

ACCURACY OF THE HEART RATE INDEX METHOD FOR ESTIMATING VO₂MAX IN MALE RECREATIONAL RUNNERS: A COMPARISON OF THREE GRADED EXERCISE TEST PROTOCOLS



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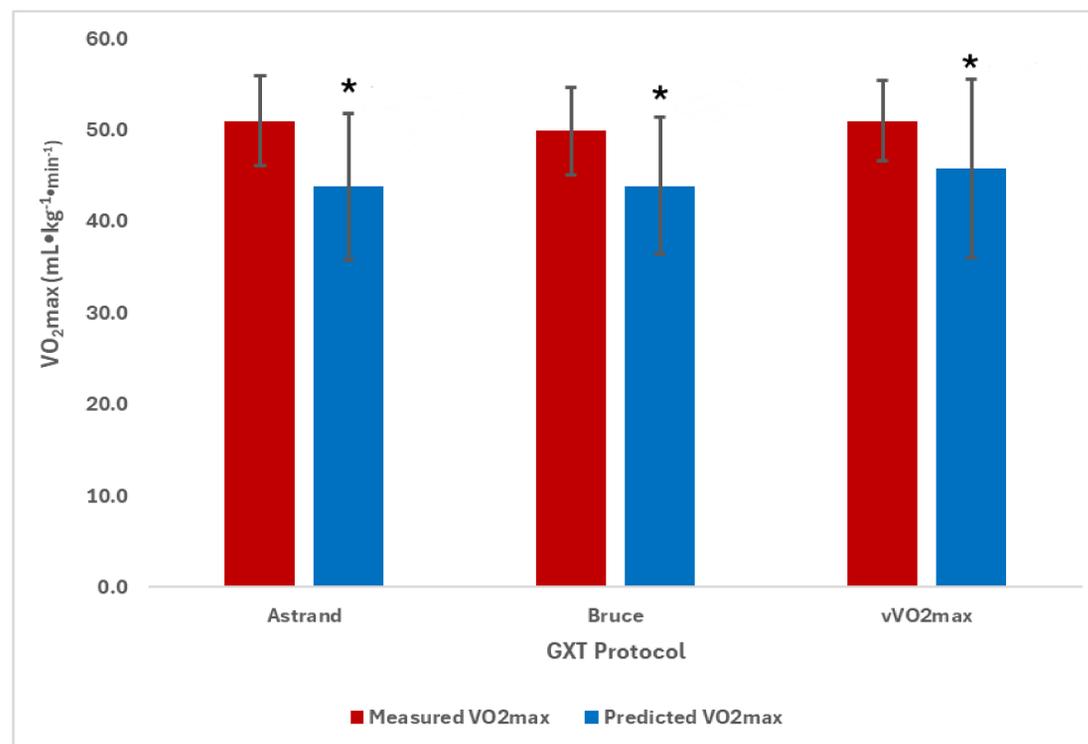
Introduction

- Heart Rate Index (HRI) estimates maximal oxygen consumption (VO₂max) using resting heart rate (RHR) and maximal heart rate (MHR) from a graded exercise test (GXT) [Wicks et al., 2011].
- HRI offers a simple, non-invasive alternative to equipment-intensive VO₂max testing methods.
- Limited research has evaluated the validity of HRI across different treadmill GXT protocols.
- Differences in treadmill protocols may impact the accuracy of HRI-derived VO₂max estimates.
- Purpose: To evaluate the accuracy of the HRI method for estimating VO₂max across three commonly used treadmill GXT protocols.

Methods

- A convenience sample of nine recreationally active male runners participated (age = 22.6 ± 5.4 yrs; height = 163.8 ± 6.4 cm; weight = 83.8 ± 10.8 kg).
- Participants completed three treadmill GXTs: Astrand, Bruce, and vVO₂max protocols. Each test was separated by 72 hours to one week.
- Resting heart rate (RHR) and maximal heart rate (MHR) were recorded for each protocol.
- Heart Rate Index (HRI) was calculated as MHR / RHR.
- Predicted VO₂max was calculated using: $([HRI \times 6] - 5) \times 3.5$. (Wicks et al., 2011).
- Direct VO₂max was measured and compared to HRI-estimated VO₂max values

Results



	Measured VO ₂ max	Predicted VO ₂ max
Astrand	51.0 ± 4.9	43.8 ± 8.0*
Bruce	49.9 ± 4.8	43.9 ± 7.5*
vVO₂max	51.0 ± 4.4	45.8 ± 9.8*

* Statistically different from Measured VO₂max (p<0.05)
Values presented as means ± standard deviation (mL·kg⁻¹·min⁻¹)

Equations

$$\text{Heart Rate Index (HRI)} = \text{MHR} / \text{RHR}$$

$$\text{VO}_2\text{max} = ([\text{HRI} \times 6] - 5) \times 3.5$$

Conclusions

- HRI-estimated VO₂max values were consistently (higher/lower) than directly measured VO₂max values across all three treadmill protocols.
- These differences were statistically significant, with a mean difference of approximately 6–7 mL·kg⁻¹·min⁻¹ (p = 0.05).
- This suggests that HRI may not provide accurate VO₂max estimates in recreational male runners.
- Prior research by Wicks et al. (2011) reported a strong correlation between HRI-estimated and direct VO₂max, whereas our findings show consistent underestimation, particularly in the Astrand and Bruce protocols.
- Although convenient, the HRI method may not be suitable in settings where precise aerobic fitness evaluation is required.

Practical Applications

- Although the HRI method provides a quick and accessible way to estimate VO₂max, its accuracy varies across different testing protocols.
- This limits its use for precise performance evaluation or training prescription in athletic populations.
- Practitioners should consider using direct VO₂max measurement or more validated estimation methods when accuracy is critical.

References

Available upon request