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Muscle Strength, Power and Functional Agility in Young Versus Mature Competitive Cricket Fast Bowlers: A Comparative Cross-Sectional Study

Bhoomika Singh[1], Megha Bhardwaj[2], Shubham Jha[3]
[1] *Postgraduate Student, Master of Physiotherapy (Sports), Department of Physiotherapy, Prakash Institute of Physiotherapy, Rehabilitation and Allied Medical Sciences, affiliated to Atal Bihari Vajpayee Medical University, Lucknow, Uttar Pradesh, India.*
[2,3] *Assistant Professor, Department of Physiotherapy, Prakash Institute of Physiotherapy, Rehabilitation and Allied Medical Sciences, affiliated to Atal Bihari Vajpayee Medical University, Lucknow, Uttar Pradesh, India.*

Abstract—**Background: Fast bowling is the most physically demanding role in cricket and depends on the coordinated contribution of lower limb power, trunk stability, upper limb strength and rapid multidirectional movement. Competitive fast bowlers continue to play well beyond the age at which peak neuromuscular capacity is usually reached, yet few studies have compared several physical performance domains simultaneously across age groups within this population.**
Objective: To compare lower body power and strength, upper body strength, shoulder, wrist and finger strength and power, core muscle strength and endurance, and functional agility between young and mature competitive cricket fast bowlers.
Methods: Thirty male competitive fast bowlers were recruited by purposive sampling from cricket academies, sports training centres, and university, district and state level teams. Participants were allocated by chronological age into a young group (20 to 30 years, n = 15) and a mature group (30 to 40 years, n = 15). After a standardised warm-up, all participants completed the Vertical Jump Test, Hex-Bar Deadlift, Bench Press, Bent-Over Row, Rotational Medicine Ball Throw, Hand Grip Strength Test, Bourbon Trunk Muscle Strength Test, Resistance Crunch Test and Illinois Agility Test in a fixed order with standardised rest intervals. Groups were compared using the independent samples t-test with significance set at $p < 0.05$.
Results: The two groups were comparable in height, body weight and body mass index. The young group performed better in vertical jump (48.6 ± 4.2 vs 42.1 ± 4.8 cm; p = 0.001), rotational medicine ball throw (12.4 ± 1.2 vs 11.1 ± 1.4 m; p = 0.011), Bourbon trunk test (78.4 ± 8.5 vs 70.2 ± 9.4 s; p = 0.018), resistance crunch (38.5 ± 4.1 vs 34.2 ± 4.8 repetitions; p = 0.013) and Illinois agility test (15.8 ± 0.9 vs 16.9 ± 1.1 s; p = 0.005). No significant between-group difference was found for hex-bar deadlift, bench press, bent-over row or hand grip strength (p > 0.05).
Conclusion: Explosive power, core performance and agility differed between young and mature competitive fast bowlers, whereas maximal strength did not. Physical profiling of fast bowlers should therefore include power, core and agility measures rather than maximal strength testing alone.

Index Terms—**Cricket; fast bowling; muscle strength; muscle power; agility; core endurance; athletic performance; sports physiotherapy**

I. INTRODUCTION

Cricket has changed considerably over the past three decades. Congested international calendars, shorter formats and franchise competitions have increased the physical load carried by players, and physical conditioning is now treated as a determinant of performance rather than a supporting activity. Within the sport, fast bowling imposes the greatest mechanical demand. A fast bowler generates high approach velocity, absorbs large ground reaction forces at front-foot contact, produces rapid trunk rotation and then decelerates, and repeats this sequence for prolonged spells while maintaining line, length and pace.

Force production during fast bowling follows a proximal to distal sequence through the kinetic chain. The lower limbs generate the initial impulse during the run-up and delivery stride, the pelvis and trunk transfer and amplify that force, and the shoulder girdle, forearm and hand deliver it to the ball. Deficits at any point in this chain reduce the efficiency of transfer and are compensated for elsewhere, which lowers ball release speed and increases mechanical stress on adjacent segments. Muscular strength provides the capacity to produce force, whereas power determines how quickly that force can be expressed, and both contribute to bowling performance in different ways.

Trunk musculature has a specific role in this population. During the delivery stride the trunk undergoes rapid flexion, lateral flexion and axial rotation while simultaneously resisting excessive motion, and the lumbar spine is loaded in compression and rotation at front-foot contact. Reduced trunk endurance alters movement mechanics and has been linked with lumbar stress injury in fast bowlers. Agility is also relevant, since bowlers field for the majority of a match and must accelerate, decelerate and change direction repeatedly after ball release.

Physical capacity is not static across a playing career. Skeletal muscle undergoes structural and functional change during adulthood that affects maximal force production, rate of force development, tendon stiffness and recovery, and these changes are typically expressed earlier in power than in maximal strength. Against this, longer competitive exposure brings refined technique, better movement economy and greater accumulated resistance training. Competitive fast bowlers between 20 and 30 years of age are generally close to peak neuromuscular capacity, while those between 30 and 40 years combine some age-related physiological change with substantially greater playing experience. How these opposing influences balance out across different physical qualities is not well established.

Existing research on cricket fast bowlers has largely examined single qualities in isolation, most often bowling velocity, lower limb power or shoulder mechanics, or has focused on injury epidemiology and workload. Comparatively few studies have assessed lower body power and strength, upper body strength, shoulder and grip performance, core strength and endurance, and functional agility together within the same cohort, and fewer still have compared these domains between age groups of competitive fast bowlers. This limits the ability of clinicians to judge which physical qualities require priority in older bowlers and which are retained.

The present study was therefore undertaken to compare selected physical performance characteristics between young (20 to 30 years) and mature (30 to 40 years) competitive cricket fast bowlers, with the aim of identifying which qualities differ with age and which are maintained.

II. MATERIALS AND METHODS

Study design and setting

A comparative cross-sectional study was conducted on competitive male cricket fast bowlers. Participants were recruited from cricket academies, sports training centres, university cricket teams, and district and state level cricket teams. All testing was carried out at a single centre under standardised environmental and procedural conditions during a defined study period.

Participants and eligibility criteria

Male competitive cricket fast bowlers aged between 20 and 40 years were eligible for inclusion. Participants were required to be actively engaged in competitive cricket, to have fast bowling as their primary playing role, to be able to understand and follow test instructions, and to be physically able to complete the test battery. Written informed consent was obtained from every participant before enrolment.

Participants were excluded if they had a current musculoskeletal injury that limited performance of the test battery, a recent significant injury of the upper limb, lower limb, shoulder, wrist, hand or spine, any neurological condition affecting strength, balance, coordination or agility, any cardiovascular or systemic condition contraindicating vigorous exercise, or recent surgery involving the musculoskeletal system. Participants who were unable to complete the protocol because of pain, discomfort or fatigue, who declined or withdrew consent, or who did not follow the standardised procedures were also excluded.

Sample size and group allocation

A total of 30 participants were recruited by purposive sampling and allocated to two equal groups on the basis of chronological age. Group A comprised 15 young fast bowlers aged 20 to 30 years and Group B comprised 15 mature fast bowlers aged 30 to 40 years. Allocation was not randomised, since the objective was to compare two naturally occurring age groups. The sample size followed the study protocol approved at the synopsis stage.

Procedure

Demographic and anthropometric data, including age, height, body weight and years of playing experience, were recorded before testing. Body mass index was calculated as weight in kilograms divided by the square of height in metres. Each participant then completed a standardised warm-up consisting of light jogging, dynamic stretching and joint mobility exercises.

All participants performed the test battery in the same predetermined order to control for the effect of fatigue, with three trials of each test and a two-minute rest interval between successive trials. The best of the three trials was recorded. Standardised verbal instructions were given before each test, the same equipment was used throughout, and adequate rest was allowed between different tests. Testing was discontinued for any participant reporting pain, dizziness or excessive fatigue. All values were entered onto a structured data collection sheet immediately after each assessment.

Outcome measures

Lower body power was assessed using the Vertical Jump Test performed by the Sargent method, with jump height recorded in centimetres. Lower body strength was assessed using the Hex-Bar Deadlift Test, with the maximum weight lifted recorded in kilograms.

Upper body strength was assessed using the Bench Press Test and the Bent-Over Row Test, with the maximum weight lifted recorded in kilograms for each. Shoulder, wrist and finger strength and power were assessed using the Rotational Medicine Ball Throw Test, recorded as throw distance in metres, and the Hand Grip Strength Test performed with a hand grip dynamometer and recorded in kilograms for each hand separately.

Core muscle strength was assessed using the Bourbon Trunk Muscle Strength Test, recorded as holding time in seconds, and core endurance was assessed using the Resistance Crunch Test, recorded as the number of repetitions completed. Functional agility was assessed using the Illinois Agility Test, with the completion time recorded in seconds; a lower time indicated better agility performance.

Statistical analysis

Data were entered and analysed using standard statistical software. Descriptive statistics were expressed as mean and standard deviation for all continuous variables. Between-group comparisons were made using the independent samples t-test. The mean difference with its 95% confidence interval and Cohen's d as a measure of effect size were calculated for each outcome; values of d of approximately 0.2, 0.5 and 0.8 were interpreted as small, moderate and large effects respectively. The level of statistical significance was set at $p < 0.05$.

Ethical considerations

The study was approved by the Institutional Ethics Committee of Prakash Institute of Physiotherapy, Rehabilitation and Allied Medical Sciences [approval number to be inserted]. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The purpose, procedures, potential benefits and possible risks were explained to each participant, and written informed consent was obtained before enrolment. Participation was voluntary and participants were free to withdraw at any stage.

III. RESULTS

Participant characteristics

All 30 recruited participants completed the full test battery and were included in the analysis. The two groups differed in age, as expected from the allocation criteria, and in years of competitive playing experience. Height, body weight and body mass index were comparable between the groups, and mean body mass index in both groups fell within the normal range. Baseline characteristics are presented in Table 1.

Table 1. Demographic and anthropometric characteristics of the participants (n = 30)

Variable	Group A: Young fast bowlers (n = 15)	Group B: Mature fast bowlers (n = 15)	Mean difference
Age (years)	24.5 ± 2.1	35.2 ± 2.8	-10.7
Height (cm)	178.4 ± 5.2	177.8 ± 4.9	0.6
Body weight (kg)	72.5 ± 6.1	74.1 ± 6.8	-1.6
Body mass index (kg/m²)	22.8 ± 1.8	23.4 ± 2.1	-0.6
Playing experience (years)	5.2 ± 1.4	12.8 ± 3.1	-7.6

Values are expressed as mean ± standard deviation.

Lower body power and strength

Vertical jump height was significantly greater in the young group than in the mature group (48.6 ± 4.2 cm vs 42.1 ± 4.8 cm; mean difference 6.5 cm, 95% CI 3.13 to 9.87; t = 3.98, p = 0.001), representing a large effect (d = 1.44). Hex-bar deadlift performance was higher in the young group but the difference did not reach statistical significance (125.4 ± 12.5 kg vs 118.2 ± 14.1 kg; mean difference 7.2 kg, 95% CI -2.77 to 17.17; t = 1.48, p = 0.149; d = 0.54).

Upper body strength

No significant between-group difference was observed for bench press performance (75.2 ± 8.4 kg vs 72.8 ± 9.1 kg; t = 0.75, p = 0.460; d = 0.27) or for bent-over row performance (68.5 ± 7.6 kg vs 66.2 ± 8.2 kg; t = 0.79, p = 0.435; d = 0.29). Both effect sizes were small.

Shoulder, wrist and finger strength and power

Rotational medicine ball throw distance was significantly greater in the young group (12.4 ± 1.2 m vs 11.1 ± 1.4 m; mean difference 1.3 m, 95% CI 0.32 to 2.28; t = 2.74, p = 0.011; d = 1.00). Hand grip strength was almost identical in the two groups and the difference was not significant (45.2 ± 4.5 kg vs 44.8 ± 4.9 kg; t = 0.23, p = 0.819; d = 0.09).

Core muscle strength and endurance

Holding time on the Bourbon Trunk Muscle Strength Test was significantly longer in the young group (78.4 ± 8.5 s vs 70.2 ± 9.4 s; mean difference 8.2 s, 95% CI 1.50 to 14.90; t = 2.52, p = 0.018; d = 0.92). The young group also completed significantly more repetitions on the Resistance Crunch Test (38.5 ± 4.1 vs 34.2 ± 4.8 repetitions; mean difference 4.3 repetitions, 95% CI 0.96 to 7.64; t = 2.67, p = 0.013; d = 0.96).

Functional agility

The young group completed the Illinois Agility Test in a significantly shorter time than the mature group (15.8 ± 0.9 s vs 16.9 ± 1.1 s; mean difference -1.1 s, 95% CI -1.85 to -0.35; t = 3.01, p = 0.005; d = 1.09), indicating better agility performance in the younger bowlers.

Summary of between-group comparisons

Of the nine performance measures assessed, five differed significantly between the groups and four did not. The significant differences involved vertical jump, rotational medicine ball throw, Bourbon trunk test, resistance crunch and Illinois agility test. The non-significant comparisons involved hex-bar deadlift, bench press, bent-over row and hand grip strength. The complete comparison is presented in Table 2, and the pattern of results by performance domain is summarised in Table 3.

Table 2. Comparison of physical performance measures between young and mature competitive cricket fast bowlers

Outcome measure	Young (n = 15)	Mature (n = 15)	Mean difference (95% CI)	t	p	d	Result
Vertical jump (cm)	48.6 ± 4.2	42.1 ± 4.8	6.50 (3.13, 9.87)	3.98	0.001	1.44	S
Hex-bar deadlift (kg)	125.4 ± 12.5	118.2 ± 14.1	7.20 (-2.77, 17.17)	1.48	0.149	0.54	NS

Outcome measure	Young (n = 15)	Mature (n = 15)	Mean difference (95% CI)	t	p	d	Result
Bench press (kg)	75.2 ± 8.4	72.8 ± 9.1	2.40 (-4.15, 8.95)	0.75	0.460	0.27	NS
Bent-over row (kg)	68.5 ± 7.6	66.2 ± 8.2	2.30 (-3.61, 8.21)	0.79	0.435	0.29	NS
Rotational medicine ball throw (m)	12.4 ± 1.2	11.1 ± 1.4	1.30 (0.32, 2.28)	2.74	0.011	1.00	S
Hand grip strength (kg)	45.2 ± 4.5	44.8 ± 4.9	0.40 (-3.12, 3.92)	0.23	0.819	0.09	NS
Bourbon trunk test (s)	78.4 ± 8.5	70.2 ± 9.4	8.20 (1.50, 14.90)	2.52	0.018	0.92	S
Resistance crunch (repetitions)	38.5 ± 4.1	34.2 ± 4.8	4.30 (0.96, 7.64)	2.67	0.013	0.96	S
Illinois agility test (s)	15.8 ± 0.9	16.9 ± 1.1	-1.10 (-1.85, -0.35)	3.01	0.005	1.09	S

Values are mean ± standard deviation. Mean difference is calculated as young minus mature. CI = confidence interval; d = Cohen's d; S = statistically significant; NS = not statistically significant. Significance was set at $p < 0.05$. For the Illinois agility test a lower time indicates better performance.

Table 3. Pattern of between-group differences by performance domain

Performance domain	Measures showing a significant difference	Measures showing no significant difference
Lower body	Vertical jump	Hex-bar deadlift
Upper body	None	Bench press, bent-over row
Shoulder, wrist and hand	Rotational medicine ball throw	Hand grip strength
Core	Bourbon trunk test, resistance crunch	None
Agility	Illinois agility test	None

In every significant comparison the young group performed better than the mature group.

IV. DISCUSSION

This study compared nine measures of physical performance between young and mature competitive cricket fast bowlers. The central finding is that the difference between the age groups was not uniform across physical qualities. Explosive power, core strength and endurance, and functional agility were all significantly better in the younger bowlers, while maximal strength of the lower limbs, upper limbs and hand was statistically comparable between the groups. Since both groups were similar in height, body weight and body mass index, these differences are unlikely to be explained by body size.

The dissociation between power and maximal strength is the most clinically relevant observation. Vertical jump height and rotational medicine ball throw distance, both of which depend on the rate at which force can be produced, showed large effects favouring the young group. Hex-bar deadlift, bench press and bent-over row, which reflect maximal force capacity, showed no significant difference and only small to moderate effects. This pattern is consistent with the wider literature on ageing in athletes, in which the rate of force development declines earlier and more steeply than maximal strength. Continued participation in resistance training appears to preserve maximal strength in mature bowlers, whereas the explosive component of muscle function is less well protected by strength training alone.

Hand grip strength was virtually identical between the groups, with the smallest effect size in the study. Grip strength reflects sustained isometric capacity of the forearm and intrinsic hand musculature rather than rapid force production, and is used repeatedly in cricket in both bowling and fielding. Its preservation in the mature group is therefore consistent with the same interpretation: qualities that depend on maximal or sustained force were retained, while those that depend on speed of force production were not.

Both measures of core performance favoured the young group, with large effects. This finding has practical significance because trunk strength and endurance influence the transfer of force between the lower and upper segments during the delivery stride and contribute to control of lumbar loading at front-foot contact. Reduced trunk endurance in mature bowlers may allow greater compensatory trunk motion during prolonged spells, which is relevant both to the maintenance of ball speed and to lumbar loading. Core conditioning is often treated as a supplementary component of training in cricket, and these results suggest that it warrants specific attention in bowlers in the older age band.

The young group was also significantly faster on the Illinois Agility Test, with a mean difference of 1.1 seconds. Agility depends on lower limb power, deceleration capacity, neuromuscular coordination and movement technique, and the finding is coherent with the vertical jump result, since both draw on rapid lower limb force production. The practical relevance extends beyond bowling itself, because fast bowlers spend most of a match fielding and are required to accelerate, decelerate and change direction repeatedly. Taken together, these findings argue against physical profiling of fast bowlers based on maximal strength testing alone. A bowler assessed only by deadlift, bench press and grip dynamometry would appear comparable across the age range studied here, and the differences in jump height, rotational power, trunk endurance and agility would not be detected. Assessment batteries used to screen and monitor competitive fast bowlers should therefore include explicit measures of power, core endurance and agility.

Clinical implications

For sports physiotherapists and strength and conditioning practitioners, the results support age-differentiated programming rather than a uniform conditioning prescription. Mature fast bowlers in this sample maintained maximal strength but showed reduced explosive and trunk performance, which suggests that programme content for this group should emphasise rate of force development, ballistic and plyometric loading, rotational power work and trunk endurance, while maintaining the existing resistance training that appears to be preserving maximal strength. Periodic reassessment of jump height, rotational throw distance, trunk endurance and agility time offers a practical way to monitor these qualities across a season.

Limitations

Several limitations should be considered when interpreting these findings. The sample was small, with 15 participants in each group, which limits statistical power; the non-significant difference in hex-bar deadlift had a moderate effect size and may represent a type II error rather than true equivalence. Participants were recruited by purposive sampling from a limited geographical area, so the findings cannot be generalised to all competitive fast bowlers. Only male bowlers aged 20 to 40 years were studied, excluding female bowlers, adolescents and bowlers above 40 years. The cross-sectional design allows comparison between age groups but cannot establish change within individuals over time, and the observed differences cannot be attributed to ageing alone. Individual differences in training history, current training load, recovery patterns and competitive exposure were recorded only as years of playing experience and were not otherwise controlled. Finally, bowling velocity, accuracy and injury history were not measured, so the relationship between the physical qualities assessed and actual bowling performance was not tested directly.

Recommendations for future research

Larger studies with adequate power, including bowlers from a wider range of competitive levels and a broader age range, would allow firmer conclusions, particularly regarding maximal strength. Longitudinal follow-up of individual bowlers would separate the effects of ageing from those of training history. Future work should also examine the association between these physical measures and objectively recorded ball release speed, bowling accuracy and injury incidence, and should evaluate whether targeted power, core and agility interventions alter the differences observed here.

V. CONCLUSION

Young competitive cricket fast bowlers aged 20 to 30 years demonstrated significantly better lower body explosive power, rotational shoulder power, core strength and endurance, and functional agility than mature fast bowlers aged 30 to 40 years, while maximal lower limb strength, upper limb strength and hand grip strength were comparable between the two groups. Age was therefore associated with differences in some physical qualities and not others. Comprehensive physical assessment of competitive fast bowlers should include measures of power, core performance and agility alongside maximal strength testing, and conditioning programmes for bowlers in the older age band should give specific attention to rate of force development, trunk endurance and agility.

VI. DECLARATIONS

Ethics approval and consent to participate

The study protocol was approved by the Institutional Ethics Committee of Prakash Institute of Physiotherapy, Rehabilitation and Allied Medical Sciences [approval number and date to be inserted]. Written informed consent was obtained from all participants prior to enrolment.

Consent for publication

Not applicable. No individually identifiable participant data are included in this manuscript.

Availability of data and materials

The datasets generated and analysed during the present study are available from the corresponding author on reasonable request.

Conflict of interest

The authors declare that they have no competing interests.

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Author contributions

BS conceptualised the study, collected the data, performed the analysis and prepared the initial draft of the manuscript. MB supervised the study, contributed to the design and methodology, and critically revised the manuscript. SJ contributed to the design, interpretation of the data and critical revision of the manuscript. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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REFERENCES

[1] Johnstone JA, Hughes G, Ford PA, Watson T, Mitchell ACS. The athletic profile of fast bowling in cricket: a review. J Strength Cond Res. 2014;28(5):1465-73.

[2] Bartlett RM, Stockill NP. The biomechanics of fast bowling in men's cricket: a review. Sports Biomech. 2019;18(2):130-51.

[3] Portus MR, Sinclair PJ, Burke ST, Moore DJA, Farhart PJ. Cricket fast bowling performance and technique and the influence of selected physical factors. J Sports Sci. 2000;18(12):999-1011.

[4] Petersen CJ, Pyne DB, Portus MR, Dawson BT. Kinematic and physical determinants of fast bowling performance in cricket. J Sci Med Sport. 2016;19(1):77-82.

[5] Worthington PJ, King MA, Ranson CA. Relationships between fast bowling technique and ball release speed in cricket. J Appl Biomech. 2013;29(1):78-84.

[6] Pote L, Christie CJ. Physiological and physical demands of fast bowling in cricket match play. J Sports Sci. 2017;35(14):1390-7.

[7] Noakes TD, Durandt JJ. Physiological requirements of cricket. J Sports Sci. 2000;18(12):919-29.
[8] Suchomel TJ, Nimphius S, Stone MH. The importance of muscular strength in athletic performance. Sports Med. 2016;46(10):1419-49.
[9] Mukandi A, Turner A, Ramprakash R. Strength and conditioning considerations for cricket fast bowlers. Strength Cond J. 2018;40(3):52-64.
[10] McMaster DT, Gill N, Cronin J. A brief review of strength and power training for professional cricket players. Strength Cond J. 2017;39(3):1-13.
[11] Harridge SDR, Lazarus NR. Physical activity, aging, and physiological function. Physiology (Bethesda). 2017;32(2):152-61.
[12] McGregor SJ, Hunter I. Age-related changes in explosive power and strength among athletes. J Strength Cond Res. 2019;33(4):980-8.
[13] Taylor KL, Cronin J, Gill ND. The effect of age and training experience on force-velocity profiles. J Strength Cond Res. 2019;33(10):2654-63.
[14] Behm DG, Andersen LL. The role of resistance training in youth and mature athletic populations. Eur J Appl Physiol. 2019;119(6):1263-78.
[15] Comfort P, Jones PA, Moir GL. Strength and power characteristics of elite athletes: current findings and applications. J Strength Cond Res. 2018;32(4):1145-58.
[16] Seitz LB, Haff GG. Factors modulating post-activation potentiation of jump, sprint and throw performance: a systematic review. Sports Med. 2016;46(2):231-40.
[17] Ghosalkar P, Nigam A, Saini R. Association between explosive power and agility among state-level cricketers. Int J Physiol Nutr Phys Educ. 2020;5(2):112-15.
[18] Thour A. Comparison of agility and flexibility between fast bowlers and batsmen in cricket. Int J Yogic Hum Mov Sports Sci. 2018;3(2):3153-5.
[19] Ramachandran S, Singh M, Connor JD, et al. Effects of training interventions on fast bowling performance: a systematic review and meta-analysis. Sports Med Open. 2022;8(1):45.
[20] Letter J, Dwyer D, Drinkwater EJ. Physical differences between faster and slower elite pace bowlers. J Strength Cond Res. 2022;36(5):1240-6.
[21] Crewe HC, Finch CF, Orchard JW, Newsham-West R. Fast bowling workload and the risk of injury in cricket. Br J Sports Med. 2018;52(4):230-6.
[22] Gabbett TJ. The training-injury prevention paradox: should athletes be training smarter and harder? Br J Sports Med. 2016;50(5):273-80.
[23] Duffield R, Carney M, Karppinen S. Match-play characteristics and physical performance profiles of fast bowlers. J Strength Cond Res. 2020;34(8):2210-18.
[24] Cummins C, Orr R, O'Connor H. The role of anthropometric and physical characteristics in cricket performance. J Sports Med. 2019; 2019:4583210.
[25] Pyne DB, Saunders PU. Fitness testing and physical profiling in team and individual sports. Int J Sports Physiol Perform. 2016;11(3):289-95.
[26] Weakley J, Till K, Read D. The effects of velocity-based training on strength and power performance. Sports Med. 2020;50(3):503-15.