



COMPARATIVE ANALYSIS OF MENTAL TOUGHNESS AMONG CLOSED AND OPEN SKILL SPORTS PLAYERS

Chinmaya Sahoo¹,
Sanjib Kumar Bhowmik²,
Saon Sanyal Bhowmik³ⁱ

¹Assistant Professor,
Lakshmibai National Institute of Physical Education,
North East Regional Centre,
Guwahati, Assam,
India

²Associate Professor, Dr.,
Department of Physical Education,
Tripura University (A Central University),
Suryamaninagar, Agartala, Tripura,
India

³Assistant Professor, Dr.,
Lakshmibai National Institute of Physical Education,
North East Regional Centre,
Guwahati, Assam,
India

Abstract:

Mental toughness is considered an important psychological attribute that enables athletes to perform consistently under competitive pressure. The present study examined differences in mental toughness between athletes participating in open-skill and closed-skill sports. A total of sixty athletes (N = 60) enrolled in Bachelor of Physical Education (B.P.Ed.) and Master of Physical Education (M.P.Ed.) programmes at Lakshmibai National Institute of Physical Education, North East Regional Centre, Guwahati, were selected for the study. The participants were divided into two groups: open-skill athletes (n = 30) and closed-skill athletes (n = 30). Mental toughness was assessed using Loehr's Psychological Performance Inventory (PPI), which measures seven psychological components: self-confidence, negative energy control, attention control, visual imagery control, motivational level, positive energy control, and attitude control. Descriptive statistics and multivariate analysis of variance (MANOVA) were employed for data analysis. The findings revealed no statistically significant difference in mental toughness between open-skill and closed-skill athletes ($\Lambda = 0.866$, $F(7, 52) = 1.152$, $p = 0.346$). The

ⁱ Correspondence : email chinmayacap@gmail.com, sanjibbhowmik@tripurauniv.ac.in, saonsanyal@rediffmail.com

results indicate that mental toughness may develop through training and competitive experience rather than being determined by the type of sport.

Keywords: mental toughness, sport psychology, open skill sports, closed skill sports, athletic performance

1. Introduction

Sport performance is influenced by several interacting factors, including physical conditioning, technical proficiency, tactical knowledge, and psychological preparedness. Among these components, psychological attributes have gained increasing attention in sport science research due to their significant influence on athlete performance and consistency. One of the most widely discussed psychological constructs in sport psychology is mental toughness.

Mental toughness is generally defined as the ability of an athlete to maintain focus, confidence, and emotional control while coping with pressure and adversity during competition. Athletes who possess higher levels of mental toughness tend to demonstrate better concentration, stronger motivation, and improved resilience when facing challenging situations.

In the context of sport classification, activities are often categorized as open-skill or closed-skill sports depending on the predictability of the environment in which they are performed. Open-skill sports such as badminton, tennis, and table tennis require athletes to respond to constantly changing environmental conditions, including opponent actions and game dynamics. In contrast, closed-skill sports such as swimming, track and field, and yoga occur in relatively stable and predictable environments where movements are self-paced and controlled.

2. Methodology

2.1 Participants

A total of sixty athletes (N = 60) participated in the study. The participants were students enrolled in Bachelor of Physical Education (B.P.Ed.) and Master of Physical Education (M.P.Ed.) programmes at Lakshmibai National Institute of Physical Education, North East Regional Centre, Guwahati, Assam.

All participants had at least district-level competitive experience. The participants were divided into two equal groups:

- **Open-skill athletes (N = 30):** badminton, tennis, and table tennis players.
- **Closed-skill athletes (N = 30):** track and field, swimming, and yoga participants.

2.2 Research Design

The study employed a comparative analysis to examine differences in mental toughness between athletes participating in open-skill and closed-skill sports.

2.3 Instrument

Mental toughness was measured using Loehr’s Psychological Performance Inventory (PPI). The instrument consists of 42 questionnaire items designed to measure seven psychological components representing mental toughness: self-confidence, negative energy control, attention control, visual imagery control, motivational level, positive energy control, and attitude control. Participants responded using a six-point Likert scale.

2.4 Statistical Analysis

The collected data were analyzed using descriptive statistics (Mean and Standard Deviation), and Independent Samples t-tests and Multivariate Analysis of Variance (MANOVA) were used to examine differences between groups. All hypotheses were tested at the 0.05 level of significance.

3. Results

The present study examined differences in mental toughness between open-skill and closed-skill athletes using multivariate statistical analysis. Mental toughness was assessed across seven psychological dimensions derived from Loehr’s Psychological Performance inventory, namely self-confidence, negative energy control, attention control, visual imagery control, motivational level, positive energy control, and attitude control.

Table 1(a): Descriptive Statistics on the Subfactors of Mental Toughness among Open Skill and Closed Skill Athletes

Factor	Sports Group	Mean	SD	N
Self Confidence	Open Skill	25.57	3.45	30
	Closed Skill	24.30	3.10	30
	Total	24.93	3.31	60
Negative Energy Control	Open Skill	20.37	4.06	30
	Closed Skill	18.83	3.51	30
	Total	19.60	3.84	60
Attention Control	Open Skill	19.83	2.86	30
	Closed Skill	19.47	3.15	30
	Total	19.65	2.99	60
Visual Imagery Control	Open Skill	24.50	3.47	30
	Closed Skill	23.00	2.70	30
	Total	23.75	3.17	60

Table 1(a) indicates the mean and SD of psychological factors of mental toughness among open and closed skill athletes.

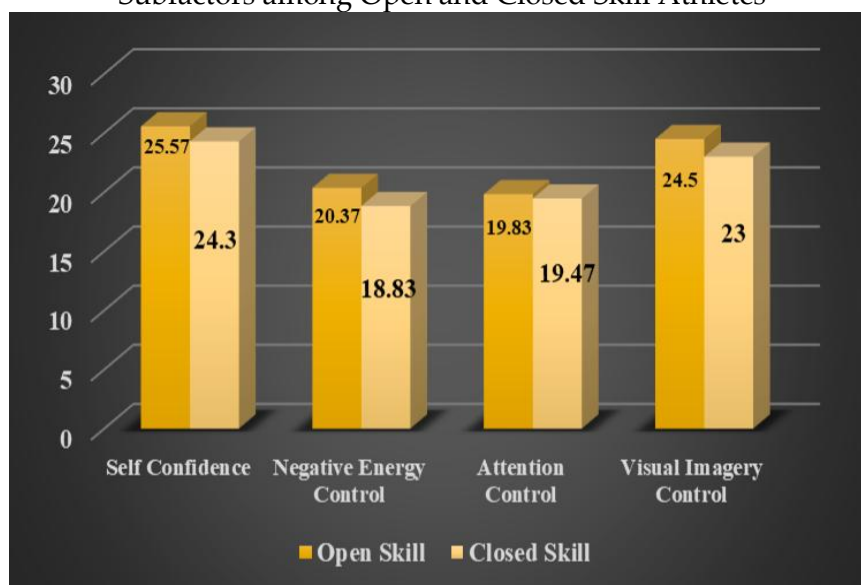
The total mean and standard deviation of the mental toughness sub-factors, namely self-confidence, negative energy control, attention control, and visual imagery control, were found to be 24.93 ± 3.31 , 19.60 ± 3.84 , 19.65 ± 2.99 , and 23.75 ± 3.17 , respectively.

With regard to the sub-factor of self-confidence, the mean and standard deviation for open skill athletes were 25.57 ± 3.45 , whereas closed skill athletes recorded a mean and standard deviation of 24.30 ± 3.10 .

Similarly, in the sub-factor of negative energy control, open skill athletes obtained a mean and standard deviation of 20.37 ± 4.06 , while closed skill athletes recorded 18.83 ± 3.51 .

In the case of attention control, the mean and standard deviation for open skill athletes were 19.83 ± 2.86 , whereas closed skill athletes showed a mean and standard deviation of 19.47 ± 3.15 .

Figure 1(a): Means Scores of Mental Toughness Subfactors among Open and Closed Skill Athletes



Furthermore, in the sub-factor of visual imagery control, the mean and standard deviation among open skill athletes were 24.50 ± 3.47 , while closed skill athletes recorded a mean and standard deviation of 23.00 ± 2.70 . The mean scores are presented in Figure 1(a).

Table 1(b): Descriptive Statistics on the Subfactors of Mental Toughness among Open Skill and Closed Skill Athletes

Factor	Sports Group	Mean	SD	N
Motivational Level	Open Skill	25.30	3.51	30
	Closed Skill	24.30	3.34	30
	Total	24.80	3.43	60
Positive Energy Control	Open Skill	24.93	3.46	30
	Closed Skill	24.60	2.63	30
	Total	24.77	3.05	60
Attitude Control	Open Skill	25.67	3.14	30
	Closed Skill	25.33	2.84	30
	Total	25.50	2.97	60

Table 1(b) indicates the mean and SD of psychological factors of mental toughness among open and closed skill athletes. The total mean and SD of mental toughness sub-factors, viz., motivational level, positive energy control and attitude control, among open and closed skill athletes are 24.80 ± 3.43 , 24.77 ± 3.05 and 25.50 ± 2.97 , respectively.

The mean and SD in the sub-factor of motivational level among open and closed skill athletes are 25.30 ± 3.51 and 24.30 ± 3.34 , respectively. The mean and SD in the sub-factor of positive energy control among open and closed skill athletes are 24.93 ± 3.46 and 24.60 ± 2.63 , respectively. The mean and SD sub-factor of attitude control among open and closed skill athletes are 25.67 ± 3.14 and 25.33 ± 2.84 , respectively. The mean scores are presented in Figure 1(b).

The descriptive statistics indicated that both groups demonstrated similar levels of mental toughness across all psychological dimensions measured by the PPI. Open-skill athletes showed slightly higher mean scores in several components, such as self-confidence and motivation; however, these differences were relatively small.

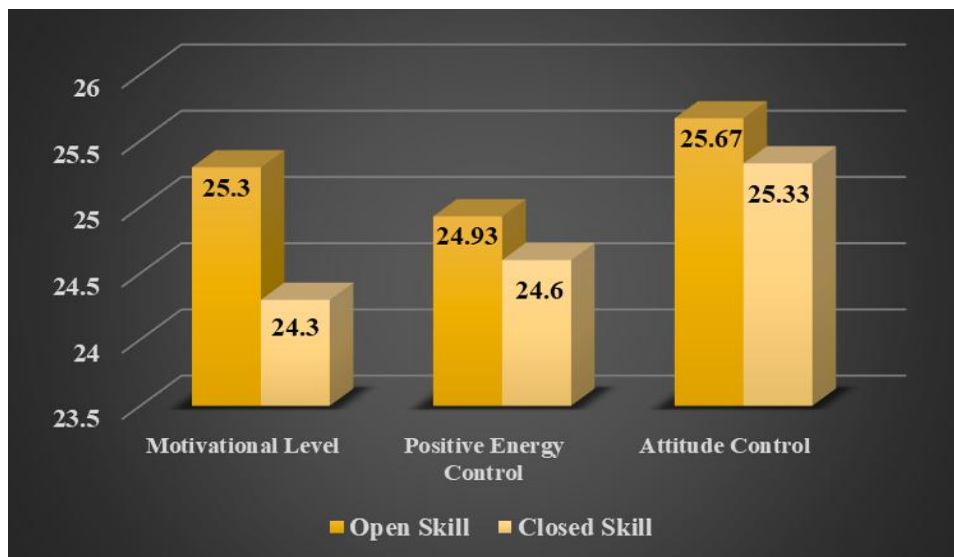


Figure 1(b): Means Scores of Mental Toughness Subfactors among Open and Closed Skill Athletes

Table 2: Multivariate Analysis on Mental Toughness among Open Skill and Closed Skill Athletes

Test	Value	F	Hypothesis df	Error df	Sig.
Pillai's Trace	0.134	1.152	7	52	0.346
Wilks' Lambda	0.866	1.152	7	52	0.346
Hotelling's Trace	0.155	1.152	7	52	0.346
Roy's Largest Root	0.155	1.152	7	52	0.346

To determine whether these differences were statistically significant, a Multivariate Analysis of Variance (MANOVA) was conducted with sport type as the independent variable and the seven mental toughness components as dependent variables. The results of the MANOVA test indicated a non-significant multivariate effect:

Since the probability value exceeded the established significance level ($p > 0.05$), the null hypothesis was accepted. Therefore, no statistically significant difference was observed in mental toughness between athletes participating in open-skill and closed-skill sports.

Table 2 represented a multivariate analysis of the psychological factor of mental toughness among open and closed skill athletes. Though there are four multivariate tests, the value of Wilks' lambda was considered. The value of Wilks' lambda (0.866) was found to be insignificant at the 0.05 level of significance ($p = 0.346$).

Since the multivariate analysis was found to be insignificant, no further analysis was done. The insignificant value of MANOVA depicted that the mental toughness was at similar levels when comparing open and closed skill athletes.

4. Discussion

The primary objective of the present study was to compare mental toughness among athletes engaged in open-skill and closed-skill sports. The findings revealed that both groups exhibited similar levels of mental toughness across the measured psychological dimensions. These results suggested that mental toughness might develop through training, competitive experience, and psychological preparation rather than being determined solely by the type of sport.

5. Conclusion

The present study examined differences in mental toughness between athletes participating in open-skill and closed-skill sports. The results indicated that no statistically significant difference existed between the two groups. These findings suggest that mental toughness is a fundamental psychological attribute required for successful athletic performance across different sport contexts.

Creative Commons License Statement

This research work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc-nd/4.0>. To view the complete legal code, visit <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode.en>. Under the terms of this license, members of the community may copy, distribute, and transmit the article, provided that proper, prominent, and unambiguous attribution is given to the authors, and the material is not used for commercial purposes or modified in any way. Reuse is only allowed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Author(s)

Chinmaya Sahoo, Assistant Professor, Lakshmibai National Institute of Physical Education, North East Regional Centre, Guwahati, Assam, India. Author contribution: data collection.

Email: chinmayacap@gmail.com

Sanjib Kumar Bhowmik, Associate Professor, Department of Physical Education, Tripura University (A Central University), Agartala, India. Author contribution: literature search, study design, data interpretation, statistical analysis, manuscript preparation, and proofreading.

Orcid ID: <https://orcid.org/0009-0008-5222-8572>

Email: sanjibbhowmik@tripurauniv.ac.in

Saon Sanyal Bhowmik, Assistant Professor, Lakshmibai National Institute of Physical Education, North East Regional Centre, Guwahati, Assam, India. Author contribution: literature search, study design, data interpretation, statistical analysis, manuscript preparation and proofreading.

Orcid ID: <https://orcid.org/0009-0004-3522-3252>

Email: saonsanyal@rediffmail.com

References

- Clough PJ, Earle K, Sewell D. Mental toughness: The concept and its measurement. *Solutions in Sport Psychology*. 2002. Retrieved from https://www.researchgate.net/publication/313119986_Mental_toughness_The_concept_and_its_measurement
- Field A. *Discovering Statistics Using IBM SPSS Statistics*. 5th ed. London: SAGE Publications; 2018. Retrieved from https://books.google.ro/books/about/Discovering_Statistics_Using_IBM_SPSS_Stat.html?id=83L2EAAAQBAJ&redir_esc=y
- Jones G, Hanton S, Connaughton D. A framework of mental toughness in the world's best performers. *The Sport Psychologist*. 2007. <https://doi.org/10.1123/tsp.21.2.243>
- Loehr JE. *Mental Toughness Training for Sports*. Lexington, MA: Stephen Greene Press; 1986. Retrieved from https://books.google.ro/books/about/Mental_Toughness_Training_for_Sports.html?id=fHpYAAAAYAAJ&redir_esc=y
- Schmidt RA, Lee TD. *Motor Control and Learning*. Human Kinetics; 2011. Retrieved from https://books.google.ro/books/about/Motor_Control_and_Learning.html?id=z69gyDKroS0C&redir_esc=y
- Weinberg RS, Gould D. *Foundations of Sport and Exercise Psychology*. Human Kinetics; 2019. Retrieved from https://books.google.ro/books/about/Foundations_of_Sport_and_Exercise_Psychology.html?id=ACBwDwAAQBAJ&redir_esc=y