



Original research

Young children's motor skill performance: Relationships with activity types and parent perception of athletic competence



Jennifer R. O'Neill^{a,*}, Harriet G. Williams^a, Karin A. Pfeiffer^b, Marsha Dowda^a,
Kerry L. McIver^a, William H. Brown^c, Russell R. Pate^a

^a Department of Exercise Science, University of South Carolina, USA

^b Department of Kinesiology, Michigan State University, USA

^c Department of Educational Studies, University of South Carolina, USA

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ABSTRACT

Objectives: The aims were to examine the relationship between children's motor skill levels and types of physical activities performed during preschool attendance, and to examine the relationship between motor skill performance and parent perception of athletic competence.

Design: Cross-sectional.

Methods: Participants were 264, 3-, 4-, and 5-year-old children from 22 preschools. Locomotor and object control skills were assessed with a standardized motor skill protocol. Direct observation (OSRAC-P) was used to record activity types: walk, run, jump/skip, dance, and throw. Parents rated their child's athletic competence. Children were categorized into tertiles for locomotor and object control scores. Mixed models were used to test for differences across motor skill tertiles for each aim. Models controlled for sex, age, race/ethnicity, body mass index, and parent education, with preschool as a random variable.

Results: Children in the highest locomotor tertile engaged in more dancing than children in the lowest tertile ($p = 0.04$). Children in the highest object control tertile engaged in throwing more frequently than children in lower tertiles ($p < 0.05$). Parents of children in the highest locomotor tertile perceived their children's competence as higher than parents of children in lower tertiles ($p < 0.05$). Parents of children in the lowest object control tertile perceived their children's competence as significantly lower than parents of children in higher tertiles ($p < 0.05$).

Conclusions: These findings point to the need for policy and practice research to help parents and child care professionals provide opportunities for young children to learn and practice motor skills.

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1. Introduction

Understanding preschool age children's motor skill levels and their relationship to participation in gross motor activities has relevance for developing comprehensive and well-rounded educational experiences for young children. Several expert panels have recognized the importance of young children learning and practicing fundamental gross motor skills.^{1–3} Researchers have examined the relationship between preschool children's motor skill levels and their overall physical activity levels,^{4–6} and some have tested interventions to improve children's motor skills.^{7–10} Young children's motor skill proficiency may also be related to the types of physical activities in which they participate, and direct observation can be used to identify types of activities. To our knowledge, no published studies have examined the relationship between motor skill

levels and types of physical activities children engage in during the preschool day, although two studies examined physical activities and motor skills in the home setting.^{11,12}

Young children need opportunities to be active, because physical activity facilitates the development of fundamental motor skills.¹³ For preschool children, these opportunities occur primarily in the preschool and home settings. Because parents are gate keepers for influencing their children's physical activity levels and motor skill development, it is necessary to understand how parent perceptions of children's abilities relate to their motor skill performance. Although researchers have examined the relationship between parent perception of athletic competence and young children's physical activity,^{14,15} few studies have examined the relationship between young children's motor skill performance and parent perceptions of motor skill abilities.^{16,17} Cools and colleagues reported that fathers' inquiries to teachers regarding their daughters' motor development was negatively associated with girls' fundamental motor skills, suggesting that parents may be able to detect poor skills.¹⁶ To our knowledge, no studies have examined the

* Corresponding author.

E-mail address: oneilljr@mailbox.sc.edu (J.R. O'Neill).

relationship between motor skill performance and parent perceptions of young children's athletic competence.

The primary purpose of this study was to examine the relationship between motor skill performance and types of physical activities in which children participated during attendance at preschool. We hypothesized that: (a) children with higher locomotor scores would participate more frequently in walking, running, jumping, and dancing than peers with lower locomotor scores, and (b) children with higher object control scores would participate in throwing, rolling, catching, and kicking more often than peers with lower object control scores. Secondly, we examined the relationship between motor skill performance and parent perceptions of children's athletic competence.

2. Methods

Participants were 264, 3- to 5-year-old children from 22 preschools (commercial, faith-based, and Head Start) enrolled in the Children's Activity and Movement in Preschool Study (CHAMPS). Written informed consent was obtained from each child's guardian prior to collection of data. The University of South Carolina Institutional Review Board provided ethics approval for the study, including the study design, the protocol, and the informed consent procedure. The funding source had no role in the collection, analysis and interpretation of the data; in the writing of the report; and in the decision to submit the article for publication.

A standardized motor skill protocol was used to measure gross motor skill performance.¹⁸ The protocol is based on the TGMD-2 and assesses the movement process characteristics of six locomotor and six object control skills. The protocol has high reliability and validity.¹⁸ Prior to a child performing two trials per skill, two demonstrations per skill were given. The sequence of locomotor skills was run, jump, slide, gallop, leap, and hop. The sequence for object control skills was throw, roll, kick, catch, dribble, and strike. Movement process characteristics were rated as 1 (present) or 0 (absent). For three skills, ratings of 0, 1, or 2 indicated characteristics of movement of the trunk and arm (throw/strike) and leg (hop).

The Observational System for Recording Physical Activity in Children-Preschool Version (OSRAC-P) was used to directly observe the specific types of physical activity the children performed.¹⁹ Five of 18 possible physical activity types were of interest: walk, run, jump/skip, dance, and throw. "Jump/skip" included jumping, skipping, hopping, and galloping, and "throw" captured throwing, kicking, catching, and rolling balls. "Dance" was defined as any dance or expressive movement such as spinning in circles or acting out instructions to a song. Over a 30-min observation period, 60 intervals were coded. During each 30-s interval, the child was observed for 5 s; the observer then recorded the appropriate codes during the next 25 s. During the 2-week data collection period at each preschool, each child was randomly assigned observations across days, observation blocks, and observers. Each child was observed for 10–12, 30-min sessions, a total of 600–720 intervals per child. Kappa values for inter-observer reliability were above 0.80 for all categories, including activity type.²⁰ For "throw," we included observations with intensities of Level 2: stationary with limb or trunk movements, Level 3: slow-easy movements, Level 4: moderate movements, and Level 5: fast movements.¹⁹ For "dance," "jump/skip," "walk," and "run," we used observations with intensities coded as Levels 3–5. Not all children were observed participating in all activity types.

Parents completed a survey that included a rating of their perception of their child's athletic competence; they rated their child's coordination compared with other children of the same age and sex.²¹ The response scale was a 5-point Likert scale, from 1 (much

Table 1
Participant characteristics (N = 264).

Characteristics	n	Percent
Sex		
Female	127	48.1
Male	137	51.9
Age		
3 years	117	44.3
4 years	123	46.6
5 years	24	9.1
Race/ethnicity		
White	101	38.3
African American	133	50.4
Other	24	9.1
Unknown	6	2.3
Parent education		
>High School	140	53.0
≤ High School	124	47.0
Weight status		
Normal weight	195	73.9
Overweight or obese ^a	69	26.1

^a Defined as ≥85th percentile based on the CDC growth charts.

less coordinated) to 5 (much more coordinated). The test-retest reliability of this question was $R = 0.81$.²¹ Parents also reported their child's sex, race/ethnicity (categorized as African American, White, or Other), date of birth, and their own highest level of education.

Height was measured using a portable stadiometer (Shorr Productions; Olney, MD). Weight was measured using an electronic scale (Seca, Model 770; Hamburg, Germany). The average of two measurements was used and BMI was calculated as kg/m^2 .

For statistical analyses, we first calculated descriptive characteristics of the sample. Then, we placed children into tertiles of both locomotor and object control scores. We conducted a series of mixed model analysis of covariance with types of physical activity (walk, run, or jump/skip) as the dependent variable, and tertiles of locomotor score as the group factor. Because the dependent variables dance and throw were positively skewed, generalized linear mixed models using a Poisson distribution and the log link function were used. The group factors for dance and throw were tertiles of locomotor score and object control score, respectively. We also used mixed models to test for differences between parent perception of child's athletic competence across the locomotor and object control tertiles. All models were analyzed using SAS Version 9.2 with preschool as a random variable, and adjusted for sex, age, race/ethnicity, BMI, and parent education.

3. Results

Characteristics of the sample are presented in Table 1. The sample was 51.9% male and 50.4% African American, and 53% of parents had more than a high school education. The mean age of children was 4.1 ± 0.6 years; the mean body mass index (BMI) was $16.3 \pm 2.3 \text{ kg/m}^2$. Children engaged in sedentary behavior 87.2%, light activity 8.3%, and moderate to vigorous physical activity (MVPA) 2.6% of the time observed.

During the preschool day, children in the highest locomotor tertile engaged in a higher percentage of intervals of dancing than children in the lowest locomotor tertile ($p = 0.04$) (Table 2). Although not significant, there was a trend for children in the highest locomotor tertile to participate in a higher percentage of intervals of jumping/skipping than children in the lowest locomotor tertile ($p = 0.08$). There were no significant differences in percentage of intervals of walking or running across tertiles of locomotor scores. Children in the highest object control tertile were observed throwing in a higher percentage of intervals than children in the low and intermediate object control tertiles ($p < 0.05$).

Table 2
Percent of intervals, mean (SE), of physical activity types observed during the preschool day by tertiles of motor skill performance scores (N = 264).^a

	Locomotor physical activity types			
	Dance	Jump/skip	Walk	Run
Locomotor tertiles				
Low	.07(.05)	.45(.07)	6.89(.48)	1.26(.19)
Intermediate	.10(.04)	.53(.07)	7.13(.43)	1.41(.17)
High	.19(.04)	.61(.07)	6.61(.45)	1.46(.18)
	Object control physical activity type			
	Throw			
Object control tertiles				
Low		.06		(.03)
Intermediate		.06		(.03)
High		.14 ^{b,c}		(.03)

^a Adjustment for sex, age, race/ethnicity, body mass index, and parent education, with preschool as a random variable.

^b High tertile differs from low tertile ($p < .05$).

^c High tertile differs from intermediate tertile ($p < .05$).

Parents' perceptions of athletic competence of children in the highest locomotor tertile were higher than those of parents of children in the lower tertiles ($p < 0.05$) (Table 3). Similarly, parents' perceptions of athletic competence of children in the highest object control tertile were higher than those of parents of children in the lowest tertile ($p < 0.05$). Parents' perceptions of competence of children in the intermediate object control tertile also were higher than that of parents of children in the lowest tertile ($p < 0.05$).

4. Discussion

The key finding of this study is that we observed positive relationships between level of motor skill performance and the specific types of activities children engaged in during the preschool day. The same relationship was found twice; for both locomotor and object control skills. Further, children with better motor skill proficiency tended to be engaged more frequently in more advanced activities that could promote and support increased participation in physical activity. To our knowledge, this is the first study to examine the relationship between motor skill levels and types of physical activities children engage in during the preschool day, although two studies examined physical activities and motor skills in the home setting.^{11,12} Saakslahiti and colleagues found limited or no relationship between locomotor skills and physical activity, but their data did suggest a positive relationship between object control skills and physical activity levels.¹¹ The second study reported no relationship between performance on the bunny hop test and physical activity observed in the home.¹² Our findings indicate that motor

Table 3
Parent perception of child's athletic competence by tertiles of motor skill performance scores (N = 256)^a

Locomotor tertiles	Mean	SE
Low	3.28	.10
Intermediate	3.28	.09
High	3.56 ^b	.09
Object control tertiles		
Low	3.13	.10
Intermediate	3.45 ^c	.09
High	3.54 ^d	.10

^a Adjustment for sex, age, race/ethnicity, body mass index, and parent education, with preschool as a random variable.

^b High tertile differs from low and intermediate tertiles ($p < .05$).

^c Intermediate tertile differs from low tertile ($p < .05$).

^d High tertile differs from low tertile ($p < .05$).

skill level may be an important factor in the promotion of physical activity in young children.

Young children need regular physical activity to develop fundamental motor skills.¹³ The Institute of Medicine has stated that offering opportunities to be active during the preschool day is important for young children to learn and practice motor skills.¹ Suggested strategies to increase opportunities to be active during the preschool day include providing daily outdoor time, providing a variety of developmentally appropriate structured and unstructured physical activities, providing adequate indoor and outdoor space and portable play equipment, and integrating physical activity into activities designed to promote children's cognitive and social development.¹

In addition, we also observed that parents of children in the highest motor skill tertiles perceived their children's athletic competence to be higher than parents of children in the lower tertiles. Thus, parents in our study seemed to be aware of their child's motor skill abilities. A recent study found similar results among girls; fathers' inquiries to teachers regarding their daughter's motor development was negatively associated with girls' fundamental motor skills, suggesting that parents may be able to detect poor skills.¹⁶ The current study suggests that many parents have a reasonably accurate perception of their children's motor skill abilities.

Parental support for physical activity is important for preschool age children.¹⁴ If parents perceive their child to have a lower level of coordination, parents could be encouraged to take several steps to provide parental support by increasing opportunities for their child to be active. First, they could be encouraged to be physically active with their child and to increase the amount of time their child spends in active play. Second, parents could be encouraged to enroll their child in structured activity programs, such as creative movement classes, music and movement classes, gymnastic classes for young children, and classes at the YMCA and local parks and recreation departments. These programs offer children opportunities to practice locomotor and object control motor skills, the types of skills observed in this study to be associated with physical activity. Third, parents could be encouraged to interact with teachers and staff at child care centers to optimize time and opportunities to engage in physical activity. The Institute of Medicine recommends that professionals working with parents and those working with young children should be trained in ways to increase children's physical activity and to counsel parents about their children's physical activity.¹ Parents and teachers should work together to provide opportunities for young children to learn and practice motor skills.

The strengths of our study include a large, diverse sample from three common types of preschools, systematic measurement of motor skills using a comprehensive protocol which emphasized both performance and quality of movement, and objective assessment of physical activity by well-trained observers. Limitations include the limited generalizability of the findings (data were collected in one metropolitan area in South Carolina) and the cross-sectional design. This design does not allow for causal inferences, and this is a major issue concerning this relationship, as it could operate either way: higher motor skill levels may lead to greater participation in physical activity, or more frequent physical activity may lead to improvements in motor skill proficiency. Because our data do not allow for inferences about causality, longitudinal studies are needed to systematically explore relationships between children's motor skill performance and types of physical activity during the early childhood years.

5. Conclusion

In summary, we found a positive relationship between young children's level of motor skill performance and the activities they

were observed doing during the preschool day. Motor skill performance was positively associated with parent perceptions of children's athletic competence. These findings point to the need for policy and practice research to help child care professionals and parents provide opportunities for young children to learn and practice motor skills.

6. Practical implications

- Preschool children with higher motor skill levels participated in more activities that promote those motor skills than children with lower motor skill levels.
- Parents in our study seemed to have a good idea about their child's motor skill abilities.
- Parents and teachers should work together to provide opportunities for young children to learn and practice motor skills.

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