Massey University
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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

....."

Dr James Faulkner

Dr Danielle Lambrick

Acknowledgements

First of all I would like to formally thank my supervisors Dr James Faulkner and Dr Danielle Lambrick. It is through their continuous support, guidance, dedication and encouragement that this study was made possible. I gratefully acknowledge everything they have done and wish them all the best for the future. Furthermore, I would like to thank Newtown School and St-Anne's School. In particular, Mr Kelvin Harper and Mr Matt Kolic whose assistance and cooperation during this study, not only immeasurably facilitated the process but also made it a fun and enjoyable experience. This study would not have been possible without all the participants involved and I am truly grateful for their commitment, patience and enthusiasm. I am very proud of each and every one of the participants in this study for continually giving their best during laboratory and field based testing sessions. Many thanks to Wendy O'Brien, Sport and Exercise Laboratory Manager, for her continued help and reassurance during the many technical inconveniences encountered. I would also like to thank my fellow Post-Graduate students and 3rd year practicum students who volunteered to assist in time of need, this was greatly appreciated.

Finally, I would like to thank my family and friends, for their continual patience, understanding and encouragement through all aspects of this study. I would especially like to acknowledge my Mum and Dad, who not only provided the financial assistance required to complete this degree, but who have continually loved, supported and encouraged, me even when I was under pressure. I will be forever thankful for everything my parents have done for me, not just in the last year but through all aspects of my life.

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Abbreviations

EX- Exercise

CON- Control

NW- Normal weight

OB - Obese

pre-INT- pre intervention

post-INT - post intervention

$\dot{V}O_2$ - oxygen consumption

$\dot{V}O_2$peak - peak oxygen consumption

$\dot{V}O_2$max - maximal oxygen consumption

%$\dot{V}O_2$peak - percent of $\dot{V}O_2$peak in proportion to peak value

$\dot{V}_E$ - minute ventilation

$\dot{V}_E$peak- peak minute ventilation

%$\dot{V}_E$peak - 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

LDL - low density lipoprotein cholesterol

VLDL - very-low density lipoprotein cholesterol

TC - total cholesterol

TG - triglycerides

VAT - visceral adipose tissue

SAAT - subcutaneous abdominal adipose tissue

FFM - fat free mass

MM - muscle mass

BMR - basal metabolic rate

RPE - ratings of perceived exertion

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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·m^2) 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·m^2). All participants completed two, pre-intervention (pre-INT) exercise tests on a treadmill i) discontinuous graded exercise test (GXT) to peak oxygen consumption ($\dot{V}O_2$peak) and ii) a submaximal exercise test at running speeds equivalent to moderate (ventilatory threshold [VT]) and heavy (40% delta [difference between $\dot{V}O_2$peak 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 $\dot{V}O_2$peak 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.