EDITORIAL

Accelerometers for Measuring Physical Activity Behavior in Children

BRAD METCALF

Senior Research Statistician, The EarlyBird Diabetes Study, Department of Endocrinology and Metabolism, Peninsula Medical School, Plymouth, UK. Brad.Metcalf@phnt.swest.nhs.uk

Assessment of physical activity in children was, until recently, somewhat of a challenge, with research relying on subjective questionnaires and diaries. For the past 10 years or so, small electronic motion sensors (*i.e.* pedometers and accelerometers) have provided an objective means of measuring this lifestyle behaviour. Accelerometers are fast becoming the objective method of choice as they are capable of measuring the intensity and duration of the child's activity as well as the overall amount. Whilst there are several different accelerometers available, the most common is the Actigraph (formerly MTI and CSA) accelerometer. The Actigraph is small, unobtrusive, robust, and does not have external buttons or a display screen, making it ideal for use in often inquisitive and competitive children.

In this issue of *Indian Pediatrics*, Krishnaveni and colleagues use Actigraphs to measure the physical activity of around 100 pre-pubertal children in India(1). The study is methodologically equipped to address its primary objective - to describe the physical activity level and pattern of the children. The authors comment that the activity recorded by their children was lower than those of white European children reported by others. They speculate that the factors responsible for this difference could be environmental (*e.g.* reduced outdoor spaces, fierce academic competition) or biological (*e.g.* the 'low muscle - high adipose' body composition of the Indian child). In support of a biological explanation, Owen, *et al.*(2) showed that among children living in the UK, sharing many environmental factors (*e.g.* the physical environment, schooling, weather), those of South Asian origin recorded 5-10% less activity than the white Europeans.

Accelerometers have proved to be of high technical reliability(3), but it is important to note that this alone does not guarantee a measure of high overall reliability. Children are rarely asked to wear accelerometers for more than a single 4-7 day period, as in the study by Krishnaveni, *et al.*(1), and this may not be representative of their 'usual' habitual activity. My own research has shown that the mean of four repeated 4-7 day samples provides 90% reliability in ordering children from least to most active, compared to just 71% reliability from a single 4-7 day sample(4). The true underlying associations between physical activity and health may be subtle and difficult to detect if studies continue to sample such short, one-off periods.

Another contentious issue regarding the use of accelerometers is the lack of agreement between studies regarding cut-points for defining intensity levels. For example, Krishnaveni and colleagues established a cut-point of ≥3000 counts/min for what they described as 'vigorous' activity, yet it was within the range of cut-points typically used to define 'moderate-and-vigorous' activity (MVPA) - ≥2000 to ≥3600 counts/min. The wide range of cut-points being used to define MVPA makes comparisons between studies very difficult. Accordingly, Actigraph cut-points should be standardized to agreed levels of energy expenditure

(*e.g.* by METs) rather than to loose interpretations of the terms themselves.

Krishnaveni and colleagues attempted to validate the Actigraph as a tool for characterising activity patterns by comparing its data with diary-based estimates of energy expenditure collected during the same week. The authors showed that there was poor agreement between the two methods, at every intensity, especially vigorous activity. Whilst these results are interesting, the findings are likely to reflect the limitations of the diary rather than the Actigraph. Portable indirect calorimetry would provide a more suitable method for this kind of validation as they collect minute-to-minute measurements that could be synchronised perfectly to the accelerometer recordings(5).

The article by Krishnaveni, *et al*.(1) reported moderate inverse associations between physical activity and adiposity, consistent with most other cross-sectional studies. The authors conclude that *"describing activity levels is a first step towards reducing sedentary behaviour, and adiposity…"*. This leap of faith is intuitive but in practice is proving somewhat paradoxical - attempts to improve children's body composition with extra activity have so far been unsuccessful(6). Understanding why such attempts fail is crucial to the success of future activity interventions, yet few studies offer reasons beyond simple speculation. Accelerometer data is capable of showing that the intervention failed to increase overall activity, and can also reveal the reasons why. With data being recorded against clock time it is possible to see if children had off-set any session-specific increases by being less active at other times, or if intervention-sessions themselves had been insufficient. Future intervention studies should consider utilising the time-resolved nature of accelerometer data.

As we aim to understand which children are inactive and why, it is encouraging to see that accelerometers are measuring children's activity in so many countries across different continents. Westernised lifestyles are often blamed, in part, for today's so called 'inactive' child and India provides a perfect setting to test this with many parts of the country currently experiencing the transition to westernisation.

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