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Contents lists available at SciVerse ScienceDirect

Journal of Science and Medicine in Sport

journal homepage: www.elsevier.com/locate/jjsams

Original research

Physical fitness predicts adiposity longitudinal changes over childhood and adolescence

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ARTICLE INFO

Article history:

Received 26 December 2011

Received in revised form 8 June 2012

Accepted 30 June 2012

Keywords:

Obesity

Skinfold thickness

Exercise

Growth

Longitudinal studies

Child development

ABSTRACT

Objectives: The purpose of this study was to examine the influence of physical fitness (PF) on the development of subcutaneous adipose tissue in children followed longitudinally over a 9 year period ranging from childhood to adolescence.

Design: This longitudinal study followed 518 healthy participants (262 boys, 256 girls) over a 9-year period ranging from childhood (age 6) to adolescence (age 15). Adiposity (triceps and subscapular skinfolds), and fitness (60 s sit-ups, flexed arm hang, standing long jump, 50 m dash, 10 m shuttle run, sit-and-reach, and 20 m pacer run) were assessed at four annual time points during primary school, and on a follow up, 6 years later, during secondary school.

Methods: Growth in subcutaneous fat was modeled within a HLM statistical framework, using fitness components as time changing predictors.

Results: Flexed arm hang ($\beta = -0.059$; $p = 0.000$), standing long jump ($\beta = -0.072$; $p = 0.000$), 60 s sit-ups ($\beta = -0.041$; $p = 0.040$), 50 m dash ($\beta = 0.956$; $p = 0.000$), and 20 m PACER ($\beta = -0.077$; $p = 0.000$) tests, were found to predict changes on body fat growth over the years, independently of sex.

Conclusions: Improving PF individual levels can positively influence adiposity deposition over the time period covering childhood and adolescence. That occurs independently of the typical sex differentiated adiposity growth.

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1. Introduction

The prevalence of obesity in childhood and adolescence is increasing worldwide both in developed countries and those undergoing economic transition.¹ This evidence represents an obvious secular trend in the velocity of fat deposition along individual growth, and of particular interest to developmental studies, during childhood and adolescence periods.²

Risk factors for childhood obesity include parental fatness, high birth weight, diet (including early infant feeding practices), rate of maturation (especially among girls), physical inactivity, low levels of physical activity, low socioeconomic status, and several behavioral and psychological factors.³ Although the relative importance of specific risk factors are not ordinarily specified at the individual level, a sedentary lifestyle and excessive energy intake are

often considered as key mechanisms contributing to the potentially unhealthy weight gain and obesity.

The primary component in the excessive weight gain phenomena in children is subcutaneous adiposity.⁴ Nevertheless, given that tracking coefficients for fatness show to be only low to moderate during childhood and adolescence,⁵ there seems to be room to improve our knowledge about fat development using additional predictors. Among other possibilities, but paramount to a holistic view of developmental health, physical fitness has surely proved to be a good candidate. We know that being unfit during childhood and adolescence is associated with a greater risk of obesity,^{6,7} and that higher fitness levels afford for a better insulin sensitivity profile, thus emphasizing the role of fitness even among overweight and obese children.⁸

As to our knowledge, information on the prediction of adiposity growth over these critical periods (childhood and adolescence) for obesity development is scarce or nonexistent. Although an inverse relationship between physical fitness and overweight has been found among school-aged children, the direction and magnitude of the causation is not clearly established.⁹ So, the purpose of this study is to longitudinally investigate the effects of physical fitness

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