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The effect of long-term soccer training on left ventricular structure and function in elite male youth soccer players

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INTRODUCTION:
Cardiac adaptations in elite, male adolescent, youth soccer players have been demonstrated in relation to training status, but the time course of these adaptations and the delineation of the influence of growth and maturation from the training effect on these adaptations remain unclear. Consequently, the aims of the study were to evaluate the impact of 3-years of elite-level soccer training on changes in left ventricular (LV) structure and function in a group of highly trained elite youth male soccer players (SP) as they transitioned through the pre-to-adolescent phase of their growth and development.
METHODS:
Twenty-two elite male youth SP from the highest Level of English Premier League Academy U-12 teams were evaluated once a year for 3 consecutive soccer seasons as the players progressed from the U-12 to U-14 teams. In tandem, a group of fifteen recreationally active control participants (CON) were also evaluated over the same 3-year period. Two-dimensional transthoracic echocardiography was used to quantify LV structure and function.
RESULTS:
A linear mixed effect model was developed to simultaneously control for the fixed effects of Group (SP, CON), Year (1, 2, 3) and with maturity offset adjusted as a covariate on all the dependent variables between each year. After adjusting for the influence of growth and maturation, training-induced increases in Years 2 and 3 were noted for: LV end diastolic volume (LVEDV; p=0.02) and LV end systolic volume (LVESV; p=0.02) in the SP compared to CON. Training-induced decrements were noted for LV ejection fraction (LVEF; p=0.006) and Tissue Doppler (TDI) derived S (p=0.001).
CONCLUSION:
The major finding from this novel, three-year observational investigation was that after controlling for the influence of growth and maturation , there was more evidence of eccentric remodeling (LV chamber enlargement) rather than eccentric hypertrophy (concomitant LV chamber dilatation and increase in LV wall thickness) in SP compared to CON. Furthermore, there was also evidence of functional adaptations in the form of decrements in LVEF and TDI-S' over time in SP compared to CON after adjusting for a period of rapid growth. Significant training volume increases (Years 2 and 3) were aligned with LV volumetric adaptations (LVEDV and LVESV) and decrements in systolic function (LVEF, S) in the SP that were independent of the influence of growth and maturation . Decrements in systolic function were suggestive of a functional reserve for exercise. The evidence from this original body of work suggests that there is a training volume-based threshold that stimulates LV structural and functional adaptations independent of the influence of growth and maturation in highly-trained youth soccer players.

Topic: **Physiology**

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