

Innovative Footwear Solutions for Active Recovery: A Practical Approach to Enhancing Peripheral Circulation

INTRODUCTION

- Reduced oxygen availability to exercising muscles leads to faster muscle fatigue. Blood flow ensures a steady supply of oxygen and nutrients while removing waste, both critical for recovery. [1]
- Focus on peripheral circulation and its enhancements
- Use of OOFOS active recovery footwear
- NIRS to measure changes in peripheral circulation
- Evolution of footwear effectiveness in improving circulation



Fig 1. OOFOS active recovery footwear used in this study.

BACKGROUND

Active recovery involves low-intensity activities that promote blood flow, muscle repair, and waste removal after exercise. Footwear can significantly impact recovery by influencing blood flow and oxygenation in the lower limbs. [2]

Hypothesis: The use of active recovery footwear enhances tissue oxygenation leading to faster recovery.

METHODS

- Oxyhemoglobin (O2Hb): Hemoglobin carrying oxygen to the body's tissues.
- Deoxyhemoglobin (HHb): Hemoglobin that has released oxygen and is returning to the lungs for reoxygenation.

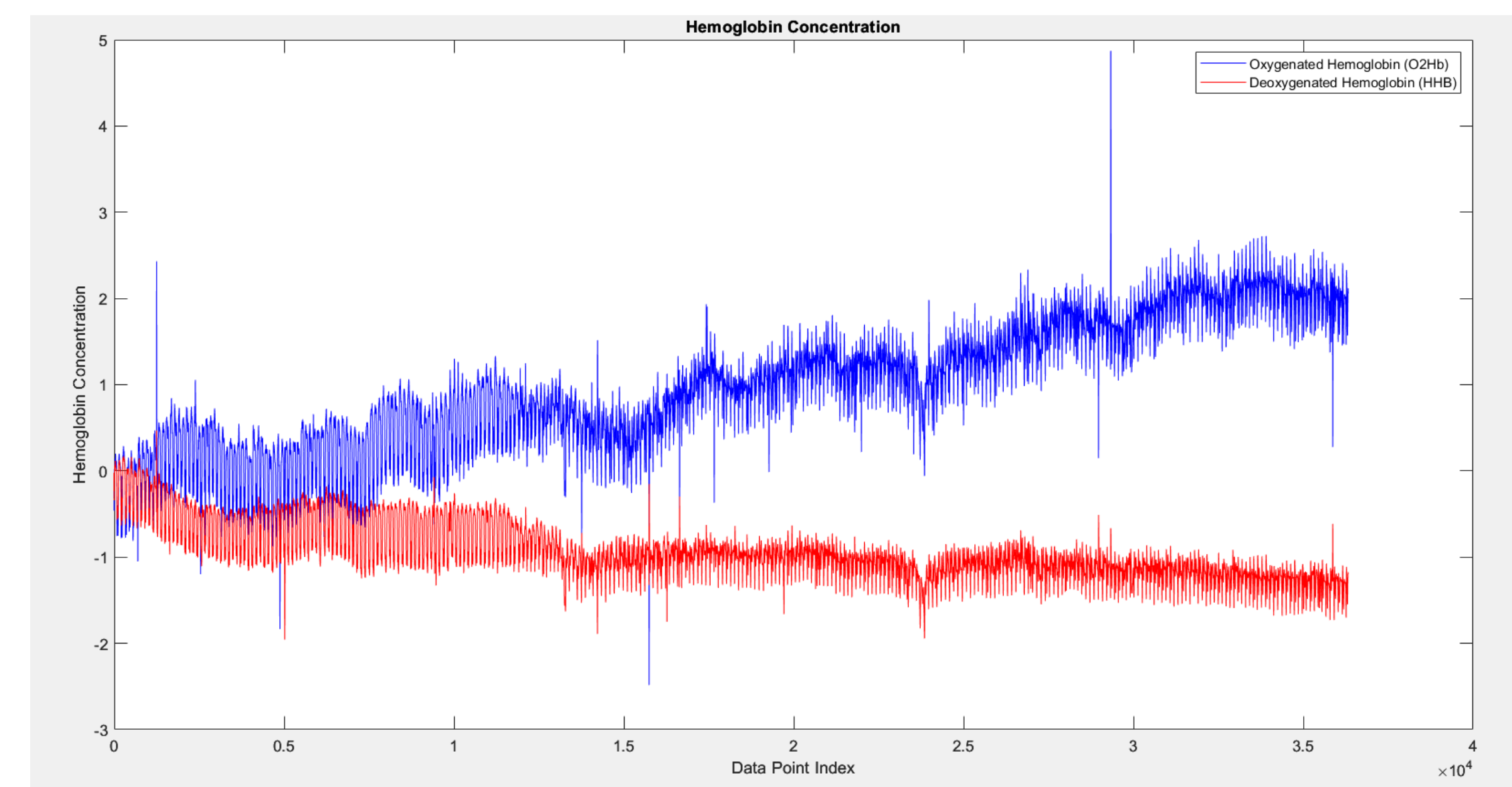


Fig 4. The plot illustrates the typical behavior of oxygenated hemoglobin (O2Hb) and deoxygenated hemoglobin (HHb) during active recovery. O2Hb levels gradually increase as oxygen delivery improves, while HHb levels decrease, reflecting enhanced oxygen extraction and circulation in the recovering tissue.

- 4 conditions: OOFOS, HOKA, Standard, Barefoot
- 6 minutes on treadmill (1.8 MPH) with 3 minutes breaks
- Start with baseline recordings (barefoot)
- Randomized condition order using online wheel spinner
- Participants wore shorts for normal blood flow and optode placements
- NIRS optodes placed on both
- Data sampled at 100 Hz and only the normal optodes were used
- One-way ANOVA test was performed for significance

RESULTS

Average tHb and ΔO2Hb & HHb

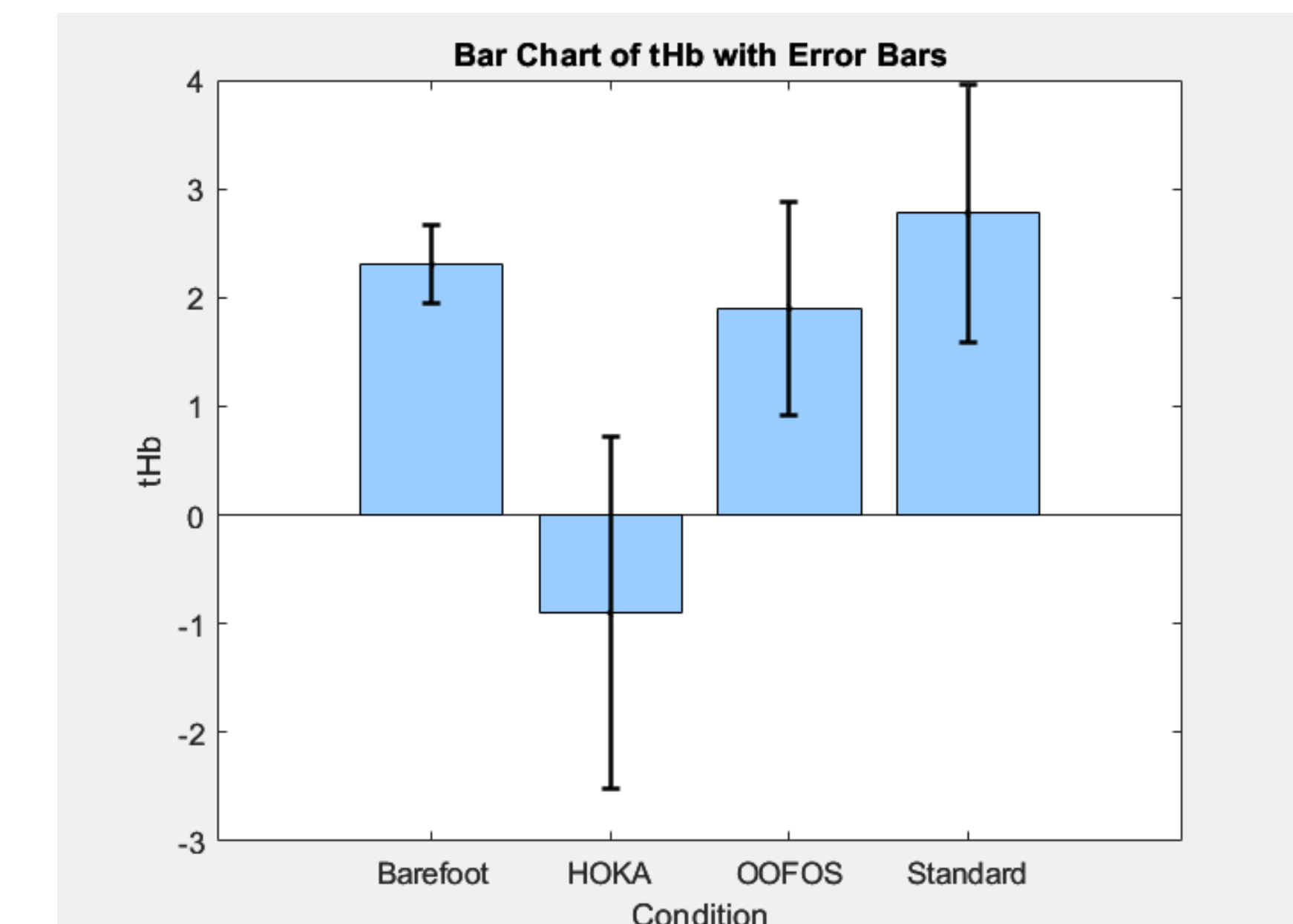


Fig 6. Bar chart of mean tHb across conditions (Barefoot, HOKA, OOFOS, Standard) with SEM error bars. Barefoot, OOFOS, Standard positive tHb; HOKA negative tHb, largest variability. Statistical analysis showed no significant due to low sample size.

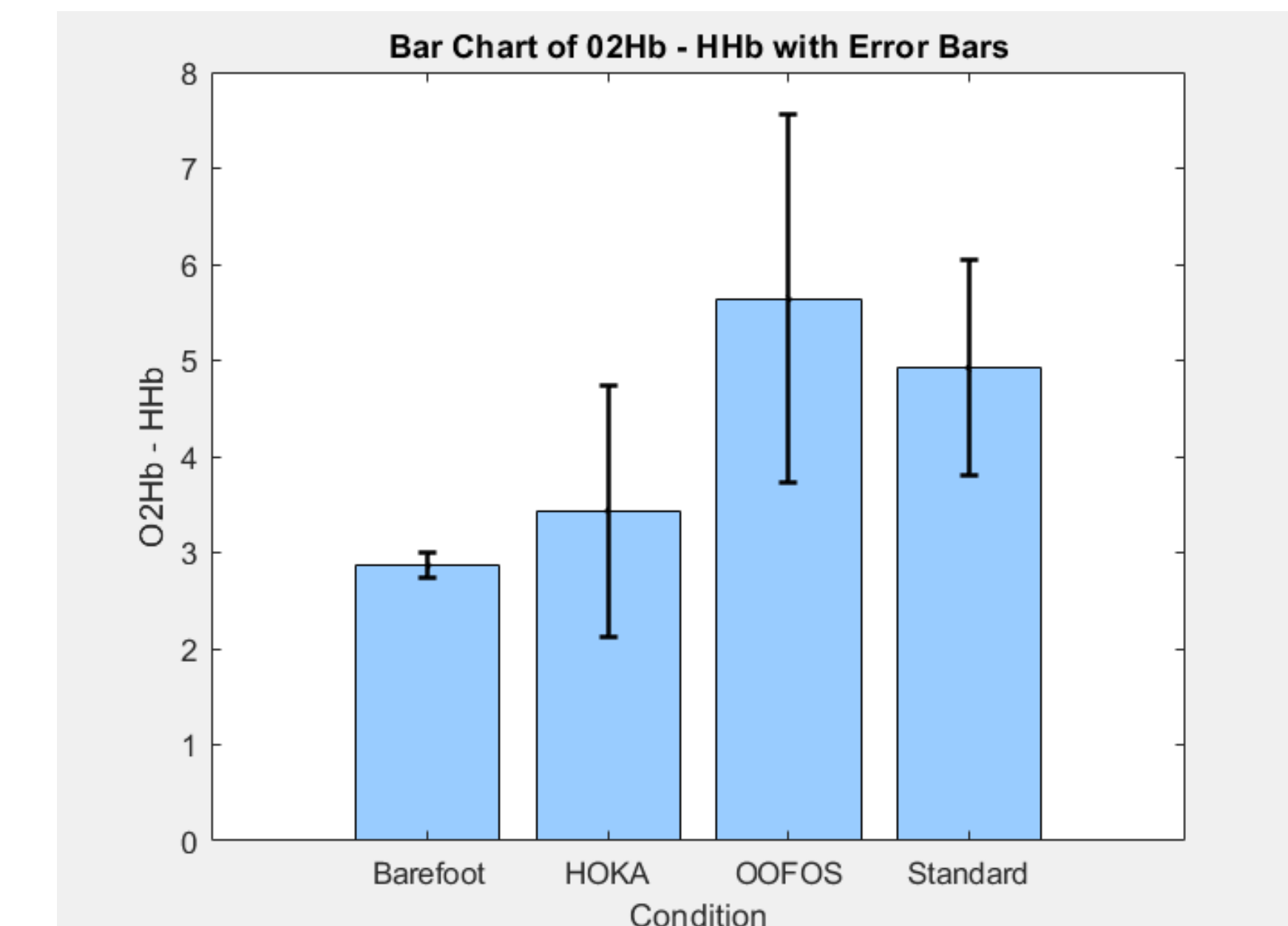


Fig 7. Bar chart of mean tHb across conditions (Barefoot, HOKA, OOFOS, Standard) with SEM error bars. Statistical analysis showed no significant due to low sample size.

METHODS

Recording Set-up

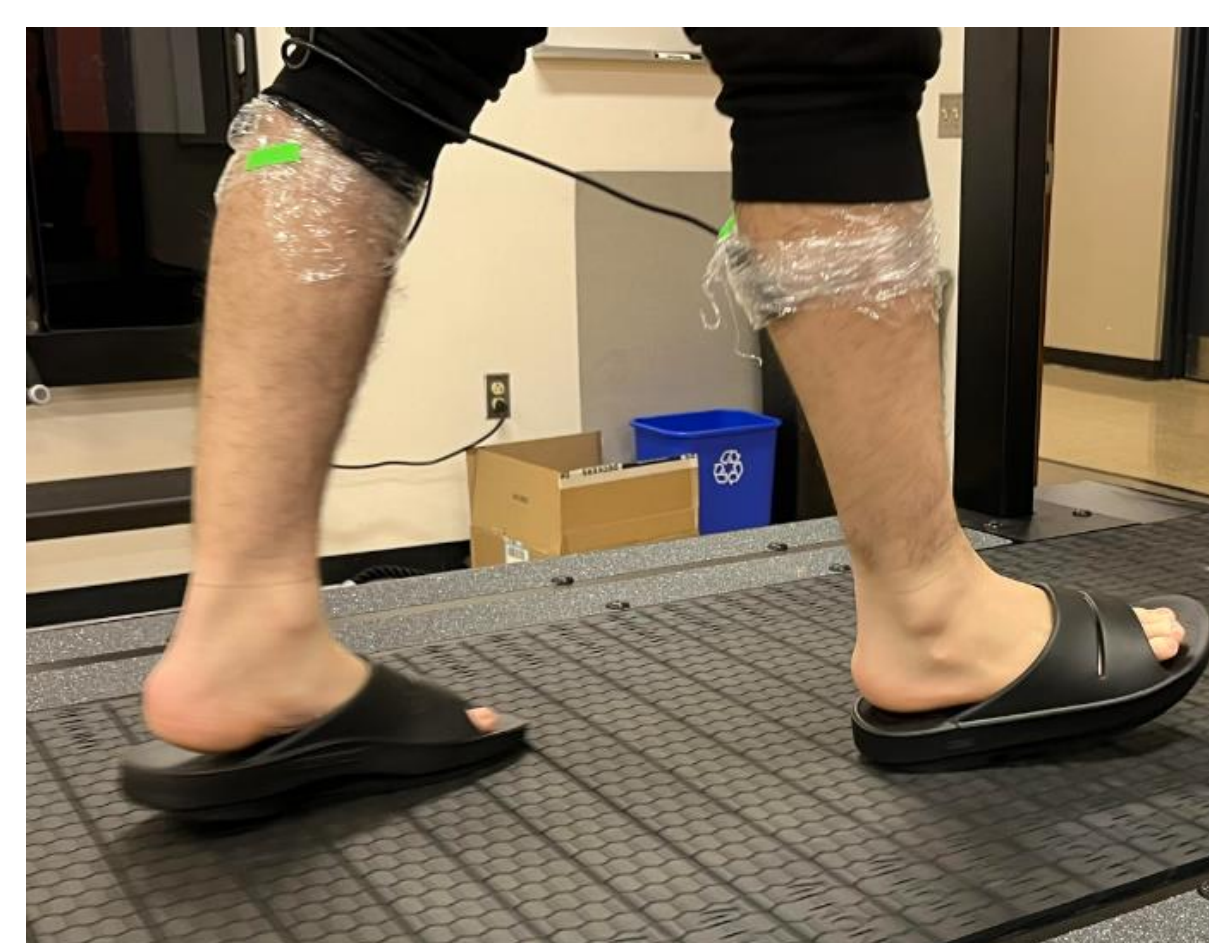


Fig 2. NIRS Optodes Placement on Calves between the gastrocnemius muscle at a 45°. Woodway treadmill model ELG was utilized for the subject testing.



Fig 3 NIRS Device by Artinis
•Equipped with optodes for near-infrared light emission.
•Detects changes in light absorption in tissues.
•Measures hemoglobin concentration levels.[3]

RESULTS

Raw Data for Visualization

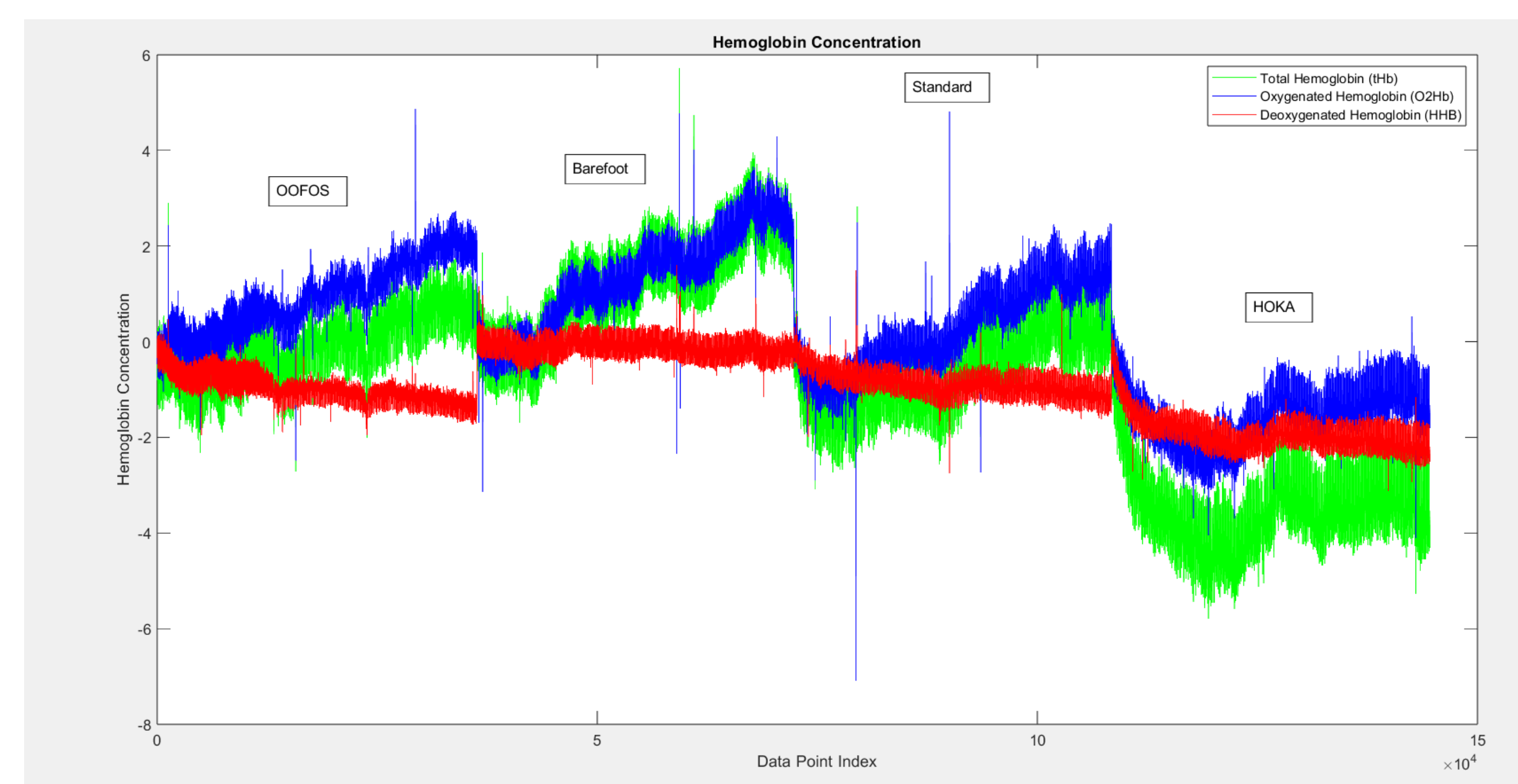


Fig 5. Raw data visualization for one of the subjects showcasing the behavior of tHb, O2Hb and HHb.

SUMMARY, CONCLUSIONS AND FUTURE DIRECTIONS

- OOFOS footwear demonstrated a positive effect on peripheral circulation during active recovery, as evidenced by increased tHb levels and improved O2HB/HHb balance.
- The results suggest that enhanced circulation may contribute to faster recovery and reduced fatigue in physically active individuals. However, there is no significant difference between any of the conditions.
- Future Direction: Variability across subjects indicates the need for further research with a larger sample size to generalize findings.

REFERENCES

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- [2] King, Jordan. "Physiology, Cardiac Output." *StatPearls [Internet]*. U.S. National Library of Medicine, 17 July 2023.
- [3] Apprich, Sophie. "Beyond the Brain: Unveiling the Mind-Muscle Connection with Simultaneous NIRS - Artinis Medical Systems: (F)NIRS Devices." *Artinis Medical Systems | (F)NIRS Devices*, Artinis Medical Systems | (F)NIRS devices, 20 Aug. 2024. www.artinis.com/blogpost-all/simultaneously-measuring-brain-and-muscle-

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