



A Study on Mental toughness Dimensions of Cricket Players at Different Level of Competition based on the Seven-Factor Model

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Abstract

Background: Mental toughness refers to the collection of psychological factor that is essential for proper functioning of mind. Cricket is considered a mental game among elite level performers. Seven-factor model is a widely used measure of mental toughness dimensions.

Objective: Our objective was analysis of specific psychological characteristics of cricket players at district, state and national levels with the help of Seven-Factor Model (SFM).

Material and Method: In this study, 120 male subjects (60 Batsmen and 60 Pace bowlers) were selected from various sports academies/training center of India. Psychological Performance Inventory (PPI-42) was utilized to measure mental toughness dimensions. One-way MANOVAs (Multivariate Analysis of Variance) were used to compare the difference among psychological variables at different levels of batsmen and pace bowlers.

Results: National level batsmen scored high in self-confidence as compared to district level (MD= 3.15; $p<0.05$); and state level (MD= 1.35; $p>0.05$) batsmen. National level pace bowlers scored high in negative energy control (MD=3.75; $p<0.05$) as compared to district level pace bowlers. National level pace bowlers scored high in attentional control (MD= 4.05; $p<0.05$) and district level (MD= 3.35; $p<0.05$) pace bowlers. National level batsmen showed high visual/imagery control (MD=2.85; $p<0.05$) as compared to district as well as state level batsmen. Different levels of Pace bowlers and batsmen did not differ significantly on positive energy control and attitude control.

Conclusion: To our knowledge, this is the first study to characterize mental toughness traits of cricket players at different levels of competition based on the dimensions of Seven Factor Model (SFM). Our study indicates that certain mental toughness traits accompany cricket players at different levels of participation (District, State, and National level). National level pace bowlers exhibited greater negative energy control, attentional control and motivational level whereas national level batsmen showed greater self-confidence, negative energy control, visual/imagery control, and performance attitude control as compared to inferior levels of participation. As the game of cricket requires a variety of ways to fully define the concept of "Form", other aspects of mental strength such as focus, arousal control, positive self-talk etc. training features that should focus on talent identification and cricket coaching.

Keywords: Cricket; Seven-Factor Model (SFM); PPI-42.

Introduction

Cricket is a popular team game based on many Commonwealth countries. In the past, it was only played at a certain time (winter in Asian countries and in summer in western countries). But the game has gained so much popularity over the past few decades that it is now being played all year round. Mental toughness refers to the collection of psychological factor that is essential for proper functioning. Athletes, coaches, and sports psychologists have implicated mental toughness as one of the most important psychological symptoms associated with athletic success.

The current game of cricket also depended on the ability of mental toughness of the players.

Once mental toughness was developed, three measures were considered to maintain this structure: the desire and motivation for unsatisfied and incorporated success, a support network involving sports and non-sports personnel, and effective use of basic and advanced mental skills.

The Seven-Factor model is a widely used method of assessing mental toughness. The seven-factor model is very helpful in assessing the characteristics of mental toughness among athletes at different levels of success mentally strong athlete's use their best strength during play when the situation is tense. Factors that build resilience are self-confidence, the ability to control fear, anger and frustration, concentration, positive image, patience to achieve certain things, and control the mood in sequence.

Therefore, our purpose was to investigate the difference in mental toughness traits at different levels of pace bowlers and batsmen (District, State and National level).

Methods & Materials

Participants

A total of 120 male cricketers (60 batsmen & 60 pace bowlers) aged 18-25 years were deliberately selected from various sports academies / training centers in India. According to the aim of the study, 20 participants were selected from three participation levels (district, state and national) in the category of batsmen and pace bowlers.

Variables

In this study, we used 42-item Psychological Performance Inventory (PPI-42), originally developed by James E. Loehr (Loehr 1982). This psychological inventory measures seven dimensions of mental toughness: self-confidence, negative energy control, attention control, visual/imagery control, motivational level, positive energy level, attitude control

Test administration

All cricketers were given appropriate instructions regarding the procedure for filing their response in PPI-42. Before filling out the questionnaire, the test administrator thoroughly explained each item in PPI-42 and responded to the participants' doubts if any.

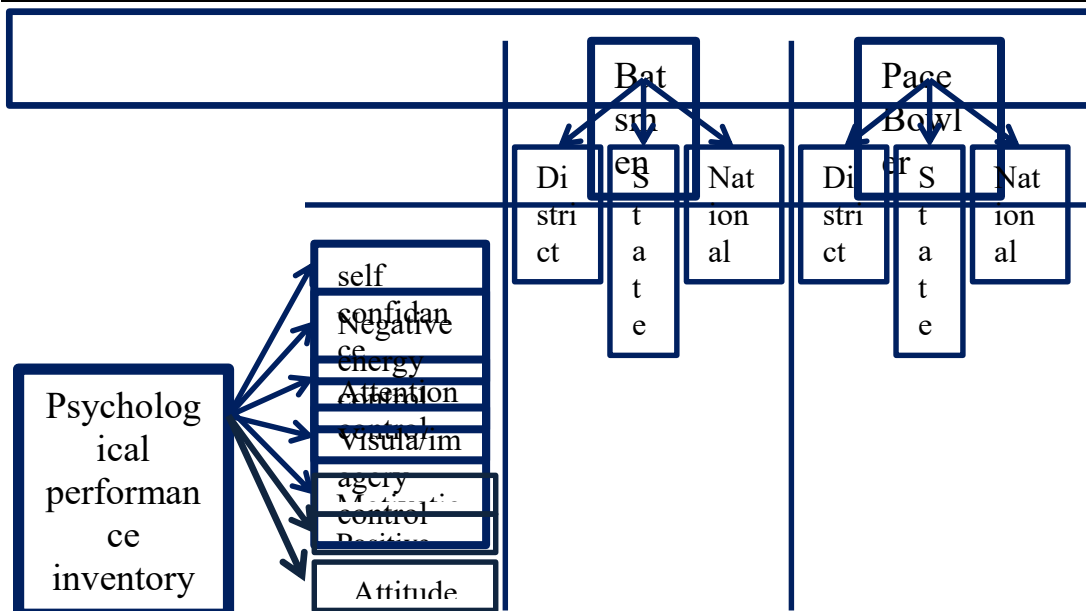


Figure1. MANOVA Design for the current study.

Statistical analysis

Statistical analysis was performed using SPSS v22 (IBM inc., Chicago, USA). The descriptive features include the mean ± SD of all categories. According to PPI-42, the mental performance list is considered a latent factor that includes features such as self-confidence, negative energy control, attentional control, visual / imagery control, motivation level, positive energy level, and attitude control; Since our study is designed as a comparative analysis of psychological characteristics between different levels of cricketers, MANOVA (multivariate analysis of variance) is used for group paths between three levels of participation of batsmen and pace bowlers groups. Used to compare: district, state and national. P<0.05 is considered statistically significant.

Results

As per the objective of present study, we performed the statistical analysis as shown in the figure 1. The descriptive characteristics (mean ± standard deviation) of both the categories i.e. batsmen and pace bowlers at three different levels are presented in table A1 (appendix 1).

Table 1. Multivariate statistics Psychological Performance Inventory variables of Pace Bowlers and Batsmen at different levels

Group	Box’s M Test		Wilk’s λ		Partial eta squared	Power
	F	P value*	Value	F		
Pace Bowlers	1.385	0.030	0.577	2.309	0.241	0.963
Batsmen	0.987	0.503	0.540	2.626	0.265	0.982

F=F-statistics

*P-value in bold face indicates significance at 0.05 level of significance.

The results of multivariate tests performed on psychological performance inventory variables at different levels of pace bowlers and batsmen are presented in table 1. The equality of covariance matrices was assessed using the Box's M test which yielded statistical significance in pace bowler. This means that the covariance matrices were not equal, which is an important assumption for the application of multivariate analysis. The equality of covariance matrices was assessed using the Box's M test which yielded statistical insignificance in batsmen. This means that the covariance matrices were equal, which is an important assumption for the application of multivariate analysis. The error variances of all the psychological performance inventory variables were also equal for both pace bowlers and batsmen group except self-confidence variable of pace bowler as evaluated by Levene's test of homogeneity of error variances (Table 2). The one-way MANOVA test was statistically significant for pace bowlers ($F(14,102) = 2.309$; $p < 0.05$; Wilk's $\lambda = 0.577$; partial $\eta^2 = 0.241$; Table 1) indicating that the pace bowlers at district, state, and national levels had differences in psychological performance inventory variables. Similarly, one-way MANOVA test for batsmen resulted in statistical significance ($F(14,102) = 2.626$; $p < 0.05$; Wilk's $\lambda = 0.540$; partial $\eta^2 = 0.265$; Table 1) and it meant that batsmen at district, state, and national levels had differences in psychological performance inventory variables.

Table 2. Univariate between-subject tests for psychological performance inventory variables for pace bowlers and batsmen at different levels.

Dependent Variable	Group	Levene's Test		F	P value*	Partial eta squared	Power
		F	P value				
Self confidence	Pace Bowlers	3.585	0.034	2.075	0.135	0.068	0.470
	Batsmen	0.328	0.722	6.303	0.003	0.181	0.882
Negative energy control	Pace Bowlers	0.646	0.528	5.419	0.007	0.160	0.826
	Batsmen	0.488	0.617	3.135	0.051	0.099	0.580
Attentional control	Pace Bowlers	1.007	0.372	8.543	0.001	0.231	0.959
	Batsmen	2.306	0.109	2.646	0.080	0.085	0.505
Visual imagery/control	Pace Bowlers	0.003	0.997	2.172	0.123	0.071	0.427
	Batsmen	0.923	0.403	3.475	0.038	0.109	0.627
Motivational level	Pace Bowlers	1.982	0.147	7.123	0.002	0.200	0.919
	Batsmen	0.822	0.445	0.129	0.879	0.005	0.069
Positive energy control	Pace Bowlers	0.753	0.475	2.246	0.115	0.073	0.439
	Batsmen	0.555	0.577	0.808	0.451	0.028	0.182
Performance attitude control	Pace Bowlers	1.340	0.270	2.487	0.092	0.080	0.480
	Batsmen	1.371	0.262	2.692	0.076	0.086	0.513

F=F-statistics

*Bonferroni correction to the p-value. Corrected p-value=0.05/5. P-value in bold faces indicates significance at 0.01 level of significance.

To determine those psychological performance inventory variables which produced significant differences among pace bowlers and batsmen at different levels, univariate between-subject tests were employed.

Self confidence

In self-confidence we found insignificant difference in univariate among district, state, and national level pace bowlers ($F(2,57) = 2.075$, $p > 0.01$, partial $\eta^2 = 0.068$; Table 2). Post-Hoc comparison suggested that national level pace bowlers scored low in self-confidence as compared to district level (Mean difference= 0.30; $p > 0.05$;

95% CI: 2.7132-2.1132; Table 3; Figure 1) and state level (mean difference= 1.60; p>0.05; 95% CI: 0.8132-4.0132; Table 3) pace bowlers. No significant difference was observed between district and state level pace bowlers. But among batsmen, univariate test yielded differed significantly results ($F(2,57) = 6.303, p < 0.01, \text{partial } \eta^2 = 0.181$; Table 2) suggesting that the batsmen at different levels were indifferent although pair wise comparison showed difference between national vs. district level batsmen (mean difference=3.15; p<0.05; 95% CI: 5.2922-1.0078; Table 4; Figure 2).

Table 3. Post-Hoc pair wise comparison for Pace bowlers at different levels

Variable	Level (I)	Level (J)	MD	P value*	95% C.I.
Self confidence	District	State	-1.90	.149	4.3132-0.5132
		National	-0.30	.952	2.7132-2.1132
	State	National	-1.60	.256	0.8132-4.0132
Negative energy control	District	State	-2.20	.142	4.9547-0.5547
		National	-3.75	.005	6.5047-0.9953
	State	National	-1.55	.372	4.3047-1.2047
Attentional control	District	State	-3.35	.006	5.8704-0.8296
		National	-4.05	.001	6.5704-1.5296
	State	National	-0.70	.783	3.2204-1.8204
Visual imagery/control	District	State	-1.95	.350	5.3141-1.4141
		National	-0.90	.797	2.4641-4.2641
	State	National	-2.85	.112	0.5141-6.2141
Motivational level	District	State	-3.35	.007	5.8930-0.8070
		National	-3.55	.004	6.0930-1.0070
	State	National	-0.20	.980	2.7430-2.3430
Positive energy control	District	State	-3.05	.102	6.5685-0.4685
		National	-1.05	.754	4.5685-6.5685
	State	National	-2.00	.364	1.5185-5.5185
Performance attitude control	District	State	-2.70	.097	5.7792-0.3792
		National	-0.55	.903	3.6292-2.5292
	State	National	-2.15	.222	0.9292-5.2292

MD= Mean Difference, CI= Confidence Interval

*P-values in bold face indicate statistical significance at 0.05 level of significance.

Negative energy control

In negative energy control, pace bowlers were found indifferent among district, state, and national level ($F(2,57) = 5.419, p < 0.01, \text{partial } \eta^2 = 0.160$; Table 2) and batsmen at different levels insignificantly ($F(2,57) = 3.135, p > 0.01, \text{partial } \eta^2 = 0.099$; Table 2). Post-Hoc comparison suggested significant difference in pace bowler between district vs. national level (mean difference=3.75; p<0.05; 95% CI: 6.5047-0.9953; Table 3; Figure 1) and state level (mean difference= 1.55; p>0.05; 95% CI: 4.3047-1.2047; Table 3; Figure 1). There was no difference between state vs. national level batsmen on negative energy control (Table 4; Figure 2).

Table 4. Post-Hoc pairwise comparison for batsmen at different levels

Variable	Level (I)	Level (J)	MD	P value*	95% C.I.
Self confidence	District	State	-1.80	.116	3.9422-0.3422
		National	-3.15	.002	5.2922-1.0078
	State	National	-1.35	.291	3.4922-0.7922
Negative energy control	District	State	-1.65	.157	3.7751-0.4751
		National	-2.10	.053	4.2251-0.0251
	State	National	-0.45	.867	2.5751-1.6751
Attentional control	District	State	-1.15	.425	3.3499-1.0499
		National	-2.10	.064	4.2999-0.0999
	State	National	-0.95	.555	3.1499-1.2499
Visual/ imagery control	District	State	-0.75	.782	3.4470-1.9470
		National	-2.85	.036	5.5470-0.1530
	State	National	-2.10	.156	4.7970-0.5970
Motivational level	District	State	-0.60	.899	3.8763-2.6763
		National	-0.60	.899	3.8763-2.6763
	State	National	-0.00	1.000	3.2763-3.2763
Positive energy control	District	State	-1.80	.420	5.2225-1.6225
		National	-0.75	.858	4.1725-2.6725
	State	National	-1.05	.742	2.3725-4.4725
Performance attitude control	District	State	-0.95	.681	3.6791-1.7791
		National	-2.60	.065	5.3291-0.1291
	State	National	-1.65	.320	4.3791-1.0791

MD= Mean Difference, CI= Confidence Interval

*P-values in bold face indicate statistical significance at 0.05 level of significance.

Attentional control

We found significant difference among district, state, and national level pace bowlers on attentional control ($F(2,57) = 8.543, p < 0.01, \text{partial } \eta^2 = 0.231$; Table 2) and batsmen at different levels insignificantly ($F(2,57) = 2.646, p > 0.01, \text{partial } \eta^2 = 0.085$; Table 2). Post-Hoc comparison suggested that national level pace bowlers scored high on attentional control as compared to district level (Mean difference= 4.05; $p < 0.05$; 95% CI: 6.5704-1.5296; Table 3; Figure 1) and district level pace bowler scored high than state level pace bowler (mean difference= 3.35; $p < 0.05$; 95% CI: 5.8704-0.8296; Table 3; Figure 1). No significant difference was observed between state and national level pace bowlers. There was no difference between state vs. national level batsmen on attentional control (Table 4; Figure 2).

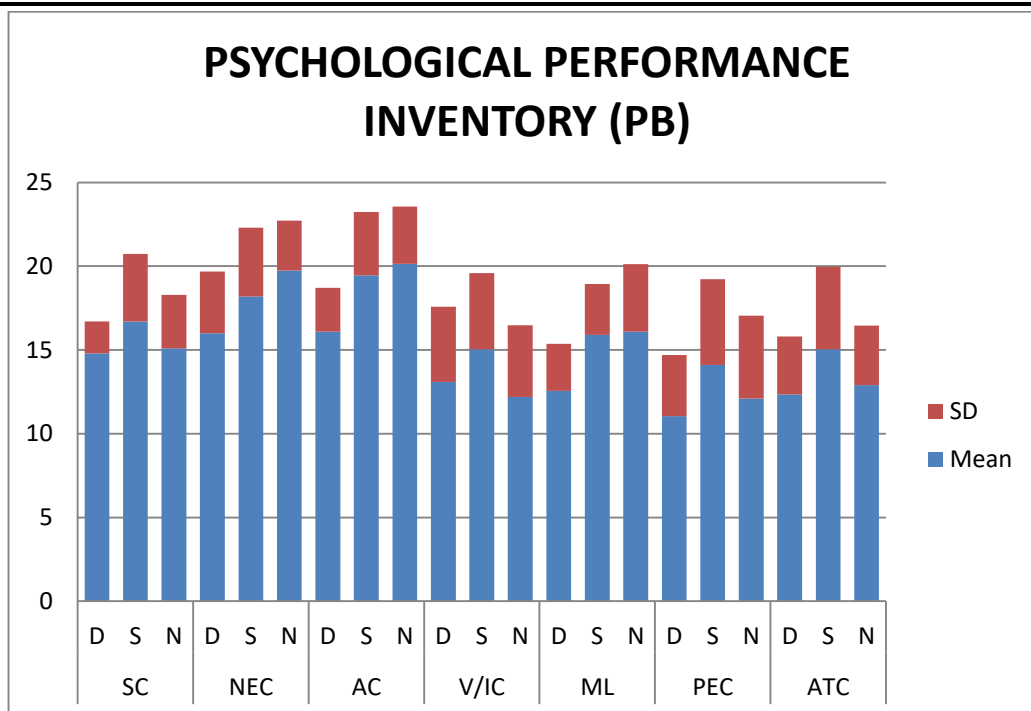


Figure 2. Graphical representation of psychological performance inventory dimensions of Pace bowlers.

Visual/ Imagery control

In visual/imagery control, pace bowlers were found insignificant difference among district, state, and national level ($F(2,57) = 2.172, p > 0.01, \text{partial } \eta^2 = 0.071$; Table 2) and batsmen at different levels also shows insignificant different ($F(2,57) = 2.646, p > 0.01, \text{partial } \eta^2 = 0.085$; Table 2). Post-Hoc comparison suggested insignificant difference at any level of pace bowler. There was significant difference in batsman between district vs. national level (mean difference = 2.85; $p < 0.05$; 95% CI: 5.5470-0.1530; Table 4; Figure 2) and state level (mean difference = 2.10; $p > 0.05$; 95% CI: 4.7970-0.5970; Table 4; Figure 2). There was no difference between district vs. state level batsmen on visual/imagery control (Table 4; Figure 2).

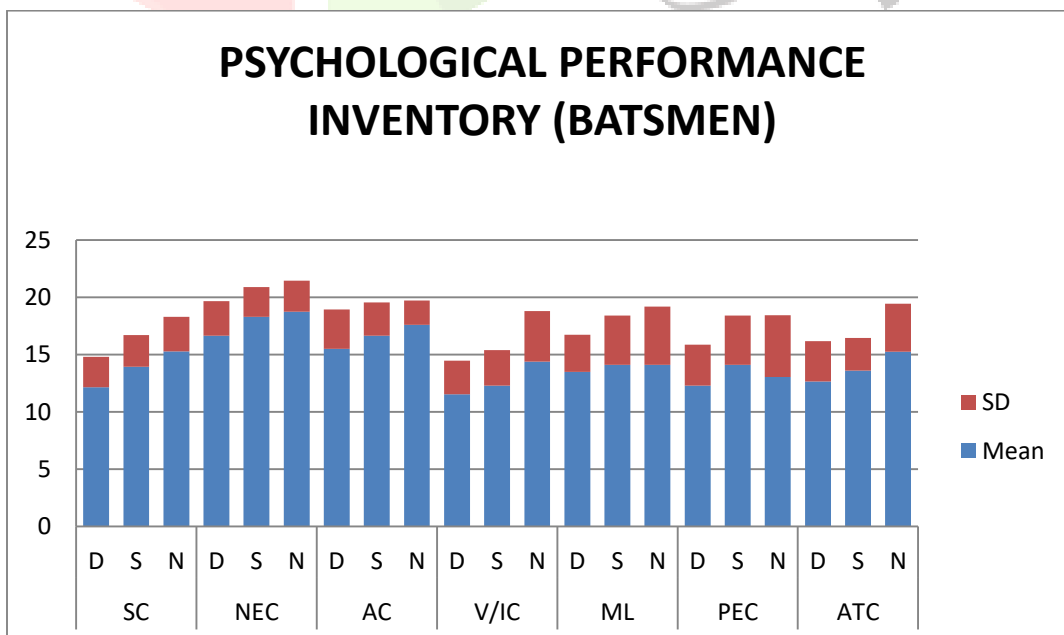


Figure 3. Graphical representation of psychological performance inventory dimensions of batsmen.

Motivational level

In motivational level we found no significant difference but close to being significant in univariate between-subject test among pace bowlers ($F(2,57) = 7.123, p > 0.01, \text{partial } \eta^2 = 0.200$; Table 2). And we found no significant difference in univariate between-subject test among batsmen ($F(2,57) = 0.129, p > 0.01, \text{partial } \eta^2 = 0.005$; Table 2) at different levels. Post-Hoc comparison suggested significant difference in pace bowler between district vs. national level (mean difference = 3.55; $p < 0.05$; 95% CI: 6.0930-1.0070; Table 3; Figure 1) and state level (mean difference = 0.20; $p > 0.05$; 95% CI: 2.7430-2.3430; Table 3; Figure 1). There was no significant difference at any level of batsman on motivational level variable (Table 4; Figure 2).

Positive energy control

In positive energy control we found no significant difference univariate between-subject test among pace bowlers ($F(2,57) = 2.246, p > 0.01, \text{partial } \eta^2 = 0.073$; Table 2). And we found no significant difference in univariate between-subject test among batsmen ($F(2,57) = 0.808, p > 0.01, \text{partial } \eta^2 = 0.028$; Table 2) at different levels. Post-Hoc comparison suggested insignificant difference in pace bowler between district vs. national level (mean difference = 1.05; $p > 0.05$; 95% CI: 4.5685-6.5685; Table 3; Figure 1) and state level (mean difference = 2.00; $p > 0.05$; 95% CI: 1.5185-5.5185; Table 3; Figure 1) pace bowler. There was no significant difference at any level of batsman on positive energy control variable (Table 4; Figure 2).

Performance attitude control

In performance attitude control we found no significant difference univariate between-subject test among pace bowlers ($F(2,57) = 2.487, p > 0.01, \text{partial } \eta^2 = 0.080$; Table 2) and we found no significant difference in univariate between-subject test among batsmen ($F(2,57) = 2.692, p > 0.01, \text{partial } \eta^2 = 0.086$; Table 2) at different levels. Post-Hoc comparison suggested insignificant difference in pace bowler between district vs. national level (mean difference = 0.55; $p > 0.05$; 95% CI: 3.6292-2.5292; Table 3; Figure 1) and state level (mean difference = 2.15; $p > 0.05$; 95% CI: 0.9292-5.2292; Table 3; Figure 1) pace bowler. Post-Hoc comparison suggested there was no significant difference at any level of batsmen on performance attitude control (Table 4; Figure 2).

Discussion

Mental toughness refers to the collection of psychological factors that are essential for proper functioning of mind at different situation. Athletes, coaches, and sports psychologists have implicated mental toughness as one of the most important psychological symptoms associated with athletic success. Those cricketers with higher levels of mental toughness reported better performance and lower levels of emotional distress compared to cricket players with lower levels of mental toughness.

Conclusion

To study characterize mental toughness traits of cricket players at different levels of competition based on the dimensions of Seven Factor Model (SFM). Study indicates that certain mental toughness traits accompany cricket players at different levels of participation (District, State, and National level). National level pace bowlers exhibited greater negative energy control, attentional control and motivational level whereas national level batsmen showed greater self-confidence, negative energy control, visual/imagery control, and performance attitude control as compared to inferior levels of participation. Since the game of cricket demands multi-factorial approach to fully elucidate the concept of “Form”, other facets of mental toughness such as focus, personality, self-belief, optimism etc. should also be explored in an attempt to optimize the salient inherent and trainable traits that should be focused in talent identification and coaching in cricket.

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