESULTS**: The cell proliferation assay showed clear differences among timepoints. Cell proliferation significantly increased by ~9% (759 ± 36 vs. 829 ± 28 RFU, p = 0.004) at 50km when compared with 0km results. Proliferation was reduced by 18% (759 ± 36 vs. 679 ± 12 RFU, p = 0.007) at 24hrs when compared with 0km results. CD31+ CAC number increased by 23% at 50km from 0km (65,674 ± 4,296 vs. 80,934 ± 3,236 cells/10^5 events, p = 0.01) and returned to baseline levels at 24hrs. Conversely, CD3+, CD3+/CD31+, and CD34+ CACs tended to decrease immediately after the race by 35% (48,024 ± 4,597 vs. 31,262 ± 2,249 cells/10^5 events , p = 0.04), 33% (25,221 ± 2,972 vs. 16,835 ± 1,826 cells/10^5 events, p = 0.08) and 49% (100 ± 24 vs. 51 ± 11 cells/10^5 events) respectively, and returned to baseline levels at 24hrs. **CONCLUSION**: CAC mobilization and paracrine function may actually improve after an acute, prolonged bout of aerobic exercise in trained subjects. While CD34+ and CD3+ CAC numbers decreased immediately following the race, the increase in CD31+ CACs may have contributed to increased cell proliferation immediately after the race, which may have implications for the effects of exercise on CAC and vascular function.