Impact of cardiac remodelling on physical fitness measured by VO2 max in preadolescent and adolescent endurance athletes

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Topic(s):
Athlete's Heart

Background:
Endurance training is associated with both physiological cardiac remodelling and increased maximal oxygen uptake. The relationship between VO2 max and cardiac dimension has not been described in young athletes or in longitudinal studies.

Aims:
This study aims to explore the impact of cardiac remodelling on VO2 max in a cohort of young athletes assessed at age 12, 15 and 18.

Methods:
Seventy-six promising young cross country skiers were examined at age 12 with echocardiography, including 3D and cardiopulmonary exercise test (CPX). Forty-six (61%) participated in the first follow-up at age 15 and 36 (47%) athletes completed the second follow-up at age 18. The impact of left ventricular (LV) mass and LV end-diastolic volume (EDV) on VO2 max at each time point was assessed using mixed model analysis. Correlation coefficients were calculated at each time point.

Results:
There were moderate to very strong correlations between the cardiac parameters and VO2 max at all time points (Figure). In the full model, each improvement in VO2 max of 1000 mL/min at age 15 was associated with an increase in LV mass of 18 g (p<0.001) and an increase in LV EDV of 36 mL (p<0.001), while each improvement in VO2 max of 1000 mL/min at age 18 was associated with an increase in LV mass of 19 g (p<0.001) and LV EDV of 31 mL (p<0.001).

Conclusion:
Physical fitness measured by VO2 max is strongly correlated to LV mass and volume in adolescent athletes, suggesting a strong link between cardiac adaption and VO2 max in young athletes.