Total thigh fat volume is not associated with VO$_{2}$peak-work rate maximal relationship in overweight women

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Introduction

The VO$_{2}$max is a useful reference to prescribe cardiovascular training in obese populations, although its direct assessment is difficult and expensive. Traditionally, VO$_{2}$ peak-work rate relationship has been used for VO$_{2}$ estimation. Nevertheless, this relationship has been shown to be altered in obesity; it has been quantified in unloaded cycle to be 5.8 ml.kg.min$^{-1}$ (Wasserman and Whipp 1975; Hansen, Sue et al. 1984). Other factors should be considered such as the effect of body fat mass, trunk and limb's fat overload, the relationship at VO$_{2}$peak or evaluations with other types of exercises. The purpose of this study was to analyse the effect of thigh fat accumulation in the VO$_{2}$ peak-work rate maximal relationship independently of other variables of human body composition during walking. It is an important question to estimate VO$_{2}$peak in populations with different patterns of body composition.

Methods

Balke’s modified cardiopulmonary exercise testing in treadmill (Quinton 645) was applied at 121 overweight premenopausal women (age, 38.4±5.6 yrs; BMI, 30.11±3.48 kg.m$^{-2}$; %fat mass, 46.4±4.26). Peak uptake oxygen was measured using a breath by breath system with zircon’s O$_{2}$ gas analyser coupled to measurement pulmonary flow (MedGraphics® MN, USA), with an accuracy ±3% and ±0.1% respectively (peak oxygen uptake was VO$_{2}$peak, 24.7±3.6 ml.kg.min$^{-1}$ and final performance in the test was 11.1±2.7 min). The women were weighted in the balance of BOD POD (Life Measurements Instruments, Concord, CA, USA) and height was measured with a scale (SECA Hamburg, Germany) to the nearest 0.1 kg and 0.1 cm respectively. The human body composition was assessment included two methods: total body fat mass (TBFM) and fat free mass (FFM) was estimated with dual energy densitometry (DXA, Hologic QDR 1500, MA, USA) (36.0±8.6 kg and FFM, 38.4±4.26 kg ) and total thigh fat and skeletal muscle volume (TTFV and TTSMV, respectively) was evaluated with CT (Computerized Axial Tomography, Siemens Somaton Plus). Finally, work rate has been considered like exercise total time (ETT) in minutes when VO$_{2}$max was obtained because the increase is constant minute to minute.

Results

General lineal model was used to test the effect of TBFM and TTFV on the VO$_{2}$ peak-work rate relationship. The TBFM entered in the model when VO$_{2}$ was controlled for body weight (BD) (0.014, p<0.05) but not when VO$_{2}$ was controlled to fat free mass weight (0.097; p<0.05). TTFV never entered in the models independently of FFM (0.81, p<0.05) or BD (0.1, p<0.05)

Discussion/Conclusion

The more obese women more have a higher VO$_{2}$ uptake than lighter participants, for the same maximal work rate. Factors other than body fat distribution influence the upward displacement of the VO$_{2}$peak-work rate relationship regarding body weight because energy can be obtained from other body muscles not overloaded to overcome the work rate. This is a more difficult task when excess body fat is distributed through the whole body. A new model is necessary to estimate the maximal VO$_{2}$ uptake for obese women when using external load for estimation.

References
