Original Article

Comparing Speed Progression in Pre-Adolescent Girls: A Developmental Analysis

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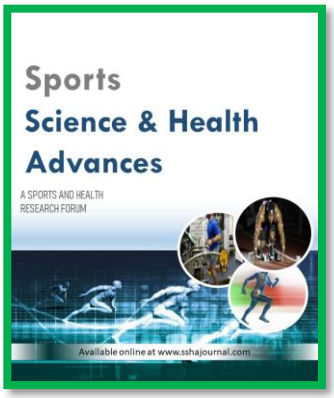

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Abstract

Background: Speed progression in pre-adolescent girls highlights physical development during late childhood, characterized by growth in motor skills, strength, and coordination. Sprint performance varies with age, yet little research exists on sprint abilities in school girls from rural Bangladesh. **Study Purpose**: This study aimed to assess sprint performance differences among 9-, 10-, and 11-year-old schoolgirls from rural areas in Jashore, Bangladesh, to understand age-related progression in short-distance speed. **Materials and Methods:** Sixty school girls participated in the study, with 20 in each age group: 9, 10, and 11 years. Speed was assessed through 10m and 50m sprint tests under dry, low-wind conditions, with a digital stopwatch capturing times at the 10m and 50m marks. Each participant completed two trials, and the best times were recorded. Descriptive statistics (mean and standard deviation) were computed for each group. A one-way ANOVA followed by an LSD post hoc test evaluated significant differences in sprint performance across age groups at a 0.05 significance level. **Results:** The 10m sprint showed significant differences among age groups $F(2, 57) = 5.06$, $p = 0.01$. Post hoc analysis revealed that 11-year-olds ran significantly faster than 9-year-olds (mean difference = 0.173, $p = 0.00$), but there were no significant differences between the 9- and 10-year-olds or the 10- and 11-year-olds. For the 50m sprint, no significant differences were found among age groups $F(2, 57) = 1.79$, $p = 0.18$. **Conclusions:** The findings indicate an age-related improvement in short-distance sprint ability, with significant gains evident between ages 9 and 11 over 10m but not 50m. These insights are valuable for developing age-appropriate training programs aimed at enhancing speed in young girls from rural backgrounds.

Keywords: Sprint Performance, Pre-Adolescent, School girls, Speed Development

Introduction

Speed progression is essential for enhancing athletic performance and overall health in children. In youth sports and physical development, speed progression is recognized as a key factor in overall fitness and physical literacy (Warner et al., 2021; Grauduszus et al., 2023; Mola & Shaw, 2024a). Developing speed in young girls, especially between ages 9 and 11, is critical for tracking physical growth and enhancing training during this sensitive developmental period. Research identifies this age as a prime period for speed development due to rapid neuromuscular changes (Singh et al., 2024a; Viru et al., 1998). Both physical activity and structured training—especially exercises that use repetitive movements and engaging games to challenge mental and physical capacities significantly improve speed, agility, and strength (Kohl & Cook, 2013; Rahman & Sharma, 2023).

Pre-adolescence brings biological changes, such as increased muscle mass and coordination that contribute to improvements in short sprints and speed-based activities (Backes & Bonnie, 2019). Hormonal changes during this stage create distinct growth patterns for boys and girls, with girls often reaching peak growth earlier, impacting their speed and agility development uniquely (Viner et al., 2017; Breehl & Caban, 2023). Training programs emphasizing sprints, agility drills, and coordination exercises can improve speed and physical literacy, highlighting the importance of age-appropriate training that aligns with natural growth patterns to maximize potential in young girls (Allen & Kelly, 2015).

The development of physical abilities, such as speed, is crucial for growth and athletic potential (Reza et al., 2024). Speed progression is influenced by age, gender, genetics, and environmental factors like training and nutrition, making it vital in many sports (Malina et al., 2004; Taye et al., 2024). Research indicates that children develop speed at different rates, with girls typically progressing more slowly than boys due to physiological differences, especially after puberty, when hormonal changes affect muscle composition and power (Philippaerts et al., 2006). Structured physical activity from an early age positively influences speed development, talented development and strength and conditioning programs enhance running speed and athletic skills (Lloyd et al., 2015; Mola & Shaw, 2024b). Early involvement in speed-based activities, such as sprinting and agility drills, can help girls offset slower speed gains post-puberty by refining motor skills and coordination (Vescovi & McGuigan, 2008). Studies show that training tailored to developmental stages can improve speed, motor learning, and high-intensity performance (Singh et al., 2024b; Sutapa et al., 2021). Sprinting and agility training also boost strength and power, essential for various sports (Meylan & Malatesta, 2009). However, speed progression in girls varies based on age, genetics, and training type, underscoring the need for age-appropriate, gender-sensitive programs to minimize injury risk and promote safe development (Faigenbaum & Myer, 2010; Islam et al., 2024).

Sprinting involves several key movement mechanics: step length, which is the distance between each foot contact; step frequency, the rate of steps; contact time, which measures the duration of ground support; and flight time, the airborne phase (Lockie et al., 2015; Mola & Adane, 2020). Building explosive leg strength is particularly important for girls as it enhances overall fitness, motor skills, and sprint speed, while also fostering self-confidence and positively impacting social skills and self-esteem (Sutapa et al., 2021). High levels of explosive power improve abilities such as jumping, sprinting, and rapid directional changes, which are essential for coordinated limb movement and overall fitness (Suchomel et al., 2016; Rahman & Islam, 2021). The exercise program helps improve both agility and speed for young girls (Fenta & Mola, 2023). However, older children demonstrate better performance in short sprints due to superior muscle strength and neuromuscular efficiency, while sprint performance remains comparable among school-aged girls due to similar development in speed endurance.

Speed progression between the ages of 9 and 11 represents a critical phase of physical development, driven by neuromuscular and hormonal changes that enhance motor skills, coordination, and speed-related performance. These changes also improve overall health outcomes, such as cardiovascular fitness and muscular strength. Structured, speed-focused training during this period is essential for addressing gender-based differences in speed development, as girls often experience slower gains after puberty due to hormonal shifts affecting muscle composition and strength. However, limited research explores how age and environmental factors, particularly in rural areas, influence speed development. This study examines sprint performance differences among 9-, 10-, and 11-year-old school girls from rural areas in Jashore, Bangladesh, hypothesizing that age differences lead to significant improvements in short-distance speed.

Materials and Methods

Participants

A total of sixty (N = 60) school girls volunteered for the study, with 20 participants from each of the 9-, 10-, and 11-year age groups. Participants were grouped by whole-year age categories: ages 9.00–9.99 years as 9 years, 10.00–10.99 years as 10 years, and 11.00–11.99 as 11 years. Written informed consent was obtained from each child's parent or legal guardian, including the child's birth date. All the girls were enrolled in primary schools across eight locations in Jashore, Bangladesh. They came from rural areas, with most hailing from lower to middle-income families.

Variables and Criterion Measures

Speed was assessed using the 10m and 50m tests, with the time (in seconds) taken to complete each distance serving as the primary criterion for the study.

10m and 50m Sprint Time Test Procedure

The sprint timing test was conducted over a 50m distance under dry, low-wind conditions. Times were measured using a digital stopwatch (Casio Electronics Co., Ltd., China) with two timing checkpoints: the first at the 10m mark and the second at the 50m finish line. Seed times were recorded from the start to 10m (Zone 1) and from the start to 50m (Zone 2) (Dorgo et al., 2020). Subjects' speed was assessed using their recorded times for both Zone 1 and Zone 2. Each participant completed two attempts, with the best time recorded to the nearest hundredth of a second.

Statistical Analysis

The data analysis was performed using IBM SPSS software (version 25). For each group, calculations included the mean, standard deviation, standard error of the mean, and the range of minimum to maximum values. A one-way analysis of variance (ANOVA) test was used, followed by a least significant difference (LSD) post hoc test to determine any significant group differences. A 0.05 significance level was set for these analyses.

Results

The following Table 1 presents the descriptive statistics (mean, standard deviation, standard error, minimum, and maximum) of the sprint abilities of girls in the 9-, 10-, and 11-year age groups, while Figure 1 illustrates the sprint mean times for each age group.

Table 1 Descriptive Statistics of Sprint Tests across Different Age Groups

Tests	Groups	N	Mean	Std. Dev.	Std. Err.	Minimum	Maximum
10m. Sprint	9 Year	20	2.52	0.15	0.03	2.30	2.84
	10 Year	20	2.45	0.15	0.03	2.18	2.77
	11 Year	20	2.34	0.22	0.05	2.00	2.78
50m. Sprint	9 Year	20	9.05	1.14	0.26	7.69	11.31
	10 Year	20	8.97	0.89	0.20	7.95	11.10
	11 Year	20	8.57	0.36	0.08	8.00	9.22

Table 2. One-way ANOVA of Sprint Tests across Different Age Groups

Tests	Groups	Sum of Squares	df	Mean Square	F-ratio	p-value
10m. Sprint	Between Groups	0.304	2	0.152	5.06	0.01
	Within Groups	1.713	57	0.030		
50m. Sprint	Between Groups	2.664	2	1.332	1.79	0.18
	Within Groups	42.314	57	0.742		

*. Significant at 0.05 level

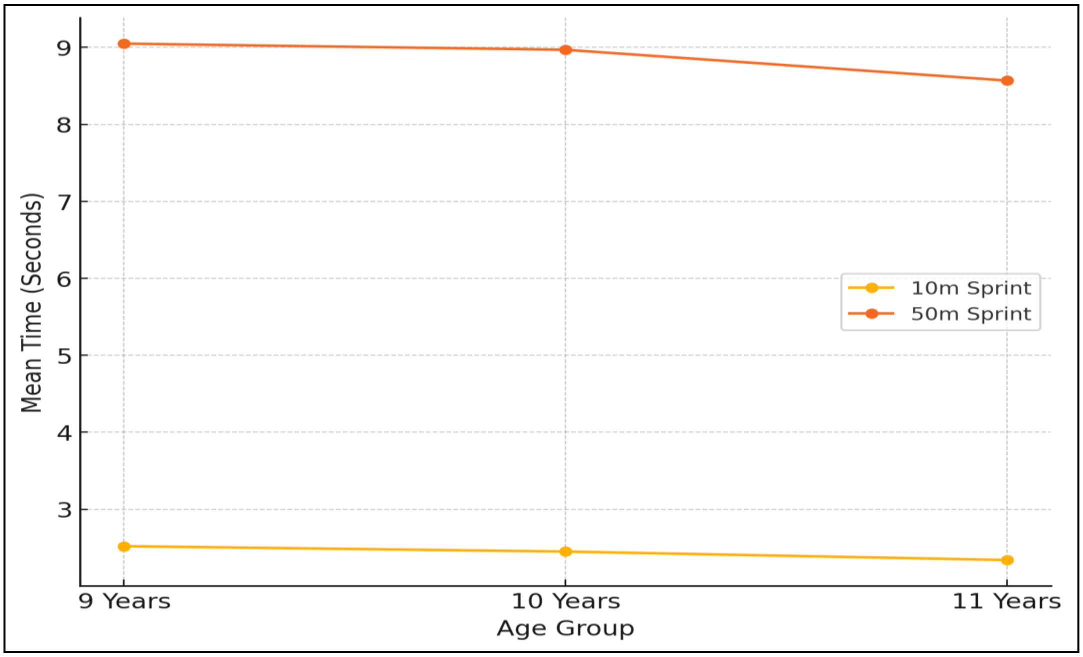

Figure 1. Sprint Times by Age Groups

Table 2 one-way ANOVA was conducted to compare sprint performance across age groups (9, 10, and 11) for both the 10m and 50m sprints. For the 10m sprint, there was a statistically significant difference between the groups, $F(2, 57) = 5.06$, $p = 0.01$, indicating a meaningful variance in sprint times across the age groups. However, for the 50m sprint, no significant difference was found between the age groups, $F(2, 57) = 1.79$, $p = 0.18$, meaning sprint times were similar across these groups.

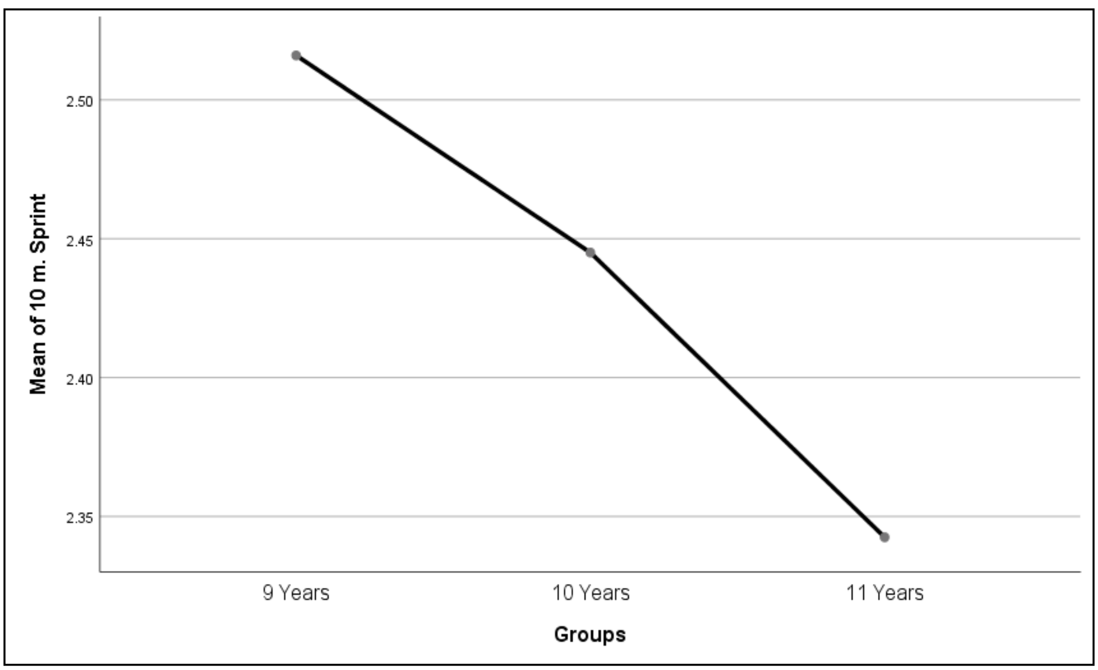

Figure 2 Mean Plot of 10-meter Sprint in Three Groups

Table 3. Post-hoc (LSD) Test of 10-meter Sprint

Test	Groups	Groups	Mean Diff.	Std. Error	Sig. Level
10 m. Sprint	9 Year	10 Years	0.07100	0.05482	0.20
		11 Years	.17350*	0.05482	0.00
	10 Year	9 Years	-0.07100	0.05482	0.20
		11 Years	0.10250	0.05482	0.07
	11 Year	9 Years	-.17350*	0.05482	0.00
		10 Years	-0.10250	0.05482	0.07

*. The mean difference is significant at the 0.05 level.

Table 3 post-hoc Least Significant Difference (LSD) test was conducted to further examine pairwise comparisons between the age groups for the 10m sprint times. The results indicated that the 9-year-olds (M = 2.52) had significantly slower sprint times compared to the 11-year-olds (M = 2.34), with a mean difference of 0.173, p = .00. However, no significant difference was found between the 9-year-olds and the 10-year-olds (M = 2.45), p = .20. Similarly, the 10-year-olds showed no significant difference in sprint times when compared to the 11-year-olds (M = 2.34), with a mean difference of 0.102, p = .07, although the p-value was borderline significant.

Discussion

This study found a significant difference in 10-meter sprint times across age groups 9, 10, and 11 (p = 0.01), whereas no significant difference was observed for the 50-meter sprint (p = 0.18). Post-hoc analysis revealed that 9-year-olds were significantly slower than 11-year-olds in the 10-meter sprint, but no notable differences were found between 9- and 10-year-olds or between 10- and 11-year-olds. Previous research emphasizes that speed development in different age groups can enhance various aspects of sprint performance (Polevoy et al., 2024a). For example, physical exercises targeting strength and speed are particularly effective for children aged 12 and 13 (Polevoy et al., 2024b). During the acceleration phase (0–10 m) of the 10-meter test, significant improvements in speed are observed across the 11- to 16-year age range (Santander et al., 2022). Similarly, sprint test phases—0–10 m, 10–20 m, 20–30 m, and the overall 0–30 m—highlight performance differences in young girls (Papaiakovou et al., 2009). The World Health Organization (2020) recommends that children and adolescents aged 5–17 engage in at least 60 minutes of moderate- to vigorous-intensity aerobic activity daily to promote overall health and physical development. Furthermore, children divided into groups based on gender and age (11 and 12 years) showed statistically significant differences in 30-meter sprint performance (Imamoğlu & Şener, 2019).

Older children typically have better-developed muscle strength, coordination, and neuromuscular efficiency, enabling quicker acceleration and improved performance in short sprints like the 10m. This advantage is due to greater force output and more effective muscle fiber recruitment. In contrast, the 50m sprint relies more on sustained speed and endurance, which develop similarly across ages 9 to 11, resulting in comparable performance over longer distances.

Conclusions

This study reveals age-related improvements in short-distance sprint performance among school-going girls aged 9 to 11 from rural Bangladesh, who is not trained athletes. Significant gains were found in the 10m sprint between ages 9 and 11, reflecting neuromuscular and motor skill development typical in this age group. However, no significant differences emerged for the 50m sprint, suggesting that these speed gains are most evident in shorter sprints. These findings highlight the potential of age-specific, structured physical activities to enhance speed development in school girls, which could support overall physical fitness and growth during late childhood.

Implementation and Future Directions

For implementation, schools, particularly in rural settings, could incorporate structured sprint training into their physical education curricula. Programs should be age-appropriate, progressively challenging, and inclusive to ensure equal opportunities for boys and girls. Furthermore, community-based initiatives focusing on physical fitness could promote long-term engagement in physical activity, ultimately improving health outcomes. Future studies should aim to include a larger, more diverse sample size to validate these findings across different demographics and environments, providing more robust evidence for optimizing youth sprint performance.

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Conflicts of interest: The authors declare no conflicts of interest.

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