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Relationship between Motor Skill Competence and Physical Activity in Girls

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ABSTRACT

This study examined the relationship between motor skill competence, and physical activity in 8–9 years-old girls (N=352). Locomotor and object control skill competence was assessed, using the Test of Gross Motor Development-2, and the Physical Activity Questionnaire for Children was used to assess physical activity. Regression analysis revealed that locomotor proficiency accounted for 20% (P = 0.001) of variance associated with self-reported moderate to vigorous physical activity. The findings warrant future investigations that examine interventions that focus on locomotor skills to promote physical activity in girls.

Key Words: Locomotor Skill, Physical Activity, Female, Object Control Skill.

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INTRODUCTION

The evidence is overwhelming that physical activity (PA) is important for health (1-3). Being active, it has many important short-term health benefits for youth in physical and psycho-social domains (4). Since PA behaviors track to some degree from youth to adulthood (5), there is a concern that inactive youth will become inactive adults. However, Strong *et al.* (2005) recommended that all school-age youth should participate daily for an hour or more of moderate to vigorous physical activity that is developmentally appropriate practice (DAP), enjoyable, and involves a variety of activities (4). Further, data clearly indicates that girls engage in significantly less PA, compared to their counterparts (6). Thus, there is a critical need to pay attention to patterns and influences of physical activity within this population. This is a major concern globally, and a growing concern in Middle Eastern countries, due to reports of the increasing prevalence of obesity (7) and physical inactivity in girls (8).

One potential behavioral correlates of children's PA is their motor skill competence (MSC) (9). MSC is defined in terms of proficiency in common fundamental movement skills (10). Fundamental movement skills are the building blocks for more complex motor skills and movement patterns, and represent the underlying performance competency required to participate in many forms of PA (9). They are often divided into two domains: locomotor skills (e.g., run, hop, and jump), and object-control (e.g., catch, throw, and kick). The development of fundamental movement skills competence is prominent in early childhood, and primary school physical education curricula, because of the importance of fundamental movement skills play in children's physical, cognitive, and social development (9).

Studies investigating the relationship between MSC and PA in children and adolescents provide little consensus, with commence in motor skills weakly (11-13) to moderately (12) associated with PA, and explaining as little as 3%, and as much as 25% (14) of the variance in habitual activity. Differences in the strength of the reported correlations can likely be explained by differences in the age groups examined, and in the measurement of PA (self-parent reports vs. objective measurement), and MSC (product-oriented vs. process-oriented assessment). The relationship between MSC and PA; however, has been investigated rarely in school children. Research study on MSC showed that it was positively associated with sport participation (15), and total PA (16). Further, MSC in all these studies was measured by product-oriented instruments, and one study found positive relationship between process-assessment MSC, and moderate-to-vigorous PA in children (13). At the beginning levels of MSC, product, or outcome of performance are often inconsistent and low, and thus may not adequately differentiate between individuals (17). Examining consistencies in movement patterns, or technique through process-assessment, irrespective of inconsistent performance outcomes, can provide more useful information on MSC in young children (17).

The aim of this cross-sectional study was to examine the relationship between process-measured MSC, and self-report measured moderate-to-vigorous PA in school girls and to investigate if the relationships differ by fundamental movement skills sub-domains?

MATERIALS AND METHODS

Participants. Third-grade girls from a state primary school located in the urban southwestern part of Tehran Province (Shahr-e-Qods), Iran, were invited to participate voluntarily in the study. Informed

parental consent was obtained for 352 girls (mean age = 8.7 years; SD = 0.3 years) and the Institutional Review Board of the corresponding author's university approved the present study. The sample included children in the low-moderate range of socio-economic background, with no reported history of learning difficulties, or behavioural, physical, neurological, or orthopaedic diagnoses.

Motor skill competence. The Test of Gross Motor Development-2 (TGMD-2) was used to examine motor skill competence (18). The TGMD-2, designed to assess 12 gross motor skills, is subdivided into two areas: locomotor skills (run, gallop, hop, leap, jump, and slide), and object control skills (two-hand strike, stationary bounce, catch, kick, throw, and underhand roll). Each participant skill performance is evaluated, based on qualitative performance criteria, with scores of 1, or 0 indicating the presence, or absence of each criterion tested. The highest total score for the two subtests is 48 points. Higher raw scores and total score represent higher motor skill competence, while lower scores and total score indicate the absence of critical elements (i.e., motor skill competence) (18). TGMD-2 is valid and reliable for 3-10-year-old Iranian children, and internal consistency coefficients for locomotor, object control, and gross motor quotient includes 0.78, 0.74, and 0.80, respectively (19).

Physical activity. The Physical Activity Questionnaire for Older Children (PAQ-C) was used to determine the participant's physical activity level (20). PAQ-C requests participants to respond to the physical activity behavior for the past 7 days by asking them to check a list of activities for frequency of participation on a scale from 'no', 1-2 times per week, 3-4, 5-6, to 7 times, or more. Questions are also asked about their physical activity behavior during physical education; recess, at lunch-time, right after school, and evenings, as well as

'the last weekend'. This questionnaire has been supported by a valid and reliable measure and Cronbach's alpha of 0.89 was measured in Iranian children (21).

Procedure. Prior to gathering data, participants and parents/guardians were given written information about nature of the study. Written permission was obtained from the participants and parents/guardians, prior to their child's involvement in the study. All tests occurred during the school day. Firstly, the TGMD-2 was completed on across 4 weeks. Inter-rater reliability (>90% agreement) was established for the 2 coders. The PA was assessed with the PAQ-C. This test was also administered during the participant's classroom time. All assessments followed the established procedure, and protocol that was indicated in the training manuals; and all assessments were conducted by one examiner, and one trained assistant.

Statistical Analysis. Pearson's product-moment correlations (r) were used to study the relationship between motor skill competences, and physical activity. Multiple linear regressions were used to determine the best predictor of girls' participation in moderate to vigorous physical activity. Data analysis was conducted using SPSS ver. 16.0 for windows; statistical significance was set at $P < 0.05$.

RESULTS

Table 1 provides an overview of descriptive statistics. Subjects had higher scores in locomotor skill domain in comparison with object control skill domain (Table 1). For the sample, GMQ was found to marginally relate to moderate-to-vigorous PA outcome ($r = 0.39$, $P < 0.01$). Further, PA was regressed on locomotor skill, and object control skill sub-domains.

Correlates of Girls' Moderate to Vigorous Physical Activity. Pearson's correlations showed significant relationships among correlates (Table 2). A stepwise regression

analysis indicates that locomotor skill competence accounted for significant amounts of variance for moderate to vigorous physical activity ($R^2=0.20$, $F=87.45$, $P = 0.001$) (Table 3).

Table 1: Descriptive data and row scores (N=352)

Variable	Mean	SD
Age (year)	8.78	0.32
LS	41.92	6.57
OCS	34.34	5.51
GMQ	76/26	9/28
PA	3.31	0.88

Note: BMI: Body Mass Index; OCS: Object Control Skills; LS: Locomotor Skills; PA: Physical Activity; GMQ: Gross Motor Quotation.

Table 2: Correlation (Pearson, two tailed) of girls' moderate to vigorous physical activity participation

	PA	LS row scores	OCS row scores
LS row scores	.447**		
OCS row scores	.135*	.173**	
GMQ	.39**	.81**	.71**

Note: OCS: Object Control Skills; LS: Locomotor Skills; PA: Physical Activity; GMQ: Gross Motor Quotation. * $p<.05$. ** $p<.001$.

Table 3: Predictors of girl's moderate to vigorous physical activity

Dependent variables	Predictor	R Square	Adjusted R Square	Regression coefficient (β)	P value
PA	LS	0.20	0.44	0.19	0.001*

* $p<0.01$

DISCUSSION and CONCLUSION

The relationships between MSC include locomotor and object control skills, and self-report PA were examined in girls. In this study, participants were found to be scored higher for locomotor skills. MSC was positively correlated with self-report PA in children. For girls, locomotor skills, and not object control skills, accounted for variance in PA outcome.

The theoretical basis explaining the mechanism of a positive association between MSC and PA, it was found among girls in the current study, purports that competence in motor skills provides the behavioral

proficiency required for participation in variety of PA (9); and may influence other determinants of behaviors, such as, perceptions of competence (22). Children may opt out of opportunities for PA, or may have preference for more sedentary pursuits, in the absence of prerequisite motor competence (23).

This explanation, however, assumes that MSC are the cause rather than consequence of PA, which cannot be inferred from the cross-sectional analyses reported in previous studies in this study. Greater PA opportunities might also provide the context to improve MSC, which is important to

consider when examining childhood population, where MSC and motor coordination are at the earliest stage of development (24). Longitudinal (25) and experimental studies (26, 27), however, have generally been unable to provide evidence of causal relationship between MSC and PA in youth. Further, recent evidence in older children indicates that motor competency in childhood predicts self-report PA in adolescence (28), suggesting that, at some stage of child and adolescent development, competence in motor skills plays a causal role in determining PA behavior (28).

Partitioning fundamental movement skills in sub-domains in the current study and others (11-13), has suggested that locomotor skill relate to girls' PA, and this plausible considering their role in popular activities participated by elementary/primary school-aged girls, based on facilities in their school. Sallis and Owen (1998) and Sallis *et al.* (2000) have reported positive association between physical environment variables (access to facilities, programs, time, opportunities to exercise), and child and adolescent PA, with school identified as an important setting in which to promote PA (29, 30). In older children, this sub-domain of skills has been shown to relate positively and more strongly to PA (11-13).

The video assessments of MSC using a validated, process-oriented measure, was the method that reduced measurement bias in the current study. Further, fundamental movement skills measure was able to

differentiate behavior into meaningful subcategories, allowing for a unique examination of relationship between MSC and PA in girls population.

This study has several limitations. Firstly, the sample selected was from low-to-moderate socioeconomic status and one geographical location. Results can only be generalized to specific populations, Iranian girls. Secondly, PA assessment in current study may have been limited by the use of PAQOC. This questionnaire does not provide an estimate of caloric expenditure, or specific frequency, time, and intensity information and does not discriminate between specific activity intensities (20). Moreover, as PA was assessed during autumn/winter, the data may also have been confounded by seasonal and weather-related variations.

APPLICABLE REMARKS

- This study strengthens the literature regarding the relationship between motor skill competence and physical activity.
- It highlights the importance of locomotor skills for intervention studies targeting to promote Iranian girls moderate to vigorous physical activity.

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ارتباط شایستگی مهارت‌های حرکتی و فعالیت بدنی دختران

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چکیده

در این مطالعه ارتباط بین شایستگی‌های مهارت حرکتی و فعالیت بدنی در دختران ۹-۸ سال بررسی شد. شایستگی در مهارت‌های کنترل شیء و جابجایی با استفاده از آزمون رشد حرکتی درشت-۲ ارزیابی و فعالیت بدنی با استفاده از پرسشنامه‌ی فعالیت بدنی برای کودکان اندازه‌گیری شد. تحلیل رگرسیون نشان داد که تبخر در مهارت جابجایی موجب ۲۰٪ تغییرپذیری در فعالیت بدنی متوسط تا شدید دختران شد ($p=0.001$). یافته‌های این مطالعه بر نیاز به برنامه‌های مداخله‌ای متمرکز بر مهارت‌های جابجایی به منظور ارتقاء سطح فعالیت بدنی دختران تأکید می‌کند.

واژگان کلیدی: مهارت جابجایی، مهارت کنترل شیء، دختران، فعالیت بدنی.

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