



Comparative analysis of batting performance versus bowling performance in box cricket players under pressure during second-innings death overs among players aged 18–26 years

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DOI: <https://doi.org/10.66856/ijasr.2026.11.4.11083>

Abstract

Background: Box cricket is a shortened and high-intensity modification of conventional cricket that is commonly played in confined spaces with fewer overs, fewer wickets, and restricted opportunities for recovery after an unsuccessful delivery or shot. These characteristics may increase the importance of performance during the final overs of the second innings, when the batting team is required to score rapidly and the bowling team must restrict scoring opportunities. Pressure Index (PI) provides a quantitative approach to describing situational pressure during limited-overs cricket.

Methods: A comparative experimental study was conducted among 36 male box cricket players aged 18–26 years from Surat. Participants had at least 6 months of box cricket experience. Convenient sampling was used, and observations were obtained from box cricket matches conducted over a 6-month study period. Analysis was performed using SPSS version 22. Normality was assessed using the Shapiro–Wilk test, and an independent-samples t-test was used to compare PI between batters and bowlers.

Results: The mean PI was 36.49 ± 36.21 for batters and 29.67 ± 11.53 for bowlers. Although the mean PI was numerically higher among batters, the difference was not statistically significant ($t = 0.762$, $df = 34$, $p = 0.452$). The large standard deviation among batters indicated substantial variability in pressure exposure. The Shapiro–Wilk test demonstrated non-normality for the batting PI distribution ($W = 0.60$, $p < 0.001$), whereas the bowling PI distribution was approximately normal ($W = 0.94$, $p = 0.274$).

Conclusion: Both batters and bowlers experienced substantial pressure during second-innings death overs in box cricket. Although batters demonstrated a higher mean PI, the between-group difference was not statistically significant. The findings suggest that pressure during death overs should be considered a dual-demand situation involving both run-scoring and run-restriction responsibilities.

Keywords: Box cricket, pressure index, batting performance, bowling performance, death overs, second innings, cricket, sports performance, young adults

Introduction

In the complicated bat-and-ball sport of cricket, technical, tactical, physical, and psychological aspects all affect performance. Performance in batting and bowling can change depending on the circumstances of the game, especially when players are under more pressure to succeed. As a result, in addition to traditional technical data, performance analysis in cricket has increasingly included contextual aspects ^[1]. In a limited-overs cricket match, the batting team must manage the loss of wickets while achieving a predetermined objective in a short number of deliveries during the second innings, creating a unique pressure situation. The bowling team must simultaneously prevent the opposition from reaching the goal. Methods for measuring pressure on bowling and batting teams during the second innings of limited-overs competitions have been suggested by earlier research ^[2]. Since then, the idea of a Pressure Index (PI) has been applied to measure the amount of pressure felt at various points throughout a cricket innings. The necessary run rate, the number of deliveries left, and the number of wickets in hand are some of the variables that might affect pressure ^[2, 3]. In order to measure pressure on the team batting second and to compare pressure at various points throughout a match, recent research has

improved pressure-index techniques for Twenty20 cricket ^[3].

Because there are fewer deliveries left and more tactical demands on bowlers and batsmen, the last overs of an innings—often referred to as the "death overs"—are especially crucial. Factors like bowling qualities, batter quality, wickets in hand, and match conditions can affect success during this period, according to research on death-over performance ^[4].

From a psychological standpoint, performance under pressure is also important. Pressure can affect one's ability to pay attention, make decisions, and use motor abilities that have been learnt. "Choking under pressure" is the term used to characterize the phenomena of performance decline under strain, which has been extensively documented in sports psychology ^[5, 6]. The impact of pressure and competitive anxiety on batting performance has also been studied in cricket-specific studies ^[7]. While pressure and performance in traditional cricket formats have been extensively studied, box cricket, especially the last three overs of the second innings, has received relatively less attention. The playing field, size, length of the match, and tactical requirements of box cricket are different from those of traditional cricket. As a result, conclusions drawn from traditional cricket may not

always apply to box cricket. Therefore, the current study compares how box cricket players between the ages of 18 and 26 perform when batting and bowling under pressure during the last three overs of the second innings. To measure pressure and make it easier to compare bowling and batting performance, a Pressure Index was employed. Thus, the study compares the batting and bowling performances of box cricket players between the ages of 18 and 26 during the second innings death overs.

Materials and Methodology

A comparative experimental study was conducted among box cricket players to compare batting and bowling performance under pressure during the final three overs of the second innings. The study population consisted of box cricket players participating in matches conducted at various locations in Surat, Gujarat. The study was carried out over a period of six months, and a total of 36 male box cricket players were recruited using a convenient sampling technique. Participants were eligible for inclusion if they were male, aged between 18 and 26 years, had at least six months of experience in box cricket, and participated as batters or bowlers during the relevant second-innings death-over phase. Participants were specifically observed during the final three overs of the second innings. Players were excluded if they had an active unmanaged musculoskeletal injury, reported episodes of migraine, dizziness, or headache, or had not participated in the final three overs of the second innings. Only matches that reached a formal conclusion, defined as a win or lose, were considered for analysis.

Outcome Measure

The primary outcome measure was the Pressure Index (PI). Pressure-index approaches have previously been developed to quantify pressure experienced by teams and players during the second innings of limited-overs cricket [2, 3]. The present study applied the Pressure Index framework specified in the study protocol to quantify pressure during the final three overs.

Results

Data were analysed using SPSS version 22. Descriptive statistics were expressed as mean, standard deviation, frequency and percentage, as appropriate. The Shapiro–Wilk test was used to assess the distribution of the Pressure Index in the two groups. Because the study compared Pressure Index values between independent groups, an independent-samples t-test was used according to the original statistical analysis plan. Statistical significance was considered at $p < 0.05$.

A total of 36 healthy male box cricket players aged 18–26 years were included in the study. The participants were divided into two groups: 18 batters and 18 bowlers. All participants fulfilled the predefined eligibility criteria and were observed during the final three overs of the second innings. Among

the batters, the majority of participants (78%) belonged to the 21–23-year age group, followed by 17% in the 18–20-year age group and 5% in the 24–26-year age group. Among the bowlers, 56% were aged 18–20 years, 39% were aged 21–23 years and 5% were aged 24–26 years.

Body Mass Index Characteristics

The BMI distribution differed descriptively between the two groups. Among batters, 47% were classified as overweight (BMI 25–29.9 kg/m²), 32% had normal BMI (18.5–24.9 kg/m²), 16% were underweight (<18.5 kg/m²), and 5% were classified as obese (>30 kg/m²). Among bowlers, 55% had normal BMI, 28% were overweight and 17% were underweight. No bowler was classified as obese. These findings indicate that both groups included participants across different BMI categories, although overweight status was more frequent among batters, whereas normal BMI was more common among bowlers.

Batting Performance

A mean run score of 22 ± 0 was found in the descriptive analysis of batting performance. A high scoring rate during the observed phase of play was indicated by the mean strike rate of 340.48 ± 26.20 . The stated boundary percentage was $100\% \pm 0$, meaning that boundary scoring was used to produce the recorded runs in the analyzed observations. These batting-performance statistics should be checked against the original score sheets or raw dataset prior to final journal submission because the source dataset used for this research comprises aggregate values rather than individual player-level observations.

Bowling Performance

The average number of wickets taken by bowlers was 0.50 ± 0.50 . 20.00 ± 4.00 runs per over was the average economy rate. The average percentage of dot balls was found to be $42\% \pm 0.083$. The economy-rate number suggests significant run surrender during the examined period, while the bowling outcomes show that the bowlers faced significant scoring pressure in the last overs.

Pressure Index

For each of the 36 individuals, the Pressure Index (PI) was computed. The total PI varied between 6.19 and 171.50. The average PI was 33.08 ± 26.71 . Significant inter-individual variation in pressure exposure is indicated by the comparatively high standard deviation when compared to the mean. Among hitters, this variation was especially noticeable. The Shapiro–Wilk test was used to evaluate the Pressure Index distribution independently for bowlers and batters. A statistically significant deviation from normalcy was shown by the Shapiro–Wilk value for batters, which was $W=0.60$ with 18 degrees of freedom and $p < 0.001$. The Shapiro–Wilk statistic for bowlers was $W=0.94$ with 18 degrees of freedom and $p=0.274$. As a result, there was no statistically significant deviation from normalcy in the Pressure Index distribution across bowlers.

Group	n	Shapiro–Wilk W	p value	Interpretation
Batters	18	0.60	<0.001	Non-normal distribution
Bowlers	18	0.94	0.274	Approximately normal distribution

The marked non-normality among batters is important when interpreting the subsequent between-group comparison. Comparison of Pressure Index Between Batters and Bowlers The mean Pressure Index among batters was 36.49 ± 36.21 , whereas the mean Pressure Index among bowlers was 29.67 ± 11.53 . Thus, the observed mean difference was 6.82 Pressure Index units, with the batter group demonstrating a numerically higher mean PI.

Group	n	Mean PI	SD	SE
Batters	18	36.49	36.21	8.54
Bowlers	18	29.67	11.53	2.72

Levene's test for equality of variances was not statistically significant ($F=2.390$, $p=0.131$). Therefore, there was no statistically significant evidence of unequal variances between the two groups.

Using the independent-samples t-test with equal variances assumed, the difference in Pressure Index between batters and bowlers was not statistically significant ($t=0.762$, $df=34$, $p=0.452$).

The corresponding Welch test also produced a non-significant result ($t=0.762$, $df=20.414$, $p=0.455$).

Therefore, although batters demonstrated a numerically higher mean Pressure Index than bowlers, the observed difference was not statistically significant.

Table 1: Comparison of Pressure Index Between Batters and Bowlers

Statistical parameter	Result
Mean PI – Batters	36.49 ± 36.21
Mean PI – Bowlers	29.67 ± 11.53
Mean difference	6.82
Levene's F	2.390
Levene's p	0.131
Independent t-test	0.762
df	34
p value	0.452
Welch t-test	0.762
Welch df	20.414
Welch p value	0.455

There was no statistically significant difference in pressure between bowling and batting in the major comparison. Thus, based on the stated independent-samples t-test, the null hypothesis that there was no difference in Pressure Index between hitters and bowlers cannot be rejected. Therefore, rather than indicating that batters were under noticeably more pressure, the numerical difference in mean PI should be seen as a descriptive finding. There is significantly more variation in the Pressure Index among hitters, as evidenced by the large standard deviation among batters (36.21) compared to bowlers (11.53). One extreme batting Pressure Index value of 171.50 was found in the original dataset. This number contributed to the significant variability in the batting group and was significantly greater than the other observations. According to the source, the batting mean PI dropped to roughly 28.55 ± 13.68 when this one observation was removed as part of an exploratory sensitivity study, while bowlers' mean PI was 29.67 ± 11.53 . The removal of the observation from the primary analysis should not be justified by this analysis, which should be viewed as exploratory. Unless a predetermined methodological explanation proves that the

observation is an invalid measurement, it should be kept. Pressure Index and Batting Performance Relationship There was very little association ($r=0.03$) between the Pressure Index and runs scored among batters. Additionally, there was a modest association ($r=0.15$) between PI and strike rate and a weak correlation ($r=0.10$) between PI and boundary percentage. These results suggest that there was no discernible linear link between the recorded batting-performance markers and the pressure situation's size within this sample. Crucially, the source dataset did not include p values for these associations. As a result, the correlations should be characterized as observed relationships, and without access to the raw participant-level data, no assertion about their statistical significance should be made. The connection between bowling performance and the pressure index PI showed a moderately positive connection ($r=0.44$) with economy rate among bowlers. Additionally, PI showed a moderately negative connection ($r=-0.36$) with dot-ball %. There was very little connection ($r=0.04$) between PI and wickets taken. Consequently, there was no clear linear correlation between PI and wickets taken, although higher PI values were descriptively linked to better economy rates and smaller proportions of dot balls. Once more, the statistical significance of these relationships cannot be determined from the given aggregate data since the source does not supply p values or confidence intervals for them. DISCUSSION: In this study, 36 male box cricket players between the ages of 18 and 26 had their batting and bowling Pressure Index values evaluated over the last three overs of the second innings. The main conclusion was that batters had a numerically higher mean Pressure Index (36.49 ± 36.21) than bowlers (29.67 ± 11.53), but this difference was not statistically significant ($p=0.452$). Therefore, rather than showing that batting was noticeably more stressful than bowling, the result should be read as evidence of statistically equivalent pressure levels between the two groups. The pressure to reach a target in a limited number of deliveries while keeping wickets affects the second innings of limited-overs cricket. In second-innings limited-overs cricket, Bhattacharjee and Lemmer created pressure metrics for bowling and batting and suggested that pressure might be measured based on the conditions of the match and the resources at hand ^[1]. A pressure measure for T20 international cricket was created more recently by Mallawa Araghchi *et al.* ^[2]. This index considers the evolving relationship between scoring requirements and resources remaining throughout the second innings. These methods offer a theoretical framework for analyzing pressure in shorter cricket formats. The current study applies this idea to box cricket, where innings are shorter and individual pitches may have greater effects. However, the results should be interpreted mainly as an application of the study's specified Pressure Index rather than as validation of a new pressure instrument because the current study used a box-cricket sample and the available dataset does not provide enough methodological detail to independently validate the PI calculation.

A significant descriptive finding is that batters had a higher standard deviation (36.21) than bowlers (11.53). The hitting group's PI values showed significant variability, indicating that each batter's exposure to pressure was different. This is in line with the general idea that pressure during a run chase varies depending on the target, wickets, necessary scoring

rate, and number of deliveries left ^[1, 2]. The batting group's variability was further exacerbated by the extraordinary PI observation of 171.50. The mean batting PI dropped to 28.55 ± 13.68 when this observation was analyzed independently. The apparent difference in group averages was sensitive to an extreme observation, according to this exploratory study. As a result, when characterizing pressure in small samples, the median and distribution of PI may offer more information than the arithmetic mean. Increased performance and tactical demands are hallmarks of the death-over phase. Bowling length, bowling line, batter quality, and wickets in hand were all linked to runs conceded during the death period of international men's 50-over cricket, according to Jamil *et al.*'s analysis of 3,767 deliveries ^[3]. Their results show that the technical aspects of play and the match context have a significant impact on performance during the dying phase. In the current study, PI had a moderately negative association with dot-ball % ($r=-0.36$) and a moderately positive correlation with bowlers' economy rate ($r=0.44$). From a descriptive standpoint, this implies that circumstances linked to increased pressure might be accompanied by higher run concession and fewer dot-ball opportunities. However, without the appropriate p values or confidence intervals, these correlations cannot be deemed statistically significant. In this tiny sample, pressure exposure did not appear to have a clear linear link with wicket-taking, as evidenced by the weak correlation ($r=0.04$) between PI and wickets taken. Wicket-taking may not accurately reflect the pressure encountered during a specific over or match situation because it is influenced by a variety of technical and contextual factors. PI and runs ($r=0.03$), strike rate ($r=0.15$), and boundary percentage ($r=0.10$) among hitters showed weak relationships. This implies that the chosen batting results in the current sample did not show a consistent linear connection with increased pressure exposure. Therefore, pressure and performance should be viewed as linked but different constructs: runs, strike rate, and boundaries describe performance results, while PI represents the match scenario or pressure exposure. From a psychological standpoint, pressure can affect decision-making, attentional control, and the performance of skilled motor behaviours. However, psychological concepts like anxiety, perceived pressure, and attentional control were not directly measured in this study. As a result, the observed PI values should not be used to directly infer psychological mechanisms. Overall, the current findings show that both batsmen and bowlers are under pressure during the last three overs of the second innings. However, there was no discernible difference between the two groups according to the statistical comparison. Larger samples, numerous matches, participant-level data, and statistical techniques suitable for non-normal distributions should all be used in future research.

Conclusion

The current study examined the Pressure Index values of bowlers and batters in the last three overs of the second innings among box cricket players between the ages of 18 and 26. The average Pressure Index for batters was 36.49 ± 36.21 , while the average for bowlers was 29.67 ± 11.53 .

Despite the fact that batters' mean PI was numerically greater, the difference was not statistically significant ($t=0.762$, $df=34$, $p=0.452$). The idea that hitters were under far more pressure than bowlers is therefore not supported by the data. Rather, the findings show statistically similar pressure levels for the two playing roles, with batters exhibiting more variation in pressure exposure. The correlation results also indicate that, among bowlers, PI had moderate descriptive connections with economy rate and dot-ball %, but only weak relationships with batting outcomes. Larger samples and participant-level data are needed to validate these findings.

Limitations

The study faced notable limitations. With only 36 participants recruited through convenience sampling, generalizability is restricted. The narrow inclusion of male players aged 18–26 years in box cricket at Surat further limits scope. Statistical issues included a non-normal batting PI distribution, an extreme observation skewing mean and variance, and absence of participant-level raw data, p values, and confidence intervals for correlations. Finally, the reliability and validity of the CRICHEREOS tool must be verified against original validation sources before publication.

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