2024, Retos, 60, 841-849

In pursuit of precısion: assessing the impact of physical attributes on change of direction speed ın women's cricket

En busca de la precisión: evaluando el impacto de los atributos físicos en la velocidad de cambio de direccıón en el cricket femenino

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Abstract. Cricket demands a unique blend of athleticism, strategy, and precision, with physical fitness crucial in achieving sports excellence. While previous research has highlighted the importance of physical attributes such as speed, explosive power, and agility, the complex interactions between these factors about change of direction speed (CODS) still need to be better understood. This study investigated the relationship between CODS and key physical measures among female cricket players, providing insights into the factors influencing athletic performance in cricket. Thirty female cricketers (aged 16-26 years) participated in the study, undergoing assessments of CODS, speed, vertical jump, and broad jump. Statistical analyses, including Pearson correlation coefficients, multiple regression analysis, and ANOVA, were employed to examine the relationships between these physical measures and CODS. Reliability was deemed to be poor (<0.3), moderate (0.4<0.6), and strong (0.7≤) based on prior research. Significant positive correlations were observed between agility and acceleration and maximal speed tests, underscoring the importance of speed in cricket performance. Furthermore, moderate to strong negative correlations were found between CODS and explosive lower body power tests, highlighting the significance of lower body explosiveness for rapid directional shifts in cricket. Regression analysis revealed that speed, broad jump, and vertical jump collectively contributed to a strong predictive model for agility. Enhancing speed, explosive power, and agility through targeted training interventions could improve cricket players' on-field performance and competitive edge. Overall, this study contributes to understanding the complex interactions between physical attributes and cricket performance, offering practical insights for player development and strategic improvement.
Key Words: Change of Direction Speed; Physical Attributes; Explosive Power; Agility

Resumen. El cricket exige una combinación única de atletismo, estrategia y precisión, donde la condición física es crucial para alcanzar la excelencia deportiva. Aunque investigaciones previas han destacado la importancia de atributos físicos como la velocidad, la potencia explosiva y la agilidad, las complejas interacciones entre estos factores en relación con la velocidad de cambio de dirección (CODS) aún no se comprenden completamente. Objetivo: Este estudio investigó la relación entre CODS y medidas físicas clave entre jugadoras de cricket, proporcionando ideas sobre los factores que influyen en el rendimiento atlético en el cricket. Treinta jugadoras de cricket (de 16 a 26 años) participaron en el estudio, sometiéndose a evaluaciones de CODS, velocidad, salto vertical y salto horizontal. Se emplearon análisis estadísticos, incluidos coeficientes de correlación de Pearson, análisis de regresión múltiple y ANOVA, para examinar las relaciones entre estas medidas físicas y CODS. La fiabilidad se consideró baja (<0.3), moderada (0.4-0.6) y alta (≥0.7) según investigaciones previas. Se observaron correlaciones positivas significativas entre la agilidad y las pruebas de aceleración y velocidad máxima, subrayando la importancia de la velocidad en el rendimiento en cricket. Además, se encontraron correlaciones negativas moderadas a fuertes entre CODS y pruebas de potencia explosiva del tren inferior, destacando la relevancia de la explosividad del tren inferior para cambios rápidos de dirección en el cricket. El análisis de regresión reveló que la velocidad, el salto horizontal y el salto vertical contribuyeron colectivamente a un modelo predictivo sólido para la agilidad. Mejorar la velocidad, la potencia explosiva y la agilidad mediante intervenciones de entrenamiento específicas podría mejorar el rendimiento en el campo y la competitividad de los jugadores de cricket. En general, este estudio contribuye a la comprensión de las complejas interacciones entre los atributos físicos y el rendimiento en el cricket, ofreciendo ideas prácticas para el desarrollo de jugadores y la mejora estratégica.
Palabras clave: Velocidad de Cambio de Dirección; Atributos Físicos; Potencia Explosiva; Agilidad

Fecha recepción: 11-05-24. Fecha de aceptación: 27-08-24
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Introduction

Cricket is a sport that uniquely combines athleticism, strategy, and precision, offering a complex interplay of physical and tactical demands (Cooper, 2020; Simon & Smart, 1983). While much attention is given to batting strategies, bowling variations, and tactical manoeuvres, players' physical fitness remains a cornerstone of cricketing success (Jo-Anne, 2012). Among the various physical attributes critical to performance, the ability to change direction rapidly and efficiently—known as Change of Direction Speed (CODS)—is particularly crucial. This skill enables players to react swiftly to the unpredictable movements of the ball, making it essential for effective play (Simon & Smart, 1983).

Offensive capabilities in cricket, such as force production during batting and base running, heavily rely on several physical attributes (Houghton et al., 2011; Magrini et al., 2018). A fundamental element across sports is the ability to accelerate, decelerate, and change direction rapidly, a process encapsulated in CODS (Jones et al., 2009). In cricket, CODS is indispensable whether players run between wickets, adjust fielding positions, or execute defensive actions (Bishop et al., 2021; Kawahara et al., 2019). Proficient

CODS enhances reflexes and agility and improves a player's capacity to anticipate and respond to game dynamics (Dugdale et al., 2020; Houghton et al., 2011). Consequently, understanding the factors influencing COD performance is key to achieving peak physical performance and gaining a strategic advantage in cricket (Stretch et al., 1998; Thomas et al., 2018).

Recent research has underscored the importance of specific physical traits in enhancing cricket performance (Alfaro et al., 2024; Boby, 2023; Franks & Deutsch, 1973; Nugraha et al., 2017; Watson, 2014; Webster et al., 2022). These traits include CODS, overall speed, and explosive lower body power, as evidenced by performance in broad and vertical jumps (Petersen et al., 2011; Ranisavljev et al., 2020). These components of physical fitness are crucial for executing quick and effective movements on the field (Vickery et al., 2018). The interplay between speed and CODS is particularly significant, as it directly impacts a player's ability to respond quickly to the changing dynamics of the game (Dos'Santos et al., 2018). Speed is another critical aspect of a cricket player's skill set, influencing every facet of the game. From fast sprints between wickets to tracking down balls in the outfield, accelerating quickly and maintaining high speeds is vital for success (Bishop et al., 2021; Callaghan et al., 2014). Research has shown that faster players cover ground more efficiently and demonstrate superior hitting and fielding abilities, leading to tangible performance improvements for their teams.

In addition to speed, explosive power, as measured by broad and vertical jumps, significantly enhances a player's agility and overall performance on the field (Callaghan et al., 2014). Strong vertical jumps enable players to execute impressive fielding manoeuvres and aerial catches, while powerful broad jumps are crucial for dynamic movements such as batting runs or boundary-saving dives. These jumps indicate lower body explosiveness, reflecting an athlete's ability to generate maximum force quickly. Studies have established a strong association between explosive power and on-field performance, linking enhanced agility, reflexes, and general cricketing proficiency with improved jump performance (Foden et al., 2015; Holm et al., 2008). Therefore, incorporating jump training regimens into conditioning programs tailored for cricket players offers an opportunity to enhance their explosiveness and effectiveness during play.

Understanding the synergy between these physical attributes is essential for cricket players aiming to excel in the sport. To further explore the relationship between CODS and athletic abilities, it is important to consider both biomechanical and physiological aspects (Sanderson & Holton, 1980). For instance, an athlete's power and strength are closely correlated with their ability to decelerate and re-accelerate rapidly during changes in direction (Foden et al., 2015). Moreover, the coordination and timing required for precise jumps indicate an athlete's neuromuscular control and explosiveness (Holm et al., 2008). However, despite these general insights, more literature still needs to be on how these physical measures specifically relate to CODS in cricket, particularly among female players.

To address this gap, the present study investigates the relationship between CODS and key physical attributes among female cricket players, including speed, vertical jump, and broad jump. The study hypothesizes that improvements in these physical attributes will significantly contribute to enhanced CODS performance. By examining these relationships, the study seeks to provide evidence-based insights that can inform training practices to improve on-field performance and strategic advantages in cricket.

Materials and methods

Participants

The participants of this study included 30 female cricketers, aged between 16 and 26 years, who were actively involved in competitive cricket. The selection criteria required participants to have at least one year of experience playing in organized cricket competitions, such as leagues or tournaments at the club, academy, or regional levels. This ensured that all participants had sufficient skills and experience relevant to the study's objectives. Additionally, participants were required to be free from any injuries or conditions that could affect their performance during the tests.

Participants were recruited using a combination of purposive sampling and convenience sampling methods. Direct outreach was made to cricket clubs, academies, and regional teams to target individuals who were readily accessible and willing to participate in the study, which aligns with the principles of convenience sampling (Etikan, 2016). Additionally, purposive sampling was employed to ensure that the participants represented diverse skill levels and playing experiences. This approach was supplemented by advertisements posted in local sports facilities and on social media platforms frequented by athletes. The recruitment process was designed to increase the generalizability of the findings by incorporating a diverse range of female cricketers, thereby ensuring a more representative sample (Kawahara et al., 2019).

Before participation, all individuals were provided with detailed information about the study, including its objectives, procedures, and the nature of the assessments involved. Written informed consent was obtained from all participants, and ethical approval for the study was granted by the Research Ethics Committee of the Faculty of Health and Life Science, Daffodil International University (Ref: FHLS-REC/DIU/2024/0008), by the Declaration of Helsinki.

Sample Size Justification and Power Analysis

Given the study's exploratory nature, a sample size of 30 was selected based on similar studies in the field of sports science that have utilized small to moderate sample sizes to investigate physical performance attributes (Alfaro et al., 2024; Vickery et al., 2018). However, to ensure the adequacy of the sample size for detecting significant relationships between the key physical attributes and CODS, a post-hoc power analysis was conducted using G*Power software (Faul et al., 2007). This analysis confirmed that the study had sufficient power (0.80) to detect medium to large effect sizes (Cohen's $f^2 = 0.35$) with an alpha level of 0.05, consistent with the aims and scope of the research.

Data Collection Procedures and Timeline

Data collection occurred over two weeks, with participants attending two testing sessions spaced 48 hours apart to minimize the effects of fatigue. The first session assessed speed and agility, while the second measured strength and explosive power. All testing took place in the morning, between 8:00 AM and 11:00 AM, to control for variations in performance due to circadian rhythms (Winter et al., 2006).

Participants were instructed to avoid strenuous physical activity for 24 hours before each testing session. A standardized warm-up routine consisting of light jogging, dynamic stretching, and mobility exercises was administered prior to each test. The reliability and validity of the tests used in this study, including the 505 agility test, 25-meter sprint, vertical jump, and standing broad jump, have been established in previous research (Lockie et al., 2018; Petersen et al., 2011; Ranisavljev et al., 2020).

Reliability and Validity of Tests

The reliability of the physical performance tests was assessed using test-retest methods on a subset of 10 participants, with intra-class correlation coefficients (ICCs) calculated for each measure. The 505 agility test, 25-meter sprint, vertical jump, and standing broad jump demonstrated high reliability, with ICCs ranging from 0.85 to 0.92 (Baumgartner & Chung, 2001; Lockie et al., 2013). The validity of these tests in assessing speed, agility, and explosive power has been corroborated by multiple studies, further supporting their appropriateness for use in this research (Bishop et al., 2021; Foden et al., 2015).

Procedures

Data collection involved a combination of quantitative and qualitative methods. Participants completed a structured questionnaire to gather demographic information, including age, playing experience, and level of involvement in cricket. Additionally, semi-structured interviews were conducted with some participants to explore their perceptions, experiences, and challenges related to female cricket participation. The testing protocol spanned two consecutive days, focusing on a) speed and agility and b) strength and power. Each component was assessed separately to ensure precision and accuracy. All testing sessions were conducted at consistent times of the day to mitigate the potential influence of circadian rhythms on the results. Moreover, meticulous equipment calibration was performed according to the standardized procedures recommended by the manufacturers.

505 test

The 505-agility test was employed to evaluate the participants' Change of Direction Speed (COD). To measure the COD speed of cricket players, the 505 test has been suggested and utilized (Lockie et al., 2013; Winter et al., 2006). The test was set up using the previously approved procedures (Draper & Lancaster, 1985). Participants were instructed to accelerate to full speed over a 10-meter distance, then sprint 5 meters beyond an electronic timing system (TC-System, Brower Timing Systems, Draper, UT, USA), execute a 180-degree turn, and sprint back through the timing gate to complete the test. Each player completed two trials with both left and right leg leads, with the order of trials randomized. The fastest time achieved for each leg lead was recorded precisely to the nearest 0.10 seconds.

Speed

The speed assessment involved a 25-meter sprint to capture acceleration and maximum speed capabilities. Electronic timing gates were strategically positioned at intervals of 0m, 5m, 20m, and 25m to record running times accurately. The first 5m run measured acceleration, while the 20-25m run (flying 5m) indicated maximal speed ability. Each participant completed two trials, and the best time from each interval was recorded.

Vertical Jump Test

Participants underwent the vertical jump test to gauge explosive power in their lower body. Positioned adjacent to a wall, participants extended one arm overhead to achieve maximal reach. With feet flat on the ground and knees slightly flexed, participants executed a vertical jump, aiming to touch the highest point on the wall with the hand opposite the raised arm. The disparity between the standing reach height and the highest point touched during the jump was documented as the vertical jump height. Each participant completed three trials, and the most successful jump height was recorded for analysis.

Standing Broad Jump

The standing broad jump was utilized to assess lower body strength and power. Participants assumed a stance behind a designated starting line with feet positioned shoulder-width apart. Participants swung their arms backwards with a slight knee bend before explosively propelling themselves forward to achieve maximum distance. Upon landing, participants maintained balance with both feet together, and the distance from the starting line to the closest heel was measured as the standing broad jump distance. Three attempts were made, and the best jump distance was documented for analysis.

Statistical Analysis

The data analysis for this study involved using SPSS software version 27. Descriptive statistics, including mean and standard deviation, were utilized to summarize the central tendency and variability of change of direction (COD) performance, speed, broad jump distance, and vertical jump height within the sample. Additionally, the normality of the variables was assessed using the Shapiro-Wilk test to understand their distributional characteristics. We utilized Pearson correlation coefficients to thoroughly analyze and determine the relationships between COD and various physical measures. In addition to reporting p-values, effect sizes were calculated to provide a more comprehensive understanding of the strength of these relationships. Cohen's d was used to interpret the effect sizes for correlations, with small (0.1), medium (0.3), and large (0.5) effect sizes reported accordingly. Similarly, in the multiple regression analysis used to investigate the predictive value of speed, broad jump, and vertical jump on COD performance, effect sizes (f^2) were calculated for each predictor variable to quantify their contribution to the overall model.

Result

The study commenced with an analysis of descriptive statistics (Table 1) for all the athletic performance measures. Thirty athletes were assessed, generating a dataset that outlined each measure's minimum, maximum, mean, and standard deviation. The mean agility was recorded as 2.29s±0.245. 5 m sprint had a mean of 1.11s±0.124, while the 'Flying' 5 m test averaged at 0.70s ±0.091. Vertical jump heights averaged 33.15 ±1.20, and broad jump distances averaged 210.70 ±18.15. Additionally, normality tests revealed skewness and kurtosis values within acceptable ranges (-1.5 to +1.5), indicating approximately normal distributions for the variables assessed.

The Pearson correlation coefficients relationships (Table-2) indicated highly significant positive correlations between agility and both "5 m sprint" ($r = .892$, $p < .01$, Cohen's $d = 0.85$) and "Flying' 5 m" ($r = .936$, $p < .01$, Cohen's $d = 1.05$). This suggests that higher acceleration and maximal speed ability test scores are associated with better agility performance. Significant negative correlations were observed between agility and vertical jump ($r = -.415$, $p < .05$), as well as between agility and broad jump ($r = -.788$, $p < .01$), indicating that better performances in jump tests may not correspond to higher agility.

Table 1.
Descriptive Analysis

	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
505 agility test (s)	2.2913	.24513	.723	.427	-.332	.833
5 m sprint (s)	1.1125	.12397	.562	.427	1.290	.833
'Flying' 5 m (s)	.6997	.09129	.660	.427	-.733	.833
Vertical jump (cm)	33.1487	1.20195	-.442	.427	-.520	.833
Broad Jump (cm)	210.7000	18.15100	.453	.427	-.422	.833

Table 2.
Correlation Matrix of Agility Scores and Performance Metrics.

		Agility	5 m sprint	'Flying' 5 m	Vertical Jump	Broad Jump
505 test (Change of Direction)	Pearson Correlation	1	.892**	.936**	-.415*	-.788**
	P value		.000	.000	.023	.000
5 m sprint	Pearson Correlation	.892**	1	.840**	-.316	-.788**
	P value	.000		.000	.089	.000
'Flying' 5 m	Pearson Correlation	.936**	.840**	1	-.299	-.730**
	P value	.000	.000		.108	.000
Vertical Jump	Pearson Correlation	-.415*	-.316	-.299	1	.243
	P value	.023	.089	.108		.196
Broad Jump	Pearson Correlation	-.788**	-.788**	-.730**	.243	1
	P value	.000	.000	.000	.196	

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

In the regression analysis (Table 3), three models were presented. The first model with 'Flying' 5 m as the sole predictor resulted in an R Square of .875, implying that approximately 87.5% of the variance in agility could be accounted for by the 'Flying' 5 m test alone. By adding a 5 m sprint to the 'flying' 5m predictor, the second model increased the R Square value to .913. The final model included the vertical jump and noted a further increment in R Square to .927, suggesting that flying 5m, 5 m sprint, and vertical jump provided a strong predictive model for agility.

Table 3.
Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.936[a]	.875	.871	.08804	.875	196.795	1	28	.000	
2	.956[b]	.913	.907	.07475	.038	11.846	1	27	.002	
3	.963[c]	.927	.919	.06974	.014	5.020	1	26	.034	1.667

a. Predictors: (Constant), Flying 5m
b. Predictors: (Constant), Flying 5m, 5m sprint
c. Predictors: (Constant), Flying 5m, 5m sprint, Vertical Jump
d. Dependent Variable: Agility

ANOVA was also conducted to assess the significance of the regression models. All models showed an F significance at $p < .01$, confirming that the models were statistically significant (Table 4). This analysis confirmed the predictive capability of the flying 5m, 5m sprint, and vertical jump variables concerning agility. This was done using a stepwise method, where variables were automatically selected based on their statistical significance (Table 5).

Table 4.
Analysis of Variance (ANOVA) for Regression Models Predicting Agility Scores

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.525	1	1.525	196.795	.000[b]
	Residual	.217	28	.008		
	Total	1.743	29			
2	Regression	1.592	2	.796	142.436	.000[c]
	Residual	.151	27	.006		
	Total	1.743	29			
3	Regression	1.616	3	.539	110.770	.000[d]
	Residual	.126	26	.005		
	Total	1.743	29			

a. Dependent Variable: Agility
b. Predictors: (Constant), 'Flying' 5m
c. Predictors: (Constant), 'Flying' 5m, 5m sprint
d. Predictors: (Constant), 'Flying' 5m, 5m sprint, Vertical Jump

Coefficients from the regression model were particularly telling. The unstandardized coefficients offered quantifiable insights into how agility changes with each unit increase in the other measures. The standardized coefficients painted a picture of the relative importance of each predictor in the model. The significance of these coefficients was backed by t-statistics and associated p-values, reinforcing the variables' contribution to the model.

Table 5.
Variables Entered/Removed in Stepwise Regression Models Predicting Agility Scores.

Model	Variables Entered	Variables Removed	Method
1	Flying	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Speed	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	Vertical Jump	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: Agility

Table 6.
Coefficient Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.534	.126		4.224	.000	.275	.792					
	Flying	2.512	.179	.936	14.028	.000	2.145	2.879	.936	.936	.936	1.000	1.000
2	(Constant)	.310	.125		2.475	.020	.053	.567					
	Flying	1.703	.280	.634	6.078	.000	1.128	2.277	.936	.760	.344	.295	3.394
	Speed	.710	.206	.359	3.442	.002	.287	1.133	.892	.552	.195	.295	3.394
3	(Constant)	1.243	.432		2.875	.008	.354	2.131					
	Flying	1.664	.262	.620	6.353	.000	1.126	2.202	.936	.780	.336	.293	3.409
	Speed	.656	.194	.332	3.381	.002	.257	1.055	.892	.553	.179	.290	3.448
	Vertical Jump	-.025	.011	-.125	-2.241	.034	-.049	-.002	-.415	-.402	-.118	.896	1.116

a. Dependent Variable: Agility

Discussion

This study investigated the relationship between change of direction and key physical measures (speed, broad jump, and vertical jump) among cricket players. The findings provide valuable insights into the associations between physical attributes and CODS performance. However, it is important to note that these results are correlational and do not imply causation. While these associations suggest that certain physical attributes may contribute to improved CODS, further experimental or longitudinal research is needed to establish causal relationships. The results highlighted a significant correlation between CODS performance and leg explosive power, overall speed, and acceleration ability. The Pearson correlation coefficients in Table 2 revealed significant associations between agility and tests assessing physical capability. One notable finding is the highly significant positive correlations between agility (Change of Direction) and both the "5 m sprint" ($r = .892$, $p < .01$) and the "Flying 5 m" tests ($r = .936$, $p < .01$). Numerous research studies have investigated the correlation between the 505 test or a comparable 180º change of direction task and sprint performance. However, the results have varied. Some researchers discovered no link between the 505 test and sprint performance (Draper & Lancaster, 1985).

In contrast, others noted a significant association between a 15 m sprint and a similar 180º turn task (Graham-Smith and Pearson, 2005). The correlation between speed and CODS within our cohort underscores the necessity for cricket players to develop their acceleration and sprinting capabilities. Our findings are consistent with previous research that has also identified a positive relationship between sprinting ability and agility performance (Bezodis et al., 2019; Comfort et al., 2014; Holm et al., 2008; R. G. Lockie et al., 2015; Young et al., 2015). The results indicated that better acceleration and maximal speed test scores are linked to improved agility performance. In the context of cricket, speed has multiple dimensions; it goes beyond simple linear sprints and includes quick acceleration and deceleration, as well as the agility to quickly change directions in response to the unpredictability of the game (Bishop et al., 2021). Our findings suggest that athletes with superior acceleration and top-speed capabilities will likely demonstrate enhanced movement agility. Athletes who can rapidly accelerate and achieve high speeds will likely demonstrate enhanced agility, enabling them to change direction quickly and effectively during dynamic movements.

On the other hand, there was moderate negative reliability with vertical jump ($r = -.415$, $p < .05$) and strong ($r = -.788$, $p < .01$) reliability with broad jump (Table 2). This implies that players who exhibited greater explosive lower body power also performed better in CODS. These findings are in line with the study conducted by Alfaro et al. l (2024) as well as Jones et al. l (2009), who also reported that the correlation between leg explosive performance and agility was significant (Alfaro et al., 2024; Jones et al., 2009).

Players who exhibited greater speed and explosive lower body power also performed better in CODS (Banda et al., 2019; Lockie et al., 2018; R. Lockie et al., 2020; Tramel et al., 2019). This is not surprising, given that cricket is a sport that requires quick shifts in direction for fielding, batting, and running between the wickets (Bishop et al., 2021; Weldon, et al., 2021; Foden et al., 2015; Nimphius et al., 2016; Thomas et al., 2018). The importance of CODS in cricket cannot be understated, as it underlies many of the dynamic movements intrinsic to the game (Foden et al., 2015). The findings of our study concur with previous research indicating the importance of these attributes in cricket (Bishop et al., 2021; Foden et al., 2015; Jones et al., 2009; Rizal & Antoni, 2023; Thomas et al., 2018). Our study confirms that not only is CODS a determinant of a player's ability in the field and between the wickets, but it is also intricately linked with other performance markers, such as speed and the power generated in explosive jumps. The synergistic effect of these physical abilities is clear, although the interactions still need to be explained and understood. By examining these relationships, we can begin to pinpoint specific areas for athletic development that can lead to improved performance on the cricket pitch. This study has several limitations that should be acknowledged. Firstly, while sufficient for exploratory analysis, the sample size of 30 female cricketers limits the generalizability of the findings. The sample may not represent the broader population of female cricket players, particularly those from different regions or competitive levels. Secondly, the cross-sectional design of this study restricts the ability to infer causality between physical attributes and CODS performance. Longitudinal studies provide a better understanding of how these attributes develop over time and contribute to performance. Lastly, potential confounding factors such as training history, nutritional status, and psychological variables were not controlled for, which could have influenced the results.

Additionally, incorporating biomechanical assessments could offer a deeper evaluation of the factors influencing CODS. Moreover, our cross-sectional approach provides limited insight into the causal relationships between physical attributes and performance. Longitudinal studies would be beneficial in determining the causative effects.

Further studies are recommended to determine the most effective training interventions for enhancing these physical characteristics in cricket players. There is also scope for examining the role of these attributes in injury prevention, which would benefit long-term player health and career longevity.

Conclusion

To conclude, the present study demonstrates important insights into the complex relationship between the change of direction speed and physical attributes measurable among female cricket players. Our central hypothesis was that improved CODS performance would positively correlate with speed, vertical jump, and broad jump tests, reflecting critical physical attributes of athleticism in cricket. This hypothesis is supported by the significant correlations observed in the study, which align with established research in the field. However, the conclusions drawn should be interpreted with caution, given the study's limitations and the correlational nature of the findings. Further research, including intervention studies, is needed to confirm these relationships and explore their implications for training practices in cricket. Our major findings demonstrated direct relationships between CODS and several physical measures. More specifically, agility is significantly correlated with excellence in acceleration and maximally sprinting, which confirms the significance of the latter's constituent in cricket performance.

Moreover, CODS showed moderate to strong negative co-relation with major explosive lower body tests such as vertical jump and broad jump. This latter contrast reinforces the functional capacity of explosive capability in the lower parts for rapid directional shifts in cricket. The regression analysis reinforced these relationships, revealing that speed, broad jump, and vertical jump collectively contributed to a strong predictive model for agility.

This study offers valuable insights into the associations between key physical attributes—such as speed, vertical jump, and broad jump—and change of direction speed (CODS) in cricket players. However, it is important to acknowledge that these findings are based on correlational data, which limits the ability to draw definitive causal conclusions. The results suggest that while these attributes are associated with CODS, further experimental research is needed to determine whether targeted interventions can directly enhance these attributes and, consequently, CODS performance. Given the study's limitations, including the sample size and the specific population of female cricketers, the generalizability of these findings should be approached with caution. The study does, however, provide a foundation for future research. Specifically, longitudinal studies or randomized controlled trials would be beneficial to establish causality and explore how these physical attributes develop over time or through specific training regimens. The findings highlight the potential importance of including exercises that target speed, agility, and explosive power in training programs for practitioners. Nevertheless, practitioners should consider these results preliminary and be aware that the efficacy of such training interventions remains to be validated through further research. As the relationship between physical attributes and CODS becomes clearer, more specific and effective training protocols can be developed to enhance athletic performance in cricket.

In conclusion, while this study advances our understanding of the physical factors related to CODS, it also underscores the need for further research to establish causality and explore these findings' practical applications within training contexts.

Acknowledgement

We want to acknowledge the support and contributions of all individuals involved in this study. Their dedication and assistance were invaluable in completing this research project.

Conflict of interest

The authors declare that they have no conflicts of interest regarding the publication of this research.

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