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: peak VO2=44.5-218*sex+27.1*age+37.4*weight (p ≤ 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.