Measured and predicted oxygen uptake in healthy adults

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Introduction

Measurement of maximal oxygen uptake ($\dot{V}o_{2max}$) is considered to be the gold standard (GS) to determine aerobic capacity in human (Evans *et al.*, 2015). Determination of $\dot{V}o_{2max}$ requires a costly equipment and a high intensity exercise that may not be performed easily in untrained individuals and/ or with health concerns. Several tests have been designed to predict $\dot{V}o_{2max}$ in human in order to reduce risk, costs and other drawbacks linked to the direct measurement of $\dot{V}o_{2max}$. Among them, the one-mile track walk test (1 mile-WT; Kline *et al.*, 1987) is a simple test that does not require specialized equipment. In addition, a non–exercise based-equation model (NE-BEM; Jurca *et al.*, 2005) has been proposed to estimate $\dot{V}o_{2max}$ in healthy individuals. This study tests the validity of the 1 mile-WT and NE-BEM to estimate $\dot{V}o_{2max}$ in a group of healthy adults.

Materials and Methods

Prior to testing, all 12 participants (men, 2; women, 10) completed a written informed consent form. They performed a maximal graded exercise test on a treadmill up to exhaustion with the expired air of the individual undergoing analysis for O_2 content using the Cosmed K4b^2 (COSMED, Rome, Italy; Fig. 1). The test began at a speed of at 7 km/h (no incline) for 5 minutes to be increased by 2 km/h every 3 minutes.

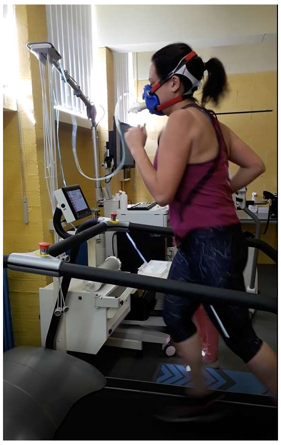

Figure 1: maximal graded exercise test on treadmill

Figure 2: participants walking one-mile as fast as possible

For the 1 mile-WT, participants were instructed to perform a one-mile walk as fast as possible (Fig. 2). The time to perform the walk was included in an equation to predict $\dot{V}o_{2max}$ taking into account individual characteristics and final heart rate (HR). The NE-BEM estimates $\dot{V}o_{2max}$ based on a calculation including gender, age, body mass index, resting HR, and self-reported physical activity (Fig.3).

Figure 3: : self-reported physical activity does not require an exercise test

Six statistical methods, with different assumptions, were used to estimate the level of agreement between measured and estimated $\dot{V}o_{2max}$ values. Bland–Altman plots were also constructed.

Results

The mean (±SD) $\dot{V}o_{2max}$ was 41.2±4.1 with the GS vs. 44.6±5.4 and 34.7±5.1 mL.kg^{-1}.min^{-1} as estimated by the 1 mile-WT and the NE-BEM, respectively. There was no agreement between the different tests (Fig. 4).

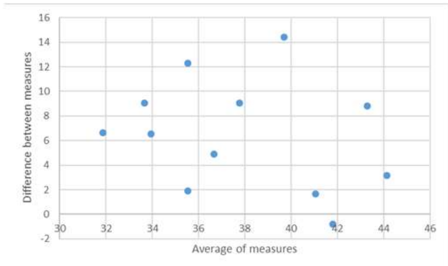

Figure 4: plot of differences between gold values and values estimated by Jurca *et al.*, 2005 equation *versus* the mean of both values

Conclusion

The estimation of $\dot{V}o_{2max}$ in a group of non-homogenous individuals (variety of race, gender, age and BMI) was not valid using the prediction equations referenced in the literature highlighting the need to validate a model specific to the test modality.

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