

Contemporary reference values for peak oxygen uptake in healthy European children and adolescents

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Background: The aim of the present study was to establish prediction equations and to describe contemporary reference values for healthy boys and girls from West-Europe.

Design: Cross sectional multicenter study.

Methods: Between January 2000 and April 2015, 1580 healthy children (1010 boys; mean age 12.4 years; range 5-18) completed a maximal graded exercise test until volitional exhaustion either on a bicycle or on a treadmill. Minute ventilation, oxygen uptake (VO₂), and carbon dioxide (CO₂) production were measured on a breath-by-breath basis and continuous electrocardiography was performed. Peak VO₂ was expressed per kg bodyweight. Prediction equations based on sex, age and weight were calculated by means of regression analysis and cross-validated through concordance correlation coefficient determination and Bland-Altman analyses. LMS chart maker was used to provide age-related percentile curves.

Results: Multivariate regression analysis revealed age, sex and weight as statistically significant determinants of peak VO₂. Hence, following prediction equation was established and cross-validated: $\text{peak VO}_2 = 44.5 - 218 \cdot \text{sex} + 27.1 \cdot \text{age} + 37.4 \cdot \text{weight}$ ($p \leq 0.001$; sex=0 for boys and sex=1 for girls). Finally, the distribution of peak VO₂ per kg body weight with age was described by percentile curves (Figure 1 and 2) and reference values were established for boys and girls separately.

Conclusions: Our study is the largest and most recent population-based study to provide sex-specific reference data and a prediction equation for peak VO₂ for a West-European population of healthy children between the ages of 6-18 years.

