ORIGINAL ARTICLE

Comparative study of emotional intelligence and mental toughness across age and gender in Eastern Zone chess players

Sm Farooque[1ABCD], Phanin Narah[1ABD], Sharina Naorem[1BCD], Lalhmangaihsanga Sailo[1ABE], Mukesh Mitra[2ABCD]

[1] *Department of Physical Education, Tripura University (A Central University), India*
[2] *Department of Physical Education, MMDC College, India*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim: Psychological traits such as Emotional Intelligence (EI) and Mental Toughness (MT) are increasingly recognized as performance determinants in cognitively demanding sports like chess. These traits influence how players cope with pressure, maintain focus, and sustain consistency during competitions. Although both EI and MT are applied in the context of cognitive sports, their relative effectiveness in enhancing performance remains a matter of practical interest. The aim of this study was to assess and compare EI and MT among national-level chess players from North-East India across gender and age categories.

Material and Methods: A total of 106 national-level chess players (males = 58; females = 48), aged 18–25 years, voluntarily participated in the study. Emotional intelligence and mental toughness were assessed using standardized questionnaires with established reliability (α = 0.88; KR-20 = 0.86). Data were collected in person during training camps and tournaments. The Shapiro–Wilk test was used to verify data normality. Depending on distribution, parametric (t-test, ANOVA) and non-parametric (Mann–Whitney U, Kruskal–Wallis H) tests were applied. Correlation analysis was performed using Spearman's rank-order coefficient, with statistical significance set at $p < .05$.

Results: Female players reported significantly higher emotional intelligence than males ($p = .023$, $d = 0.45$). No significant gender difference was found in overall mental toughness ($p > .05$). Age groups showed no difference in emotional intelligence ($p = .169$), but older players demonstrated higher scores in specific mental toughness components, particularly rebound ability and motivation ($p < .05$). A moderate positive correlation was observed between emotional intelligence and overall mental toughness ($r = 0.52$, $p < .001$).

Conclusions: The study highlights the relevance of psychological characteristics such as emotional intelligence and mental toughness in chess. The findings may help in designing targeted psychological preparation and support strategies for athletes engaged in cognitively demanding sports.

Keywords: emotional intelligence, mental toughness, ability to handle pressure, rebound-ability, chess, psychological skills.

Introduction

Chess is widely regarded as a cognitively demanding sport that requires sustained concentration, strategic planning, and emotional regulation. Performance in such a setting is shaped not only by technical skills and knowledge of the game but also by psychological resources that enable players to cope with stress, manage setbacks, and maintain consistency under competitive pressure. Among these resources, Emotional Intelligence (EI) and Mental Toughness (MT) have gained attention for their potential to influence motivation, resilience, and decision-making. They are therefore regarded as factors of interest when examining success in cognitive sports. Within the broader framework of physical culture, these mental attributes are essential for maintaining psychological balance, promoting adaptive functioning, and supporting health through recreation and mental training. Chess, although non-physical in nature, shares the aims of physical culture and rehabilitation by fostering self-control, stress tolerance, and emotional stability, which are key components of holistic human development.

Building on this perspective, EI refers to the ability to perceive, understand, and manage one's own and others' emotions [1]. In sports, emotionally intelligent athletes can regulate their emotional responses effectively [2]. MT, in turn, reflects the capacity to cope with pressure, adversity, and stress without giving up. It encompasses confidence, constancy, control, and resilience [3]. An athlete's success depends not only on physical abilities but also on a strong mental structure [4]. Thus, in a cognitively demanding sport like chess, these psychological constructs are likely integral to peak performance.

doi:10.15561/physcult.2025.0205

In the context of chess, an elite cognitive sport, both EI and MT appear especially relevant. Players must make complex strategic decisions under time pressure while managing the emotional highs of victory and the lows of defeat. Although specific studies on EI and MT in chess are limited, related research illustrates their role. One study [5] found that Turkish chess players scored high on a mental endurance inventory, and this "mental endurance" strongly predicted their psychological well-being. The authors noted that "having mental ability does not mean mental toughness," emphasizing that resilience must be developed separately. In other sports contexts, researchers [6] likewise observed that elite success depends on both physical and psychological strengths. By analogy, chess players with high EI and MT may be better at sustaining focus, handling stress, and maintaining composure in critical positions. These traits can help players avoid emotional swings (e.g., frustration after a mistake) and make more consistently sound moves.

Demographic factors such as age and gender also influence EI and MT, but findings are mixed. Some studies suggest these skills develop with experience, while others show no clear trend. For example, researchers [6] compared young athletes (aged 12–18) and observed that younger adolescents (12–15 years) scored higher on EI measures than older teens. In contrast, another study [7] found that older male athletes (26–33 years) had higher mental endurance and EI scores than their younger counterparts. Gender differences are likewise inconsistent. Female student-athletes scored higher than males on the confidence and constancy dimensions of MT, as well as on overall MT [8]. Related findings indicate that female athletes often exhibit superior emotional regulation and consistency under pressure [9]. Conversely, one study [10] reported higher EI scores among young male athletes than among females. These mixed results suggest that age and gender may shape psychological skills in complex ways, possibly interacting with cultural or sport-specific factors. In chess, for instance, maturation may enhance emotion regulation, while gender norms could influence confidence levels or emotional expression. Emotional intelligence and mental toughness are well-established determinants of athletic success [11], yet their specific roles in chess and their modulation by demographic factors are not well understood. In this context, demographic patterns in psychological traits may provide "strategic recommendations" for optimizing performance [11].

Analysis of research findings has shown that emotional intelligence and mental toughness contribute to athletic performance, including in cognitive competitions like chess. Researchers emphasize the practical importance of demographic context, as age and gender can shape these psychological constructs. At the same time, chess and specific populations remain insufficiently characterized with respect to psychological profiles. This includes the culturally distinct Eastern Zone states of India, which have produced competitive chess talent. Nevertheless, there remains a need for further research. This gap continues to hinder a comprehensive analysis of how psychological factors operate within the context of competitive chess. The aim of this study was to assess and compare EI and MT among national-level chess players from North-East India across gender and age categories.

Materials and Methods

Participants

A total of 106 national-level chess players (males = 58; females = 48), aged 18–25 years, voluntarily participated in the study. The participants were purposively selected from various states in North-East India, including Assam, Manipur, Mizoram, Tripura, and Arunachal Pradesh. All had represented their respective states in official national-level chess tournaments recognized by the national sports federation. For comparative analysis, participants were divided into two age-based groups: 18–21 years (n = 54) and 22–25 years (n = 52). Gender-based comparisons were also conducted to examine potential psychological differences between male and female chess players.

All participants were informed about the study objectives, assured of the confidentiality and anonymity of their responses, and reminded that participation was voluntary. Written informed consent was obtained from each participant before data collection began. The study was conducted in accordance with the ethical standards of the Declaration of Helsinki and approved by the institutional ethics committee.

Study Design

Emotional Intelligence Scale

Emotional intelligence was assessed using the standardized *Emotional Intelligence Scale* developed by Dr. Nicola Schutte et al. [12]. The scale is based on the theoretical model proposed by Mayer and Salovey [13] and comprises 33 self-report items rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). It measures an individual's ability to perceive, understand, regulate, and utilize emotions effectively in both personal and interpersonal contexts. The total score is obtained by summing all item responses, with higher scores indicating higher emotional intelligence. The reliability coefficient (Cronbach's alpha) for the present study sample was 0.88, demonstrating a high level of internal consistency.

Mental Toughness Questionnaire

Mental toughness was measured using the

Mental Toughness Questionnaire developed by Dr. Alan Goldberg [14]. This questionnaire consists of 30 items with dichotomous (true/false) response options. It is structured around five subscales, each containing six items: Rebound Ability, Ability to Handle Pressure, Concentration, Confidence, and Motivation. Each item was scored as 1 if the response matched the validated scoring key and 0 otherwise, yielding subscale scores ranging from 0 to 6. A higher subscale score indicates greater strength in that particular domain of mental toughness. The overall mental toughness score was obtained by summing the scores from all five subscales, producing a maximum possible total of 30. Internal consistency for each subscale and for the total score was assessed using the Kuder–Richardson Formula 20 (KR-20), a reliability measure suitable for dichotomous items, frequently applied in studies related to sport and physical culture [15, 16]. The internal consistency coefficients for the five subscales ranged from 0.70 to 0.84, confirming satisfactory reliability.

Data collection was conducted in person at training camps, tournament venues, and institutional sports facilities where the participants were available. The questionnaires were administered in a paper-based format in a controlled and distraction-free setting. Standardized instructions were provided both verbally and in writing to ensure consistent understanding of the items. Participants were instructed to answer the items independently. They were encouraged to seek clarification only for comprehension-related queries, not for the item content. Each administration session lasted approximately 25 to 30 minutes. All completed responses were carefully screened for completeness before inclusion in the final dataset. No compensation or incentives were provided to participants, and the confidentiality of individual responses was strictly maintained throughout the study.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics software, version 26. Descriptive statistics, including means, standard deviations, minimum and maximum scores, and internal consistency estimates, were computed for both emotional intelligence and mental toughness variables. The internal consistency of the Emotional Intelligence Scale was assessed using Cronbach's alpha, while the reliability of the dichotomously scored MTQ was evaluated using the Kuder–Richardson Formula 20. The Shapiro–Wilk test was employed to examine the normality of score distributions for each variable.

Since the Emotional Intelligence scores followed a normal distribution, parametric tests were applied for inferential comparisons. Independent samples t-tests were used to examine gender-based differences, and one-way analysis of variance (ANOVA) was used to compare emotional intelligence across age groups. In contrast, the Mental Toughness total and subscale scores did not meet the assumption of normality. Therefore, non-parametric statistical techniques were employed. The Mann–Whitney U test was used to analyze gender differences, and the Kruskal–Wallis H test was used to examine age group differences in the five subdomains of mental toughness.

Spearman's rank-order correlation coefficient was computed to determine the strength and direction of associations between emotional intelligence and overall mental toughness, as well as with each mental toughness subscale. A significance level of $p < .05$ was maintained throughout the analysis.

Results

Table 1 presents the descriptive statistics and reliability coefficients for emotional intelligence and the five subdomains of mental toughness. The table includes the number of participants, means, standard deviations, minimum and maximum values, and reliability estimates for each variable.

Table 1 summarizes the descriptive statistics for EI and the five MT subdomains, along with internal consistency estimates. The mean EI score was 131.62 ± 10.24. MT subscale scores ranged from 0 to 6, with the highest mean observed for Motivation (4.63 ± 0.97). Reliability analysis showed good internal consistency for all variables. Cronbach's alpha for the EI scale was 0.88, and KR-20 coefficients for the MT subscales ranged from 0.70 (Motivation) to 0.84 (Concentration), indicating acceptable reliability.

Table 2 presents the results of the Shapiro–Wilk test used to examine the normality of data distribution for emotional intelligence and mental

Table 1. Descriptive Statistics and Reliability of Emotional Intelligence and Mental Toughness Subscales

Variable	N	Mean	SD	Min	Max	Reliability
Emotional Intelligence (EI)	106	131.62	10.24	107	153	α = 0.88
Rebound Ability	106	4.51	1.02	2	6	KR-20 = 0.82
Ability to Handle Pressure	106	4.42	1.13	1	6	KR-20 = 0.78
Concentration	106	4.36	1.21	1	6	KR-20 = 0.84
Confidence	106	4.48	1.08	2	6	KR-20 = 0.79
Motivation	106	4.63	0.97	3	6	KR-20 = 0.70

toughness variables. The table shows that emotional intelligence scores met the assumption of normality, whereas all subscales of mental toughness did not.

As shown in Table 2, emotional intelligence followed a normal distribution, while all subdomains of mental toughness exhibited non-normal distributions. These findings justified the use of parametric tests for emotional intelligence and non-parametric procedures for mental toughness in subsequent analyses.

Table 3 presents the comparison of emotional intelligence and mental toughness scores between male and female chess players. Parametric and non-parametric tests were applied according to data distribution to identify potential gender-related differences across all measured variables.

Table 2. Shapiro–Wilk Test for Normality

Variable	W Statistic	p-value	Interpretation
Emotional Intelligence	0.991	0.677	Normally distributed
Rebound Ability	0.958	0.005	Not normally distributed
Handle Pressure	0.951	0.003	Not normally distributed
Concentration	0.947	0.001	Not normally distributed
Confidence	0.954	0.004	Not normally distributed
Motivation	0.945	0.002	Not normally distributed

Table 3. Gender Differences in Emotional Intelligence and Mental Toughness Subscales

Variable	Gender	Mean / Median (SD)	Test	p-value	Effect Size
Emotional Intelligence	Male	129.74 ± 10.52	t (104) = -2.31	0.023*	d = 0.45
	Female	133.61 ± 9.53			
Rebound Ability	Male	Mdn = 4	U = 1208.5	0.089	r = 0.17
	Female	Mdn = 5			
Handle Pressure	Male	Mdn = 4	U = 1185.0	0.076	r = 0.18
	Female	Mdn = 5			
Concentration	Male	Mdn = 4	U = 1156.0	0.062	r = 0.19
	Female	Mdn = 5			
Confidence	Male	Mdn = 5	U = 1250.0	0.112	r = 0.15
	Female	Mdn = 5			
Motivation	Male	Mdn = 4	U = 1238.5	0.101	r = 0.16
	Female	Mdn = 5			

*Significant at p < .05

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Concentration	Male	Mdn = 4	U = 1156.0	0.062	r = 0.19
	Female	Mdn = 5			
Confidence	Male	Mdn = 5	U = 1250.0	0.112	r = 0.15
	Female	Mdn = 5			
Motivation	Male	Mdn = 4	U = 1238.5	0.101	r = 0.16
	Female	Mdn = 5			

*Significant at p < .05

Table 4. Age Group Differences in Emotional Intelligence and MT Subscales

Variable	Age Group	Mean / Median	Test	p-value	Effect Size
Emotional Intelligence	18–21	130.45 ± 10.81	F (1,104) = 1.92	0.169	$\eta^2 = 0.02$
	22–25	132.75 ± 9.52			
Rebound Ability	18–21	Mdn = 4	U = 1032.5	0.015*	r ≈ 0.26
	22–25	Mdn = 5			
Motivation	18–21	Mdn = 4	U = 1068.0	0.021*	r ≈ 0.24
	22–25	Mdn = 5			
Other Subscales	—	—	—	> 0.05	ns

*Significant at p < .05

Table 5. Correlations Between Emotional Intelligence and MT Subscales

MT Subscale	Spearman's ρ	p-value
Rebound Ability	0.348	0.004*
Handle Pressure	0.421	< .001*
Concentration	0.467	< .001*
Confidence	0.336	0.006*
Motivation	0.389	0.002*
Total MT Score	0.508	< .001*

*Significant at p < .05

As shown in Table 3, female players demonstrated higher emotional intelligence scores than males, with a moderate effect size. Differences across mental toughness subscales were not statistically significant, although females tended to show slightly higher median values in several domains, particularly in concentration and the ability to handle pressure.

Table 4 presents the comparison of emotional intelligence and mental toughness scores between the two age groups of chess players. Parametric and non-parametric tests were applied depending on the data distribution to identify potential age-related variations across the studied variables.

As shown in Table 4, emotional intelligence did not differ significantly between younger and older chess players. However, older players showed higher levels of mental toughness in specific domains, particularly in rebound ability and motivation. No significant differences were observed in the remaining subscales of mental toughness.

Table 5 presents the correlation coefficients between emotional intelligence and the subscales of mental toughness. Spearman's rank-order correlations were computed to examine the strength and direction of associations between these variables.

As shown in Table 5, emotional intelligence demonstrated a positive association with overall mental toughness. Similar positive relationships were observed across all subdomains, with stronger correlations evident for concentration, the ability to handle pressure, and motivation.

Overall, the results showed that emotional intelligence was normally distributed, whereas most mental toughness indicators were not. Female players exhibited higher emotional intelligence, while age-related differences were mainly reflected in specific aspects of mental toughness, such as rebound ability and motivation. Positive associations were observed between emotional intelligence and all components of mental toughness, indicating that greater emotional competence was related to higher psychological resilience in chess players.

Discussion

The main aim of this study was to assess and compare emotional intelligence and mental toughness among national-level chess players from North-East India across gender and age categories. The findings showed that female players demonstrated higher emotional intelligence than males, whereas gender differences in mental toughness were not significant. Age did not affect emotional intelligence but was related to certain aspects of mental toughness, with older players showing greater rebound ability and motivation. A moderate positive association was also observed between emotional intelligence and overall mental toughness.

Prior research indicates that individuals engaged in chess exhibit heightened emotional regulation and cognitive control, both essential for superior performance [17]. These attributes align with the demands of the sport, including sustained focus, error avoidance, and resilience under psychological

stress [18]. The higher emotional intelligence often observed in female players can be explained through gender-linked patterns of emotional processing. Women typically demonstrate stronger emotion perception and regulation [19], which in chess may translate into more effective handling of competitive stress and strategic emotional management. Emotional awareness supports decision-making under pressure, as suggested by previous findings [20], and may facilitate adaptive responses to adversity and anticipation of opponents' behaviour.

The development of mental toughness is influenced by experience and age. As individuals progress through competitive stages, they gain exposure to high-pressure situations and setbacks, which fosters greater psychological resilience [21]. Chess players, in particular, benefit from repeated exposure to tournament tension, mistakes, and shifting momentum, all of which contribute to stronger coping strategies. The subdomains of concentration and rebound ability are especially cultivated due to the extended duration and high cognitive load of chess games [22]. The observed positive relationship between emotional intelligence and mental toughness is consistent with theoretical propositions suggesting that emotional control enhances cognitive resilience [23]. In chess, players with stronger emotional regulation are better equipped to handle pressure, maintain concentration, and recover from mistakes [24]. Emotional competence therefore appears to strengthen mental toughness by promoting adaptive stress responses and attentional control.

From the perspective of physical culture and rehabilitation, these psychological mechanisms reflect broader processes of self-regulation and stress management that contribute to maintaining mental well-being and functional balance. Developing emotional control and resilience through cognitive sports like chess can thus complement recreational and educational programs aimed at fostering holistic health and adaptive behaviour.

Furthermore, mental toughness, encompassing consistency and psychological stamina, is integral to chess performance. Tournament preparedness, characterized by strategy, emotional regulation, and endurance across multiple rounds, reflects this trait [25]. The development of such mental habits aligns with broader psychological models, including the Individual Zone of Optimal Functioning [13, 24], which emphasizes individualized emotional control strategies. Skill progression in chess is also intertwined with psychological growth. Greater concentration, pressure control, and motivational resilience not only represent behavioural adaptation but also cognitive maturation, contributing to strategic depth and pattern recognition [12]. The integrated model of emotional intelligence and mental toughness suggests that emotional regulation enhances focus and reduces reactivity to errors, while mental toughness supports recovery and sustained effort during prolonged games.

Interventions aimed at improving mindfulness and preparation for competitive pressure, which are widely applied in physical sports, are also gaining empirical support in chess [26]. Approaches such as mental rehearsal, emotion regulation strategies, and cognitive behavioural techniques have been shown to enhance both emotional intelligence and mental toughness [27]. These findings support the recommendation that psychological skill training should be integrated into chess coaching, extending beyond purely technical or tactical instruction. In addition, combining quantitative assessments with psychophysiological indicators such as heart rate variability, cortisol levels, and eye tracking during gameplay can provide deeper insight into stress reactivity and emotional cognitive regulation. This multi method approach offers greater ecological validity and complements traditional self-report scales [27].

Taken together, the findings underscore that success in chess extends beyond technical mastery and strategic knowledge. Psychological resources, particularly emotional intelligence and mental toughness, play a vital role in sustaining performance during prolonged cognitive challenges. The interplay of these traits suggests that mental preparation and emotional regulation are core components of excellence in cognitive sports such as chess.

Limitations and Future Directions

This study has several limitations that should be considered when interpreting the findings. The sample was limited to national-level chess players from the North-Eastern region of India, which may restrict the generalizability of the results to other cultural or competitive contexts. The cross-sectional design also prevents causal inferences regarding the relationship between emotional intelligence and mental toughness.

Future research should employ longitudinal designs to track the development of these psychological attributes across different stages of athletic experience. Experimental or intervention-based studies could further clarify whether targeted psychological training enhances emotional and cognitive resilience. Incorporating physiological and observational measures, such as heart rate variability, cortisol levels, or eye tracking during gameplay, would provide more comprehensive insight into stress responses and emotion–cognition interaction in competitive settings.

Expanding research to include players of different competitive levels and cultural backgrounds could deepen understanding of psychological variability in chess and other cognitively demanding sports.

Conclusions

This study highlights the significance of psychological factors such as emotional intelligence and mental toughness in chess performance. These attributes jointly contribute to emotional regulation, resilience, and cognitive stability under competitive pressure. The findings emphasize the value of integrating psychological preparation into chess training programs, with a focus on emotional control and stress management. Strengthening these mental components may enhance players' ability to sustain performance in cognitively demanding environments and support long-term psychological development in sport.

In the broader framework of physical culture and rehabilitation, the development of emotional intelligence and mental toughness may serve not only competitive performance but also psychological balance, self-regulation, and overall well-being. These findings suggest that cognitive sports like chess can be effectively integrated into recreational and educational programs that aim to enhance mental resilience and adaptive capacity.

Highlight

This study offers a psychological characterization of national-level chess players from the North-Eastern region of India, focusing on emotional intelligence (EI) and mental toughness (MT) across gender and age groups. It represents one of the first systematic investigations into cognitive sport performance within this underrepresented population. The results showed that female players demonstrated higher EI, while age was associated with increased MT, suggesting that experience enhances psychological resilience. A moderate positive correlation between EI and MT indicates their complementary roles in sustaining cognitive performance under competitive pressure. The use of validated assessment tools and appropriate statistical analyses supports the reliability of the findings. These outcomes underscore the importance of integrating structured psychological preparation into chess training, highlighting the growing relevance of emotional and mental skills in cognitive sports.

Acknowledgement

The authors express their sincere gratitude to all national-level chess players from Eastern India who voluntarily participated in this study and contributed their valuable time and insights. Special thanks are extended to the coaches and officials who facilitated data collection during competitive events.

Conflict of Interest

The authors declare that there is no conflict of interest.

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Information about the authors:

SM Farooque; (Corresponding Author); https://orcid.org/0000-0003-1018-6745; smharish9@gmail.com; Department of Physical Education, Tripura University (A Central University); Agartala, India.

Phanin Narah; https://orcid.org/0009-0009-0474-4211; narahphanin@gmail.com; Department of Physical Education, Tripura University (A Central University); Agartala, India.

Sharina Naorem; https://orcid.org/0009-0006-0516-3935; sharinanaorem00@gmail.com; Department of Physical Education, Tripura University (A Central University); Agartala, India.

Lalhmangaihsanga Sailo; https://orcid.org/0009-0005-9660-7521; lalhmangaihsangas@gmail.com; Department of Physical Education, Tripura University (A Central University); Agartala, India.

Mukesh Mitra; Assistant Professor; https://orcid.org/0000-0003-2129-8355; golu.wa.mitra@gmail.com; Department of Physical Education, MMDC College; Sabroom, Tripura, India.

Cite this article as:
Farooque S, Narah P, Naorem S, Sailo L, Mitra M. Comparative study of emotional intelligence and mental toughness across age and gender in Eastern Zone chess players. *Physical Culture, Recreation and Rehabilitation*, 2025;4(2):102–110.
https://doi.org/10.15561/physcult.2025.0205

Received: 01.09.2025
Accepted: 07.10.2025; Published: 30.12.2025