Associations of Cardiorespiratory and Musculoskeletal Fitness with Body Mass Index and Waist Circumference: Fitness versus Fatness in a Population-based Sample of Chilean 8th Graders

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Background: In addition to excess adiposity, low cardiorespiratory fitness (CRF) and low musculoskeletal fitness (MSF) are important, independent risk factors for future cardio-metabolic disease in adolescents. To the best of our knowledge the fitness versus fatness relationship has not been studied in a population-based sample in Latin America.

Hypothesis: We hypothesized that the physical fitness variables of CRF and MSF will be negatively associated with BMI and WC in an adolescent population in Chile, independent of potential confounders, but that a significant proportion of adolescents with poor body composition will exhibit healthy fitness levels.

Methods: This cross-sectional study was based on a representative, single-stage, stratified cluster sample of 19,929 8th graders (median age = 14 years) in the 2011 National Education Survey from all regions of Chile. CRF was assessed with the 20 m shuttle run test, MSF with standing broad jump, and body composition with BMI and WC. CRF, MSF, BMI, and WC were classified according to health-related standards, validated against cardio-metabolic risk factors. Gender-stratified logistic regression models for both CRF and MSF included socioeconomic status, age, region, the other fitness variable, BMI, and WC. Analyses were weighted and considered complex sample design.

Results: In both genders, the adjusted prevalence of high-risk CRF was higher among students with high-risk BMI (boys: prevalence ratio (PR) = 1.88; girls: PR = 1.71; both p<0.05) and with high-risk WC (boys: PR = 1.77; girls: PR = 1.21; both p<0.05), compared with their healthy counterparts. BMI but not WC was an independent correlate of high-risk MSF in girls (PR = 1.32; p<0.05). Both BMI (PR=1.64; p<0.05) and WC (PR=1.11; p<0.05) were independent correlates of high-risk MSF in boys. A substantial proportion of students with poor body composition had healthy fitness, and vice versa: 46% of boys and 25% of girls with high-risk BMI had healthy CRF. Conversely, 35% of boys and 55% of girls with high-risk CRF had a healthy BMI. Similarly, 47% of boys and 51% of girls with high-risk BMI had healthy MSF whereas 43% of boys and girls with high-risk MSF had a healthy BMI.

Conclusions: In this large representative sample of Chilean adolescents, BMI and WC were inversely correlated with CRF and MSF. Nonetheless, the sizeable proportion of adolescents with poor body composition but healthy fitness, and vice versa, underscores the importance of assessing both CRF and MSF for a more complete representation of adolescent cardio-metabolic risk.

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