Can Heart-Rate Monitors Predict Muscle Anaerobic Threshold during Intense Exercise?

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I. INTRODUCTION

The point at which lactic acid starts to build up in the muscle during intense anaerobic exercise is known as the anaerobic (AT) or lactic threshold (LT). The goal for many athletes is to increase this threshold, allowing them to perform longer at high intensity by training at or slightly above the AT. Heart-rate monitors and fitness trackers, which have a projected global market size of USD 114 billion in 2028[1], are used to guide athletes during their training programs to improve their anaerobic capacity.

II. STUDY OBJECTIVE & PROTOCOL

The objective of this study was to investigate the efficacy of heart-rate monitoring in predicting muscle AT during intense exercise in relation to the respiratory exchange ratio (RER) and relative body oxygen consumption (VO2) and to investigate new techniques for sports monitoring. Twenty healthy and abled-body adults with moderately to high fitness levels participated in an incremental exercise protocol consisting of 5-minute intervals on a stationary spin bike. An electrocardiogram (ECG) chest sensor was used to measure and monitor the heart rate, while a metabolic cart was used to measure and monitor RER and VO_2. RER > 1.0 was used to determine the AT, which was compared to the heart rate data.

III. RESULTS

It was observed that there was no indication of a consistent anaerobic heart rate zone to determine AT for all participants ($p > 0.05$). In Figure 1, a comparison and common trend is shown between RER and heart rate, where the heart rate displays a linear trajectory despite RER indicating AT at Step 4[2].

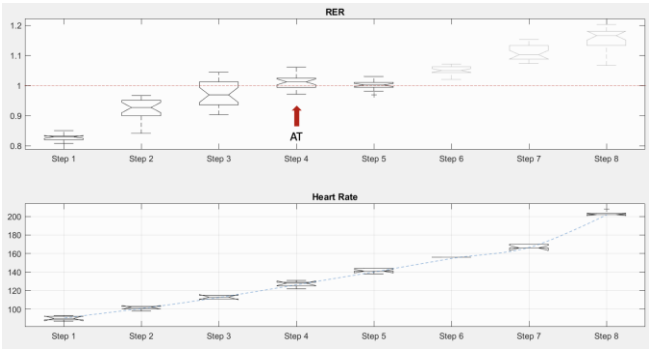

Fig. 1. RER vs. Heart Rate – representative results in one of the participants.

IV. CONCLUSION

This suggests that heart rate monitoring is an insufficient means for predicting AT and that there is a need for more advanced wearable monitoring technologies that can monitor and detect changes in exercising muscle metabolism that are associated with AT.

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