

CORRESPONDENCE

Reference values for maximal work capacity in healthy children

To the Editor:

Recently, the *European Respiratory Journal* published a paper by GULMANS *et al.* [1] on reference values for maximal work capacity (W_{\max}) in healthy children [1]. The paper described the W_{\max} of boys and girls using a model which related W_{\max} per kilogram of fat free mass (FFM) to age and gender. For the model to be valid the relationship between W_{\max} and FFM should have been a proportionality (*i.e.* $W_{\max}/\text{FFM} = k$) [2]. However, the mean data cited relating W_{\max} to age included a significant constant term (fig. 1):

$$W_{\max} = 596 \text{ FFM} + 3.51 \text{ (W)}$$

This led JEC and JWR to write to the Editor questioning the appropriateness of the model and to VAMG and K de M replying to reassert its validity.

The subsequent correspondence did not clarify the issue, thus publication of the correspondence was withheld and a joint exploration of the two approaches undertaken.

The proportional model was reconsidered by relating W_{\max}/FFM to FFM, age, gender and gender \times age, using multiple regression analysis with stepwise admission of

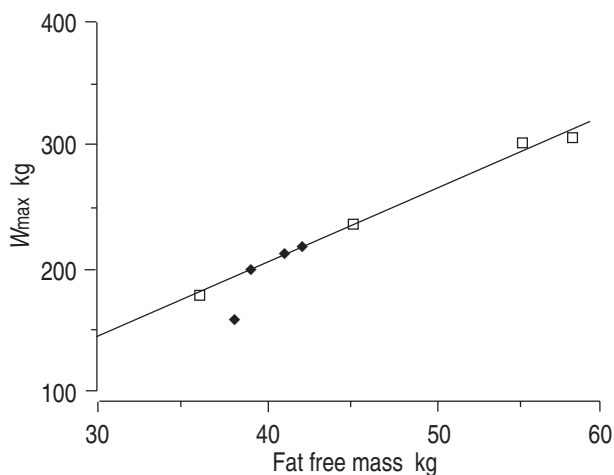


Fig. 1. - Significant linear relationship of work capacity (W_{\max}) on fat free mass, calculated from mean data by age groups for boys (□). The mean data for girls (◆) are superimposed.

terms and also with forced inclusion of the interaction. The coefficients on age and gender were significant ($p < 0.05$), but FFM was not significant ($p = 0.07$) and there was no contribution from the interaction.

For the linear model with the same reference variables, the W_{\max} was related to FFM, age and gender. If percentage body fat (Fat%) was included as an additional variable it replaced gender in the relationship:

$$W_{\max} = 3.39 \text{ Age} + 4.89 \text{ FFM} - 0.90 \text{ Fat\%} - 23.2$$

($r^2 = 0.84$, residual standard deviation (RSD) 23 W)

Based on analysis of residuals, SEM of the estimates of W_{\max} were, for the proportional model ± 23.4 W, for the linear model including gender ± 23.1 W and for the linear model including Fat% ± 23.0 W. These terms did not differ significantly.

We conclude that the percentiles of maximal work per kilogram of fat free mass derived from the individual data, adequately took into account the effects of age and gender, but that a linear model provided a marginally (but not significantly) better fit. It is likely that greater accuracy would have been achieved if allowance had also been made for the level of habitual physical activity [3]; we recommend that this information be collected in future studies.

References

1. Gulmans VAM, de Meer K, Binkhorst RA, Helders PJM, Sans WHM. Reference values for maximum work capacity in relation to body composition in healthy Dutch children. *Eur Respir J* 1997; 10: 94-97.
2. Tanner JM. Fallacy of per-weight and per-surface area standards, and their relation to spurious correlation. *J Appl Physiol* 1949; 2: 1-15.
3. Weller JJ, El-Gamal FM, Parker L, Reed JW, Cotes JE. Indirect estimation of maximal oxygen uptake for study of working populations. *Br J Ind Med* 1988; 45: 532-537.

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