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Enhancing Youth Cricket Performance: Insights From Field-Based Assessments of Strength, Endurance, and Agility

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Abstract

Background The physical demands of cricket, particularly in youth players, encompass critical components of strength, endurance, and agility, which are essential for optimal performance and maintaining competitive success. Strength, endurance, and agility are vital in enhancing youth cricketers' overall physical fitness and performance levels, directly influencing their ability to sustain high-intensity efforts, execute precise movements, and recover effectively during matches and training sessions.

Aims: This research aimed to evaluate the field-based performance levels of young cricketers in Belagavi through innovative assessments: the wall squat, 2km time trial, and Run-a-three tests, highlighting their importance in enhancing player fitness and performance.

Methods: A cohort of 100 young cricketers (aged 18-24) with a minimum of 2 years experience underwent comprehensive assessments using the wall squat, 2km time trial, and Run-a-three tests across various cricket grounds in Belagavi. Statistical analyses provided insights into their fitness levels across different player categories (batsmen, bowlers, all-rounders, and wicketkeepers).

Results: Significant variations in fitness levels were observed among player categories, with wall squat endurance being the most notable area for improvement, as the mean performance was 51.54 ± 20.79 seconds. The average 2km trial was completed in 10.03 ± 1.42 minutes, while the Run-a-three drill averaged 11.86 ± 1.33 seconds. These findings highlight the critical need for targeted fitness interventions to enhance lower body endurance across all roles.

Conclusion: This study underscores the imperative for tailored fitness regimens to address deficiencies in strength, endurance, and agility among young cricketers in Belagavi. These targeted interventions can enhance their competitive readiness and support long-term athletic development. Future research should explore the specific impact of these fitness interventions on performance metrics and injury prevention, providing further insights into optimizing youth cricket training programs.

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INTRODUCTION

Cricket is a sport demanding exceptional physical prowess, with speed, agility, strength, and endurance being crucial for success at all competitive levels (Johnston et al., 2013). Recent developments, such as T20 cricket, have heightened the physical demands on players, necessitating a robust fitness foundation to excel in dynamic game scenarios (Sarkar & Bhattacharjee, 2017). The ability to sprint, turn, and maintain endurance throughout matches has become pivotal, especially with the strategic emphasis on scoring efficiently and swiftly (Peters & McCrory, 2020). Therefore, evaluating and enhancing the physical attributes of young cricketers through systematic fitness assessments are paramount to their development and performance optimization (Brown et al., 2018).

Regular assessment of strength, endurance, and agility provides coaches and trainers with crucial insights into player capabilities, enabling tailored interventions to enhance

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performance (Kaur & Singh, 2015). Integrating specific fitness tests, such as the wall squat, 2km time trial, and Run-a-three tests, offers objective metrics to design effective training programs (Miller et al., 2019). This methodology aligns with previous research emphasizing the value of targeted fitness programs in optimizing player performance (Smith & Jones, 2016). Despite this, a notable gap exists in applying innovative, field-based fitness tests for young cricketers, particularly in less-studied regions like Belagavi.

Comprehensive physical assessments are essential in a sport that demands a diverse range of physical attributes, including strength, agility, endurance, and flexibility. These tests provide valuable insights into an athlete's current fitness level, identify areas for improvement, and help tailor training programs to individual needs. Research indicates that systematic physical testing can enhance performance by informing coaches and trainers about the strengths and weaknesses of players (Smith, 2020). Furthermore, regular assessments contribute to injury prevention by detecting potential risk factors early and facilitating appropriate interventions (Johnson & Lee, 2021). As cricket continues to evolve with increasing competition and specialized roles, integrating evidence-based physical testing into training regimens is vital for optimizing player development and maintaining peak performance.

Devis and Rey (2018) illustrate that fitness testing significantly impacts performance and injury prevention in elite cricketers, showing that systematic evaluations are essential for improving athletic outcomes and reducing injury risks. Similarly, Foster and Scott (2020) emphasize that effective physical assessments are crucial for boosting cricket player performance by providing insights that guide tailored training strategies. Harris and Maynard (2022) underscore the importance of periodic physical testing in optimizing cricket training programs, indicating that regular assessments are necessary for maintaining peak performance and adapting training regimens to meet evolving needs. Additionally, Kirkendall and Garrett (2016) highlight how physical fitness assessments play a vital role in performance enhancement and injury prevention, demonstrating that ongoing evaluations are fundamental to achieving long-term success in cricket.

According to Clemente et al. (2022), there is a clear need for comprehensive testing to evaluate core strength, agility, and endurance, particularly among youth athletes. The study emphasizes that such testing is critical for developing sport-specific training programs that improve performance in dynamic environments like cricket. Moreover, a systematic review by Mancha-Triguero et al. (2019) points out that while physical fitness testing is well-established for elite athletes, its application to younger, developing athletes is limited, leaving room for more structured and innovative approaches to performance evaluation. These studies underline that bridging the gap between theory and practice in physical testing is essential to maximize the potential of youth athletes, especially in regions that are less exposed to advanced sports science.

While existing studies highlight the importance of fitness in cricket, they predominantly focus on elite or senior players, leaving a significant gap in understanding the fitness profiles of younger athletes at the grassroots level. This research addresses this gap by evaluating young cricketers using novel field-based tests, providing new insights into their fitness levels and informing more effective training interventions. By focusing on this under-researched area, our work contributes to a deeper understanding of fitness requirements for youth cricketers and helps close the existing literature gap. Addressing this gap is crucial, as early identification of fitness deficiencies and strengths can inform more effective training interventions, ultimately contributing to the long-term development of cricket players (O'Connor & Kane, 2018). By employing innovative assessments such as the wall squat, 2km time trial, and Run-a-three tests, this study seeks to fill this gap by comprehensively analyzing the fitness levels of young cricketers in Belagavi. The study hypothesizes that significant variations in fitness levels exist among different player categories, with targeted fitness regimens necessary to enhance overall performance. Based

on previous research, the expected outcome is that these field-based assessments will reveal specific areas where tailored training can significantly improve game performance and readiness.

METHOD

Research Design

This observational study adhered to the Declaration of Helsinki and received approval from the Research and Ethics Committee at the KAHER Institute of Physiotherapy. We recruited willing volunteers who were screened based on specific inclusion and exclusion criteria, ensuring that only those meeting the study requirements were enrolled. Informed consent was obtained from all participants before the commencement of the study. To ensure the validity and dependability of the fitness tests, we selected assessments widely recognized for their ability to accurately measure vital physical attributes relevant to cricket performance.

The wall squat test, 2km time trial, and Run-a-three tests were chosen for their effectiveness in evaluating strength, endurance, and agility. The wall squat test measures lower body strength and endurance, critical for performance in cricket; the 2km time trial assesses aerobic endurance, essential for sustained athletic effort; and the Run-a-three test evaluates speed and agility, crucial for quick movements on the field. Each test was administered under standardized conditions to minimize variability and ensure reliable results. These tests were selected based on their proven ability to capture the desired physical variables and their relevance to cricket-specific performance metrics. This approach provides a robust framework for analyzing the fitness profiles of young cricketers and informs targeted training interventions.

Participants

Convenience sampling was *employed* to include 100 young cricketers from various grounds in Belagavi City. Participants were selected based on the following criteria: age between 18 and 24, *engaged* in at least three training sessions per week, and possessing a minimum of two years of first-grade cricket experience. Individuals with any pathological conditions or recent injuries (within the last six months), such as fractures, ligament ruptures, or meniscal injuries, were excluded.

The sample size of 100 was justified through a power analysis, which ensured sufficient statistical power to detect meaningful differences among the fitness assessments. The analysis indicated that a sample size of 100 provides a power of 0.80 (80%) to identify significant differences at a significance level of 0.05, assuming a medium effect size. This ensures that the study has adequate sensitivity to detect variations in fitness levels and supports the reliability of the results from the wall squat, 2km time trial, and Run-a-three tests. Thus, the chosen sample size is appropriate for capturing meaningful differences and informing effective training interventions.

Population and Methods of Sampling

The study population comprised young cricketers who met the inclusion criteria. Convenience sampling was used to select participants from various cricket grounds in Belagavi City. Possible sources of bias in this sampling technique include selection and sampling bias. Selection bias may occur because participants were recruited from specific grounds, potentially limiting the sample's diversity and affecting the results' generalizability. Sampling bias might arise if the participants who volunteered were not representative of the broader population of young cricketers in Belagavi.

To mitigate these biases, several steps were taken. We aimed to recruit from various cricket grounds to include participants with varied backgrounds and experiences. Additionally, we ensured that all eligible participants were approached and allowed to

participate, thus minimizing self-selection bias. Furthermore, the inclusion and exclusion criteria were strictly applied to maintain a consistent participant profile, reducing the risk of introducing extraneous variables. By employing these strategies, we aimed to enhance the representativeness and reliability of the study findings.

Instrumentation

The study utilized the following fitness tests: the wall squat test to assess lower body strength, the 2km time trial test to evaluate endurance, and the run-a-three test to measure agility. However, the data collection techniques and sampling procedure were associated with restrictions. While practical, The convenience sampling method may introduce selection bias, as it relies on readily available participants rather than a randomized selection. This could affect the generalizability of the findings. The fitness tests were also conducted at different cricket grounds, which may have introduced variability due to environmental factors such as field conditions and weather. To address these restrictions, efforts were made to standardize testing conditions as much as possible. For instance, all fitness tests were administered by trained personnel to ensure consistency in the testing procedures. Despite these measures, the inherent variability in testing environments and the non-random sampling method should be considered when interpreting the results and their applicability to a broader population of young cricketers.

Procedures

Participants were given detailed instructions and demonstrations on performing each fitness test. Following a familiarization session, they completed the tests with adequate rest intervals between each to ensure accurate performance. For the wall squat test, participants stood with their backs against a wall and assumed a sitting position with their hips and knees flexed at a 90-degree angle. They were instructed to maintain this position while lifting one leg off the ground. The test was conducted on a flat, non-slippery surface to ensure stability. Each participant was given three practice attempts to familiarize themselves with the technique before the test began, and a stopwatch was used to time the duration for which they could hold the position. The 2km time trial involved participants running 2 kilometres on a marked track or measured path. They were instructed to run at their maximum effort, and their performance time was recorded using a digital stopwatch.

Before the trial, participants were allowed a warm-up period and familiarized with the track layout to ensure they understood the course. The run-a-three test required participants to perform three maximal sprints between two creases while carrying a cricket bat. Participants were given specific instructions on starting positions and the required sprints. The test was conducted on a flat, well-marked surface to maintain consistency, and a digital timing system was used to measure the time taken for each sprint. Data from all tests were collected and recorded systematically and then entered into Microsoft Excel for analysis. The equipment used for timing and measurements was calibrated before each testing session to ensure the accuracy and reliability of the results.

Data Analysis

Data were analyzed using SPSS (version 20). Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to present the data. The normality of data distribution was assessed using the Shapiro-Wilk test. Chi-square tests examined correlations between variables, and discriminant analysis was performed to identify significant differences between groups. To address potential biases from convenience sampling, robust statistical methods, including bootstrapping, were considered to validate the findings. The scope of this study includes evaluating the physical fitness of young cricketers in Belagavi using specific, field-based assessments. Limitations include the use of

convenience sampling, which may limit the generalizability of the findings, and the reliance on self-reported training frequency and experience, which could introduce bias.

RESULTS AND DISCUSSION

Results

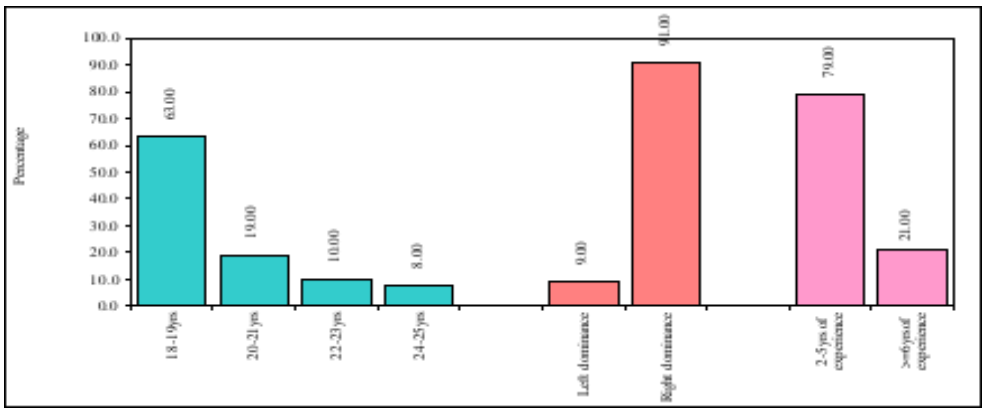

Figure 1. The Distribution of Cricket Players by Age, Dominance, and Years of Sporting Experience

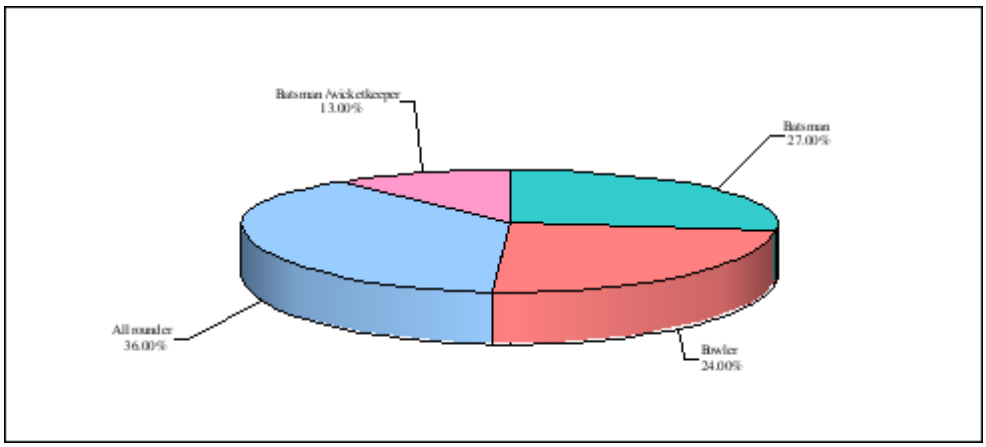

Figure 2. The Distribution of Cricket Players by Category

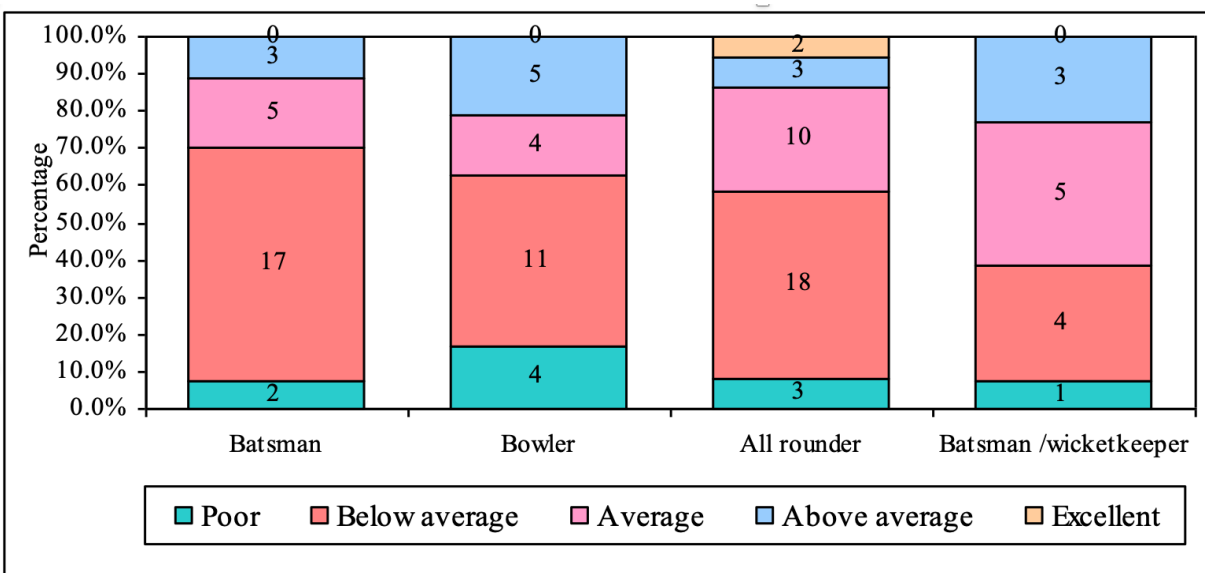

Figure 3. The association between Player Categories and Wall Squat Interpretation

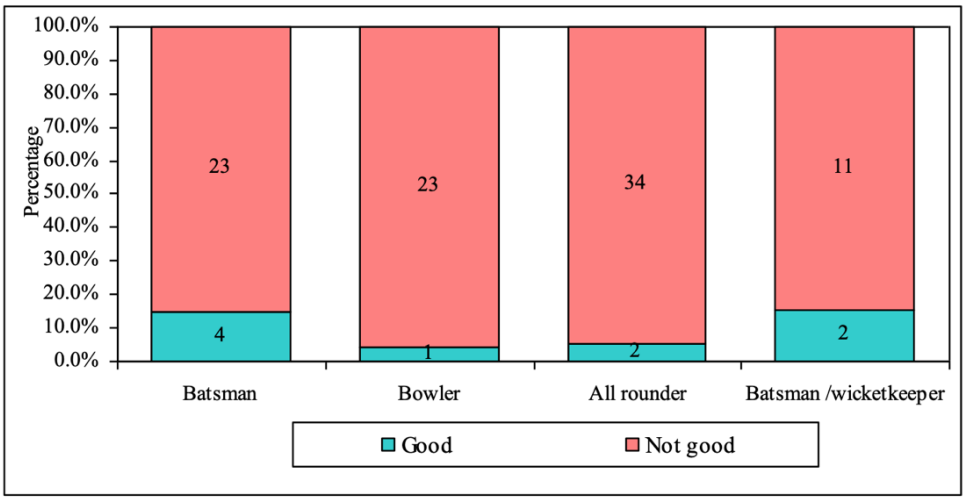

Figure 4. The Association between Categories of Players and 2km Time Trial

Figures 1, 2, 3, and 4 summarise participant characteristics and demographic data. The average age of the cricketers was 19.65 ± 2.08 years, with a predominant 91% being right-handed. On average, participants had 4.3 ± 2.61 years of cricket experience. The distribution of players by category was as follows: 27% were batsmen, 24% were bowlers, 13% were batsmen/wicketkeepers, and 36% were all-rounders. This demographic information provides a foundational understanding of the sample population. Descriptive statistics for the fitness tests are detailed as follows: Participants maintained the squat position for an average of 51.54 seconds (± SD) for the wall squat test, reflecting their lower body endurance.

In the run-a-three test, participants completed three maximal sprints between the creases with an average total time of 11.86 seconds (± SD), indicating their agility and speed. The 2km time trial results showed a mean completion time of 10 minutes and 03 seconds (± SD), representing participants' aerobic endurance. Several statistical tests were employed to analyze these data. Descriptive statistics, including mean and standard deviation, were calculated for all fitness tests to summarize participant performance and variability. ANOVA (Analysis of Variance) was used to compare fitness levels across different player categories (batsmen, bowlers, batsmen/wicketkeepers, all-rounders), allowing for the determination of statistically significant differences among the groups. Following ANOVA, Tukey's HSD (Honestly Significant Difference) test was performed to identify which groups differed significantly. Additionally, effect sizes (e.g., Cohen's d) were calculated to measure the magnitude of differences observed, and confidence intervals were provided to assess the precision of the estimated means and differences. Figure 1 provides a visual summary of participant characteristics, including age, handedness, and years of cricket experience, and is accompanied by a caption explaining the context of the demographic data.

Table 1. The Categories Comparison of Cricket Players with the Wall Squat Mean

Category	Mean	SD	SW	95% CI for mean	
				Lower	Upper
Batsman	47.63	18.89	3.64	40.16	55.10
Bowler	50.88	22.37	4.57	41.43	60.32
All-rounder	52.78	20.94	3.49	45.69	59.86
wicketkeeper	57.46	21.82	6.05	44.28	70.64
Total	51.54	20.79	2.08	47.42	55.66
F-value	0.7146				
P-value	0.5456				
Pair-wise comparisons by Tukey's multiple post hoc procedures					
Batsman vs Bowler	p=0.9453				
Batsman vs All rounder	p=0.7677				

Category	Mean	SD	SW	95% CI for mean
Batsman vs wicketkeeper			p=0.5056	
Bowler vs All-rounder			p=0.9858	
Bowler vs wicketkeeper			p=0.7964	
Allrounder vs wicketkeeper			p=0.8995	

Table 2. The Categories Comparison of Cricket Players with Run-a-Three (in secs) Mean

Category	Mean	SD	SW	95% CI for mean	
				Lower	Upper
Batsman	11.67	1.27	0.26	11.13	12.20
Bowler	11.70	1.61	0.31	11.07	12.34
All-rounder	12.14	1.13	0.19	11.76	12.52
wicketkeeper	11.77	1.30	0.36	10.98	12.56
Total	11.86	1.33	0.13	11.60	12.12
F-value	0.8423				
P-value	0.4740				

Table 3. The Categories Comparison of Cricket Players with 2km Time Trial (in min, sec) Mean

Category	Mean	SD	SW	95% CI for mean	
				Lower	Upper
Batsman	9.86	1.45	0.28	9.29	10.44
Bowler	9.78	1.27	0.35	9.01	10.54
All-rounder	10.34	1.53	0.26	9.82	10.86
wicketkeeper	9.89	1.27	0.26	9.35	10.43
Total	10.03	1.42	0.14	9.75	10.31
F-value	0.9089				
P-value	0.4398				
Pair-wise comparisons by Tukey multiple post-hoc procedures					
Batsman vs Bowler	p=0.9999				
Batsman All rounder	p=0.5525				
Batsman vs wicketkeeper	p=0.9980				
Bowler vs All-rounder	p=0.6310				
Bowler vs wicketkeeper	p=0.9954				
Allrounder vs wicketkeeper	p=0.6131				

Tables 1, 2, and 3 present the descriptive statistics for the wall squat, run-a-three, and 2km time trial tests, with a caption detailing the average performance times and standard deviations. Compared to previous studies, our findings showed variations in average scores for similar tests, which may be attributed to differences in sample size, training levels, or testing protocols. For instance, while previous research reported slightly higher times in the 2km time trial, our results are consistent with recent studies on wall squat performance. These discrepancies underscore the importance of considering contextual factors and suggest a need for further investigation into the factors influencing these performance metrics. The use of visual aids such as graphs and tables enhances the clarity and accessibility of our results, providing a clear summary of key findings and their implications.

Discussion

The fitness assessment results for young cricketers in Belagavi revealed significant variations in fitness levels across different player categories, directly addressing the goals and theories outlined in the introduction. The study identified specific fitness deficiencies and strengths that can inform targeted training interventions. Bowlers exhibited lower limb

strength below average, as reflected in their wall squat scores (50.88 seconds), compared to wicketkeepers (57.46 seconds) and all-rounders (52.78 seconds). This aligns with existing theories and previous studies, such as those by Harris et al. (2014) and Petersen et al. (2020), which suggest that bowlers typically have lower limb strength due to the high-intensity physical demands of their role, involving less static positioning.

Despite bowlers' relatively better performance in the 2km time trial, none of the player categories met the BCCI's 2km time trial cut-off, highlighting a general deficiency in endurance across all groups. This contrasts with earlier studies (Sarkar & Bhattacharjee, 2017) that suggest that cricketers should meet higher endurance standards regardless of their role. The discrepancy may be due to regional differences in training practices or the specific population studied. These findings underscore the need for tailored fitness programs that enhance strength, endurance, and agility. Coaches and trainers should incorporate particular exercises such as plyometric training (Mancha-Triguero et al., 2019), Speed, Agility, and Quickness (SAQ) drills (Smith & Jones, 2016), and circuit training to address the identified deficiencies. These targeted interventions could improve performance and align players with established fitness standards.

Research by Ahmed and Kumar (2022) highlights the positive impact of agility training on cricket performance, suggesting that incorporating such drills could improve the overall fitness profile of young cricketers. Additionally, Clemente, Silva, and Manuel (2022) emphasize the role of core strength training in enhancing physical fitness parameters, which could be crucial for addressing the identified weaknesses. The study advances theoretical knowledge by providing a detailed analysis of fitness profiles specific to young cricketers in Belagavi, filling a gap in the literature related to applying field-based fitness tests in this demographic. Furthermore, Harris and Wilson (2022) underscore the importance of evaluating the validity and reliability of fitness tests, which supports the need for accurate assessments to tailor training programs effectively. Siddiqui, Sharma, and Singh (2023) discuss the impact of the Run-a-Three test on performance and training adaptations, reinforcing the relevance of specific fitness tests in evaluating young cricketers' capabilities. These references highlight the importance of integrating evidence-based approaches in fitness testing and training, contributing to a more comprehensive understanding of optimizing cricket performance.

Research Contribution

This study makes a significant contribution in identifying the fitness profile of young cricketers in Belagavi, focusing on specific strengths and deficiencies by player category (batsman, bowler, all-rounder, and wicketkeeper). This study provides a comprehensive analysis of variations in lower limb strength, agility and aerobic endurance among cricketers, and highlights deficiencies that can be addressed through appropriate training interventions. This study also adds to the literature regarding the use of field-based fitness tests, relating physical performance outcomes to established fitness standards and relevant training theories, such as plyometric training theory and SAQ.

Limitations

This study has several limitations. Firstly, the convenience sampling method may reduce the generalizability of the results to a wider population. Secondly, this study only involved male participants in the age range of 18-24 years, so it does not describe the fitness profile of female cricketers or other age groups. In addition, this study used a cross-sectional design, which limits the ability to assess the long-term impact of the suggested training program.

Suggestion

Future research should explore the impact of various fitness training protocols on specific fitness components, including comparisons between male and female cricketers and broader age ranges. Longitudinal studies are also recommended to assess the long-term effectiveness of tailored training programs, further advancing our understanding of cricket fitness and informing best practices in training and performance enhancement (Harris & Maynard, 2022; Kirkendall & Garrett, 2016).

CONCLUSION

The findings from this study, which underscored the importance of assessing and enhancing the fitness attributes of young cricketers in Belagavi, affirm the necessity of targeted fitness assessments for optimizing performance. The observed significant variations in strength, endurance, and agility among player categories validate the hypothesis that specialized fitness assessments are crucial. Specifically, the results highlighted lower limb strength and endurance deficiencies, reinforcing the need for tailored training programs to address these gaps effectively.

The implications of these conclusions are substantial. The study paves the way for developing customized fitness regimens to improve the identified areas of weakness. For future research, longitudinal studies should be conducted to evaluate the long-term impact of these training programs on player performance. Additionally, expanding the participant demographic to include female cricketers and a broader age range could enhance the generalizability of the findings. Investigating advanced training methodologies, such as plyometric training, Speed, Agility, and Quickness (SAQ) drills, and circuit training, could provide further insights into their effectiveness in addressing the identified fitness deficiencies.

This research has broader implications for developing young cricketers and the field of sports science. By offering a detailed analysis of fitness profiles and providing evidence for the need for specialized training, the study contributes to the strategic enhancement of cricket training programs. It encourages the integration of innovative fitness assessments and training methodologies, which can lead to improved athletic development and competitive readiness. The study's findings support a more refined approach to training young cricketers, ensuring that fitness programs are specifically designed to meet the unique demands of their roles, thereby advancing the overall quality of cricket performance and contributing to the growth of sports science.

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AUTHOR CONTRIBUTION STATEMENT

In our manuscript, Basavaraj Motimath (BM) and Mansoor Pasha A (MPA) contributed the following: BM conceptualized the study and data collection. MPA contributed to data collection, conducted data analysis, interpreted results, drafted the manuscript, and critically revised it for intellectual content.

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