



A comparison of complete blood counts of capillary and venous blood samples in active individuals

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Introduction

Venipuncture, or venous blood sampling is currently the “gold standard” for clinical applications related to the evaluation of hematological and immunological aspects, however it is not ideal for all patients. Numerous patients have inaccessible peripheral veins, including severely burned patients, oncology patients whose veins are restricted for therapeutic procedures, bariatric patients with deep veins, geriatric patients with varicose veins, patients with severe peripheral edema, and recent surgical patients with scars. If a relationship is established between capillary and venous blood, capillary blood via microsampling may be optimal due to greater patient comfort and easier access due to less repeat draws and smaller volumes. A complete blood count (CBC) can be performed to assess the similarities and differences between venous blood and capillary blood at rest, immediately after exercise, and during recovery.

Purpose

Primary purpose: assess the degree of similarity between venous blood and capillary blood at rest, immediately after 40 minutes of moderate-intensity exercise on a stationary cycle ergometer at 90-98% of ventilatory threshold, and 30 minutes after the exercise regimen during recovery

Secondary purpose: explore biological sex CBC differences between venous blood and capillary blood

Visit One

Medical History
Par-Q
Informed Consent
Resting ECG
Familiarization protocol with cycle ergometer

Visit Two

DXA
Graded Exercise Test
Determine VO2 max and VT
Blood Lactate Sample

Visit Three

Resting Blood Samples
40 min Exercise Protocol
0 min Post Blood Samples
30 min Post Blood Samples

Data Analysis

Figure 1: Average Lymphocyte Count of Venous and Capillary Samples

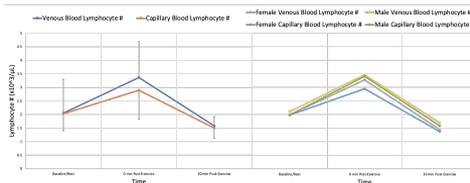


Figure 3: Average Monocyte Count of Venous and Capillary Samples



Figure 2: Average Neutrophil Count of Venous and Capillary Samples

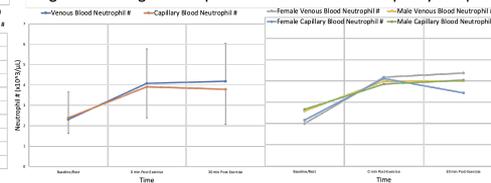
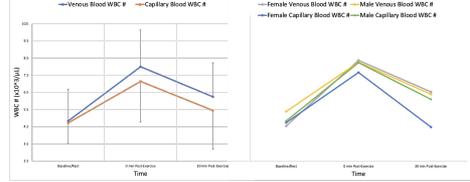


Figure 4: Average WBC Count of Venous and Capillary Samples



Participant Demographics

The participants of this study included males and females from the age of 18 to 35 years old. Participants must exercise moderately 5 days per week for 30-60 minutes or exercise vigorously 3 days per week for 20-60 minutes to qualify. Athletes who performed a combination of both moderate and vigorous exercise were also accepted.

Table 1. Participant Demographics

	Age	BMI	Working % VO ₂ Max	Working % VT
Overall Avg (SD) n= 22	23.6 (3.8)	26.3 (3.2)	69.7 (7.4)	87.2 (15.3)
Male Avg. (SD) n= 11	23.0 (2.8)	27.4 (2.7)	69.8 (7.7)	85.2 (15.5)
Female Avg. (SD) n= 11	24.1 (4.7)	25.1 (3.3)	69.7 (7.9)	89.2 (15.8)

Discussion

- The correlation coefficients for lymphocyte, neutrophil, monocyte, and overall white blood cell counts in venous and capillary blood are 0.992, 0.992, 0.996, and 0.987, respectively. A correlation coefficient of 1.000 indicates a statistically perfect correlation. Thus, these values indicate that the CBC of capillary blood is strongly associated with that of venous blood.
- There were no significant differences between male and female capillary and venous blood at rest, 0 minutes post-, and 30 minutes post-exercise.
- Based on Figures 1-4, the WBCs increase greatly in response to exercise, which supports prior research focused on the immune response to moderate to vigorous exercise.
- Venous blood samples in Figures 1, 3 and 4 remain approximately the same as or slightly higher than their capillary counterpart conveying a strong, positive correlation between venous and capillary samples.
- Neutrophils (Figure 3) convey a slightly different response than lymphocytes and monocytes as the capillary resting blood sample is slightly higher than that of the venous blood sample. In addition, neutrophils remain relatively constant for the 0 minute post- and 30 minute post-exercise sample while lymphocytes and monocytes gradually decrease following completion of exercise.

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- MacLennan, Calman Aa,b,c; van Oosterhout, Joep JGd; White, Sarah Aa,e; Drayson, Mark Tb; Zijlstra, Eduard Ed; Molyneux, Malcolm Ea,f Finger-prick blood samples can be used interchangeably with venous samples for CD4 cell counting indicating their potential for use in CD4 rapid tests, *AIDS*: July 31, 2007
- Chavan, P., Bhat, V., Tiwari, M., Gavhane, U., & Pal, S. K. (2016). Comparison of Complete Blood Count Parameters between Venous and Capillary Blood in Oncology Patients. *Journal of laboratory physicians*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4785771/>.