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Massey University
COLLEGE OF SCIENCES

The effect of a child-specific high intensity games intervention on physiological responses in normal weight and obese children

Submitted by Nicole Westrupp to Massey University Wellington as a thesis towards the degree of Master of Health Science with Sport and Exercise Science (February, 2013)

“I certify that all material in this dissertation which is not my own work has been identified and that no material is included for which a degree has previously been conferred upon me

.....”

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Abbreviations

EX- Exercise	LDL - low density lipoprotein cholesterol
CON- Control	VLDL - very-low density lipoprotein cholesterol
NW- Normal weight	TC - total cholesterol
OB - Obese	TG - triglycerides
pre-INT- pre intervention	VAT - visceral adipose tissue
post-INT - post intervention	SAAT - subcutaneous abdominal adipose tissue
$\dot{V} O_2$ - oxygen consumption	FFM - fat free mass
$\dot{V} O_{2peak}$ - peak oxygen consumption	MM - muscle mass
$\dot{V} O_{2max}$ - maximal oxygen consumption	BMR - basal metabolic rate
% $\dot{V} O_{2peak}$ - percent of $\dot{V} O_{2peak}$ in proportion to peak value	RPE - ratings of perceived exertion
\dot{V}_E - minute ventilation	
\dot{V}_{Epeak} - peak minute ventilation	
% \dot{V}_{Epeak} - percent of minute ventilation in proportion to peak value	
VT - ventilatory threshold	
40% delta - 40% of the difference between VT	
GXT- graded exercise test	
%BF - body fat percentage	
BMI - body mass index	
HR – heart rate	
HRpeak – peak heart rate	
%HRpeak – percent of heart rate peak in portion to peak value	
HDL – high density lipoprotein cholesterol	

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Abstract

To date, little is known about the use of child-specific high-intensity games-based exercise to improve body composition, cardiovascular indices, musculoskeletal health, psychological and social well-being. Past research in children has predominantly focused on the effect of laboratory or games based moderate intensity exercise interventions on the aforementioned markers of health (Janssen & LeBlanc, 2010). Therefore, the aim of this investigation is to assess the effect of a 6 week high-intensity games-based intervention on the physiological responses and physical parameters in normal and overweight or obese children aged 8 to 10 years. Twenty eight children were randomized into an exercise group (EX; 9.3 ± 0.9 y, 1.40 ± 0.10 m, 41.0 ± 12.4 kg, 20.5 ± 4.4 kg·m²) and 27 children into a control group (CON; 9.3 ± 0.8 y, 1.40 ± 0.09 m, 39.0 ± 11.3 kg, 19.5 ± 4.1 kg·m²). All participants completed two, pre-intervention (pre-INT) exercise tests on a treadmill i) discontinuous graded exercise test (GXT) to peak oxygen consumption ($\dot{V}O_{2peak}$) and ii) a submaximal exercise test at running speeds equivalent to moderate (ventilatory threshold [VT]) and heavy (40% delta [difference between $\dot{V}O_{2peak}$ and VT]) intensity exercise for a total of 6 minutes. The EX group took part in 2 x 40 minute high-intensity child-specific games-based exercise sessions per week for 6 weeks. Follow-up assessments identical to the pre-INT were completed thereafter for all participants. The EX group from pre to post intervention (post-INT) demonstrated a significant increase in absolute $\dot{V}O_{2peak}$ and running speed for the GXT test ($P < .05$); and demonstrated a significant increase in their running speed at VT (7.8 ± 0.9 vs. 8.2 ± 0.8 km·h⁻¹) and 40% delta (9.4 ± 1.0 vs. 9.9 ± 1.1 km·h⁻¹; $P < .05$) when compared to the CON group. A significant decrease in $\dot{V}O_2$ at VT and 40% delta was also observed for the EX group in comparison to the CON group ($P < .05$), thus demonstrating an improvement in exercise efficiency. In conclusion, a short duration (6 week) child-specific high intensity games

intervention may improve maximal functional capacity and exercise efficiency, independent of body mass in children aged 8 to 10 years. An increase in the oxygen carrying capacity of blood, and capillary and mitochondrial density within the skeletal muscle are potential mechanisms for the aforementioned outcomes. Findings from this study provide important information concerning the practical application of physical activity within school or clinical-based programmes to improve health and physical fitness.