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Original research

Associations between young children's perceived and actual ball skill competence and physical activity

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ABSTRACT

Objectives: The relationship between actual and perceived object control competence (ball skills) and the contribution to young children's physical activity is not known.

Design: Cross sectional study.

Methods: The Test Gross Motor Development-2 assessed actual object control competence and a modified version of the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children assessed perceived object control competence. Moderate- to vigorous-intensity physical activity was measured via accelerometry. Three mixed regression models were performed: (i) object control competence as the predictor and the outcome as perceived object control, (ii) perceived object control competence as the predictor and the outcome moderate to vigorous physical activity and (iii) actual object control as the predictor and the outcome moderate to vigorous physical activity. Models adjusted for school clustering, monitor wear time, sex and age. Interactions between respective predictor variables and sex were performed if warranted. A total of 102 children (56% boys, 44% girls) aged 4–8 years (M 6.3, SD 0.92) completed assessments.

Results: Girls had lower perceived and actual object control competence and were less active than boys. Actual object control competence was positively associated with perceived object control competence ($B=0.11$, $t(96)=2.25$, $p<0.001$, $p=0.027$) and this relationship did not differ by sex ($p=0.449$); however, neither actual ($p=0.092$) nor perceived object control competence ($p=0.827$) were associated with moderate to vigorous physical activity.

Discussion: Young children's perceived ball skill abilities appear to relate to actual competence; however, these measures were not associated with physical activity. In older children, object control skill is associated with physical activity so targeting young children's object control skills is an intervention priority.

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1. Introduction

Fundamental movement skill (FMS) ability (e.g. being able to throw, kick and jump) in children and adolescents is positively associated with engagement in physical activity.¹ Furthermore, object control (OC) skill competence (involving manipulation of an object such as a ball) might be a key proficiency to target for promoting higher levels of physical activity behaviour. The longitudinal Physical Activity and Skills Study (PASS) study found children's OC skill competency in late primary school was

associated with adolescents' physical activity² and that children's OC competence tracked over time, but children's locomotor competence did not.³ Perceived competence is also important to consider as it has been suggested to more directly affect motivation towards physical activity than actual competence.⁴ The PASS study also found perceived competence mediated the relationship between children's actual OC skill competency and adolescent physical activity.⁵ In systematic reviews of physical activity correlates, perceived competence is positively associated with adolescent physical activity.^{6,7}

In children, the relationship between perceptions of competence, actual competence and physical activity is more uncertain having not been investigated in children in great detail to date. For instance, a review of physical activity correlates in children found an indeterminate relationship between perceived competence and

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physical activity,⁶ with a more recent review not reporting any studies investigating this association in children.⁸ One study in preschool children found perceived competence was not associated with pedometer steps but actual locomotor ($r=0.46$) and object control (OC) competence ($r=0.44$) were moderately correlated with pedometer steps.⁹ A study in kindergarten children reported a low correlation between perceived physical competence and actual OC competence ($r=0.14$),¹⁰ whilst a study in preschool children reported a moderate association ($r=0.43$).¹¹

It is considered 'normative' for young children to overestimate their abilities because of cognitive limitations in finding it hard to distinguish between their 'ideal' in terms of competence, and their own reality.¹² Young children engage in 'temporal comparisons' in which they compare themselves to how they performed on a previous occasion, rather than 'social comparisons' which would help them to have a perception of how they perform relative to peers.¹² Nevertheless, even if children systematically overestimate their ability, there still may be potential to predict physical activity behaviour from such perceptions which is important as it may identify characteristics of those at risk of low physical activity. Furthermore, this early period has been termed a 'window of opportunity' with the idea that it is an opportune time for intervention, as children (even if low skilled) can still be keen participators in activity.¹⁰ If we are going to intervene in this early period then it is important to have an understanding of children's perceived and actual competence.

The aim of this study was to investigate associations between young children's perceived and actual OC competence and physical activity. Since girls are reported to be less OC skilled^{3,13} and less physically active,¹⁴ a secondary aim was to explore sex differences.

2. Methods

The study reports on the baseline results of an intervention study (not described here). Convenience sampling was used, with three primary schools consenting to participate. A total of 119 out of 510 parents of children in the first three year levels of school provided consent for their child to participate in the study (23% consent rate). Ethics approval was granted from all relevant departmental bodies (i.e. the University, the schools authority, and the School Principals). Demographic data were completed by parents who returned a short survey at the time of providing consent for their child to participate in the study. Respondent parents were asked to report their country of birth, whether English was the main language spoken in the household and highest level of education.

The Test of Gross Motor Development- 2nd Edition (TGMD-2) assessed actual OC competence (striking a stationary ball, stationary dribble, kicking, catching, overhand throwing, and underhand rolling).¹⁵ The TGMD-2 is a process oriented measure, assessing the components of each skill rather than the outcome or product of the skill execution. It was administered according to standard procedures. Each attempt was scored with each component of the skill receiving a '1' if correctly executed or a '0' if not. Each skill had between 3 to 5 components that needed to be demonstrated for the skill to be performed proficiently. Scores of the two trials were summed to obtain a raw score for each skill and then the six skill scores for each child were summed to provide an OC score. All children were assessed in the school setting using live observation by two observers trained for that purpose (12 h conducted by an expert trainer). In the field, inter-rater reliability was assessed on 37 children for all six skills; equating to 222 skill tests (intra-class correlation [ICC] = 0.93, 95% confidence intervals [CI] 0.87–0.96).¹⁶

A pictorial instrument to assess perceived OC competence based on the six OC skills in the TGMD-2 was developed.¹⁷ Newly created items assessed object control competence using the format

and item structure from the physical competence subscale of the Pictorial Scale of Perceived Competence and Acceptance for Young Children.¹⁸ Boys received the booklet depicting boy cartoon figures and vice versa for girls. For each skill, children were provided with two pictures, one 'good' picture showing a child who was competent in the skill and the second 'poor' picture showing lower competence in the skill (e.g. "this child is pretty good at *throwing*, this child is not that good at *throwing*, which child is most like you?"). The child was then required to first choose which picture was most like him or her and then decide between two further options. For the 'good' picture the child decided between: 'really good at...' or 'pretty good at...', and for the 'poor' picture the child decided between: 'sort of good at...' or 'not that good at...'; resulting in four possible options for each item. These scores were summed into a perceived OC score (possible range 6–24). The OC subscale was reliability tested on two occasions one week apart in a sample of 35 children from a similar population but not part of the current study, with the ICC considered good (0.78).¹⁷ Internal consistency was 0.63 at time one, and 0.72 at time two. In a different sample of 58 children internal consistency was 0.70.¹⁷

Children's physical activity levels were measured for eight consecutive days using hip-mounted GT3X ActiGraph (Pensacola, FL) accelerometers. The epoch length used was 15 s. Children were instructed to wear the monitor during all waking hours except during water-based activities (e.g. showering, bathing). Accelerometers have been validated for assessing children's physical activity in laboratory and field settings.¹⁹ Accelerometer data were initially downloaded using ActiLife Software (version 5.10). Data were then analysed using customised Excel macros. Non-wear time was defined as 20 min of consecutive zeros; commonly used to define non-wear in children.²⁰ The time children spent in moderate- to vigorous-intensity physical activity (MVPA) was determined using the Evenson cut-point, which was derived using a 15 second epoch length.²¹ This cut-point was used as it provides a fixed cut-point that can be used across age groups, and has been found to have significantly greater classification accuracy for MVPA compared to other commonly used cut-points in 5–15 year old youth.²² The average time spent in MVPA per day and average daily wear time was computed using data collected on each valid day. A valid day was defined as ≥ 8 h on weekdays and ≥ 7 h on weekend days. To be included in the analyses, children were required to have worn the monitor on at least four days.

Independent *t*-tests were conducted to assess sex differences in actual OC, perceived OC and MVPA. Three mixed regression models were performed with school modelled as a random factor to adjust for potential clustering at the school level: (i) OC competence as the predictor and the outcome as perceived OC, (ii) perceived OC competence as the predictor and the outcome MVPA and (iii) actual OC as the predictor and with MVPA as the outcome. Interactions between respective predictor variables and sex were performed if these variables were both significantly associated with the outcome variable. All models adjusted for sex, age and average daily accelerometer wear time. SPSS version 22 was used and $p < 0.05$ was the set significance value.

3. Results

A total of 102 children (56% boys, 44% girls) aged 4–8 years (M 6.3, SD 0.92) completed all assessments; or in the case of physical activity, met the inclusion criteria. In the population sampled, children can start school from the age of 4 years. As a result, all participants were in full-time primary school education. Of 100 respondent parents, 80% were born in Australia, and most (87%) spoke mainly English in the household. A total of 76% of parents had a university education, 12% had completed high school, 8% had

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