VALIDATION OF THE ACTIHEART MONITOR FOR COMBINED HEART RATE AND MOVEMENT IN OVERWEIGHT, OBESE AND ATHLETE CHILD POPULATIONS

PK. Doyle-Baker[1], & Allison A. Venner[1,2], Faculty of Kinesiology[1] & Dept. of Medical Sciences[2], University of Calgary, AB

Introduction

There are currently no known studies that have validated the Actiheart monitor on overweight, obese and athletic pediatric populations. The economy and movement techniques in these populations could significantly differ from a healthy, nonobese population. The overall goal of this study was to determine the validity of the Actiheart in a laboratory setting at rest and while walking and running on a treadmill. This was to be completed on 7 to 11 year old overweight children and 7 to 11 year old highly athletic children. Initial testing and a thorough review of the literature revealed that it was necessary to take a step back and develop a reproducible resting and treadmill protocol for these children. This needed to be accomplished before the Actiheart could be further validated.

Objective

The objective was to determine if previously published protocols using single-pieced HR and movement sensor in children during treadmill walking and running could be replicated with a combined HR and movement sensor: the Actiheart monitor. This monitor had been validated in healthy children, but not in overweight or athletic children. Resting energy expenditure (EE) and submaximal EE was measured by indirect calorimetry at rest and during a progressive treadmill exercise test.

Setting

Human Performance Laboratory (HPL), University of Calgary.

Participants

Three athletic males (mean age 9 years; 34.1 kg; 140 cm), one athletic female (11 yrs; 34.3 kg; 149 cm) and one overweight female (7 yrs; 33.3 kg; 128 cm) have participated in this study, to date.

Methodology

The protocol by Corder et al. was previously used to validate the Acitheart monitor on healthy children (2). This was initially utilized on two children in this study. After further consultation with Ms. Rosie Neil, coordinator of the HPL we modified the other protocols in Table 1 to try and obtain more accurate results for children. The new protocol began at a speed of 3 mph and a grade of 0% for the first 3 minutes. Subsequently, speed increased to 4.5 (or 5.0) mph. Every 3 minutes the grade increased by 2% until a maximum of 6%. At minute 15, speed further increased to 6 mph. During each test, the child would undergo an initial 15 – 20 minute period of rest to obtain resting energy expenditure. Subsequently, they would undergo the treadmill protocol. Data was obtained by a Truemax 2400 metabolic cart, the Actiheart monitor, a Polar heart rate monitor and the AMP monitor.

Main Results

The Corder et al. (2) protocol was not appropriate for the first two athletic children. Consequently, we extensively examined the literature for a more appropriate protocol. No published protocol was deemed appropriate to enable a child to obtain a VO_2 peak or to obtain any form of steady state; therefore a modification of the available protocols was completed. This adaptation, whereby speed and grade eventually reached 6 mph and 6%, respectively, appears to be appropriate for athletic children. However, it is still too difficult for overweight children. A new protocol is currently being designed for overweight children with the objective to maintain a walking speed during an incremental increase in the treadmill grade.

Table 1. Review of literature on treadmill maximum oxygen uptake protocols in of children.

Article	Basic Protocol Summary
Corder et al. (2)	Speed (2 mph) and grade (0%) were constant for 1st -3 mins. Speed increased every minute (0.2 mph) and grade (0%) was constant. After minute 9, speed increased (0.2 mph) every 3-mins and grade (2%) increased every min. Between 15-20 mins, grade was at 0%, and speed increased from 5.59 to 7.58 mph (0.5 per 30 sec).
Trowbridge et al. (4)	Speed (2 mph) was constant for 15 mins, while grade increased from 0–25%; speed and grade subsequently increased by 0.4 mph and 2.5%, respectively, up to 22 mins.
Cumming et al. (3)	Speed and grade increased every 3-mins, for a total of 15 mins. Speed increased from 1.7 to 5.0 mph; grade increased from 10 to 18%
Armstrong et al. (1)	Grade (0%) was constant for 11 mins, while speed increased from 4.4 to 6.2 mph. Grade then increased by 2.5% every 3-mins and speed remained constant until a total of 18 mins.

Discussion/Conclusion

The lack of an appropriate protocol for athletic children and overweight children has proven to be a key limiting factor in completing this research. Current literature is lacking in its ability to understand a child's physiology and how best to work with children in a laboratory setting. In addition, our laboratory has done minimal exercise physiology testing protocols in children. This has meant that available resources and equipment are limited, although they are slowly coming together because of this study and other work by Dr. Doyle-Baker and Ms. Venner.

The outcome of this study will provide more information than initially anticipated. In addition to the validation of the Actiheart monitor, it will provide a better understanding of how to more accurately test children and further elucidate how overweight and athletic children differ in their physiology.

References

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Source of funding: Sport Science Association of Alberta (SSAA) through the ASRPWF.

For more information contact: Dr. PK Doyle-Baker: 2500 University Drive NW, Faculty of Kinesiology, University of Calgary, Calgary, AB, T2N 1N4