

Gender Differences in Motor Skill Development and Physical Activity Patterns Among Adolescents

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Article Info	Abstract
Article type: Research Article Article history: Received 22 March 2026 Received in revised form 24 May 2026 Accepted 08 June 2026 Available online 29 June 2026 Keywords: Adolescent, Motor Skills, Exercise, Gender Differences, Exercise.	Introduction: Gender differences in motor competence (MC) and physical activity (PA) emerge during adolescence, potentially influencing lifelong health behaviors. Recognizing these disparities is essential for developing targeted strategies that encourage active lifestyles. Objective: To investigate gender differences in MC and PA patterns among adolescents. Method: This cross-sectional study included 150 adolescents aged 12–16 years (75 boys, 75 girls) recruited from four secondary schools. MC was assessed using the TGMD-3. PA was objectively measured via accelerometers over seven consecutive days. Independent-samples t-tests and Pearson correlations utilized for data analysis. Results: Boys demonstrated significantly higher object control (35.8 ± 5.2 vs. 30.7 ± 4.9; $t(148)=7.05$, $p<0.001$, $d=1.15$) and total MC scores (67.9 ± 8.3 vs. 64.2 ± 7.9; $t(148)=3.10$, $p=0.002$, $d=0.50$), while locomotor skills were slightly higher in girls but not statistically significant (33.5 ± 4.6 vs. 32.1 ± 4.8; $t(148)=-1.79$, $p=0.08$). Boys engaged in more moderate-to-vigorous PA (MVPA) than girls (61.2 ± 12.5 vs. 48.3 ± 11.8 min/day; $t(148)=6.48$, $p<0.001$, $d=1.06$). Object control skills were positively correlated with MVPA in both boys ($r=0.42$, $p<0.001$) and girls ($r=0.36$, $p=0.002$). Conclusions: Gender differences in object control skills and PA exist during adolescence, with higher competence associated with greater MVPA. Interventions targeting skill development, particularly object control in girls, may help reduce disparities in PA and support lifelong active behaviors. Cite this Article: Farzanegi, P. (2026). Gender Differences in Motor Skill Development and Physical Activity Patterns Among Adolescents. <i>Physical Activity in Children</i>, 3(1), 37-42. https://doi.org/10.22034/pach.2026.577348.1083

1. Introduction

Adolescence is a major developmental stage defined by swift biological, psychological, and social transformations that significantly influence health and well-being throughout life (1). Within this period, the advancement of motor competence (MC) and the formation of PA patterns are crucial in determining physical health, functional abilities, and lifestyle choices in later adulthood (2). Although the advantages of regular PA are widely recognized, global data reveal a notable decrease in PA among adolescents, with marked disparities between genders (3,4). It is crucial to comprehend the variations in MC and PA behavior between boys and girls during this critical developmental stage, as this knowledge is vital for designing effective health promotion strategies and interventions.

MC involves the acquisition and refinement of fundamental movement abilities, which are vital for participation in diverse PA (5,6). MC has been strongly associated with PA, greater physical fitness, and enhanced psychosocial outcomes (7,8). Adolescence represents a transitional phase in MC, during which previously acquired skills are consolidated, adapted,

and applied in more complex and sport-specific contexts (1,2). However, disparities in MC often emerge or become more pronounced during this period, frequently along gender lines.

Research consistently highlights gender disparities in the MC. Typically, boys show greater proficiency in object control skills, including throwing, kicking, and striking, whereas girls tend to perform equally well or even excel in specific locomotor and balance-related abilities (9,10). These differences are influenced by a combination of biological factors, such as pubertal timing, muscle mass distribution, and neuromuscular maturation, as well as sociocultural influences including gender norms, access to sport opportunities, and parental and peer support (11,12). During adolescence, biological maturation occurs at different rates for boys and girls, potentially contributing to divergent trajectories in motor performance and PA engagement (13).

PA patterns during adolescence are similarly shaped by gender-specific factors. Large-scale epidemiological studies consistently show that boys are more physically active than girls across most age groups, particularly in moderate-to-vigorous PA

(MVPA) (14,15). Girls are also more likely to experience steeper declines in PA during early and mid-adolescence (16). These patterns are concerning given the well-established links between physical inactivity and increased risk of health outcomes (17,18). Moreover, lower PA levels during adolescence often track into adulthood, reinforcing long-term health disparities between genders (19,20).

The relationship between motor competence (MC) and PA is widely conceptualized within developmental and ecological frameworks. According to the *developmental model of motor competence*, early motor skill proficiency facilitates continued engagement in PA by enhancing perceived competence, enjoyment, and motivation (21,22). Conversely, low MC may lead to withdrawal from PA, particularly in social contexts where peer comparison and performance evaluation are prominent (23). This mechanism may be especially relevant for adolescent girls, who often report lower perceived physical competence and higher levels of body-related self-consciousness, factors that can discourage participation in PA.

Social and environmental contexts further contribute to gender differences in PA and MC (9,24). School-based physical education, community sports programs, and recreational opportunities often reflect implicit gender biases, with greater emphasis placed on competitive, performance-oriented activities traditionally associated with boys (25). Girls may encounter fewer opportunities for MC, less encouragement, or social pressures that prioritize appearance over MC (16,17). Additionally, cultural norms regarding femininity and masculinity can shape adolescents' attitudes toward PA, influencing both participation choices and MC trajectories (26).

Self-Determination Theory further provides a psychological framework for understanding engagement in PA during adolescence (27,28). Adolescents who perceive themselves as physically competent and who receive social support from peers, teachers, and family members are more likely to develop intrinsic motivation toward PA. Gender differences in perceived competence, social expectations, and motivational climate may therefore contribute to disparities in both MC and PA patterns (22,29).

Despite extensive evidence indicating gender differences in PA participation, relatively few studies have examined MC and PA patterns simultaneously within a unified framework during adolescence (10,30). Understanding how these factors interact is particularly important because MC may act as a key mechanism explaining why boys and girls differ in their engagement in PA. Furthermore, previous research has produced mixed findings due to variations in measurement methods, age groups, and sociocultural contexts, highlighting the need for further empirical investigation.

Therefore, the present study aims to examine gender differences in MC and PA patterns among adolescents. In addition, the study seeks to explore the

relationship between MC and PA engagement in order to better understand how these variables interact during adolescence. Identifying these relationships may provide valuable insights for the development of targeted interventions and educational strategies aimed at promoting equitable opportunities for MC and PA behavior among gender.

2. Methods

2.1. Study Design

This research utilized a cross-sectional observational approach to examine the variations in MC and PA patterns between genders in adolescents.

2.2. Participants

Participants in the study consisted of adolescents aged 12 to 16 years, who were recruited from four public secondary schools. To qualify for inclusion, individuals had to be free from physical or neurological conditions that could significantly hinder motor performance or limit their ability to engage in PA. Those with recent musculoskeletal injuries or chronic conditions affecting movement were excluded from participation. Ultimately, the study included 150 adolescents, evenly divided with 75 boys and 75 girls.

2.3. Measurements

2.3.1. Motor Skill Development

MC was evaluated through the Test of Gross Motor Development-Third Edition (TGMD-3), a recognized and validated instrument for measuring fundamental movement skills in adolescents. This assessment focuses on locomotor skills and object control skills. Each skill was rated based on predefined performance criteria, leading to the calculation of composite scores for locomotor skills, object control, and overall MC. The evaluations were carried out individually in either a gymnasium or an outdoor sports facility by trained research assistants, adhering to standardized administration protocols.

2.3.2. Physical Activity Pattern

PA pattern was quantitatively assessed through the use of accelerometers (ActiGraph GT3X) worn on the waist over a continuous period of seven days, encompassing both weekdays and weekends. These devices recorded minute-by-minute data on various activity intensities, including sedentary behavior, light, moderate, and vigorous PA. To ensure data validity, participants were required to wear the accelerometer for a minimum of 10 hours per day on at least four days, which had to include at least one weekend day. The primary outcome was determined by calculating the average daily minutes of MVPA.

2.3.3. Anthropometric Variables

Height and weight were assessed using a stadiometer and a digital scale, respectively, to determine body mass index (BMI; kg/m²). BMI was incorporated as a covariate in the analysis because of its possible impact on MC and PA patterns.

2.4. Procedure

Data collection occurred during school hours over a four-week period. Anthropometric measurements were taken first, followed by TGMD-3 motor skill assessments conducted in small groups to ensure accuracy and attention. Participants were then fitted with accelerometers and instructed on proper wear and care. Parents were provided with written instructions regarding the accelerometer protocol to ensure compliance. Following the seven-day wear period, devices were collected, and data were downloaded for processing and analysis.

2.5. Data Analysis

Descriptive statistics, including mean and standard deviation, were computed for all variables under consideration. To investigate gender disparities, independent-samples t-test and chi-square test were employed. The magnitude of gender differences was quantified using effect sizes, calculated via Cohen's d. Furthermore, multiple linear regression analyses were

performed to assess the influence of gender, MC, and BMI on PA levels, while controlling for potential confounding variables like age and school. A significance threshold was established at $p < 0.05$, with all statistical analyses executed using SPSS version 28 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. Participant Demographics

A total of 150 adolescents took part in the study, with an equal representation of boys and girls, each group consisting of 75 participants (Table 1). The average age of the participants was 14.0 ± 1.3 years. Statistical analysis revealed no significant age differences ($t(148) = 0.42$, $p = 0.68$). Additionally, while the mean BMI was marginally higher in boys (21.5 ± 3.1 kg/m²) than in girls (20.8 ± 3.2 kg/m²), this difference was not statistically significant ($t(148) = 1.31$, $p = 0.19$).

Table 1. Demographic Characteristics of Participants.

Variable	Boys (n = 75)	Girls (n = 75)	p
Age (years), mean $\pm$ SD	14.1 $\pm$ 1.3	13.9 $\pm$ 1.3	0.68
BMI (kg/m ²), mean $\pm$ SD	21.5 $\pm$ 3.1	20.8 $\pm$ 3.2	0.19
Organized Sports Participation, n (%)	50 (66.7)	42 (56.0)	0.16

3.2. Descriptive Statistics of Motor Skill Development and Physical Activity

Boys achieved higher scores in object control skills, whereas girls demonstrated marginally better locomotor skill performance. Although boys also

obtained higher overall MC scores, the difference between sexes was less pronounced. Data collected from accelerometers further revealed that boys accumulated greater amounts of MVPA compared with girls (Table 2 and Figure 1).

Table 2. Descriptive Statistics for Motor Skills and Physical Activity.

Measure	Boys Mean $\pm$ SD	Girls Mean $\pm$ SD
Locomotor Score (TGMD-3)	32.1 $\pm$ 4.8	33.5 $\pm$ 4.6
Object Control Score (TGMD-3)	35.8 $\pm$ 5.2	30.7 $\pm$ 4.9
Total Motor Competence	67.9 $\pm$ 8.3	64.2 $\pm$ 7.9
MVPA (min/day)	61.2 $\pm$ 12.5	48.3 $\pm$ 11.8

3.3. Gender Comparisons

Boys achieved significantly higher scores in object control skills than girls ($t(148) = 7.05$, $p < 0.001$, Cohen's $d = 1.15$). Boys also demonstrated significantly greater overall MC ($t(148) = 3.10$, $p = 0.002$, $d = 0.50$). In contrast,

girls obtained marginally higher locomotor skill scores; however, the difference did not reach statistical significance ($t(148) = -1.79$, $p = 0.08$, $d = 0.29$). Finally, boys accumulated significantly more MVPA per day compared with girls ($t(148) = 6.48$, $p < 0.001$, $d = 1.06$) (Table 3 and Figure 1).

Table 3. Gender Differences in the Study Variables.

Measure	t	p	Cohen's d
Locomotor Score	-1.79	0.08	0.29
Object Control Score	7.05	< 0.001	1.15
Total Motor Competence	3.10	0.002	0.50
MVPA (min/day)	6.48	< 0.001	1.06

3.4. Relationships Between Motor Skills and Physical Activity

Object control skills were moderately positively correlated with MVPA in both boys ($r = .42$, $p < 0.001$) and girls ($r = .36$, $p = 0.002$). Locomotor skills were weakly correlated with MVPA for boys ($r = .18$, $p = 0.13$) and girls ($r = .22$, $p = 0.06$).

3.5. Predictors of Physical Activity

The overall model was significant ($F(6,143) = 14.2$, $p < 0.001$, $R^2 = 0.37$), indicating that the included variables explained 37% of the variance in MVPA. Gender was a significant predictor, with boys engaging in higher MVPA than girls ($\beta = 0.41$, $p < 0.001$). Object control skills were also significantly associated with MVPA ($\beta = 0.32$, $p < 0.001$), whereas locomotor skills ($\beta = 0.10$, $p = 0.12$) and BMI ($\beta = -0.08$, $p = 0.21$) were not significant predictors (Figure 1).

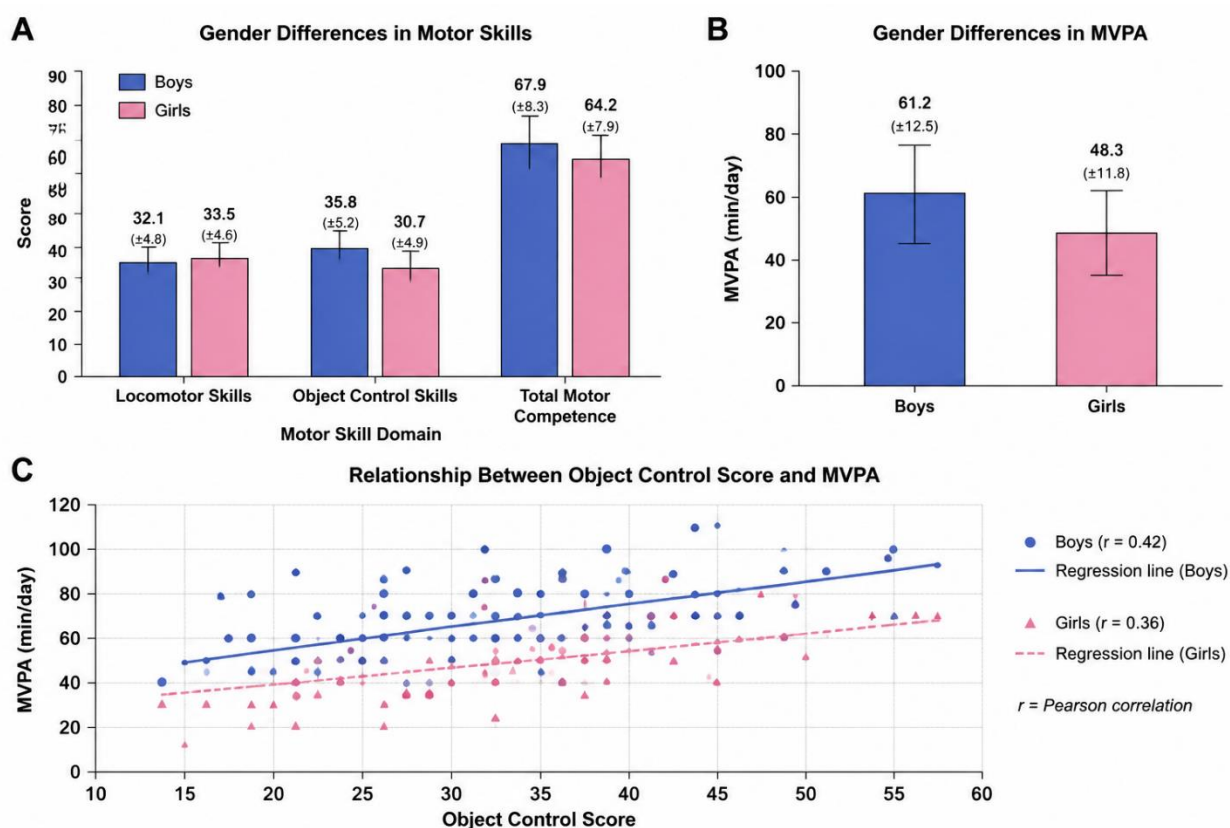


Figure 1. Gender differences in motor skill development and PA among adolescents. Panel A illustrates mean scores for TGMD-3 components across gender. Panel B presents mean daily minutes of MVPA by gender. Panel C shows the relationship between object control skills and MVPA across gender. Error bars represent standard deviations.

4. Discussion

The present study investigated sex-related differences in MC and PA among adolescents. The results indicated that boys outperformed girls in object control skills and overall MC, whereas girls achieved marginally higher locomotor skill scores; however, this difference was not statistically significant. Furthermore, boys accumulated significantly greater amounts of MVPA than girls. Positive associations were observed between object control proficiency and PA in both sexes. It was also revealed that sex and object control skills remained significant predictors of daily MVPA, while locomotor competence did not make a meaningful contribution to the model. These findings underscore the influential role of object control skills in shaping adolescents' PA behaviors and suggest that enhancing these competencies may be an effective strategy for increasing PA participation. Overall, the study adds to existing evidence demonstrating the multifaceted relationships among MC, PA engagement, and sex during the adolescent years.

From a developmental perspective, the observed gender differences align with established patterns in adolescence (21,22). During this period, biological maturation, including increases in muscle mass and neuromuscular coordination, differs between boys and girls. Boys' higher object control scores may reflect greater upper body strength and coordination gains during puberty, which facilitate throwing, striking, and catching skills. In contrast, girls frequently demonstrate comparable or slightly superior performance in locomotor skills compared with boys. This observation aligns with earlier research indicating that locomotor abilities depend more heavily on

coordination and balance than on muscular strength, and these attributes tend to mature at an earlier age in girls (15,18,31). The positive association between MC and PA supports the developmental model of MC, which posits that proficiency in fundamental movement skills encourages continued participation in PA by enhancing perceived competence and confidence. Adolescents who feel capable in their movement abilities are more likely to engage in recreational and organized PA, reinforcing a positive developmental trajectory (17,31).

The results can also be interpreted through an ecological lens, which emphasizes the dynamic interaction between adolescents and their environments. PA patterns are influenced not only by individual competence but also by access to opportunities, social norms, and environmental affordances (32,33). Boys' higher MVPA levels may reflect greater exposure to sports and active play opportunities, which are often socially encouraged for males in many cultural contexts. Girls may encounter fewer structured opportunities for skill development, social reinforcement, or safe environments conducive to vigorous activity. The correlation between object control skills and MVPA suggests that environments that support skill practice (e.g., sports fields, playgrounds, and gymnasiums) may amplify gender differences in activity patterns, as adolescents with higher competence are more likely to utilize these affordances effectively.

The identified differences between boys and girls may also be interpreted through motivational perspectives, particularly SDT. According to this framework, participation in PA is shaped by the extent

to which individuals experience fulfillment of three fundamental psychological needs: autonomy, competence, and relatedness (27,28). Adolescents who have higher perceived MC are more intrinsically motivated to participate in PA. In this study, higher object control scores in boys may have contributed to greater perceived MC, enhancing motivation and resulting in higher MVPA levels. Conversely, girls' relatively lower object control proficiency may reduce perceived competence, limiting their engagement in physically demanding activities. Social comparisons, gender norms, and self-consciousness during adolescence may exacerbate these motivational differences, contributing to lower activity levels among girls despite comparable locomotor skills.

Taken together, these findings highlight the interconnected roles of MC, environmental opportunities, and motivational processes in shaping adolescents' PA behavior. In particular, object control skills appear to serve as a key mechanism linking MC to engagement in MVPA. From a theoretical standpoint, this supports the developmental model of MC, which suggests that skill proficiency enhances perceived competence and encourages continued participation in PA. Adolescents who possess stronger object control abilities may feel more confident when participating in games and sports that require throwing, striking, or catching, thereby increasing their likelihood of engaging in organized or informal PA. In contrast, adolescents with lower proficiency may experience reduced confidence and avoid participation in physically demanding contexts. These findings also align with ecological perspectives, which emphasize that skill competence interacts with environmental affordances to influence behavior. Adolescents who possess the necessary motor skills are better able to take advantage of available opportunities for sport and active play, while those with lower competence may not fully benefit from these opportunities.

Several limitations must be recognized in this study. Firstly, the cross-sectional design limits the ability to draw causal conclusions; longitudinal research is necessary to understand how motor skill development impacts PA patterns over time. Secondly, while accelerometers offer objective data on activity levels, they may not fully account for context-specific behaviors, such as participation in sports or informal play. Additionally, the research was conducted in a small number of schools within a single region, which may limit the applicability of the findings to a wider adolescent population. Lastly, psychosocial factors like motivation, self-efficacy, and social support were not directly assessed, yet they could shed light on the mechanisms behind gender differences in activity levels. Despite these constraints, the results hold significant implications for educators, coaches, and policymakers. Interventions aimed at improving object control skills, especially among girls, could help bridge the gender gap in PA and encourage lifelong participation in movement. By fostering inclusive environments that promote skill development, provide positive reinforcement, and offer a variety of activities, it is possible to enhance both competence and intrinsic motivation. Future studies should investigate the long-term effects of motor skill interventions, the influence of psychosocial factors, and the cultural and environmental contexts that shape gender-specific patterns of PA among adolescents.

4.1. Conclusion

This study provides evidence of meaningful gender differences in MC and PA patterns during adolescence.

Boys demonstrated higher object control proficiency and engaged in greater levels of MVPA, while locomotor skills showed minimal gender differences. Importantly, object control competence emerged as a significant predictor of adolescents' PA levels, even after controlling for age, BMI, and school context. These findings support theoretical perspectives suggesting that MC plays a central role in shaping engagement in PA through mechanisms such as perceived competence, motivation, and access to movement opportunities.

From a practical standpoint, the results indicate that improving object control skills may represent a critical pathway for increasing PA participation among adolescents, particularly among girls who may have fewer opportunities to develop these skills. Educational and community-based programs should therefore emphasize inclusive skill-development environments that foster confidence, competence, and enjoyment in movement. By promoting balanced motor skill development and supportive activity contexts, it may be possible to reduce gender disparities in PA and encourage long-term participation in active lifestyles.

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Ethical Considerations: The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from the parents or legal guardians of all participating adolescents prior to their participation in the study. Age-appropriate information about the study procedures was also provided to the adolescents, and their willingness to participate was respected throughout the study.

Data Availability: The data underlying the findings of this study are available from the corresponding author upon reasonable request.

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