

**RELATIONSHIP BETWEEN PHYSICAL FITNESS COMPONENTS AND SPRINT
AND HURDLES PERFORMANCE AMONG SCHOOL-LEVEL ATHLETES IN
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ABSTRACT

The present study examined the relationship between physical fitness components and sprint and hurdles performance among school-level athletes in Rajasthan. Sprinting and hurdling require a combination of speed, explosive strength, agility, flexibility, coordination, and muscular endurance. The study aimed to determine the extent to which selected physical fitness components contribute to performance in sprint and hurdles events among school-level athletes. A sample of school-level athletes from selected schools in Rajasthan may be assessed using standardized physical fitness tests, including speed, explosive leg power, agility, flexibility, muscular endurance, and cardiovascular endurance. Sprint and hurdles performance can be evaluated through standardized race timings. Descriptive statistics and correlation analysis may be employed to examine the association between physical fitness variables and event performance. The expected findings indicate that speed, explosive strength, agility, and flexibility have significant relationships with sprint and hurdles performance, while the relative contribution of individual fitness components may vary according to the event. The study highlights the importance of developing a comprehensive fitness profile alongside technical training for young athletes. The findings may assist physical education teachers, coaches, and sports administrators in designing age-appropriate training programmes to improve sprinting and hurdling performance among school-level athletes in Rajasthan.

Keywords:

Physical Fitness, Sprint Performance, Hurdles, Speed, Explosive Strength, Agility, Flexibility, School-Level Athletes, Rajasthan, Sports Training.

INTRODUCTION

Physical fitness an integral role in achieving success in the world of competitive sports, especially in such track and field disciplines like sprinting and hurdling. Sprint and hurdles involve generation of high speed, power, strength, agility, flexibility, coordination, balance, anaerobic endurance in a relatively short time frame. For students, the importance of development of physical fitness is crucial, since adolescence is the critical period for forming motor skills and developing future sporting potential. Therefore, the knowledge of interrelation between physical fitness and athletic performance can help physical education teachers and coaches develop efficient training programs for youth athletes.

Performance in sprint largely depends on the capacity of the athlete to accelerate quickly, achieve high speed and keep it through the whole race. Physical parameters like strength of the lower limbs, explosive power, reaction capacity, speed and coordination have a great effect on these demands. For hurdle disciplines, the athlete should use not only his/her sprinting qualities but also his/her technical skills, rhythm, flexibility, balance and coordination to jump hurdles effectively and keep moving forward. Thus, despite the similarities of sprint and hurdle disciplines in terms of physical demands, hurdles involve some additional technical and flexibility demands.

However, school athletes' level of physical fitness is likely to be quite variable on account of such factors as age, biological maturity, training background, nutrition, lifestyle, and access to athletic facilities. This may become especially relevant in Rajasthan, where school athletes compete in different geographical, socio-economic and educational settings. Thus, knowing which fitness features are the most predictive of sprint and hurdles performance might prove useful in terms of talent detection and athlete training.

Notably, the correlation between particular fitness components and performance might not be the same for all athletes. Thus, speed and explosive strength of leg muscles would correlate more closely with sprint performance;

however, flexibility, dynamic balance, coordination, and sense of rhythm would also play a significant supplementary role in hurdles. At the same time, such factors as muscle strength and anaerobic endurance would affect the athlete's ability to accelerate, run at high speed, and perform complex actions on the field.

Within the realm of physical education and school level competitive sports in Rajasthan, studies on the above mentioned relationships can help coaches and educators design evidence-based training programmes. In addition, fitness tests can aid in identifying individual strengths and weaknesses among young athletes and devising individual training programs accordingly. Moreover, determination of the relationship between selected physical fitness variables and sprinting and hurdles performance can further aid in talent identification as well as preparation for inter-school, inter-district, state and national level competitions.

It is with the above mentioned reasons that the present study intends to explore the relationship between selected physical fitness components and sprint and hurdles performance.

SIGNIFICANCE OF THE STUDY

The proposed research will have both theoretical and practical importance. On a theoretical level, the study can be helpful in exploring the connection between physical fitness and athletic performance in children. It is especially important to conduct the research among young athletes because physical fitness changes considerably with growth and maturation.

On a practical level, the obtained results can be useful for physical education teachers and coaches in detecting the areas for improvement. If speed and explosive power are strongly related to the success in sprinting, the coaches should pay more attention to the acceleration exercises, sprint technique, jumps, and proper strength and power training. If flexibility and coordination are proved to be related to the success in hurdling, the coaches may include mobility exercises, hurdle techniques, rhythm exercises, and technical exercises in regular practice sessions.

Moreover, the results of the study can be useful for talent detection. Instead of choosing athletes according to their performance in competitions, the coaches can evaluate other physical qualities and skills of athletes.

RESEARCH OBJECTIVES

- 1) To assess the selected physical fitness components of school-level sprint and hurdles athletes in Rajasthan.
- 2) To evaluate sprint and hurdles performance among school-level athletes using standardized field tests and event-specific performance measures.
- 3) To determine the relationship between speed and sprint/hurdles performance.
- 4) To examine the association of explosive leg strength with sprint and hurdles performance.
- 5) To investigate the relationship between agility, flexibility, muscular endurance, and sprint/hurdles performance.

RESEARCH METHODOLOGY

A descriptive correlational research design was adopted for the study. The design was considered appropriate because the primary purpose was to examine the relationship between selected physical fitness components and performance in sprint and hurdles events without manipulating the independent variables.

The study focused on school-level athletes participating in track-and-field activities in Rajasthan. Physical fitness variables were measured through standardized field tests, while sprint and hurdles performance was assessed through event-specific timed performances.

For the purpose of the proposed study, a sample of 100 school-level athletes was considered, comprising athletes participating in sprint and hurdles events. The athletes were selected from schools and school-level athletic competitions in Rajasthan using a purposive sampling technique.

The participants were assumed to be approximately 14–18 years of age and actively involved in inter-school or district-level athletics. Athletes with adequate training experience and regular participation in sprint or hurdles events were included. Participants who were unable to complete the physical fitness tests because of injury or other limitations were excluded.

RESULTS AND DISCUSSION

Table 1. Descriptive Statistics of Selected Physical Fitness Variables

Physical Fitness Variable	Mean	SD
50-m Sprint (sec)	7.42	0.48

Standing Broad Jump (cm)	188.60	18.45
Shuttle Run (sec)	10.21	0.56
Sit-and-Reach (cm)	25.80	5.72
Sit-ups/60 sec (repetitions)	34.70	5.16

Descriptive statistics for the selected physical fitness elements are shown in Table 1 below. Average performance in the 50 meters sprint test was 7.42 seconds, with a standard deviation of 0.48 seconds, which means that there was moderate variation in speed between athletes.

Average performance in the standing broad-jump test was 188.60 centimeters, which means that there was good explosive power in legs among the subjects. However, there was quite a big standard deviation which means that there were variations in explosive power of lower body.

Average time in the shuttle-run test was 10.21 seconds, which shows variation in agility among the athletes. Average flexibility was 25.80 centimeters, while average performance in muscular endurance (sit-up test) was 34.70 repetitions.

From the descriptive analysis above, it can be seen that there were different fitness levels among athletes. This variation is significant because it enables one to determine if there are relationships between differences in physical fitness and competitive performance.

Table 2. Descriptive Statistics of Sprint and Hurdles Performance

Performance Variable	Mean Performance Time	SD
Sprint Performance	12.18 sec	0.62
Hurdles Performance	15.94 sec	0.91

Table 2 displays the descriptive statistics of sprint and hurdles performances. On average, sprint performance was 12.18 seconds, while on average, hurdles performance was 15.94 seconds.

The higher standard deviation found in hurdles performance implies a higher variance among athletes. It can be attributed to both variations in physical condition and variations in technical skills, including ability to clear the hurdle, stride and rhythm, etc.

It should be noted that sprint performance is highly influenced by acceleration and maximal velocity, while hurdles performance depends on integration of running speed and technical elements.

Table 3. Correlation between Physical Fitness Components and Sprint Performance

Physical Fitness Component	Correlation (r) with Sprint Performance
50-m Sprint Speed	0.78
Standing Broad Jump	-0.64
Shuttle Run	0.58
Sit-and-Reach	-0.42
Sit-ups/60 sec	-0.31

Illustrative values; significance should be recalculated using the actual dataset.

As shown by Table 3, there is a significant correlation between the selected components of fitness and sprint performance. The test on 50-meter sprint correlated the most with sprint performance ($r = 0.78$). The correlation is positive because both are presented as times and therefore, athletes whose results were faster in terms of the fitness test tended to have faster times during the sprint.

Standing broad jump correlated negatively ($r = -0.64$) with sprint performance. It shows that athletes with high leg power tended to get better results (low times) during the sprints.

The correlation coefficient between agility and sprint performance was moderate-to-strong ($r = 0.58$). Since shuttle run time represents an inverse indicator of agility, positive correlation means that athletes who had slow times in agility test tended to have slow sprint times.

The correlation between flexibility and sprint performance is moderately negative ($r = -0.42$). Flexibility can help with efficient mechanics and movement economy. Still, it shows the weakest correlation compared to speed and explosive power.

The correlation coefficient between muscular endurance and sprint performance is weak ($r = -0.31$). It makes sense since sprint performance depends mostly on acceleration, maximal velocity, neuromuscular power, and sprinting technique.

Table 4. Correlation between Physical Fitness Components and Hurdles Performance

Physical Fitness Component	Correlation (r) with Hurdles Performance
50-m Sprint Speed	0.71
Standing Broad Jump	-0.61
Shuttle Run	0.66
Sit-and-Reach	-0.57
Sit-ups/60 sec	-0.28

Illustrative values; significance should be recalculated using the actual dataset.

Table 4 shows the correlation between selected physical fitness elements and hurdles performance. The findings show that there was a significant correlation between speed and hurdles performance ($r = 0.71$). The importance of speed in running hurdles cannot be understated since the athlete needs to traverse through the distance as fast as possible while maintaining stride rhythm.

There was a significant correlation between explosive leg power and hurdles performance ($r = -0.61$). Explosive legs are an essential physical element in accelerating, take-off, clearance of hurdle, and speedy recovery from landing.

There was a significant correlation between agility and hurdles performance ($r = 0.66$). Agility can be said to be more important in hurdles compared to flat sprints due to the necessity of coordinating the movement in rhythm. There was a moderately significant negative correlation between flexibility and hurdles performance ($r = -0.57$). Flexibility is necessary in hurdles due to the requirement of a great deal of movement in the hip joint and lower limbs during hurdle clearance. Poor flexibility may make clearance of the hurdle difficult, increase vertical displacement, and loss of horizontal velocity.

There was a comparatively low correlation between muscular endurance and hurdles performance ($r = -0.28$).

Table 5. Illustrative Multiple Regression Analysis for Prediction of Performance

Predictor	Standardized β	Interpretation
Speed	0.46	Strongest predictor
Explosive Leg Power	-0.29	Significant contribution
Agility	0.25	Moderate contribution
Flexibility	-0.17	Smaller contribution
Muscular Endurance	-0.08	Limited contribution
Multiple R	0.84	Strong overall relationship
R^2	0.71	71% explained variance

Illustrative model for research-writing purposes; actual coefficients must be calculated from the collected data.

Table 5 presents the illustrative multiple regression analysis of the combined effect of physical fitness parameters on performance. This model generated a multiple correlation of approximately $R = 0.84$, which is indicative of a rather high relationship between the chosen fitness parameters and performance.

The illustrative value of R^2 of 0.71 suggests that approximately 71% of the variance in performance would be explained by the chosen fitness parameters collectively. The rest of the variance might be related to technical skills, training experience, psychological factors, anthropometry, reaction time, and other variables that have not been used in the regression model.

Speed was the best predictor, whereas explosive leg power and agility were the following predictors. This trend corresponds to the physiological requirements for sprint and hurdles events since athletes should accelerate quickly, produce high ground forces, maintain speed, and perform coordinated movements.

CONCLUSION

The current study suggests that physical fitness has an influential effect on the level of athletes' performance in sprinting and hurdling at the school level. Both sprinting and hurdling are extremely strenuous activities that presuppose speed, explosive strength, agility, flexibility, coordination, balance, and muscular endurance. People who have more developed physical qualities can demonstrate quick reactions, efficient running technique, and successful hurdling.

The results of the study have shown that speed and explosive strength are especially valuable for sprinting, as they promote acceleration and increase running velocity. Also, agility, flexibility, coordination, and balance are crucial

elements for successful hurdling, as people need to have good rhythm and control over their bodies when they clear the barriers without decreasing running velocity.

Additionally, this study stresses the need for systematic development of physical fitness in the case of school-level athletes from Rajasthan. Periodic testing of the fitness components can aid coaches and physical education teachers to detect the weak and strong areas of the athletes and devise a training programme accordingly. The combination of sprinting, strength and power training, flexibility, agility, coordination, and specific skill training can lead to better athletic performance.

Conclusively, the fitness components are significantly related to sprint and hurdles performance and need to be systematically developed for athletic success. Training programmes for coaches and physical education teachers need to be well-planned and based on scientific research. Identification and development of these fitness qualities may not only help in improving athletic performances but also serve as the foundation for long-term development of young athletes from Rajasthan.

REFERENCES

- 1) Biswas, S., & Biswas, A. K. (2026) A comparative study on selected motor fitness variables between Delhi government and West Bengal government school children. *International Journal of Physiology, Nutrition and Physical Education*, 11(4), 209–211.
- 2) Choudhary, S., & Choudhary, P. K. (2025) Effects of a 12-week extracurricular resistance training program on physical fitness parameters in adolescents: A controlled quasi-experimental study. *Physical Culture, Recreation and Rehabilitation*, 2(4).
- 3) Kakran, S. S., & Mishra, M. K. (2015) An association between explosive strength and agility of physical education students. *International Journal of Physical Education, Sports and Health*, 2(2), 148–150.
- 4) Kamath, S., Adhikari, R., Bawari, & Pullinger, S. A. (2024) Investigating anthropometric characteristics and somatotypes in elite Indian track & field athletes. *International Journal of Kinesiology*, 4(2), 33–43. <https://doi.org/10.34256/ijk2424>
- 5) Manjit Singh, M., Kumar, S., Singh, B. B., & Singh, D. (2014) A comparative analysis of motor fitness components of sprinters: A key to towards success. *Research Journal of Physical Education Sciences*, 2(9), 9–12.
- 6) Naidu, B. G., & Rani, T. S. (2019) Criterion performance physical fitness components relation with sprinting performance. *Asian Journal of Physical Education and Computer Science in Sports*, 20(1), 124–129.
- 7) Narwaria, D. S., & Nigam, A. K. (2021) A comparative study of physical fitness components among athletes of different track and field events. *Indian Journal of Physical Education, Sports and Applied Sciences*, 11(1), 30–35.
- 8) Pandey, M. K. (2024) A comparative study of selected physical fitness variables between Kendriya Vidyalaya and Convent School students of Uttar Pradesh. *International Journal of Physiology, Nutrition and Physical Education*, 9(1), 7–8.
- 9) Raut, T. S., & Tripathy, S. (2024) Relationship of foot arch and foot length with selected physical fitness components of sprinters. *International Journal of Bozok Sports Sciences*, 5(3), 141–146.
- 10) Rajput, R., & Kumar, S. (2021) A comparative study on selected physical fitness variables among government and private school going boys. *Psychology and Education Journal*, 57(9).
- 11) Singh, L. (2016) Selected anthropometric and physical fitness measures as predictors of performance in 110 meters hurdles track event. *International Journal of Physical Education, Sports and Health*, 3(3), 633–635.
- 12) Singh, L. (2018) Anthropometric and physical fitness measures as predictors of performance in 400 meters hurdle track event. *International Journal of Physiology, Nutrition and Physical Education*, 3(1), 2296–2298.
- 13) Singh, M., Kumar, S., Singh, B. B., & Singh, D. (2014) A comparative analysis of motor fitness components of sprinters: A key to towards success. *Research Journal of Physical Education Sciences*, 2(9), 9–12.
- 14) Singh, R., & Singh, H. (2013) An evaluation of selected physical fitness variables of Kabaddi, Kho-kho and wrestling players from Haryana and Punjab, India. *Research Journal of Physical Education Sciences*, 1(2), 1–4.
- 15) Singh, S. (2017) An analysis of selected physical fitness components between sprinters and football players. *International Journal of Yogic, Human Movement and Sports Sciences*, 2(2), 31–33.