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ASSESSING FUNDAMENTAL MOTOR SKILLS AND SEX ACROSS DIFFERENT AGE GROUPS OF ELEMENTARY SCHOOL-AGED CHILDREN

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Abstract
This study aimed to analyze and compare object-control motor skills in children aged 6–11 years based on gender and age group. A total of 62 students (males, n=34; females, n=28) participated as the research sample, with data collected during May–June 2025. Skill measurements were conducted using the object-control motor subtest from the Test of Gross Motor Development, Second Edition (TGMD-2). The obtained data were analyzed using a two-way analysis of variance (ANOVA) and Tukey's post-hoc test. The results indicate that the object-control motor skills of male children were significantly superior to those of female children (p=0.000). A significant interaction was also found between gender and age group (p=0.000). Specifically, the 8–9-year-old age group demonstrated better skills compared to the 6–7-year-old (p=0.033) and 10–11-year-old (p=0.001) age groups. No significant difference was found between the 6–7-year-old and 10–11-year-old age groups (p=0.337). These findings suggest that gender and age are influential factors in the development of object-control motor skills, with the 8–9-year-old period potentially being a critical window for the acquisition of these skills.
Keywords: *age, object control, sex*

INTRODUCTION

Fundamental motor skills (FMS) are specific movement patterns that serve as the foundation for more complex physical activities across the lifespan (Foulkes et al., 2022; Logan et al., 2017; Malambo et al., 2022; Syahputra et al., 2021) . As described by Gallahue et al., FMS encompasses not only locomotor skills such as running, jumping, and walking, but also object control skills like throwing, catching, and kicking, as well as stability skills involving balance (Kokstejn et al., 2025; Matarma et al., 2020; Roscoe et al., 2024; L. Sun et al., 2025; Syafruddin et al., 2020).

The mastery of FMS in early childhood is considered crucial as it acts as the "building blocks" for participation in a wide range of sports and recreational activities (Bakhtiar & Famelia, 2018; Behan et al., 2019; L. P. Putri et al., 2020). Moreover, as emphasized by Stodden et al., poor FMS proficiency during childhood is often correlated with lower levels of physical activity later in life, creating a

negative cycle that impacts long-term health (M. Putri et al., 2024). Consequently, the early identification of and intervention for FMS delays are of vital importance.

Fundamental movement skills (FMS) directly impact students' psychomotor development (Malambo et al., 2022). Children with well-developed FMS tend to exhibit enhanced body coordination, agility, speed, and endurance. These abilities enable them to move efficiently and confidently in various environments, both in and out of the classroom (Barnett et al., 2016; Logan et al., 2018; Lubans et al., 2010; Newell, 2020). Lubans et al. demonstrated that FMS-based intervention programs significantly improve gross motor skills, which in turn stimulates motor neural development and enhances movement efficiency (Han et al., 2018). Optimal psychomotor development not only supports active participation in physical activities but also reduces the risk of injury and improves overall quality of life (Bakhtiar et al., 2019; Kowalczyk et al., 2025). Therefore, FMS are not merely physical abilities but rather the foundation for comprehensive psychomotor maturity.

The mastery of FMS also has significant implications for students' affective domain. Children proficient in FMS tend to exhibit higher levels of self-confidence, intrinsic motivation to participate in physical activity, and a positive self-perception (Bakhtiar et al., 2020; Sortwell et al., 2024; Syahputra et al., 2020). Conversely, difficulties in mastering FMS can lead to frustration, low self-esteem, and even withdrawal from group activities that involve movement. Barnett et al. found that improved FMS positively correlates with enhanced perceived physical competence and a better body image, which ultimately fosters a lifelong love for physical activity (Philpott et al., 2021). Therefore, by facilitating the development of FMS, we also contribute to building students' mental health and emotional well-being.

A growing body of research has established a strong association between FMS and cognitive development (Lee et al., 2020; Polsley et al., 2022). Physical activities, especially those that require complex coordination and motor planning, have been shown to directly stimulate executive brain functions, including working memory, selective attention, and problem-solving abilities (Baniasadi, 2024; Escolano-Pérez et al., 2020; Latino & Tafuri, 2024). Furthermore, children with

higher levels of physical activity and proficient FMS frequently exhibit enhanced academic performance. Targeted motor interventions have been found to improve cognitive abilities such as concentration and information processing, thereby indirectly facilitating scholastic success (Fernandes et al., 2016). This suggests that motor and cognitive skills are not distinct, but are fundamentally integrated and mutually influential, jointly contributing to a child's learning capacity and environmental adaptability.

Furthermore, the mastery of FMS in childhood serves as a critical predictor of long-term health outcomes (Spring et al., 2023). Children who demonstrate higher FMS proficiency tend to exhibit greater physical activity levels throughout their lifespan, which is associated with a lower incidence of chronic conditions, including obesity, type 2 diabetes, and cardiovascular disease (Bakhtiar & Famelia, 2018). In contrast, inadequate FMS development at an early age can predispose individuals to a sedentary lifestyle and reluctance to engage in physical activity. Consequently, fostering FMS development in primary school students represents not only an educational investment but also a crucial contribution to future public health.

Given the significance of FMS, it is crucial to conduct systematic assessments to understand the status of these skills among students in various regions. This study specifically aims to describe the FMS profile of elementary school students in Padang City. Identifying the FMS profile in this area will provide crucial empirical data for education and sports policymakers. This data can be used as a basis for designing a more adaptive physical education curriculum and targeted intervention programs, thereby addressing any potential FMS gaps. With a comprehensive understanding, efforts to improve FMS can be implemented more effectively, ensuring every student has the opportunity to develop their motor potential to the fullest.

METHOD

This study employed a quantitative descriptive approach with a 2x3 factorial design. The sample consisted of 62 elementary school students aged 6–11 years

from Padang City (boys n=34, girls n=28). The sampling technique used was purposive sampling. The research was conducted from May to June 2025.

The research instrument was the Object Control sub-test of the TGMD-2 (Test of Gross Motor Development-2), which included the following tasks: catch, overhand throw, kick, underhand roll, striking a stationary ball, and stationary dribble (Bakhtiar, 2015). The TGMD is a process-oriented assessment that measures children's motor performance on locomotor and object control tasks. It is considered the most common tool for measuring fundamental motor skills (FMS) proficiency in educational, clinical, and research settings

The data analysis technique applied was Two-Way ANOVA (Analysis of Variance) using SPSS 26. The analysis aimed to determine the differences in fundamental motor skills between male and female students, differences based on age, and the interaction between sex and age. A Tukey's post-hoc test was also conducted to identify specific group differences.

RESULT AND DISCUSSION

The study utilized a two-way analysis of variance (ANOVA) with interaction to analyze the data. A subsequent Tukey's post-hoc test was then conducted to identify specific differences among the groups. Before the main hypothesis testing, a preliminary analysis was performed, which included descriptive statistics. The assumptions of normality and homogeneity of variances were verified using the Kolmogorov-Smirnov test and Levene's test, respectively, at a significance level of α=0.05. The results from both preliminary tests indicated a non-significant outcome ($p>0.05$), confirming that the data satisfied the necessary assumptions for the inferential statistical analysis.

Table 1. Sampel characteristics

Sample Characteristics	F	%
Sex		
Boys	34	54.84
Girls	28	45.16
Age (Years old)		
10 - 11	13	20.97
8 - 9	30	48.39
6 - 7	19	30.65

Table 2. Descriptive statistic

	Mean	Median	Std. Deviation	Minimum	Maximum
Gender					
Boys	34.15	35	4.35	24	42
Girls	28.35	29.5	6.72	15	38
Age (Years old)					
10 - 11	30.37	30.00	4.99	21	38
8 - 9	33.77	34.50	4.31	24	42
6 - 7	28.08	30.00	9.32	15	40

Table 3. Descriptive rating for subtest object control standar scores

Standar Score	F	%	Descriptive Ratings
17 - 20	0	0	Very Superior
15 - 16	0	0	Superior
13 - 14	0	0	Above Averange
8 - 12	12	19.35	Average
6 - 7	16	25.81	Below Average
4 - 5	22	35.48	Poor
1 - 3	12	19.35	Very Poor
Total	62	100	

As presented in Table 3, none of the 62 participants demonstrated object control skills in the three highest performance categories: very superior, superior, and above average. The highest frequency of participants was observed in the 'poor' category (35.48%), followed by the 'below average' category (25.81%), with the 'average' and 'very poor' categories each accounting for 19.35% of the samples.

Table 4. ANOVA Results

Source	Type III Sum of Squares	df	Mean	F	Sig
Gender	655.556	1	655.56	32.65	0.000
Age	535.842	2	267.92	13.35	0.000
Gender*Age	412.051	2	206.02	10.26	0.000

Table 4 presents the results of the skill difference analysis for the control group, based on gender, age, and the interaction between gender and age. From these three tests, it was evident that all values showed a significance level less than α=0.05.

Table 5. Tukey Test Calculation Results

Group (Age)	Std. Eror	Sig	95% Confidence Interval	
			Lower Bound	Upper Bound
6 - 7 with 8 - 9	1.314	0.033	-6.5614	-0.2351
6 - 7 with 10 - 11	1.613	0.337	-1.5916	6.1746
8 - 9 with 10 -11	1.488	0.001	2.1075	9.2720

Results from the Tukey post-hoc test, as detailed in Table 5, identified a significant difference in object control skills between the 6-7 and 8-9 year-old cohorts and the 8-9 and 10-11 year-old cohorts. Conversely, the comparison between the 6-7 and 10-11 year-old cohorts did not yield a significant difference.

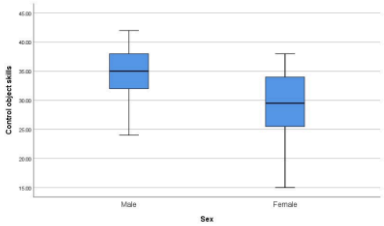

Figure 1. Object control skills Stem-and-Leaf Plot for Gender=Female.

Discussion

The findings of this study, conducted on a sample of 62 participants, revealed significant trends in motor skill proficiency. Upon converting the raw data to an Age Equivalent score, the results indicated that 56 individuals (90.32%) exhibited delayed motor development. Specifically, their measured locomotor skills were found to be commensurate with a younger age group. An illustrative case is that of a 10-year-old participant whose proficiency was found to be at the level of a 6-year-old. In contrast, 5 participants (8.06%) demonstrated age-appropriate locomotor skills, while only one participant (1.61%) showed advanced skill development. This individual, at 7 years and 9 months, possessed skills on par with those of an 8-year-old.

Furthermore, the researchers identified significant differences in object control skills among the control subjects based on age and sex. This observation aligns with a body of previous literature, which consistently indicates that boys demonstrate superior object control proficiency compared to girls (Bolger et al., 2018; D'Anna et al., 2025; Dilandes et al., 2022; John et al., 2024; Tsuda et al., 2020; Valentini et al., 2016; Vameghi et al., 2012). The performance gap between boys and girls is multifaceted, with the family environment being a key contributor to the development of motor skills. Parents serve as primary play partners and can

provide gender-influenced encouragement and stimulation, which subsequently molds a child's motor competence (Dinkel & Snyder, 2020).

There is a notable disparity in the development of fundamental motor skills between boys and girls, largely influenced by social norms and upbringing (Zheng et al., 2022). Girls often face restrictions on their participation in exploratory physical activities (such as playing ball games, jumping, and throwing) that are considered dangerous or incongruent with stereotypical gender roles (S. Sun & Chen, 2024). This phenomenon directly limits their opportunities to practice and internalize movement patterns. Conversely, boys generally receive more freedom to interact with their environment, which serves as a crucial catalyst for the comprehensive development of their fundamental motor skills.

CONCLUSION

Based on data analysis, this study concludes that gender and age significantly influence the development of object control motor skills in children aged 6–11 years. Boys consistently demonstrated better skill proficiency than girls. These findings also underscore the 8–9 year age range as a critical developmental period for mastering these skills, as a significant increase was observed within this age group. As a practical implication, it is recommended that school physical education and sports programs adopt a gender- and age-specific approach. Furthermore, the curriculum should focus on the development of object control motor skills in 8–9-year-olds to optimize their developmental potential. Future research may explore other factors that could influence these differences, such as specific sport practices or motor interventions.

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