



Effect of Circadian Rhythm On Speed And Strength Of Adult Cricket Players

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Abstract- The present study investigated the effect of circadian rhythm on speed and strength among adult cricket players of Chambal Division. A total of 20 male district-level players aged 18 ± 3 years were selected through purposive sampling. Speed was measured using a 50-meter sprint test and strength using a handgrip dynamometer at three different times of the day: morning, afternoon, and evening. The results showed that speed performance improved from morning ($M = 7.25$, $SD = 0.30$) to evening ($M = 6.90$, $SD = 0.25$), while strength increased from morning ($M = 42.5$, $SD = 4.2$) to evening ($M = 46.8$, $SD = 4.0$). Repeated measures ANOVA revealed a significant effect of time of day on speed, $F(2, 38) = 15.62$, $p < .001$, and strength, $F(2, 38) = 18.45$, $p < .001$. Multivariate analysis using Wilks' Lambda also indicated significant differences. The study concludes that circadian rhythm significantly influences performance, with peak speed and strength observed in the evening, suggesting that training schedules should align with optimal biological timing for enhanced performance.

Keywords- Circadian Rhythm, Speed Performance, Muscular Strength, Cricket Players, Time of Day, Handgrip Strength, Sprint Performance, Athletic Performance

I. Introduction

Circadian rhythm is an endogenous biological process that regulates the sleep-wake cycle and various physiological and behavioural functions within a 24-hour period. It is primarily controlled by the suprachiasmatic nucleus (SCN) located in the hypothalamus of the brain. This internal biological clock coordinates several bodily functions such as core body temperature, hormone secretion (e.g., cortisol and melatonin), metabolic activity, and neuromuscular efficiency. These physiological variables fluctuate throughout the day in a predictable pattern, thereby influencing human physical and cognitive performance.

In the context of sports performance, circadian rhythm plays a crucial role in determining the optimal timing for physical activities. Scientific evidence suggests that many physiological parameters related to athletic performance, including muscle strength, flexibility, reaction time, and anaerobic power, exhibit diurnal variation. Typically, body temperature peaks in the late afternoon and early evening, which is associated with improved muscle elasticity, nerve conduction velocity, and metabolic reactions. As a result, athletes tend to perform better during these hours compared to early morning sessions.

Cricket is a multifaceted sport that requires a combination of speed, strength, agility, and coordination. Fast bowling, sprinting between wickets, and fielding actions demand high levels of anaerobic power and muscular strength. Given that this performance components are influenced by circadian fluctuations, it is reasonable to



assume that cricket players' performance may vary depending on the time of day. Understanding these variations is particularly important for optimizing training schedules, enhancing match performance, and reducing the risk of injury.

II. Background of the Study

Over the past few decades, increasing attention has been given to the role of biological rhythms in sports science. Researchers have consistently demonstrated that athletic performance is not constant throughout the day but follows a circadian pattern. Studies have reported that peak performance in strength, power, and speed-related activities generally occurs in the late afternoon or evening, while lower performance levels are often observed in the early morning.

Despite the growing body of literature on circadian rhythm and athletic performance, most studies have been conducted in controlled laboratory settings or on athletes from Western populations. Limited research has specifically focused on cricket players, particularly in the Indian context. Furthermore, regional-level athletes, such as those from the Chambal Division, may have different lifestyle patterns, environmental conditions, and training routines that could influence their circadian rhythms and performance outcomes.

III. Research Gap

Although previous studies have established the influence of circadian rhythm on general athletic performance, there is a lack of research specifically examining its effect on key performance variables such as speed and strength in cricket players. Moreover, very few studies have focused on adult cricketers at the district or divisional level, especially from regions like the Chambal Division.

Additionally, most existing studies do not account for real-world training conditions and are often limited to isolated performance variables rather than sport-specific demands. There is also insufficient comparative analysis of performance at different times of the day within the same group of athletes.

Therefore, the present study aims to fill this gap by investigating the effect of circadian rhythm on speed and strength among adult cricket players of Chambal Division under practical field conditions. This research will contribute to a better understanding of time-of-day effects in cricket and provide valuable insights for coaches and athletes in optimizing training and performance strategies.

IV. Review of Literature

Several studies have extensively examined the impact of circadian rhythm on physical performance, consistently demonstrating that athletic abilities fluctuate across different times of the day due to underlying biological processes. Atkinson and Reilly (1996) reported that muscular strength and anaerobic performance exhibit significant diurnal variation, with peak levels typically occurring in the late afternoon or evening.



They suggested that these variations are closely linked to fluctuations in core body temperature and hormonal activity, which enhance muscle function and energy metabolism. Similarly, Reilly and Waterhouse (2009) found that body temperature and neuromuscular efficiency progressively increase throughout the day, leading to improved coordination, faster nerve conduction, and greater force production during later hours.

Drust et al. (2005) further emphasized that overall sports performance is significantly influenced by time-of-day, primarily due to endogenous biological rhythms that regulate physiological and metabolic processes. Their findings indicated that athletes tend to perform better in tasks requiring strength, speed, and power during the evening compared to the morning.

In addition, Teo et al. (2011) observed that strength and power output are higher in the late afternoon, attributing this enhancement to increased neural activation, improved motor unit recruitment, and greater muscle flexibility. They also highlighted that reduced muscle stiffness and enhanced joint mobility during this time contribute to superior performance outcomes.

Collectively, these studies provide strong evidence that circadian rhythm plays a crucial role in determining physical performance, with most performance-related variables reaching optimal levels during the late afternoon and evening due to favourable physiological and neuromuscular conditions.

V. Methodology

Research Design

A repeated measures experimental design was used.

Selection of Participants

A total of 20 male cricket players aged 18 ± 3 years were selected from the Chambal Division of Madhya Pradesh for the present study. The participants were chosen using a purposive sampling technique to ensure that only relevant and suitable subjects were included. All selected players were active district-level cricketers with regular participation in competitive matches and training sessions. Only those players who were physically fit and free from any injury or illness at the time of data collection were included in the study to maintain the accuracy and reliability of the results.

Selection of Variables

- **Independent Variable:** Time of day (Morning, Afternoon, Evening)
- **Dependent Variables:** Speed (50-meter sprint time in seconds)
Strength (Handgrip strength in kg)

Statistical Analysis

- Mean and Standard Deviation
- Repeated Measures ANOVA
- Significance level set at $p < 0.05$
- Software: SPSS (Version 26)



Results

Table 1: Descriptive Statistics of Speed Performance (N = 20)

Time of Day	Mean (M)	Std. Deviation (SD)	Std. Error Mean (SEM)	Skewness	Std. Error (Skewness)	Kurtosis	Std. Error (Kurtosis)
Morning	7.25	0.30	0.067	0.21	0.512	-0.68	0.992
Afternoon	7.10	0.28	0.063	0.15	0.512	-0.55	0.992
Evening	6.90	0.25	0.056	0.10	0.512	-0.60	0.992

The descriptive statistics for speed performance at different times of the day are presented in Table 1. The mean sprint time was highest in the morning ($M = 7.25$, $SD = 0.30$), followed by the afternoon ($M = 7.10$, $SD = 0.28$), and lowest in the evening ($M = 6.90$, $SD = 0.25$), indicating that participants performed better as the day progressed. Since lower sprint time reflects better performance, the results suggest that speed performance was optimal during the evening session.

The skewness values for morning (0.21), afternoon (0.15), and evening (0.10) were all close to zero, indicating that the data were approximately normally distributed. Additionally, kurtosis values ranged from -0.68 to -0.55, suggesting a slightly platykurtic distribution, but still within the acceptable limits for normality. The standard errors for skewness (0.512) and kurtosis (0.992) further support that there were no substantial deviations from normality.

Overall, these findings indicate that the assumption of normal distribution was met, and the data were suitable for further parametric statistical analysis.

Table 2: Descriptive Statistics of Strength Performance (N = 20)

Time of Day	Mean (M)	Std. Deviation (SD)	Std. Error Mean (SEM)	Skewness	Std. Error (Skewness)	Kurtosis	Std. Error (Kurtosis)
Morning	42.5	4.2	0.94	0.32	0.512	-0.48	0.992
Afternoon	44.0	4.5	1.01	0.27	0.512	-0.52	0.992
Evening	46.8	4.0	0.89	0.18	0.512	-0.44	0.992

The descriptive statistics for strength performance at different times of the day are presented in Table 2. The mean handgrip strength was lowest in the morning ($M = 42.5$, $SD = 4.2$), increased in the afternoon ($M = 44.0$, $SD = 4.5$), and reached its highest value in the evening ($M = 46.8$, $SD = 4.0$). This trend indicates a progressive improvement in strength performance across the day, with optimal performance observed during the evening session.



The skewness values for morning (0.32), afternoon (0.27), and evening (0.18) were all close to zero, indicating that the data were approximately normally distributed. Similarly, kurtosis values ranged from -0.52 to -0.44, suggesting a slightly platykurtic distribution but still within acceptable limits for normality. The standard errors for skewness (0.512) and kurtosis (0.992) further confirm that there were no significant deviations from normality.

Overall, these results suggest that the data meet the assumption of normal distribution and are appropriate for further parametric statistical analysis.

Table 3: Repeated Measures ANOVA for Speed and Strength (N = 20)
A. Within-Subjects Effects (Time of Day)

Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.(p-value)
SPEED	Time	1.248	2	0.624	15.62	0.000*
	Error (Time)	1.518	38	0.040		
STRENGTH	Time	182.40	2	91.20	18.45	0.000*
	Error (Time)	187.80	38	4.94		

The results of the repeated measures ANOVA for speed and strength performance across different times of the day are presented in Table 3. The analysis revealed a statistically significant effect of time of day on speed performance, $F(2, 38) = 15.62$, $p < .001$. This indicates that sprint performance differed significantly across the morning, afternoon, and evening sessions.

Similarly, a significant effect of time of day was observed for strength performance, $F(2, 38) = 18.45$, $p < .001$, suggesting that handgrip strength varied significantly at different times of the day.

The within-subjects variability for speed showed a mean square error of 0.040, while for strength it was 4.94, indicating the extent of variability not explained by the time factor. The significant F-values for both variables confirm that circadian rhythm has a meaningful impact on speed and strength performance.

Overall, these findings demonstrate that both speed and strength performances are significantly influenced by time of day, with variations likely attributed to circadian fluctuations in physiological and neuromuscular functions.

The multivariate analysis using Wilks' Lambda was conducted to examine the effect of time of day on speed and strength performance. The results indicated a statistically significant effect of time of day on speed performance, Wilks' $\Lambda = 0.45$, $F(2, 18) = 15.62$, $p < .001$. This suggests that there were significant differences in speed performance across the three-time intervals (morning, afternoon, and evening).



B. Multivariate Tests

Variable	Test (Wilks' Lambda)	Value	F	df (Hypothesis, Error)	Sig.
Speed	Wilks' Lambda	0.45	15.62	2, 18	0.000*
Strength	Wilks' Lambda	0.39	18.45	2, 18	0.000*

Similarly, the multivariate test for strength performance also revealed a significant effect of time of day, Wilks' $\Lambda = 0.39$, $F(2, 18) = 18.45$, $p < .001$, indicating that handgrip strength varied significantly across different times of the day.

The relatively lower values of Wilks' Lambda for both variables indicate a stronger effect of the independent variable (time of day) on the dependent variables. Overall, these findings confirm that circadian rhythm significantly influences both speed and strength performance among the participants.

VI. Discussion

The present study aimed to examine the effect of circadian rhythm on speed and strength performance among adult cricket players of Chambal Division. The findings clearly indicate that both speed and strength vary significantly across different times of the day, with peak performance observed in the evening, followed by the afternoon, and the lowest performance recorded in the morning. These results strongly support the hypothesis that circadian rhythm plays a significant role in influencing athletic performance.

The descriptive statistics for speed performance revealed a progressive improvement from morning ($M = 7.25$, $SD = 0.30$) to evening ($M = 6.90$, $SD = 0.25$), indicating that players performed fastest during the evening session. Since lower sprint time reflects better performance, this trend suggests that neuromuscular efficiency, reaction time, and muscle coordination improve as the day progresses. These findings are consistent with the study by Atkinson and Reilly (1996), who reported that anaerobic performance and sprint ability exhibit diurnal variation, with peak performance occurring in the late afternoon or evening. Similarly, the results align with the findings of Souissi et al. (2007), who observed that short-term maximal performance, including sprinting, is significantly higher in the evening due to optimal physiological conditions.

The improvement in speed performance can be attributed to circadian fluctuations in core body temperature. As reported by Reilly and Waterhouse (2009), body



temperature gradually increases throughout the day and reaches its peak in the late afternoon or evening. This rise in temperature enhances muscle elasticity, reduces stiffness, and increases the rate of metabolic reactions, thereby improving sprint performance. Furthermore, Drust et al. (2005) emphasized that time-of-day variations in physiological functions significantly influence sports performance, particularly in activities requiring speed and power. Therefore, the present findings strongly support the existing literature indicating that circadian rhythm positively affects speed performance during later hours of the day.

Similarly, the results for strength performance demonstrated a clear increasing trend from morning ($M = 42.5$, $SD = 4.2$) to evening ($M = 46.8$, $SD = 4.0$), indicating that handgrip strength was highest during the evening session. This suggests that muscular strength is significantly influenced by circadian rhythm. These findings are in agreement with Teo et al. (2011), who reported that strength and power output are greater in the late afternoon due to enhanced neural activation and motor unit recruitment. Additionally, Sedliak et al. (2009) found that muscle strength and hormonal responses vary across the day, with peak performance occurring in the afternoon and evening sessions.

The observed increase in strength performance may also be linked to hormonal variations, particularly testosterone levels, which play a crucial role in muscle force production. According to Chtourou and Souissi (2012), circadian rhythms influence hormonal secretion and neuromuscular coordination, leading to improved performance in strength-related activities during the evening. Moreover, Racinais et al. (2005) reported that muscle power and torque production are significantly higher later in the day, further supporting the findings of the present study.

The results of the repeated measures ANOVA further confirmed that the differences observed in speed and strength across different times of the day were statistically significant. The significant F-values for speed, $F(2, 38) = 15.62$, $p < .001$, and strength, $F(2, 38) = 18.45$, $p < .001$, indicate that time of day has a substantial effect on both performance variables. These findings are supported by Hill et al. (2014), who reported significant diurnal variations in both physical and cognitive performance, suggesting that athletes perform better during the evening due to optimal physiological readiness.

The multivariate analysis using Wilks' Lambda also demonstrated a significant effect of time of day on both speed and strength performance. The relatively low values of Wilks' Lambda (0.45 for speed and 0.39 for strength) indicate a strong influence of the independent variable (time of day) on performance outcomes. This is consistent with previous research, which has shown that circadian rhythm significantly affects multiple performance variables simultaneously.

Another important finding of the present study is that the data met the assumption of normality, as indicated by the skewness and kurtosis values within acceptable limits. This suggests that the observed variations in performance are systematic and can be reliably attributed to circadian influences rather than random variation.



From a practical perspective, the findings of this study have important implications for cricket training and performance. Since cricket involves repeated bouts of sprinting, throwing, and strength-based actions, scheduling training sessions during the evening may help maximize performance outcomes. Coaches can utilize this information to design training programs that align with the athletes' biological rhythms, thereby enhancing efficiency and reducing the risk of injury.

However, it is also important to consider that individual differences such as chronotype (morning-evening preference), sleep patterns, and environmental factors may influence circadian rhythm and performance. Future research should explore these factors in greater detail and include larger sample sizes to improve generalizability.

In conclusion, the findings of the present study are in strong agreement with previous literature and provide clear evidence that circadian rhythm significantly influences speed and strength performance in cricket players. The consistent improvement in performance from morning to evening highlights the importance of considering time-of-day effects in sports training and competition planning.

VII. Conclusion

The present study was conducted to examine the effect of circadian rhythm on speed and strength performance among adult cricket players of Chambal Division. Based on the findings of the study, it can be concluded that circadian rhythm has a significant influence on both speed and strength variables. The results clearly demonstrated that performance varied across different times of the day, with the highest level of performance recorded during the evening, followed by the afternoon, and the lowest in the morning.

The statistical analysis further confirmed that these differences were significant, indicating that time of day plays an important role in determining athletic performance. The improvement in performance during the evening hours may be attributed to physiological factors such as increased core body temperature, enhanced neuromuscular coordination, improved muscle flexibility, and optimal hormonal activity.

Thus, it can be concluded that circadian rhythm is an important determinant of physical performance in cricket players. The findings suggest that training and competition schedules should consider the time-of-day effect to maximize performance outcomes. Overall, the study provides valuable insights for coaches, trainers, and athletes in planning effective training programs aligned with the body's natural biological rhythms.

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