Journal of Science and Medicine in Sport 19 (2016) 400–406

Contents lists available at ScienceDirect

Journal of Science and Medicine in Sport

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

Original research

The influence of sport club participation on physical activity, fitness and body fat during childhood and adolescence: The LOOK Longitudinal Study

Rohan M. Telford[a,*], Richard D. Telford[b,c], Thomas Cochrane[a], Ross B. Cunningham[d], Lisa S. Olive[e], Rachel Davey[a]

[a] Centre for Research and Action in Public Health, University of Canberra, Australia
[b] Medical School, College of Medicine, Biology and Environment, Australian National University, Australia
[c] Research Institute for Sport and Exercise, University of Canberra, Australia
[d] Fenner School of Environment and Society, College of Medicine, Biology and Environment, Australian National University, Australia
[e] Department of Psychology, Australian National University, Australia

ARTICLE INFO

Article history:
Received 21 October 2014
Received in revised form 22 March 2015
Accepted 18 April 2015
Available online 14 May 2015

Keywords:
Sport
Youth
Physical activity
Fitness
Obesity
Longitudinal

ABSTRACT

Objectives: To investigate the longitudinal effect of sport participation in physical activity, fitness and body fat changes during childhood and adolescence.
Design: Longitudinal study (134 boys, 155 girls) of Australian youth aged 8–16 years.
Methods: Physical activity was assessed by pedometers and accelerometers, fitness by the 20 m shuttle-run, body fat by DEXA and club sport participation by questionnaire. Linear mixed models were used to determine the effects of sport participation and gender differences.
Results: Sports club participants were more physically active at all age groups than non-participants; boys took an extra 1800 steps ($p < 0.001$) and girls 590 steps per day ($p < 0.01$) and boys engaged in an extra 9 min and girls 6 min more moderate to vigorous PA per day (both $p < 0.05$). Fitness was higher among sports participants (boys 27% and girls 20% higher, both $p < 0.001$) and sport participant girls had 2.9% less body fat ($p < 0.05$). Higher fitness scores were maintained over time by sports participants but their greater PA diminished during adolescence, this being more evident among girls. Only 20% of sports club participants met the recommended daily average of 60 min MVPA.
Conclusions: Sport participants were more active, fitter and had less body fat (girls only) than non-sports participants. However, the associated benefits of sport with PA diminished during adolescence and the majority of sports participants did not meet recommended levels of PA. Strategies aiming to maximise the benefits of sports participation may be enhanced by providing special attention to the early adolescent period particularly among girls.

1. Introduction

Sport participation was recently identified by the International Society for Physical Activity and Health as "an investment that works" to promote physical activity.[1] In addition, a recent International Olympic Committee statement highlighted the important role of sport as a means to encourage behaviour change among youth to positively affect health.[2]

Given global appeal, sport seems an ideal vehicle to address reported low levels of physical activity (PA)[3,4] and high prevalence of obesity.[5] In Australia, sports club participation may become an increasingly important source of PA among youth, as in the school setting there is a growing trend towards allocating teaching time to academic pursuits,[6] which may be reducing time spent in physical education and sport in schools.

Cross-sectional studies indicate that youth sports club participants tend to have higher levels of PA[7,8] and cardio-respiratory fitness (CRF) compared to non-participants.[7,9] The role that sport plays in the prevention of overweight and obesity is somewhat clouded, with a recent review concluding that additional research

* Corresponding author.
E-mail addresses: rohan@look.org.au, rohan.telford@canberra.edu.au (R.M. Telford), richard.telford@look.org.au (R.D. Telford), tom.cochrane@canberra.edu.au (T. Cochrane), ross.cunningham@anu.edu.au (R.B. Cunningham), lisa.olive@anu.edu.au (L.S. Olive), rachel.davey@canberra.edu.au (R. Davey).

http://dx.doi.org/10.1016/j.jsams.2015.04.008
1440-2440/

is needed to understand how youth sport can help promote energy balance and healthy body weight.[10] Even so, the high reported sports participation rates in Australia are encouraging, with two-thirds of children aged 9–11 years participating in organised sports outside of school hours.[11]

An important consideration is that sports club participation rates tend to decline from childhood.[12] This decline emphasizes the need for longitudinal studies among youth to understand how sport impacts health over time. A longitudinal study of 7–12 year old British children[13] found sports club participation was associated with higher levels of PA and reduced adiposity at 12 but not 9 years of age. This study suggested that sports club participation may become an increasingly significant source of PA over late childhood and early adolescence, however the authors commented that these findings need to be replicated in other populations to improve the evidence base.

The aim of the current study was to examine the effect of sports club participation on objectively measured PA, CRF measured by 20 m shuttle run; and body composition measured using dual emission X-ray absorptiometry (DEXA). Data were collected annually from 8 to 12 years of age and again at age 16 years. To our knowledge this is the first study to examine how longitudinal changes in objectively measured PA, CRF and DEXA measured adiposity are associated with sports club participation over the important developmental period from childhood to mid-adolescence.

We tested the following hypotheses: (1) that youth sports club participants will have higher levels of PA, less percent body fat (%BF) and will be fitter than non-participants, (2) that the benefits of PA, CRF and %BF associated with sports club participation will persist with increasing age from childhood to adolescence, and (3) that sports club participation assists youth to meet recommended PA guidelines.

We define sports participation as youth who were members of a sports club outside of the school setting. Membership in a sports club is the typical avenue for youth in Australia to take part in extracurricular sport. Clubs are most commonly not for profit organisations that are run by volunteers through a community group or association. We use the abbreviation (SPORT) for sports club participants and (non-SPORT) for non-sports club participants.

2. Methods

This study is part of the multidisciplinary Lifestyle of our Kids (LOOK) project.[14] Grade 2 children attending government primary schools in Canberra, Australia were recruited from 29 schools and informed consent was received from parents for their child to participate from age 8 to 12 years. Both parental consent and child assent were obtained to participate in the study at 16 years. Participation was voluntary and participants could choose not to take part in any aspect of the study. The present investigation involved data collected at age 8, 9, 10, 11, 12 and 16 years from 2005 to 2013.

Questionnaires were completed by parents when their child was 8, 12 and 16 years of age. On each occasion, parents were asked the following question: In the last year, did your child belong to an organised sports club? If yes, which club? As the objective of the study was to compare SPORT and non-SPORT participants across time, subjects who changed their sport participation status were omitted from the longitudinal analysis.

Total daily physical activity (TPA) was measured annually from age 8 to 12 and again at 16 years using pedometers (Walk4Life, Plainfield, IL, USA) over seven days. From these data a physical activity index (TPAI) was derived as previously described.[15] Accelerometers (Actigraph GT1M, Pensacola, FL, USA) were used simultaneously with the pedometers at age 11, 12 and 16 years. Moderate and vigorous physical activity (MVPA) was defined as counts >2296 per minute and sedentary (SED) activity was defined as counts <100 per minute based on recommendations,[16] using an epoch length of 60 s. The first day's data were discarded to minimise reactivity and days of accelerometer data were included if there were 10 or more hours of activity, an hour being considered invalid if there were more than 30 zero counts in a row. Data were analysed using ActiLife version 6 software (Actigraph, Pensacola, FL, USA).

CRF was assessed in all measurement periods using the 20 m multistage run, a well-established field test with children.[17] Body composition was measured at age 8, 10, 12 and 16 years using DEXA (Hologic Discovery QDR-Series, Hologic, Bedford, MA, USA) and Hologic Software Version 12.4:7 used to calculate percent body fat.

As a proxy for socioeconomic status (SES), the Australian Bureau of Statistics index of socio-economic advantage and disadvantage of the school suburb was used.[18] This value is derived from income, educational attainment, and employment. The average SES index of the suburbs in our study (1085 ± SD 40 and range 982–1160) was higher than the average index Australia-wide (980 ± 84, 598–1251).

General linear mixed modelling[19] was used to determine the significance of the differences in characteristics of children (e.g. TPA, MVPA, SED, CRF, %BF) who were and were not involved in SPORT. These analyses included only subjects who maintained their sports participation status, that is, children who remained in a sports club across measurement time points (SPORT) or children who never participated in a sports club across measurement time points (non-SPORT). This allowed for the comparison of long term exposure of sports participation with long term non-sport participation. Separate models were fitted for boys and girls and each model included adjustment for repeated sets of data and socioeconomic status. Statistical significance of an effect was assessed by calculated adjusted Wald statistics.[20] Variables were scaled to meet linearity assumptions; for example, the square root of TPA was used to formulate the TPAI and the square roots of MVPA (sqrtMVPA), SED (sqrtSED) and CRF (sqrtCRF) were calculated prior to formal analysis. General model checking procedures were used to check the model assumptions. Statistical computation was undertaken using Genstat Version 16 (VSN International, Oxford, UK).

This study was approved by the Australian Capital Territory Health and Community Care Human Research Ethics Committee.

3. Results

Participant characteristics are shown in Table 1. There was a 43% study attrition rate for girls and 47% for boys from age 8 to 16 years, with no significant differences between study dropouts and those with complete data for gender, socio-economic status, sport participation (Chi square tests all $p > 0.05$), CRF, TPAI and %BF (T-tests all $p > 0.05$). There was however a difference in body weight between study dropouts (Mean = 29.2 kg, SD = 6.1) and non-dropouts (Mean = 28.2 kg, SD = 5.1) at the time of baseline measurement; $p = 0.03$.

SPORT participation was higher for boys at baseline (79% boys vs. 65% girls) and at age 16 years (71% boys vs. 59% girls). There was an 8% and 6% decline in SPORT participation in boys and girls respectively from age 8 to 16 years. Football club memberships (soccer, rugby or Australian Rules football) were most popular among boys (49%) followed by softball (8%), hockey (6%), swimming (6%), cricket (5%) and a range of minority sports, each with less than 5% participation. Among girls, swimming (12%) and netball (11%) were the most popular sports followed by softball (10%), athletics (10%),