The Feasibility, Scalability And Outcomes Of Cardiorespiratory Fitness Testing In Primary School Childen

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Abstract

Purpose. The physical activity (PA) levels and fitness of school children is increasingly a public health issue. Cardiorespiratory fitness (CRF) is a validated marker of PA levels, however there is little systematic measurement of this variable in school children. Systematic measurement would allow all stakeholders, from parents and schools to activity providers and public health agencies, to monitor changes in CRF over time and to evaluate the effectiveness of interventions. The primary purpose of this investigation was to examine the CRF of children at a number of UK primary schools over one academic year. Measures were CRF and body mass index (BMI). Secondary aims were to test the feasibility of CRF testing in primary schools more generally (previous studies have been administered by research teams, and whilst providing useful data relating to validity and reliability, provide little insight into the practicality and scalability of testing).

Methods. Participants from 14 schools (n=463) aged between 8–9 (M±SD BMI 17.61±61) completed a 20 meter shuttle run test (20–mSRT) four times during a calendar year (Oct, Feb, June, Sep). This included data collection either side of the school summer break from July–Sep. CRF (VO_2max ml·kg^{-1}·min^{-1}) was calculated using standardised prediction equations for children. To demonstrate both practicality and scalability of the protocol, testing sessions and data collection were conducted by appropriately trained and qualified personnel already operating in the schools and not by the research team, although the latter vetted this process.

Results. Paired sample t–tests indicated a significant increase in CRF during the 1st quarter of the academic year (VO_2max 49.58±4.06–51.58±5.09 p<0.01). CRF continued to increase during the school year before decreasing significantly over the summer break (51.71±5.00–49.99±4.45 p<0.01). BMI remained level during the academic year but increased significantly during the summer break (17.91±3.13–18.35±3.31 p>0.01).

Conclusions. Significant negative changes in CRF and BMI suggest children are less active in the summer break, a finding that should be used to inform future activity provision. Data also indicate that the delivery of CRF testing in primary schools is feasible and scalable.

Introduction

The health and physical activity of children is increasingly recognised as a core component of public health. The growing emphasis is evident as poor health adversely affects the quality of life, and the physical, academic and social development of children. And secondly, poor health in childhood may predispose to certain diseases and is often therefore predictive of poor health in adulthood [1]. The UK Chief Medical Officer [2] stated, "the introduction of a standardised school–based fitness assessment in England may have multiple benefits that extend beyond the benefits for the individual". Methods might range from the very basic such as the total time children spend in Physical Education (PE) lessons and/or the number of children who take part in extracurricular physical activity, to the more complex, such as the evaluation of motor skills and physical literacy, and/or the measurement of cardio–respiratory fitness.

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Methods

Participants from 14 schools (n=463) aged between 8–9 years (M±SD BMI 17.61±61) completed a 20 meter shuttle run test (20–mSRT) four times during a calendar year (Oct, Feb, June, Sep). This included data collection either side of the school summer break from July–Sep. The 20–mSRT was chosen as had previously been identified as a sufficiently valid, reliable and scalable test of children's fitness [3]. Briefly, this consisted of shuttle running between two markers placed 20 m apart at increasing speeds. The running speed increased 0.14 m·s^{-1} each minute, this change in running speed was described as a change in level. The 20–mSRT is an exhaustive protocol i.e. participants were asked to run until they could not keep pace with the automated 'bleeps'. CRF (VO_2max ml·kg^{-1}·min^{-1}) was calculated using standardised prediction equations for children [4].

To demonstrate both practicality and scalability of the protocol, testing sessions and data collection were conducted by appropriately trained and qualified personnel already operating in the schools and not by the research team, although the latter vetted this process. Fitness tests were incorporated into wider PE lessons that included fun and widely accessible activities. Protocols enforced strictly via spot checks and interviews with teachers following testing.

Results

Figure 1. BMI and CRF Fitness (VO_2max) of children throughout the school year (Oct '14, Feb '15, June '15) and after summer holidays (Sep '15). * denotes p–value < 0.05

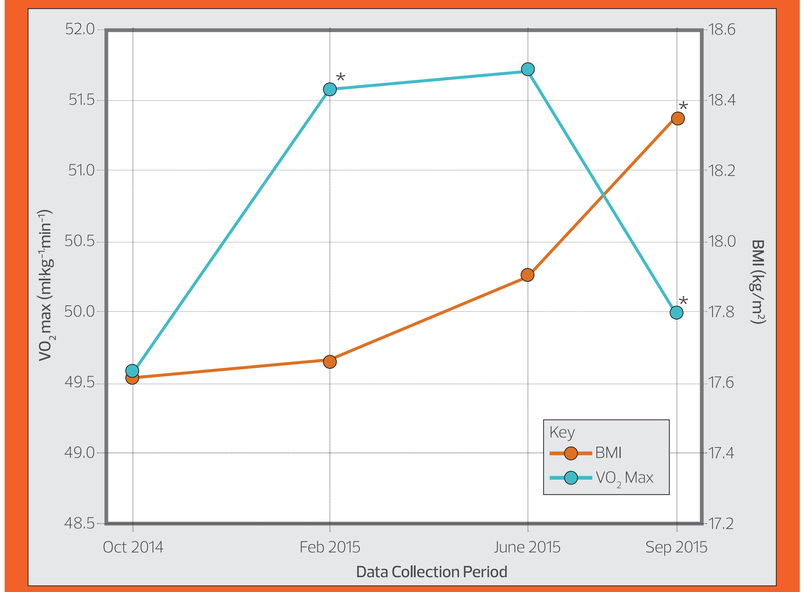

Figure 1 shows that fitness levels increased throughout the academic year (from Oct '14 to June '15). However, the fitness levels of primary school children after the summer holidays (Sep '15) were lower than the fitness levels measured before the summer holidays (June '15), indicating a reduction in physical activity over the summer holidays. This also coincides with an increase in BMI for the same period of time.

Table 1. Sample characteristics, BMI and CRF Fitness (VO_2 max) of children throughout the school year (October '14, February '15, June '15) and after summer holidays (September '15).

Data Collection			Height (m)	Weight (kg)	BMI (kg/m^2)	20–mSRT Level	Total Distance (m)	VO_2max (ml·kg^{-1}·min^{-1})
1	October	Mean	1.31	30.64	17.61	29.03	580.67	49.58
		SD	0.06	7.14	3.03	16.11	322.15	4.06
2	February	Mean	1.35	32.42	17.66	36.95	740.66	51.58
		SD	0.07	7.70	3.09	21.46	429.28	5.09
3	June	Mean	1.35	33.18	17.91	38.06	761.20	51.71
		SD	0.06	7.90	3.13	20.77	415.40	5.00
4	September	Mean	1.36	34.30	18.35	31.05	621.03	49.99
		SD	0.07	8.28	3.31	18.14	362.75	4.45

Summary and Conclusion

Significant negative changes in CRF and BMI suggest children are less active in the summer break, a finding that should be used to inform future activity provision. Data also indicate that the delivery of CRF testing in primary schools is feasible and scalable. Our analysis should further encourage practitioners and policy makers to adopt fitness testing using the 20m–SRT either as an adjunct to, or replacement for, existing mandated tests such as the UK National Child Measurement Programme.

By measuring cardiorespiratory fitness levels in children, as a validated marker of physical activity levels, it is proposed by the Chief Medical Officer that not only would it be possible for each child / parent to assess their fitness and monitor changes over time, but it would also increase engagement with physical activity of families. By formalising such an assessment, awareness of physical fitness as an area of health importance would increase throughout the population. This may provide a stimulus for the cultural change that is so desperately needed.

References

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The ukactive Research Institute holds a unique partnership between academia and industry to turn the tide of physical inactivity. It co–ordinates and delivers research designed to improve the use of physical activity in everyday life. Established in 2010, the ukactive Research Institute seeks to answer 'how can we get more people, more active, more often'?

The Research Institute aims to bridge the evidence gap between traditional laboratory based 'exercise is medicine' research and real world interventions. This is achieved by conducting research assessing the effectiveness of interventions on directly measured physical activity levels, clinically relevant markers of cardiovascular and metabolic health, and other core variables in real world interventions.

These questions will in time relate as much too economic, social and political factors as to scientific and health factors. Each project undertaken will, when completed, be publishable in a peer–reviewed journal article, constitute the basis of a major policy report /insight document, or produce otherwise strategically relevant data.

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