

Mental Toughness in Indian Elite Athletes: Psychometric Validation of the Psychological Performance Inventory

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Abstract

Background: Mental toughness is one of the psychological dimensions considered essential for performance in sports. In this study, the Psychometric validation of the Psychological Performance Inventory (PPI) was validated for the measurement of mental toughness in elite athletes. *Materials and method:* A sample of 76 elite athletes was selected via purposive sampling. To assess mental toughness, we used the Psychological Performance Inventory, by Loehr (1986). A confirmatory factor analysis was conducted to confirm the factor structure of the Psychological Performance Inventory in an Indian context. *Results:* The mean scores for negative energy control, positive energy control, attention control, and attitude control were 3.41 (SD = .18), 3.88 (SD = .23), 3.68 (SD = .15), and 3.86 (SD = .23), respectively. Only 29 items were adequately internally consistent in assessing mental toughness for Indian elite athletes. In composite reliability (CR), all factors had values above .85, indicating good reliability.

Conclusion: The lack of success among elite Indian athletes is their excessive focus on affective skills, neglect of cognitive skills. Balancing affective and cognitive skills is the way to improve mental toughness,

Keywords: *Affective, cognitive, Indian elite athletes, mental toughness, skill*

Introduction

In today's increasingly competitive games, the already thin margin between winning and losing (i.e., performance) is becoming progressively thinner. These decreasing margins are causing immense stress for athletes, as achieving the highest level of success requires a blend of complex technical skills, self-efficacy, and understanding the dynamic mental and physical environmental constraints.

Performance in competitive sports comprises three domains: technical movement or mechanics (skill), cognitive skills (ability to deal with the environment), and affective skills (an emotional component).^{1,2} An Aoyagi and Portenga have noted, 'successful performance requires both the development

and mastery of knowledge, skills, and abilities and the capability to consistently and reliably deliver (i.e. perform) at the time of performance'.³

Contesting every athletic should have ability to manage the delicate mind-body connection, which becomes dramatically clear within the competitive arena.⁴

Sugarman reported that athletes often spend so much time on physical practice in order to gain an edge in competition that they end up ignoring another essential aspect of sports performance, namely, mental skills. A trained mind is essential to achieve this skill.⁵

Mental toughness is considered as an important psychological dimension for performance excellence. Mental toughness is used as a measure of the specific cognitive and affective skills that athletes must possess for good sports performance.⁶⁻¹⁰ Broadly, mental toughness has been denoted as the quality necessary to perform better than others in a competition or to perform well in a competition.^{11,12,13}

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The cognitive aspect of mental toughness refers to the ability to deal with problems on and off the field¹² and deal with the pressure, negativity, and adversity¹³⁻¹⁴ by staying calm and focused and maintaining belief in one's own plans and actions⁶. The affective aspect, on the other hand, refers to athletes' ability to remain motivated and confident¹¹ despite numerous failures on a daily basis, both during and after competitions.

Presently, most studies on mental toughness in Indian athletes focused on comparing mental toughness among various competitive levels of a single sport, such as the school, university, and national levels.¹⁵⁻¹⁸ Few studies have examined how mental toughness correlation with other factors like win to win, winners to losers, anxiety state across various sports, such as badminton, gymnastics, athletics, and cricket^{19,20}. There is no reported study on mental toughness and its correlations with various components of mental toughness.

This study was conducted to validate the PPI in the Indian context for elite athletes and to measure mental toughness and assess the psychological reasons for the poor performance of Indian athletes at the international level.

Materials and Method

The purposive sample of 76 elite Indian athletes competing at the national and international levels, in golf (n = 20), shooting (n = 15), track and field (n = 17), tennis (n = 5), squash (n = 2), wrestling (n = 4), swimming (n = 2), and boxing (n = 3) were included in the study. The sample was collected at various international competition events in India, such as the Indian Open golf tournament, the Women's Indian Open, the International Shooting Sport Federation (ISSF) World Cup, the Asian Athletics Championship, and various camps held for national players in competition at the international level.

The Psychological Performance Inventory (PPI; Loehr 1986)²¹ was used to measure mental toughness. This 42-item scale yields a total mental toughness score, as well as seven 6-item subscale scores: (a) self-confidence; (b) negative energy control; (c) attention control; (d) visualization and imagery control; (e) motivation; (f) positive energy control; and (g) attitude control. Each item is rated on a five-point Likert scale anchored by 'almost always' and 'almost never'. The subscale scores range from 6 to 30 (with higher scores indicating more desirable levels), with total scores ranging from 42 to 210. The PPI has been found to be internally consistent,

with Cronbach's alphas for the seven subscales indicating high reliability (self-confidence = 0.69; negative energy control = 0.42; attention control = 0.75; visualization and imagery control = 0.82; motivation = 0.70; positive energy control = 0.71; attitude control = 0.71). The PPI demonstrated acceptable psychometric properties when used on athletes performing at a National or international level^{22,23}. PPI was selected because its subscales allow easy breakdown of items into affective and cognitive skills.

Procedure

Structural equation modelling (SEM) was employed to test the validity of the PPI using confirmatory factor analysis, which involves confirming how well the scale items fit the subscales (self-confidence, visualization and imagery control, motivation, positive energy control, negative energy control, attention control, and attitude control) forming the construct of mental toughness. First, the internal consistency was examined and maximized using Wille's stepwise procedure, which was repeated until removal of any of the remaining items in the scale did not lead to an increase in the corresponding subscale's alpha. Second, a partial least squares SEM (PLS-SEM) approach was used to determine whether the factor loadings of all remaining items in the final model of mental toughness were more than⁵ which would indicate the presence of convergent and factorial validity. High internal consistency and reliability further serve as proof of construct validity.

Results

The obtained data was statistically evaluated with IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp using *t*-test, Cronbach's alpha coefficient Regression (β) path coefficients, at *p* value 0.05. The mean scores of self-confidence, visualization and imagery control, and motivation were 4.33 (SD = .16), 4.13 (SD = .20), and 4.56 (SD = .04), respectively. The mean scores for negative energy control, positive energy control, attention control, and attitude control were 3.41 (SD = .18), 3.88 (SD = .23), 3.68 (SD = .15), and 3.86 (SD = .23), respectively. Subscales of the PPI were significantly correlated (*p* < 0.05, Table 1).

Table 2 indicates the significance of reliability and validity of Psychological Performance. The internal consistency reliability of each of the seven subscales was good. Using Wille's method, we found that only 29 items were adequately internally consistent in assessing

mental toughness for Indian elite athletes. Regarding the composite reliability (CR), all factors had values above .85, indicating good reliability All subscales also had average variance extracted (AVE) values of greater than .59, indicating good convergent validity. To assess the common method bias, we used Harman’s one factor test (based on a principal component analysis) to see if all the items loaded onto one factor. We found no common variance or a common latent factor (Table-3, 4).

Table 1: Descriptive statistics and correlations of Psychological Performance Inventory

Subscale	Mean	Std. Deviation	SC	VI	ML	NE	PC	AC	AT	Cronbach’s alpha
Self-confidence (SC)	4.33	.16	.79 ***							.85
Visualization and imagery control (VI)	4.13	.20		.82 ***						.86
Motivation (ML)	4.56	.04			.74 ***					.88
Negative energy control (NE)	3.41	.18				.53 ***				.78
Positive energy control (PC)	3.88	.23					.53 ***			.74
Attention control (AC)	3.68	.15						.54 ***		.70
Attitude control (AT)	3.86	.23							.59 ***	.81

Table 2: Reliability and validity of Psychological Performance Inventory

	Self-confidence	Visualization and imagery control	Motivation	Negative energy control	Positive energy control	Attention control	Attitude control
Cronbach’s alpha	0.85	0.86	0.88	0.78	0.74	0.70	0.81
Composite reliability	0.89	0.89	0.91	0.86	0.85	0.85	0.87
Convergent validity	0.62	0.59	0.67	0.61	0.65	0.75	0.63

Table 3: Factor loadings of Psychological Performance Inventory items after deletion of items with poor reliability and validity

Observed	Self-confidence	Visualization and imagery control	Motivation	Negative energy control	Positive energy control	Attention control	Attitude control
1		0.68	0.77	0.70	0.85		0.88
2	0.74	0.77	0.81		0.83		0.84
3	0.80	0.76	0.89	0.79		0.93	0.73
4	0.82	0.84	0.80	0.76		0.79	0.71
5	0.81	0.72			0.74		
6	0.74	0.81	0.82	0.84			

Table 4: Regression (β) path coefficients, t-statistics, and p-values for model paths obtained by estimating standard errors

Mental Toughness (PPI)	Original sample (O)*	Sample mean (M)	Standard deviation (STDEV)	t (O/STDEV)	p
Attention Control → Mental Toughness	0.09	0.08	0.04	2.038	0.043
Attitude Control → Mental Toughness	0.16	0.14	0.09	1.778	0.077
Motivation Level → Mental Toughness	0.28	0.27	0.06	4.572	0.000
Negative Energy Control → Mental Toughness	0.14	0.12	0.08	1.729	0.085
Positive Energy Control → Mental Toughness	0.12	0.10	0.07	1.715	0.088
Self Confidence → Mental Toughness	0.28	0.26	0.07	3.828	0.000
Visual Imagery → Mental Toughness	0.33	0.31	0.07	4.281	0.000

*Original Sample (O): Path Coefficients

Discussion

Mental toughness is a key quality for athletes, especially the elite level, where the margin for victory can be millimetres or milliseconds.

The PPI has been used in a number of empirical studies and is recommended as a useful instrument for

assessing mental toughness.^{21,22} We found that only 29 of the original 42 items of the PPI were relevant to measuring mental toughness in Indian elite athletes. Following removal of the other 13 items, we were able to confirm the convergent and discriminant validity of the seven factors through an examination of the individual parameter estimates. Furthermore, the internal

consistency coefficients of the seven factors were satisfactory, indicating that all subscales were internally consistent. Taken together, the scale items appeared to be suited to assessing mental toughness.

Affective skills help athletes maintain a strong faith in their ability to achieve a set goal, despite the low odds and lack of success⁶. This faith does not appear to fade even in the face of self-doubt about their performance or questions posed by others about their poor performance. These athletes remain in a state of optimal motivation, confidence, and control.²³ which helps them overcome and rebound from adversities and failure. In the present study, the subscales corresponding to the affective skills—motivational, visualization and imagery control, and self-confidence—made strong contributions to the construct of mental toughness among elite Indian athletes. Of these, self-confidence and visualization and imagery control were dominant, although motivation still had a high and significant contribution. By contrast, the cognitive skills of attitude control, positive energy control, and negative energy control did not have significant contributions; attention control did have a significant contribution, but it was somewhat weak. These findings show that the Indian athletes are continuously trying and motivated to achieve success via affective skills, rather than by relying on their cognitive skills.

However, during competition, the difference between winners and losers at the elite level is not a matter of motivation rather, it is down to their level of cognitive skills. Such skills allow athletes to assess and understand the situation, and then act accordingly. Numerous researchers have shown that successful athletes utilize cognitive skills to effectively deal with challenges, stressors, and pressure, irrespective of the prevailing circumstances¹³. Studies have also shown that reliance on affective skills particularly a higher motivational intensity can weaken cognitive skills and lead to poor decision making²⁴. Higher-than-optimal motivational levels can make a person act hastily and hurry without analysing the situation; this makes them more result-oriented in their approach, as opposed to process-oriented.²⁵

The results of this study might be useful for facilitating athletes' reflection on their lack of specific cognitive skills, which may be a reason for their limited success in international competitions. Athletes must be able to identify the most information-rich areas of their

display, direct their attention appropriately, and extract meaning from these areas efficiently and effectively.

The psychometric support found for the PPI after item reduction in an Indian context can increase researchers' confidence in the instrument's usability to evaluate elite athletes in India in both future research and professional practice. It could be used in developing mental training programmes that place emphasis on assessing and training cognitive skill, in addition to affective skills.

The results of our study suggest that a probable cause of the lack of success among elite Indian athletes is their excessive focus on affective skills, neglect of cognitive skills, when they are developing mental toughness. Balancing affective and cognitive skills is the way to improve mental toughness, and may help to bring consistent success for Indian athletes at the international level.

Conclusion

The lack of success among elite Indian athletes is their excessive focus on affective skills, to the neglect of cognitive skills. Balancing affective and cognitive skills is the way to improve mental toughness,

Conflict of Interest- NIL

Ethical Clearance: It was obtained from Amity Institute of Psychology and Allied Sciences, Amity University Noida, UP, India

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