

# Level of adiposity influences the difference between estimated and measured maximum VO<sub>2</sub>: An analysis based in 1,715 healthy and unhealthy adults

Christina Grüne de Souza e Silva, Claudio Gil S. Araújo  
Clínica de Medicina do Exercício – CLINIMEX/ICES - UFRJ - Rio de Janeiro, RJ



## Background

It is well-known that indirect measurements of maximum oxygen uptake (VO<sub>2</sub>max) derived from equations are associated with a large margin of error that is primarily due to differences in mechanical efficiency. As shown in a previous study (submitted for publication), it was feasible to reduce this error by utilizing gender-specific equations. Moreover, it is theoretically possible that lean and obese adults not only differ regarding mechanical efficiency but that body composition itself influences resting energy cost

## Objective

To evaluate the potential contribution of a second factor – level of central adiposity – for the magnitude of the error of estimate of VO<sub>2</sub>max

## Methods

Data from maximum cycling cardiopulmonary exercise testing under individualized ramp protocol were carried out between 2008 and 2014 in 1,715 adult subjects (68% men) aged 18 and 91 years old were analysed. Level of adiposity was stratified in three percentile ranges according to results of waist girth/height ratio (WHR): P<25, P25-75 and P>75

Correction factors for adiposity at the two extremes percentile ranges were obtained by analyzing differences between measured and estimated VO<sub>2</sub>max according to gender-specific equations:

- $VO_{2max} [mL/(kg \cdot min)] = workload (watts) \times (10.8 \text{ MEN or } 9.8 \text{ WOMEN}) + 7$

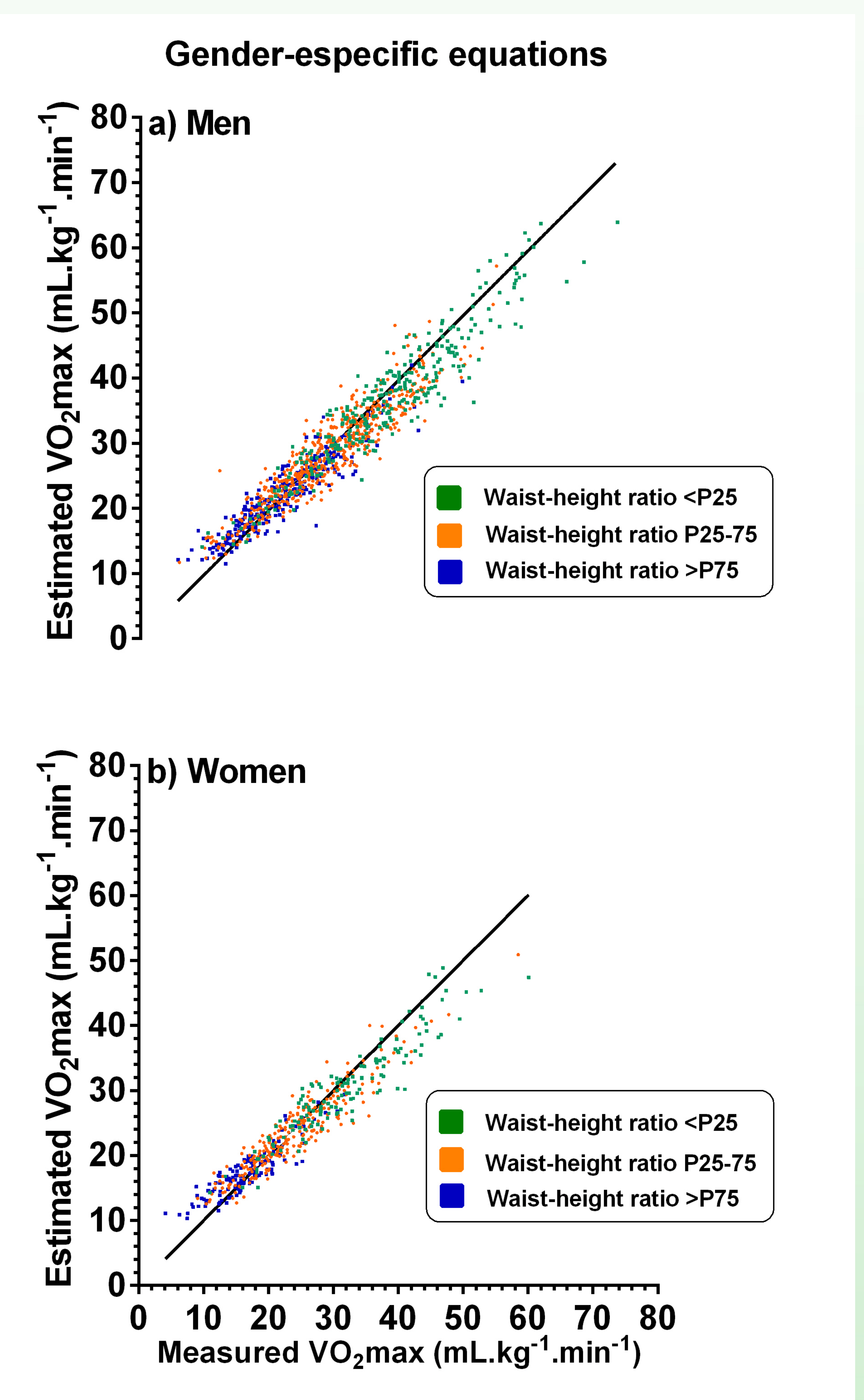
The subjects' % error of estimate  $[(\text{measured } VO_{2max} - \text{estimated } VO_{2max}) \times 100 / (\text{measured } VO_{2max})]$  were averaged – mean error of estimate - in order to compare the gender-specific equations with and without adiposity correction factor

## Results

To our sample, WHR P25 and P75 cutoff values were, respectively (men/women), 0.515/0.467 and 0.612/0.572. By determining the correction factor for adiposity, for men and women at P<25 of WHR, respectively, 3.0% and 5.0% should be added. On the other hand, for men and women located at P>75 of WHR, respectively, 2.4% and 3.4% should be subtracted. The % error of estimate VO<sub>2</sub>max calculated by gender-specific equations with and without the correction factor for adiposity were, respectively, 0.7% and 2.8% at P<25 of WHR (p<.001), and 0.9% and 3.7% at P>75 of WHR (p=.011)

## Conclusions

Low and high levels of adiposity, as represented by WHR, influence the magnitude of difference between estimated and measured maximum oxygen uptake. Incorporating correction factors in gender-specific equations for subjects at the two extreme percentile ranges of WHR contributes to reduce the margin of error in the estimate of VO<sub>2</sub>max



Financial support: CNPq/FAPERJ



