

RESEARCH ARTICLE

Enhancement of Sprint Speed Using Leg and Full-Body Strengthening Exercises Among Muslim Female College Students

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ABSTRACT

This study examined the effectiveness of leg- and full-body-strengthening exercises in improving sprint performance among Muslim female college students at a tertiary school in Pagadian City. An active comparator design of the non-equivalent pretest-posttest design was employed, comparing two intervention groups without a passive control. A total of 160 participants were initially selected, with 72 completing the leg strengthening intervention and 73 completing the full-body strengthening intervention. Sprint speed performance was measured using the USFD 20-meter sprint power test, with speed expressed in meters per second. The interventions were implemented over eight weeks during Physical Education (PE) classes, in accordance with ethical standards and informed consent procedures. Descriptive statistics, paired samples t-test, and analysis of covariance (ANCOVA) were used to analyze the data. Results revealed that participants demonstrated very slow sprint speed performance before the intervention and improved to a moderate level after the intervention. Both the leg-strengthening and full-body-strengthening groups showed statistically significant improvements in sprint speed. However, no significant difference was found between the two interventions, indicating that both were equally effective. These findings support the role of structured and progressive exercise programs in enhancing sprint-related fitness, even among non-athlete populations. The results also align with theoretical perspectives emphasizing kinetic chain coordination and task-specific training in improving movement performance. The study concludes that both leg and full-body strengthening exercises are viable strategies for improving sprint speed performance in PE settings. It highlights the importance of context-sensitive, well-designed interventions for promoting functional fitness outcomes and supports the implementation of inclusive, evidence-based Physical Education programs.

KEYWORDS sprint speed performance, leg strengthening, full-body strengthening, physical education, PATHFit

INTRODUCTION

Sprint speed is a foundational indicator of physical fitness, movement competence, and readiness in educational settings, particularly within Physical Education (PE) programs where speed-related performance reflects neuromuscular power, movement efficiency, and health status. In higher education, poor sprint performance among students may signal limited lower-limb strength, insufficient neuromuscular development, and inadequate exposure to structured movement training (Lolli *et al.*, 2022, 2023; Sinkovic *et al.*, 2023). Existing evidence suggests that inefficient sprint mechanics often stem from reduced force production, poor movement economy, and lack of sprint-specific preparation (Caldbeck & Dos'Santos, 2022; McBurnie *et al.*, 2021). In the Philippine PE context, these concerns are particularly relevant because many college students, especially non-athletes, demonstrate moderate to poor physical fitness outcomes due to inconsistent training exposure, institutional resource disparities, and contextual limitations in PATHFit implementation (Pineda *et al.*, 2024; Santiago & Ibarra, 2023; Tolentino & Sinio, 2024). Consequently, sprint speed represents not merely an athletic skill but also a practical marker of broader physical preparedness that warrants targeted intervention in tertiary education.

Globally, sprint performance has been widely recognized as a multidimensional construct shaped by strength, mechanical efficiency, and training specificity. Research consistently demonstrates that structured strength, sprint, and plyometric interventions improve acceleration and sprint outcomes, with trained populations generally outperforming untrained individuals due to superior neuromuscular coordination and force application (Morrison *et al.*, 2022; Thron *et al.*, 2024; Vigh-Larsen & Mohr, 2022). However, access to effective sprint development remains uneven, particularly among female and non-athlete populations whose participation may be influenced by sociocultural, educational, and environmental constraints (Lolli *et al.*, 2022, 2023). These disparities underscore the need for context-sensitive, school-based interventions that align with participant realities rather than relying solely on athlete-derived models. Thus, while sprint enhancement literature is robust internationally, translating these findings into inclusive PE contexts requires interventions that are feasible, culturally responsive, and adaptable to diverse student populations.

Within the Philippine and local context, Muslim female college students in Pagadian City represent an underexamined population whose sprint performance may be shaped not only by physiological factors but also by sociocultural norms, limited sports participation, and reduced exposure to vigorous physical activity. Poor sprinting times among this group may reflect lower-body strength deficits, limited neuromuscular readiness, and contextual barriers such as modesty norms, limited facilities, and lower confidence in high-intensity movement (Morrison *et al.*, 2022; Pineda *et al.*, 2024; Tolentino & Sinio, 2024). These factors are particularly significant because low sprint speed may compromise both PE performance outcomes and broader health-related fitness, including cardiovascular readiness and physical literacy (Pocan, 2024). Despite these realities, little empirical research has specifically explored sprint-focused interventions among culturally specific, non-athlete female college populations in the Philippines, creating a substantial contextual gap in both PE and sports science literature.

Although prior studies support strength-based interventions for improving speed, existing scholarship remains limited in three critical ways: population specificity, contextual delivery, and intervention practicality. Most sprint-related studies focus on athletes, mixed-sex cohorts, or laboratory-controlled settings, leaving non-athlete Muslim female college students largely absent from the evidence base (Morrison *et al.*, 2022; Thron *et al.*, 2024). Moreover, many interventions emphasize advanced or specialized training modalities rather than accessible classroom-based exercises such as single-leg squats, lunges, glute bridges, burpees, mountain climbers, and push-ups that can be realistically implemented within PATHFit

environments (Zhang *et al.*, 2023; Bettariga *et al.*, 2023). This theoretical, methodological, and contextual gap limits the applicability of prior findings for inclusive tertiary PE settings. Addressing this gap requires comparative investigation of practical, progressive, and culturally sensitive strengthening approaches capable of improving sprint performance within ordinary educational environments.

In response, this study examined the comparative effectiveness of leg-strengthening and full-body strengthening exercises in enhancing sprint speed among Muslim female college students in Pagadian City, grounded in Kinetic Chain Theory and aligned with the outcomes-based framework of CHED CMO No. 39, s. 2021 for PATHFit. Leg strengthening was designed to target lower-limb force production and acceleration mechanics, while full-body strengthening emphasized trunk stability, kinetic chain integration, and movement efficiency (Bathe *et al.*, 2023; Xiao *et al.*, 2025; Zhang *et al.*, 2023). By evaluating these interventions within an eight-week PE-based framework, the study sought to generate evidence for context-sensitive, inclusive, and feasible strategies to improve sprint performance among underserved student populations. Beyond contributing to sports science, the study supports SDG 3 (Good Health and Well-Being) and SDG 4 (Quality Education) by promoting equitable, evidence-based physical education practices that enhance both fitness and educational outcomes.

Research Objectives

This study determined the effectiveness of leg- and full-body strengthening exercises in enhancing sprint power. Specifically, this study sought to answer the following questions:

1. What is the sprint speed performance of the participants before and after the intervention?
2. Do the two groups differ significantly in their sprint speed performance before and after the interventions?
3. Which of the two interventions is more effective at improving sprint speed performance?

Statement of the Hypotheses

This study determined the effectiveness of two intervention programs in improving sprint power. The first research question is hypothesis-free, while the second and third questions were tested at the $\alpha = 0.05$ level of significance.

H₀₁: The two groups do not differ significantly in their sprint speed performance before and after the interventions.

H₀₂: None of the two interventions is more effective at improving sprint speed performance.

MATERIALS AND METHODS

This study employed an active comparator design of the non-equivalent pretest–posttest design to examine the comparative effects of leg-strengthening and full-body strengthening interventions on sprint speed performance among Muslim female college students. The design is described as an active comparator because both groups received an active intervention and were compared against each other rather than against a passive (no-treatment) control, and as non-equivalent because intact class sections, rather than randomly assigned individuals, were allocated to conditions. The design was selected because random assignment was not feasible within existing Physical Education (PE) class structures, making quasi-experimental procedures appropriate for educational intervention research while still allowing for systematic comparison of treatment effects (McKinley, 2022). Two existing class sections were assigned to each

intervention condition, enabling the researcher to evaluate changes in sprint performance before and after the eight-week intervention while maintaining the natural educational environment of PATHFit implementation. This design aligned with the study's applied objective of determining whether structured strengthening exercises could meaningfully enhance sprint speed within authentic school settings.

The participants initially consisted of 160 Muslim female tertiary students enrolled in selected Physical Education or PATHFit classes at a tertiary institution in Pagadian City, Philippines. Using intact section-based sampling, 80 participants were allocated to the leg-strengthening group and 80 to the full-body strengthening group. Following attrition due to absences, incomplete participation, or non-compliance, the final analytic sample included 72 participants in the leg-strengthening group and 73 in the full-body strengthening group. Eligibility criteria required participants to be officially enrolled students, physically capable of participating in moderate-to-vigorous activity, and available for the full intervention period, while students with injuries, medical limitations, or incomplete pretest/posttest data were excluded. This participant selection process ensured both contextual relevance and intervention feasibility within the institution's PE structure.

Sprint speed performance was assessed using the USFD 20-meter Sprint Speed Test, a field-based instrument validated for evaluating sprint-related physical qualities including speed, acceleration, force, work, and power (Tomopong, 2025). Participants completed a maximal 20-meter sprint while completion time was recorded using stopwatches, after which speed was converted into meters per second (m/s) using the standard biomechanical formula of speed as distance divided by time. This conversion enhanced interpretability because lower sprint times corresponded directly to higher speed values, allowing clearer performance comparisons across participants. The instrument was selected because short-distance sprint tests are widely recognized as reliable indicators of acceleration and sprint capability in PE and sports science contexts (Lolli *et al.*, 2022, 2023; Morrison *et al.*, 2022).

Instrument reliability and validity were established through both prior validation and pilot reliability testing. The USFD test had previously undergone validation as a sprint power and speed assessment tool (Tomopong, 2025), supporting its theoretical appropriateness for this study. Additionally, a pilot interrater reliability analysis involving 30 subjects and two raters was conducted using the Intraclass Correlation Coefficient (ICC) framework of Shrout and Fleiss (1979), yielding an ICC value of 0.987, which indicated excellent reliability and very strong rater agreement. This high reliability level suggested minimal measurement error and confirmed the suitability of the instrument for repeated sprint assessment among the study population (Ece *et al.*, 2023; Trovato *et al.*, 2022; Özkök *et al.*, 2022).

Performance scores were interpreted using context-specific speed classifications derived from pilot percentile distributions rather than universal athlete norms, acknowledging that the participants were untrained college students rather than competitive athletes. Sprint speeds were categorized as very fast (≥ 5.46 m/s), fast (5.00–5.45 m/s), moderate (4.69–4.99 m/s), slow (4.23–4.68 m/s), and very slow (≤ 4.22 m/s). This localized scoring procedure strengthened interpretive accuracy by grounding classifications in the actual performance distribution of the target population, consistent with recommendations that sprint standards should be population-specific rather than generalized from elite samples (Morrison *et al.*, 2022).

Data gathering procedures followed strict ethical and institutional safeguards. Approval was secured from the Lourdes College Research Ethics Committee prior to implementation, and all procedures complied with educational and social research ethics standards, including informed consent, participant assent, voluntary participation, and confidentiality under Republic Act No. 10173 (Data Privacy Act of 2012). Participants and guardians were informed of study purposes, risks, and benefits in understandable language,

and health appraisal forms were used to ensure physical readiness. Cultural sensitivity was also prioritized given the Muslim female participant population, with interventions implemented in ways that respected participant dignity, traditions, and safety throughout the research process.

The interventions were conducted over eight weeks during scheduled PE classes, with each session lasting approximately 25–30 minutes and including warm-up, main exercise, and cool-down phases. The leg-strengthening group performed single-leg squats, forward lunges, and glute bridges, while the full-body group completed burpees, mountain climbers, and push-ups. Both groups followed identical work-rest structures of three rounds, 45 seconds per exercise, 20 seconds rest, and one-minute rest between rounds to maintain procedural consistency. Data analysis employed descriptive statistics (mean and standard deviation), paired samples t-tests to determine within-group pretest–posttest differences, and ANCOVA to compare posttest outcomes between groups while controlling for baseline pretest differences. Assumption checks for normality and homogeneity were conducted prior to inferential testing, ensuring statistical rigor in evaluating intervention effectiveness.

RESULTS

This section presents data on the effectiveness of leg and full-body exercises in improving sprint speed, organized by research questions. Results use statistical tools such as descriptive statistics, t-tests, and ANCOVA, with descriptions accompanying each table to clarify findings.

Problem 1. What is the sprint speed performance of the participants before and after the intervention?

Table 1 presents the frequency, percentage, mean, and standard deviation of participants' sprint speed performance before and after the interventions.

Table 1. Descriptive Statistics of Running Speed Before and After the Interventions (Female)

Range	Interpretation	Full Body Strengthening Exercises				Leg Strengthening Exercises			
		Pretest		Posttest		Pretest		Posttest	
		f	%	f	%	f	%	f	%
> 5.46	Very Fast	0	0	13	18.06	0	0	15	20.55
5 - 5.45	Fast	0	0	13	18.06	0	0	15	20.55
4.69 - 4.99	Moderate	0	0	15	20.83	0	0	11	15.07
4.23 - 4.68	Slow	0	0	15	20.83	0	0	15	20.55
<4.22	Very Slow	72	100	16	22.22	73	100	17	23.29
Total		72	100	72	100	73	100	73	100
Mean		1.96		4.78		1.89		4.82	
Interpretation		Very Slow		Moderate		Very Slow		Moderate	
SD		0.22		0.68		0.31		0.77	

Prior to the intervention, both groups demonstrated very slow sprint speed performance, as reflected in their low mean scores (full-body: $M = 1.96$, $SD = 0.22$; leg: $M = 1.89$, $SD = 0.31$) and the fact that 100% of participants in both groups fell under the very slow category. Following the intervention, the mean sprint speed increased substantially in both groups (full-body: $M = 4.78$, $SD = 0.68$; leg strengthening: $M = 4.82$, $SD = 0.77$), indicating a moderate performance level.

In terms of frequency distribution, a clear shift was observed from the very slow category toward higher performance levels. In the whole-body strengthening group, the number of participants in the very slow category decreased from 72 (100%) to 16 (22.22%), with participants redistributed across slow (20.83%), moderate (20.83%), fast (18.06%), and very fast (18.06%) categories. Similarly, in the leg-strengthening group, participants in the very slow category decreased from 73 (100%) to 17 (23.29%), with increased frequencies in the slow (20.55%), moderate (15.07%), fast (20.55%), and very fast (20.55%) categories.

Problem 2. Do the two groups differ significantly in their sprint speed performance before and after the interventions?

Ho₁: The two groups do not differ significantly in their sprint speed performance before and after the interventions.

Table 2 presents the results of the paired-samples t-test comparing pre- and post-test sprint-speed performance of participants in the two experimental groups.

Table 2. Paired Samples t-test for Pre-Test and Post-Test Scores in Two Experimental Groups

Group	Test	M	Interpretation	SD	t	p	Cohen's d
Full Body Strengthening (n = 72)	Pre-test	1.96	Very Slow	0.22	-31.99 *	< .001	- 3.770
	Post-test	4.78	Moderate	0.68			
Leg Strengthening (n = 73)	Pre-test	1.89	Very Slow	0.31	-28.59 *	< .001	-3.347
	Post-test	4.82	Moderate	0.77			

*Significant at 0.05 two-tailed alpha level. M = mean, SD = standard deviation, t = t statistic, p = probability value, Cohen's d = effect size

The results show that both groups had very slow sprint speed performance during the pre-test (full-body: M = 1.96, SD = 0.22; leg: M = 1.89, SD = 0.31) and improved to a moderate level during the post-test (full-body: M = 4.78, SD = 0.68; leg: M = 4.82, SD = 0.77). The paired samples t-test revealed that the differences between pre-test and post-test scores were statistically significant in both groups (full-body: t = -31.99, p < .001; leg: t = -28.59, p < .001), indicating that the interventions led to significant improvements in sprint speed performance.

Furthermore, the effect sizes for both groups were very large (full-body: d = -3.770; leg: d = -3.347), suggesting that the magnitude of improvement was substantial. The approximately 2.5-fold increase in mean speed over eight weeks is unusually large and likely reflects, in part, the participants' initial unfamiliarity with maximal sprinting at baseline, such that early gains combined genuine training adaptation with task familiarization among these novice performers. Based on these findings, the null hypothesis is rejected, as both groups showed significant differences in sprint speed performance before and after the interventions. This indicates that the interventions significantly improved participants' sprint speed, demonstrating that the training programs effectively influenced their running speed outcomes.

Problem 3. Which of the two interventions is more effective at improving sprint speed performance?

Ho₂: None of the two interventions is more effective at improving sprint speed performance.

Table 3 presents the ANCOVA results comparing posttest sprint-speed performance between the two intervention groups, with pretest scores treated as covariates.

Table 3. ANCOVA Summary Table for Posttest Scores with Pretest Scores as Covariates

GROUPS	Adjusted Mean	Interpretation	F(1,142)	p	Partial η^2
Leg Strengthening Exercises	4.797	Moderate	0.295	0.588	0.002
Whole Body Strengthening Exercises	4.873	Moderate			

Adjusted Mean = estimated marginal mean controlling for the pretest covariate; F = F statistic; p = probability value; partial η^2 = effect size.

The results show that both groups improved from very slow performance in the pretest to a moderate level in the posttest. However, the ANCOVA revealed that the difference between the two interventions was not statistically significant ($F(1,142) = 0.295$, $p = 0.588$), with a very small effect size (partial $\eta^2 = 0.002$). This indicates that neither intervention was more effective than the other in improving sprint speed performance. Thus, the null hypothesis cannot be rejected, as both interventions produced comparable outcomes. This means that both interventions improved sprint speed performance to a similar extent, with no meaningful difference in their effects. In practical terms, either intervention can be considered comparably effective, as neither showed superiority over the other in enhancing sprint speed performance.

DISCUSSION

Participants' sprint speed performance was very slow before the intervention. A very slow sprint speed indicates that the participants ran at minimal velocity, requiring more time to cover the set distance and reflecting a limited ability to generate and apply force effectively during movement. After the intervention, their sprint speed performance improved to a moderate level. A moderate sprint speed performance means that participants were able to run at an improved but not maximal speed, indicating a fair level of efficiency in covering the distance in less time than a very slow performance.

The participants' very low pretest sprint-speed performance can be understood as a convergence of biomechanical, experiential, and sociocultural factors that likely constrained efficient sprint execution. Biomechanically, untrained individuals typically exhibit suboptimal sprint mechanics, such as reduced stride length, prolonged ground contact time, limited hip extension, and insufficient force application against the ground—all of which impair acceleration and velocity development (Vigh-Larsen & Mohr, 2022; Morrison et al., 2022).

In this context, the participants likely ran with short, hesitant steps, minimal arm drive, upright or unstable trunk posture, and weak push-off mechanics, reflecting limited lower-limb strength and poor neuromuscular coordination. The absence of prior exposure to sprint-specific or strength-based training further suggests an underdeveloped rate of force development and stretch-shortening cycle efficiency, both critical for fast sprinting (Sinkovic et al., 2023; Caldbeck & Dos'Santos, 2022). These biomechanical inefficiencies would naturally result in slower running speeds, especially during the acceleration phase.

Furthermore, as Muslim female students in higher education, participants likely had limited involvement in vigorous sports due to modesty norms, clothing, and historically lower participation in competitive or structured training. In many cases, sprinting at maximal effort may not be a familiar or regularly practiced movement, leading to cautious, conservative running patterns rather than explosive,

performance-oriented sprinting. Within the Philippine PATHFit context, where many students are non-athletes and come from varied physical activity backgrounds, moderate-to-low baseline fitness levels are also common, particularly in speed-related tasks (Santiago & Ibarra, 2023; Tolentino & Sinio, 2024).

Consequently, the participants may have approached the sprint test with low confidence, limited technical knowledge, and minimal prior conditioning, further contributing to their very slow pretest performance. Collectively, these biomechanical limitations and contextual influences paint a realistic picture of novice runners who are physically capable but not yet trained or accustomed to executing sprinting as a high-skill, high-power movement.

The shift to a moderate performance level indicates developing functional capacity for sprinting, involving more controlled force application during acceleration and short-distance running. Performance at this stage is typically marked by more consistent stride patterns, stronger push-off from the ground, and better coordination between upper- and lower-body movement. Through the hip, knee, and ankle joints, participants were better able to generate ground-reaction force to propel the body forward while maintaining trunk stability and using an active arm swing to build forward momentum (Vigh-Larsen & Mohr, 2022). The movement became more continuous and rhythmic, though still short of an explosive, fully trained sprint.

From a biomechanical perspective, the moderate sprint performance indicates developing neuromuscular coordination and rate of force development that facilitates decreased ground contact time and increased effective stride length and frequency. The stretch-shortening cycle works more effectively, aiding a seamless transition from foot strike to the push-off phase (Sinkovic *et al.*, 2023). Though still not the most explosive, a sprint at this level offers significant evidence of controlled acceleration, balance during single-leg support phases, and proper alignment throughout the movement.

Moreover, the sprint-speed performance of the groups before and after the interventions differed significantly. This indicates that both interventions are effective at enhancing sprint speed performance, supporting the theories anchored on those confirmed assumptions.

As this study showed, participants who initially exhibited very slow sprint performance responded positively to well-structured, guided physical training implemented during their PE classes. This implies that well-structured and adequately delivered exercise interventions can produce meaningful functional improvements even among recreationally active female university students with negligible prior sprinting or resistance training experience. From the researcher's perspective, the results underscore that intentional instruction, progressive overload, and context-sensitive programming matter, especially at low baseline fitness and movement experience.

From a theoretical standpoint, enhanced sprint-speed performance could lend further support to the Kinetic Chain Theory. According to the Kinetic Chain Theory, proper movement occurs through the coordinated interaction of body segments in which both proximal (core and hip) and distal (knee and ankle) components are interdependent (Adeel *et al.*, 2024; Šuc *et al.*, 2022). The measured improvements indicate that both leg- and full-body strengthening interventions improved this coordination, enabling participants to generate (and transfer) force more effectively while sprinting.

Additionally, although not part of the theoretical framework, the Principle of Specificity refers to these training adaptations occurring in response to the specific demands of an exercise, and therefore improvements in sport performance will occur through training that develops strength, coordination, and movement patterns demanded by the exercise (McBurnie *et al.*, 2021; Caldbeck & Dos'Santos, 2022).

So, based on these findings, it is evident that the results of this study support either theory. These improvements in sprint speed performance demonstrate that enhancing the potential of the kinetic chain, through targeted strengthening exercises and application(s) of training stimuli consistent with those encountered in a sprint sport environment, produces statistically meaningful performance gains. Hence, the study results align with and increase upon theoretical expectations of how a structured task specification potentiates functional gains (i.e., speed performance) through the application of well-defined physical training objectives to developed movement systems (Sinkovic *et al.*, 2023; Zhang *et al.*, 2023).

Moreover, the effectiveness of full-body strengthening exercises is due to the neuromuscular patterning, kinetic chain coordination, and the addition of total-body force that they provide for movements that are quick in nature, such as sprinting. Sprinting is a full-body task involving synchronized contributions from the trunk, upper body, and lower limbs to maximize force transfer and propulsion economy (Vigh-Larsen & Mohr, 2022; Šuc *et al.*, 2022). Multi-joint exercises develop proximal core stability and control, helping maintain upright posture, pelvic stability, and efficient force transfer during acceleration (Xiao *et al.*, 2025; Bathe *et al.*, 2023). Moreover, functional training methods within a full-body conditioning paradigm positively affect the rate of force development and neuromuscular preparedness, leading to improved sprint-related measures (Chulvi-Medrano *et al.*, 2025; Altuğ *et al.*, 2023; Wu *et al.*, 2023).

Meanwhile, leg-strengthening exercises are effective, as they directly enhance lower-extremity muscle force-generating capacity and mechanical efficiency, hallmarks that determine sprint speed. Ground reaction forces during acceleration (Vigh-Larsen & Mohr, 2022; McBurnie *et al.*, 2021) demonstrate the reliance on the capacity of hip-, knee-, and ankle-related musculature to generate high forces at high speeds during sprinting. In this regard, they may be the very foundation for force and functional power production to improve propulsive power and technique that influences sprinting speed (Sinkovic *et al.*, 2023), or lead to shorter ground contact times, which can result in enhanced peak propel speeds necessary for faster sprints (Zhang *et al.*, 2023). Biomechanical aspects of leg strength training include better joint stability, alignment, and movement control, especially with some hip-targeted or single-limb exercises that replicate sprint mechanics, contributing to higher balance, coordination, and force application early during running (Šuc *et al.*, 2022; Bettariga *et al.*, 2023; Morencos *et al.*, 2022).

Finally, the findings revealed that neither intervention was more effective than the other in improving sprint speed performance. Both leg- and full-body strengthening exercises produced comparable improvements among participants. Therefore, it can be concluded that both interventions are comparably effective in enhancing sprint speed performance.

This finding that both conditioning techniques were equally effective supports existing evidence of multiple training pathways that yield similar adaptations in sprint speed performance. This follows the Principle of Specificity, as adaptations occur only when training is specific to performance determinants; in this example, both interventions sufficiently trained the aspects that underpin a sprint (McBurnie *et al.*, 2021; Caldbeck & Dos'Santos, 2022) and thus were effective. While the approaches were certainly different, one via a more localized approach (leg strength) and the other by means of holistically applying stimulus (generalized full body strength domain), both offered sufficient stimulus for carrying over to sprintish capacities with similar outcomes.

This also aligns with previous literature indicating that both lower-limb- and full-body-focused training programs can improve sprint performance and post-neuromuscular function in addition to force production (Vigh-Larsen & Mohr, 2022; Sinkovic *et al.*, 2023). Kinetic Chain Theory states that an increase in

mechanical output can occur either through direct strengthening of specific propulsive tissues or through movement system coordination (Šuc *et al.*, 2022; Adeel *et al.*, 2024), thereby increasing efficiency. As such, the similar performance improvements observed for both interventions suggest that sprinting is a complex task with multiple contributors to performance, and theoretical training variances can yield equivalent adaptations if they appropriately target fundamental mechanical and neuromuscular demands.

CONCLUSION

The aim of the study was achieved when the results showed that each protocol, including leg and full-body strengthening, reinforced improvements in participants' sprint speed performance. The performance results were testimony that structured and progressive exercise interventions can improve sprint-related fitness levels in female college students in PE studies.

The results supported the study's theoretical background. The Kinetic Chain Theory was confirmed by sprint speed increases resulting from interventions designed to improve force production, coordination, and movement efficiency. The comparable efficacy of both interventions further supports the concept that sprint performance may be enhanced by using varied but theoretically aligned stimuli that address important neuromuscular and biomechanical demands.

Overall, this study adds to the body of evidence that classroom-based exercise interventions can enhance functional sprint speed performance in non-athlete populations, a finding that is significant for Physical Education. Also elaborating on the role of purposeful program structure, systematic analysis, and situational learning in realizing effective fitness outcomes, reinforcing the viability of inclusive PE implementation frameworks like PATHFit.

LIMITATIONS OF THE STUDY

This study has several limitations that should be considered when interpreting the findings. First, the design used intact class sections rather than randomized individual assignment and did not include a passive (no-treatment) control group, so improvements cannot be attributed to the interventions with the certainty of a randomized controlled trial. Second, the participants were novice, non-athlete sprinters who were likely unfamiliar with maximal-effort sprinting at baseline; part of the observed improvement may therefore reflect task familiarization in addition to physiological adaptation, which may partly explain the unusually large effect sizes. Third, the study was conducted with Muslim female students in a single institution in Pagadian City, which limits generalizability to other populations, sexes, and settings. Fourth, sprint time was recorded by stopwatch, which is more susceptible to measurement error than electronic timing gates. These limitations suggest that the results should be interpreted as promising but preliminary evidence.

RECOMMENDATIONS

Based on the findings, several recommendations are offered. For physical education practice, teachers may integrate brief, progressive leg- or full-body-strengthening routines into PATHFit classes, since both produced comparable gains and require minimal equipment. For coaching and program design, attention to correct sprint technique and task familiarization may help novice learners convert strength gains into speed. For institutions, providing culturally responsive, private, and appropriately resourced spaces may support fuller participation by Muslim female students in vigorous activity. For future research, scholars should employ randomized or controlled designs, larger and more diverse samples, electronic timing, and longer

follow-up to confirm the durability of improvements and to disentangle training adaptation from task familiarization.

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AI Declaration: This study utilized artificial intelligence tools to assist in preparing this article. Specifically, AI assistance was used to help condense the full thesis manuscript into a reduced journal-article format and to refine language quality, clarity, and tone, with human supervision and editing throughout. All statistical results were checked against the author's thesis and source data, and the author carefully reviewed and edited all outputs to maintain academic rigor and integrity.

Data Availability Statement: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Requests for access will be evaluated in accordance with ethical guidelines and data privacy policies.