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EFFECTS OF PLYOMETRIC AND HIGH INTENSITY INTERVAL TRAINING ON SPRINT SPEED, AGILITY AND POWER AMONG FEMALE FAST BOWLERS

Original Research

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ABSTRACT

Background: Female fast bowlers in cricket require a distinct combination of sprint speed, agility, and explosive power to meet the demands of their role. Due to their unique physiological and biomechanical profiles, conventional training methods may not fully optimize performance or prevent injuries. Plyometric training (PT) and high-intensity interval training (HIIT) are two evidence-based interventions known to enhance athletic output, yet their comparative impact on female fast bowlers remains underexplored.

Objective: To compare the effects of plyometric training and high-intensity interval training on sprint speed, agility, and power in female fast bowlers.

Methods: This randomized clinical trial was conducted over six months and included 34 female fast bowlers aged 18–25 years, recruited from local cricket academies. Participants were randomly assigned to either the PT group (n=17) or the HIIT group (n=17). The PT group performed explosive lower-body movements such as box jumps and depth jumps, targeting the stretch-shortening cycle, while the HIIT group engaged in cardiovascular drills including sprint intervals and shuttle runs at 85–95% HRmax, followed by active recovery at 50–60% HRmax. Each intervention lasted 6 weeks, with three weekly sessions. Performance was assessed pre- and post-intervention using the 40-Yard Sprint Test (40-YT), Standing Broad Jump (SBJ), and Agility Test (AT). Statistical analysis was conducted using SPSS-23, applying paired sample t-tests and independent t-tests for within- and between-group comparisons.

Results: The PT group demonstrated a mean improvement in SBJ of -76.69 ± 3.327 cm, 40-YT of 0.925 ± 0.2696 seconds, and AT of 0.706 ± 0.0267 seconds. The HIIT group showed a mean improvement in SBJ of 31.4 ± 0.911 cm, 40-YT of 0.787 ± 0.0664 seconds, and AT of 0.08 ± 0.0581 seconds. All outcomes were statistically significant ($p<0.05$).

Conclusion: Both training interventions significantly improved sprint speed, agility, and power in female fast bowlers. However, plyometric training produced greater performance gains, suggesting its superior effectiveness for this athletic population.

Keywords: Agility Test, Athletic Performance, High-Intensity Interval Training, Plyometric Exercise, Sprint Speed, Standing Broad Jump, Women's Cricket.

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INTRODUCTION

Fast bowling in cricket is a physically demanding discipline that requires an exceptional blend of sprint speed, agility, and explosive power—elements that collectively define a bowler's ability to deliver high-velocity balls with consistency, control, and tactical precision (1). For female fast bowlers, the challenge is compounded by the need to compete and excel in a field traditionally dominated by male athletes. This necessitates a deeper understanding of training methodologies that are specifically tailored to the physiological and biomechanical characteristics of female athletes (2,3). Addressing these unique demands is crucial not only for enhancing individual performance but also for narrowing the performance gap and promoting gender equity in elite cricket. Among the various training approaches, plyometric training has gained prominence as a key method for improving explosive strength and neuromuscular coordination. By leveraging the stretch-shortening cycle (SSC)—a mechanism through which muscles store and release elastic energy—plyometric exercises such as box jumps, depth jumps, and lateral bounds enhance the body's ability to generate rapid force (4-6). This capacity is particularly important for fast bowlers, whose performance hinges on powerful movements during the delivery stride, follow-through, and quick fielding maneuvers. Plyometric training not only contributes to muscular elasticity and force production but also supports overall speed and agility, which are vital components of a bowler's match readiness.

Complementing plyometric regimens, High-Intensity Interval Training (HIIT) has emerged as an effective strategy for improving cardiovascular endurance, muscular resilience, and anaerobic capacity. HIIT mirrors the intermittent nature of cricket, wherein fast bowlers alternate between periods of maximal exertion and brief recovery. This form of training is especially beneficial for female fast bowlers as it facilitates physiological adaptations in fast-twitch muscle fibers and optimizes energy utilization under high-intensity conditions (7,8). Furthermore, HIIT supports enhanced oxygen uptake and accelerates recovery—two areas where female athletes often exhibit comparatively lower baselines, potentially impacting long-term performance and stamina (9,10). Despite the recognized benefits of both plyometric and HIIT protocols, literature remains sparse on their targeted impact when applied synergistically in female fast bowlers. Most existing research has focused on male populations or generalized athletic cohorts, thereby overlooking the specific demands faced by female cricketers. This gap underscores the need for evidence-based training models that address the athletic and recovery profiles unique to female fast bowlers. This study is thus designed to evaluate the combined effect of plyometric training and high-intensity interval training on sprint speed, agility, and explosive power in female fast bowlers, aiming to establish an optimized training framework that enhances both performance and physiological adaptation in this underrepresented athletic group.

METHODS

This single-blinded, randomized clinical trial was conducted over a duration of ten months to assess the comparative effects of plyometric training and high-intensity interval training (HIIT) on female fast bowlers. The study received approval from the institutional ethical review board of the University of Education, Lahore and informed written consent was obtained from all participants prior to enrollment. The required sample size was calculated using G*Power software version 3.1.9.7, resulting in a minimum of 31 participants. An additional 10% was added to account for potential attrition, bringing the final sample size to 35 participants (11). A non-probability convenience sampling technique was employed to recruit participants from the Department of Physical Education, University of Education, Lahore. Participants were eligible for inclusion if they were female fast bowlers aged between 18 and 25 years, had at least two years of consistent experience in fast bowling, and maintained an active and healthy physical status (12). Individuals with a history of chronic injuries, musculoskeletal disorders, or any condition that could be aggravated by high-intensity training were excluded. Additional exclusion criteria included irregular participation in cricket activities and a history of cesarean delivery, as such conditions may compromise physical readiness or performance capacity during the intervention.

Participants were randomly allocated into two intervention groups: Group A received plyometric training, and Group B underwent HIIT. Both interventions were carried out over a six-week period, with three sessions per week on non-consecutive days to ensure adequate recovery. The plyometric group participated in high-intensity lower-body exercises aimed at enhancing neuromuscular coordination, sprint speed, and explosive power. Sessions lasted 45 to 60 minutes, beginning with a 10-minute warm-up, followed by 30–40 minutes of core plyometric drills including box jumps, depth jumps, lateral bounds, and tuck jumps, and concluding with a 5–10-minute cool-

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down. Exercise intensity was maintained at 80–90% of each participant's maximum effort, emphasizing the stretch-shortening cycle (SSC) to improve power output. The HIIT group followed a similarly structured protocol, consisting of cardiovascular exercises such as sprinting, shuttle runs, or cycling. Each session lasted approximately 45–50 minutes, comprising a 10-minute warm-up, 25–30 minutes of HIIT intervals, and a 5–10-minute cool-down. Intervals alternated between 30 seconds of high-intensity exertion (at 85–95% of maximum heart rate) and 60 seconds of low-intensity recovery (at 50–60% of maximum heart rate), maintaining a 1:2 work-to-rest ratio (13-15). This protocol was designed to improve anaerobic capacity, agility, and speed, aligning with the intermittent physical demands faced by fast bowlers during gameplay. All participants were monitored throughout the intervention period for adherence and any adverse events. Standardized instructions and supervision were provided to ensure consistency in protocol delivery across sessions.

RESULTS

A statistically significant improvement was observed in all three performance variables—standing broad jump (SBJ), 40-yard test (40-YT), and agility test (AT)—after the intervention, with p-values < 0.05. The mean SBJ increased from 146.58 ± 7.140 cm at baseline to 201.35 ± 23.916 cm post-intervention, resulting in a mean difference of -54.77 ± 16.78 cm. For the 40-yard sprint, the pre-treatment mean time was 5.771 ± 0.3626 seconds, which reduced to 4.913 ± 0.2617 seconds after training, showing a significant improvement with a mean difference of 0.8581 ± 0.1009 seconds. Similarly, agility test results improved, with pre-treatment scores averaging 9.361 ± 0.1995 seconds and post-treatment scores of 8.958 ± 0.2884 seconds, yielding a mean difference of 0.4032 ± 0.0889 seconds. Between-group comparisons revealed that the plyometric training group demonstrated superior gains across all outcome measures when compared to the high-intensity interval training (HIIT) group. In terms of SBJ, the plyometric group improved from 144.06 ± 4.932 cm to 220.75 ± 15.369 cm, reflecting a substantial mean increase of -76.69 ± 3.33 cm. In contrast, the HIIT group improved from 149.27 ± 8.259 cm to 180.67 ± 9.170 cm, with a mean gain of 31.4 ± 0.91 cm. For the 40-YT, the plyometric group reduced their sprint time from 5.631 ± 0.4222 seconds to 4.706 ± 0.1526 seconds (mean difference 0.925 ± 0.2696), whereas the HIIT group improved from 5.920 ± 0.2111 seconds to 5.133 ± 0.1447 seconds (mean difference 0.787 ± 0.0664). Agility performance in the plyometric group improved from 9.444 ± 0.1590 seconds to 8.738 ± 0.1857 seconds, showing a larger mean change of 0.706 ± 0.0267 seconds compared to the HIIT group, which improved from 9.273 ± 0.2052 seconds to 9.193 ± 0.1624 seconds, with a smaller mean difference of 0.08 ± 0.0581 seconds. All comparisons yielded p-values less than 0.05, indicating statistically significant differences in performance gains between the two training modalities. Plyometric training consistently outperformed HIIT in improving sprint speed, agility, and explosive power among female fast bowlers.

Table 1: Within-Group and Between-Group Comparison of Standing Broad Jump, 40-Yard Test, and Agility Test Scores Before and After Intervention in Plyometric and HIIT Groups

			Mean	**Mean Difference**	**Std. Deviation**	**P-Value**
Pair 1	PRE_STANDING_BOARD_JUMP		146.58	-54.774	7.140	.000
	POST_STANDING_BOARD_JUMP		201.35		23.916	
Pair 2	PRE_40_YARD_TEST		5.771	.8581	.3626	.000
	POST_40_YARD_TEST		4.913		.2617	
Pair 3	PRE_AGILITY		9.361	.4032	.1995	.000
	POST_AGILITY		8.958		.2884	
GROUPS			Mean Difference	Mean	Std. Deviation	P-Value
PRE_STANDING_ BOARD_JUMP		A	-5.204	144.06	4.932	.040
		B		149.27	8.259	
POST_STANDING _BOARD_JUMP		A	40.083	220.75	15.369	.000
		B		180.67	9.170	

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		Mean	Mean Difference	Std. Deviation	P-Value
PRE_40_YARD_TEST	A	-.2888	5.631	.4222	.024
	B		5.920	.2111	
POST_40_YARD_TEST	A	-.4271	4.706	.1526	.000
	B		5.133	.1447	
PRE_AGILITY	A	.1704	9.444	.1590	.015
	B		9.273	.2052	
POST_AGILITY	A	-.4558	8.738	.1857	.000
	B		9.193	.1624	

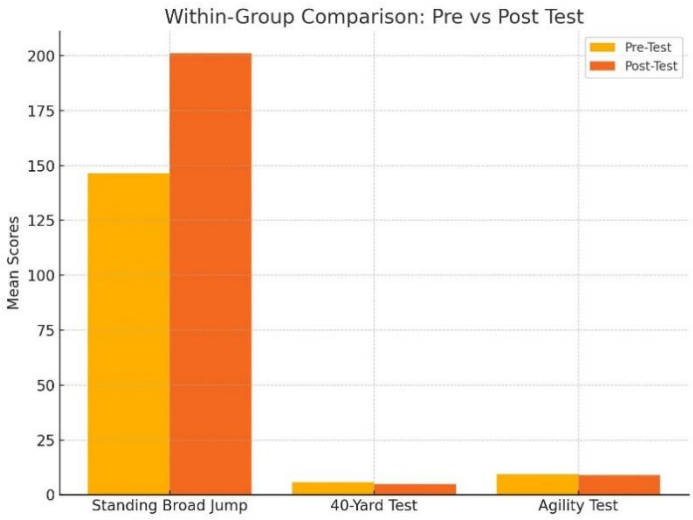

Figure 1 Within-Group Comparison: Pre vs Post Test

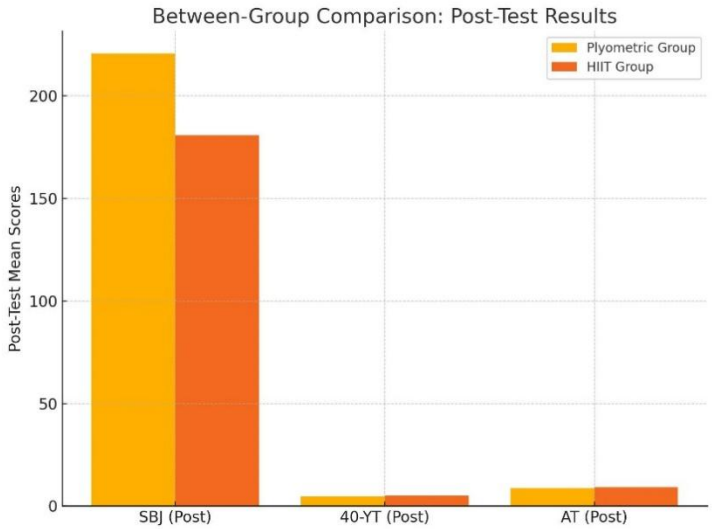

Figure 2 Between-Group Comparison: Post-Test Results

DISCUSSION

The findings of this study demonstrated a significant improvement in sprint speed, agility, and explosive power among female fast bowlers following both plyometric training and high-intensity interval training interventions, with plyometric training producing superior outcomes. Improvements were evident across all performance measures, including the standing broad jump (SBJ), 40-yard sprint (40-YT), and agility test (AT). The increase in SBJ scores indicated enhanced lower-body power, while reductions in 40-YT and AT times suggested better sprinting ability and agility following the six-week intervention. These outcomes affirm the value of structured training protocols in elevating key athletic attributes essential for fast bowling performance. Comparative analysis showed that participants who underwent plyometric training exhibited greater improvements than those in the high-intensity interval training group. The results align with earlier research which highlighted that, plyometric exercises leveraging the stretch-shortening cycle optimize neuromuscular efficiency and activate fast-twitch muscle fibers, thereby enhancing explosive force production and reaction time (16-18). Previous findings in populations such as female volleyball players and sprinters have also confirmed that plyometric protocols significantly improve vertical jump height, sprint speed, and agility, validating its cross-sport applicability for high-speed, power-dependent movements common in fast bowling (19,20). Additionally, evidence from resistance-plyometric hybrid training studies supports the conclusion that plyometric modalities foster both neural and muscular adaptations, crucial for generating high bowling velocities and executing swift directional changes on the field (21). The significance of these findings lies in their practical implications

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for conditioning programs tailored specifically to female fast bowlers, a population that has traditionally been underrepresented in sports performance research. Enhancing power, agility, and sprint capacity not only contributes to bowling performance but also reduces injury risk by improving biomechanical control and muscle readiness during high-impact movements (22). Plyometric training, by emphasizing high-force, rapid-contraction exercises, addresses these athletic demands more directly than interval-based cardiovascular conditioning alone.

A major strength of this study is its application of a randomized controlled trial design, which enhances the internal validity and reliability of the results. Furthermore, the use of objective, sport-specific performance tests provides relevant outcome measures closely tied to on-field requirements for fast bowlers. The six-week duration, combined with a consistent frequency and intensity across both groups, ensured adequate exposure to training stimuli while allowing for measurable adaptation. However, the study also presents several limitations. The sample was derived through a non-probability convenience sampling method, which may introduce selection bias and limit generalizability to broader athletic populations. Additionally, the exclusion of a control group restricts the ability to isolate training effects from external factors such as seasonal changes in activity or individual motivation. The lack of long-term follow-up precludes conclusions about the retention of performance gains over time or potential delayed onset injuries. Moreover, training responses were not stratified by individual baseline fitness levels, which may have influenced the magnitude of improvement across participants. Future research should consider incorporating a larger, randomized sample with a control arm to provide a more comprehensive evaluation of training effectiveness (23,24). Including additional outcome measures such as electromyographic analysis or hormonal profiling may offer deeper insight into the physiological mechanisms underlying performance changes. Longitudinal studies assessing the sustainability of these gains, as well as the inclusion of psychological and perceptual factors like athlete motivation and perceived exertion, could contribute to the holistic understanding of training responses in female cricketers. Overall, the present study underscores the efficacy of plyometric training in enhancing key physical attributes in female fast bowlers. These findings support the integration of sport-specific, neuromuscularly demanding exercises into regular conditioning programs to optimize performance and reduce injury risk in competitive cricket.

CONCLUSION

This study concluded that both plyometric training and high-intensity interval training were effective in enhancing sprint speed, agility, and power among female fast bowlers, demonstrating meaningful improvements in athletic performance over time. However, plyometric training produced more pronounced gains, indicating its superior effectiveness in targeting explosive strength, speed, and agility. These findings highlight the practical value of incorporating structured plyometric exercises into training regimens for female athletes in fast-paced sports like cricket, where rapid force production and quick directional changes are essential. The study reinforces the importance of sport-specific training strategies in optimizing physical capabilities and advancing performance in female fast bowlers.

AUTHOR CONTRIBUTION

Author	Contribution
Kiran Samdani*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Zohaib Shahid	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Tariq	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Asad Ali	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Fatima Liaquat	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Abdullah Zafar	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Muhammad Aleem Sabir Khan	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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REFERENCES

1. Brazier TA, Tallent J, Patterson SD, Howe LP, Callaghan SJ. The physical profile of female cricketers: An investigation between playing standard and position. Plos one. 2024;19(6): e0302647.
2. Jacobs J, Olivier B, Brandt C, Jafta G. Physical Profiles of All-Rounders, Batters, and Bowlers in Sub-Elite Women's Cricket. The Journal of Strength & Conditioning Research. 2024;38(6):1095-102.
3. Bailey D, Saw AE, Crowther RH, Sims K. Run Faster, Bowl Faster: InMatch Analysis of Elite Female Cricket Pace Bowlers. J Sport Exerc Sci. 2023; 7:21-6.
4. Lyons C, Felton P, McCabe C. Female cricket pace bowling: kinematic and anthropometric relationships with ball release speed. South African Journal of Sports Medicine. 2023;35(1).
5. Feros SA, Gerhardy MH, Fyfe JJ, Dwyer DB. The kinematics of pace bowling associated with lumbar bone stress injuries: Disparities observed in elite male and female cricketers. International Journal of Sports Science & Coaching. 2024:17479541241249814.
6. Saran M, Pawaria S, Kalra S. Kinesio taping with ballistic six plyometric training on speed, accuracy, target and joint proprioception in fast bowlers with glenohumeral instability. Comparative Exercise Physiology. 2022;18(4):357-63.
7. Ramachandran AK, Singh U, Lathlean TJ. Strength and conditioning practices for the optimisation of speed and accuracy in cricket fast bowlers: A systematic review and meta-analysis. International Journal of Sports Science & Coaching. 2022;17(5):1211-24.
8. Atakan MM, Li Y, Koşar ŞN, Turnagöl HH, Yan X. Evidence-based effects of high-intensity interval training on exercise capacity and health: A review with historical perspective. International journal of environmental research and public health. 2021;18(13):7201.
9. Hough P. High-intensity interval training. Advanced personal training: Routledge; 2021. p. 171-203.
10. Belamjahad A, Tourny C, Jebabli N, Clark CC, Laher I, Hackney AC, et al. Effects of a preseason neuromuscular training program vs. an endurancedominated program on physical fitness and injury prevention in female soccer players. Sports Medicine-Open. 2024;10(1):76.
11. Wang P, Shi C, Chen J, Gao X, Wang Z, Fan Y, et al. Training methods and evaluation of basketball players' agility quality: A systematic review. Heliyon. 2024.
12. Hall AJ, Aspe RR, Craig TP, Kavaliauskas M, Babraj J, Swinton PA. The effects of sprint interval training on physical performance: a systematic review and meta-analysis. The Journal of Strength & Conditioning Research. 2023;37(2):457-81.
13. Pardos-Mainer E, Lozano D, Torrontegui-Duarte M, Cartón-Llorente A, Roso-Moliner A. Effects of strength vs. plyometric training programs on vertical jumping, linear sprint and change of direction speed performance in female soccer players: a systematic review and meta-analysis. International journal of environmental research and public health. 2021;18(2):401.
14. Jakšić D, Maričić S, Maksimović N, Bianco A, Sekulić D, Foretić N, et al. Effects of additional plyometric training on the jump performance of elite male handball players: A systematic review. International journal of environmental research and public health. 2023;20(3):2475.
15. Stankovic M, Djordjevic D, Trajkovic N, Milanovic Z. Effects of HighIntensity Interval Training (HIIT) on Physical Performance in female team Sports: a systematic review. Sports medicine-open. 2023;9(1):78.
16. Stastny P, Musalek M, Rozcniok R, Cleather D, Novak D, Vagner M. Testing distance characteristics and reference values for ice-hockey straight sprint speed and acceleration. A systematic review and meta-analyses. Biology of sport. 2023;40(3):899-918.
17. Morral-Yepes M, Moras G, Bishop C, Gonzalo-Skok O. Assessing the reliability and validity of agility testing in team sports: a systematic review. The Journal of Strength & Conditioning Research. 2022;36(7):2035-49.
18. Topiwala D, Patole S, Golhar S, Ranglani T. Effectiveness of sprint interval training on repeated sprint ability (RSA) and lower limb power in amateur cricket batsmen at the end of 4 weeks: An experimental study. IJAR. 2021;7(8):192-201.
19. Cabrejas C, Solana-Tramunt M, Morales J, Nieto A, Bofill A, Carballeira E, et al. The effects of an eight-week integrated functional core and plyometric training program on young rhythmic gymnasts' explosive strength. International journal of environmental research and public health. 2023;20(2):1041.
20. Bao R, Chen S, Kastelic K, Drenowatz C, Li M, Zhang J, et al. Reliability of international fitness scale (IFIS) in Chinese children and adolescents. Children. 2022;9(4):531.
21. Yang G, Chen W, Qi D, Zhang J, Men Z. The Effects of a 6-Week Plyometric and Sprint Interval Training Intervention on Soccer Player's Physical Performance. J Sports Sci Med. 2024;23(1):526-36.
22. Wannouch YJ, Leahey SR, Whitworth-Turner CM, Oliver JL, Yh KC, Laffer JC, et al. A Comprehensive Analysis of 10-Yard Sprint Reliability in Male and Female Youth Athletes. The Journal of Strength & Conditioning Research. 2024;38(9): e477-e88.

23. Chen C-F, Wu H-J. The effect of an 8-week rope skipping intervention on standing long jump performance. International journal of environmental research and public health. 2022;19(14):8472.
24. Ltifi[1] MA, Bartels T, Hermassi S. modified agility T-test performance in elite seven-a-side. Strength and Conditioning in Football: Driving Physical Performance through Research and Innovation. 2024:27.