

MENTAL TOUGHNESS IN VOLLEYBALL ATHLETES: ANALYSIS BY PLAYING POSITION, ACHIEVEMENT LEVEL, AND GENDER

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ABSTRACT

This study aims to analyze differences in mental toughness among volleyball athletes based on playing position, performance achievement level, and gender, including the interactions among these factors. A quantitative approach with a descriptive-comparative and cross-sectional design was employed. The sample consisted of 320 male and female volleyball athletes in East Java, selected using purposive sampling. Mental toughness was measured using the Mental Toughness Inventory (MTI) with a four-point Likert scale, comprising 24 valid items with high reliability (Cronbach's $\alpha = 0.967$). Data were analyzed using a Three-Way Analysis of Variance (ANOVA) after meeting the assumption of homogeneity of variance. The results showed no significant main effects of performance achievement level ($p = 0.592$), gender ($p = 0.179$), or playing position ($p = 0.094$) on mental toughness. The interactions between performance achievement level and gender, performance achievement level and playing position, gender and playing position, as well as the three-way interaction were also non-significant, with all eta-squared values falling within the very small effect category (Cohen, 1988). These findings indicate that mental toughness levels among the volleyball athletes in this study were relatively similar across performance achievement level, gender, and playing position, with no evidence of significant interactions among these three characteristics.

Keywords: mental toughness; volleyball athletes; playing position; achievement level; gender

Introduction

Mental toughness refers to an individual's ability to consistently maintain optimal performance despite facing pressure, challenges, and difficulties during training and competition (Cowden, 2017). A meta-analysis conducted by Stamatis et al. (2020) demonstrated a positive association between mental toughness and sports performance, indicating that athletes with higher levels of mental toughness tend to maintain more consistent and stable performance. The characteristics of team sports such as volleyball make mental toughness particularly important because the game is fast-paced, dynamic, and highly competitive, requiring athletes to manage pressure, make rapid decisions, coordinate effectively with teammates, and adapt to changing game situations.

Several individual characteristics are thought to be associated with the level of mental toughness among volleyball athletes. Playing position may influence athletes' psychological experiences because each position involves different physical, technical, and tactical demands. Setters, middle blockers, outside hitters, opposite hitters, and liberos face different workloads, action intensities, and decision-making demands, which may result in different experiences of

competitive pressure (Rebelo et al., 2026). In addition, performance achievement level is expected to contribute to the development of mental toughness because athletes competing at higher levels generally have more extensive competitive experience, greater exposure to competitive pressure, and better psychological adaptability. Yadav & Yadav (2026) found that senior volleyball athletes demonstrated higher levels of mental toughness than junior and sub-junior athletes. Gender has also been widely examined in mental toughness research, although the findings remain mixed. Some studies have identified psychological differences based on gender, whereas others suggest that these differences may be influenced by competitive experience, quality of training, and the characteristics of the demands faced by athletes (Rebelo et al., 2026). These findings indicate that the relationships between playing position, performance achievement level, gender, and mental toughness require further investigation, particularly among volleyball athletes.

Although these three factors have each been shown to be associated with mental toughness, previous studies have generally examined playing position, performance achievement level, and gender separately or have used samples combining athletes from different sports, making the findings difficult to generalize specifically to volleyball. This approach, which examines one individual characteristic at a time, has also contributed to inconsistent findings across studies and has yet to clarify whether these three factors interact in shaping mental toughness (Cowden, 2017; Stamatis et al., 2020). In the context of competitive sports development, mental toughness may be better understood as the result of the simultaneous interplay of multiple individual characteristics rather than the effect of a single factor. For example, differences in mental toughness between male and female athletes may vary across different performance achievement levels or playing positions. This interactional framework provides the theoretical basis for the use of a Three-Way Analysis of Variance (Three-Way ANOVA) in the present study, as this approach enables the simultaneous examination of the main effects and interaction effects of the three variables.

Based on this research gap, the present study was conducted to examine differences in mental toughness among volleyball athletes based on playing position, performance achievement level, and gender, including the interactions among these three factors. The findings are expected to provide more comprehensive empirical evidence for the development of sport psychology research, particularly regarding mental toughness among volleyball athletes. The results may also serve as a basis for coaches, clubs, and sports organizations to design more targeted mental training programs that account for athletes' playing positions, performance achievement levels, and gender.

Methods

This study employed a quantitative approach with a comparative descriptive research design (Creswell & Creswell, 2018). The approach was used to examine differences in mental toughness based on playing position, performance achievement level, and gender among volleyball athletes without providing any intervention to the participants. A quantitative

approach was selected because it enables objective measurement of variables using numerical data and statistical analysis to test the research hypotheses. The study employed a cross-sectional design, in which data were collected at a single point in time to describe the participants' conditions during the study without any intervention from the researchers (Setia, 2016).

This study consisted of one dependent variable and three independent variables. The dependent variable was mental toughness among volleyball athletes, while the independent variables included playing position, performance achievement level, and gender. Mental toughness refers to an athlete's psychological ability to maintain consistent performance when facing pressure, challenges, and competitive situations. Playing position refers to the athlete's primary role during volleyball matches based on the applicable playing system and was categorized into four specific playing positions based on athletes' primary technical roles within the team: middle blocker, spiker (encompassing outside and opposite hitters), setter, and libero. This categorization was applied because each position involves different technical and psychological demands that may influence mental toughness. Performance achievement level refers to the highest official level of competition in which an athlete has participated. It was classified into two categories: national and international levels, based on competitions organized by PBVSI and FIVB. Performance achievement level was determined according to the highest level of competition previously attended by the athlete, as higher levels of competition generally involve greater performance demands and psychological pressure. Gender refers to the biological characteristic of the participants and was categorized as male or female. This variable was included to examine differences in mental toughness based on the athletes' biological characteristics.

The study population consisted of all male and female volleyball athletes who were registered and actively participated in training and development programs at volleyball clubs in East Java. The sample consisted of 350 athletes, including 30 athletes for the instrument try-out and 320 athletes for the main study. Participants were selected using purposive sampling, in which respondents were recruited based on predetermined criteria aligned with the objectives of the study. The inclusion criteria were: (1) actively participating in training at a volleyball club; (2) having participated in an official competition at a minimum national level; (3) having a relatively fixed playing position; and (4) being willing to participate by completing the questionnaire in full. The sample characteristics were categorized based on playing position (middle blocker, spiker, setter, and libero), performance achievement level (national and international), and gender (male and female).

Data were collected using a survey method with a psychological scale instrument, namely the Mental Toughness Inventory (MTI) adapted from Gucciardi et al. (2009). Because the original MTI was developed and validated in English for Australian football athletes, whereas the present study involved Indonesian volleyball athletes, the instrument was adapted prior to use through a structured translation and content-validation process. This process included forward translation into Bahasa Indonesia by a bilingual sport-science translator, back-

translation into English by an independent translator to check semantic equivalence, review by three experts in sport psychology and measurement to assess content relevance and item clarity (expert judgment/content validity), and a readability check with a small group of volleyball athletes prior to the validity and reliability testing described below. This adaptation procedure was intended to ensure the linguistic and cultural appropriateness of the instrument for the Indonesian volleyball context. The instrument consists of statements measuring four dimensions of mental toughness: thrive through challenge, sport awareness, tough attitude, and desire for success. All items were assessed using a four-point Likert scale without a neutral option to encourage respondents to provide decisive responses and minimize response bias. Respondents were instructed to answer according to their experiences and feelings while participating in athletic activities. Before being used in the main study, the instrument was pilot-tested with 30 volleyball athletes to evaluate its quality. Validity testing was conducted using Pearson Product-Moment correlation to determine whether each item adequately measured the mental toughness construct, while reliability testing was performed using Cronbach's Alpha to assess the internal consistency of the instrument. The instrument was considered acceptable when all items met the validity criteria and Cronbach's Alpha was ≥ 0.70 . Based on the pilot test results, 24 items were found to be valid and met the eligibility criteria for use as the measurement instrument in this study.

The data were analyzed using inferential statistical analysis with the assistance of IBM SPSS Statistics. Descriptive analysis was first conducted to describe the characteristics of the respondents and their overall level of mental toughness. Before hypothesis testing, prerequisite analyses were performed, including the Shapiro–Wilk normality test to determine whether the data were normally distributed and Levene's Test for homogeneity of variance to assess whether the variances across groups were homogeneous. All statistical tests in this study used a significance level of $\alpha = 0.05$. After these assumptions were met, the main analysis was conducted using a Three-Way Analysis of Variance (Three-Way ANOVA) to examine differences in mental toughness based on playing position, performance achievement level, and gender, as well as the interactions among the three variables. When the analysis indicated significant differences, the analysis was followed by a Tukey HSD post hoc test to identify the specific pairs of groups that differed significantly.

Results

Before being used in the main study, the mental toughness scale was pilot-tested on 30 athletes to assess its validity and reliability. Based on the validity test results, 24 items were declared valid because they met the eligibility criteria for use as a measurement instrument.

Table 1. Validity Test of the Mental Toughness Instrument

No	Item	Item–Rest Correlation	Cronbach's α (If the Item Is Deleted)
1.	Item 1	0.683	0.967
2.	Item 2	0.789	0.966
3.	Item 4	0.721	0.967

4.	Item 5	0.509	0.969
5.	Item 7	0.773	0.966
6.	Item 8	0.767	0.967
7.	Item 10	0.805	0.966
8.	Item 11	0.760	0.967
9.	Item 12	0.794	0.966
10.	Item 14	0.787	0.966
11.	Item 15	0.736	0.967
12.	Item 17	0.640	0.968
13.	Item 18	0.790	0.966
14.	Item 20	0.766	0.967
15.	Item 21	0.852	0.966
16.	Item 23	0.856	0.966
17.	Item 24	0.708	0.967
18.	Item 26	0.665	0.967
19.	Item 27	0.757	0.967
20.	Item 29	0.741	0.967
21.	Item 30	0.733	0.967
22.	Item 32	0.757	0.967
23.	Item 33	0.747	0.967
24.	Item 35	0.662	0.967

The reliability test was conducted to determine the extent to which the instrument consistently measures the intended variable using Cronbach's Alpha. The instrument was considered reliable when the Cronbach's Alpha coefficient was ≥ 0.70 .

Table 2. Reliability Test of the Mental Toughness Instrument

Scale	Cronbach's α	N of Items
<i>Mental Toughness</i>	0.967	24

The reliability test results showed that the research instrument had a high Cronbach's Alpha coefficient ($\alpha = 0.967$), substantially exceeding the minimum reliability threshold of 0.70. This indicates that all items on the mental toughness scale demonstrated good internal consistency and stability in measuring the research construct. It should be noted that a Cronbach's alpha of 0.967 is relatively high for a 24-item scale and exceeds the commonly cited upper benchmark of approximately 0.90-0.95, above which reliability coefficients are sometimes considered indicative of item redundancy rather than solely of strong internal consistency. This may reflect substantial conceptual overlap among some MTI items rather than a meaningfully broader measurement of the mental toughness construct. Future studies using this instrument may benefit from examining inter-item correlations or considering a shorter item set to reduce potential redundancy while retaining adequate content coverage of the construct.

Descriptive analysis was conducted to describe mental toughness scores based on the combination of competitive level, gender, and playing position.

Table 3. Descriptive Statistics Cross Tab

Achievement Level	Gender	Playing Position	N	Mean	SD	SE	CV
National	Male	Middle Blocker	29	64.14	4.397	0.817	0.069
National	Male	Spike	67	63.49	4.962	0.606	0.078
National	Male	Setter	26	62.00	9.230	1.810	0.149
National	Male	Libero	19	62.47	5.348	1.227	0.086
National	Female	Middle Blocker	10	63.90	2.644	0.836	0.041
National	Female	Spike	34	63.47	6.036	1.035	0.095
National	Female	Setter	27	61.63	4.253	0.818	0.069
National	Female	Libero	16	61.38	5.340	1.335	0.087
International	Male	Middle Blocker	6	59.33	6.501	2.654	0.110
International	Male	Spike	20	65.15	1.872	0.418	0.029
International	Male	Setter	10	63.60	5.420	1.714	0.085
International	Male	Libero	3	56.33	10.786	6.227	0.191
International	Female	Middle Blocker	15	62.67	3.374	0.871	0.054
International	Female	Spike	24	63.17	4.400	0.898	0.070
International	Female	Setter	6	64.33	2.944	1.202	0.046
International	Female	Libero	8	64.50	5.182	1.832	0.080

Based on Table, mental toughness scores varied across combinations of performance achievement level, gender, and playing position. The highest mean score was found among male spikers at the international level ($M = 65.15$; $SD = 1.872$), indicating a relatively high and stable level of mental toughness. The lowest mean score was observed among male liberos at the international level ($M = 56.33$; $SD = 10.786$), with the greatest score variation, indicating greater heterogeneity in the mental characteristics of this group. Male and female athletes at the national level showed relatively similar mean mental toughness scores across playing positions, with moderate score distributions. Greater variation was observed across playing positions and gender at the international level, although the relatively small sample sizes in some groups may have contributed to higher standard deviations and coefficients of variation. Overall, these descriptive findings indicate that mental toughness among volleyball athletes varies according to the combination of the three factors, although the differences in mean scores across groups are not extreme. These findings provide a relevant basis for further inferential analysis using a Three-Way ANOVA.

Table 4. Normality Test by Competitive Level

Level	N	Shapiro–Wilk	p-value	Normality
National	228	0.874	< .001	Not Normally Distributed
International	92	0.926	< .001	Not Normally Distributed

Table 5. Normality Test by Gender

Gender	N	Shapiro–Wilk	p-value	Normality
Male	180	0.842	< .001	Not Normally Distributed

Female	140	0.941	< .001	Not Normally Distributed
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Table 6. Normality Test by Playing Position

Position	N	Shapiro–Wilk	p-value	Normality
Middle Blocker	60	0.971	0.169	Normally Distributed
Spike	145	0.942	< .001	Not Normally Distributed
Setter	69	0.738	< .001	Not Normally Distributed
Libero	46	0.909	0.002	Not Normally Distributed

The Shapiro–Wilk test results showed that mental toughness scores for the performance achievement level categories (national: $W = 0.874$, $p < .001$; international: $W = 0.926$, $p < .001$) and gender categories (male: $W = 0.842$, $p < .001$; female: $W = 0.941$, $p < .001$) were not normally distributed. For playing position, only the middle blocker group met the normality assumption ($W = 0.971$; $p = 0.169$), whereas the spiker, setter, and libero groups showed non-normal distributions. Therefore, the normality assumption was not met in most data groups.

Table 7. Levene's Test of Homogeneity

Test	F	df1	df2	p-value
Levene's Test	1.397	15	304	0.147

The homogeneity test using Levene's Test showed an F value of 1.397 with $p = 0.147$. Since $p > 0.05$, the variances across groups can be considered homogeneous, indicating that the homogeneity assumption for ANOVA was met despite the non-normal distribution observed in some data groups. This condition allows the Three-Way ANOVA to be conducted, as this technique is relatively robust to violations of the normality assumption when sample sizes are sufficiently large and reasonably balanced across groups.

The ANOVA results in this study should therefore be interpreted as indicating general patterns of group differences rather than definitive conclusions for each individual group.

Table 8. Outliers (Highest Cook's Distance)

Case	Y	Residual	Cook's Distance
45	79	15.31	0.014
81	74	11.64	0.015
105	75	12.38	0.027
156	52	-11.69	0.014
164	48	-13.85	0.031
167	46	-16.12	0.041
170	88	24.58	0.051
176	22	-40.36	0.175

The Cook's Distance test showed that all values were well below the critical threshold of 1.0, with the highest value being 0.175 in Case 176. This finding indicates that there were no

influential outliers, and no individual observation substantially affected the stability of the ANOVA model. Considering that the homogeneity of variance assumption was met, the sample size per group was relatively large, and no influential outliers were identified, the results of the Three-Way ANOVA can be considered sufficiently robust and appropriate as a basis for drawing conclusions, although the normality assumption was not fully satisfied in several groups.

This study involved 320 volleyball athletes from national and international performance achievement levels, representing various playing positions and genders. Descriptive analysis was conducted to provide an initial overview of the distribution of mental toughness scores before inferential analysis. The reported statistics included sample size, mean, standard deviation, and minimum and maximum values.

Table 9. Descriptive Statistics of Mental Toughness Based on Athlete Characteristics

Variable	Category	N	Mean	SD	Min
Achievement Level	National	228	62.96	5.619	22
	International	92	63.28	4.623	44
Gender	Male	180	63.21	5.777	22
	Female	140	62.86	4.750	48
Playing Position	Middle Blocker	60	63.25	4.316	52
	Spike	145	63.66	4.854	52
	Setter	69	62.29	6.602	22
	Libero	46	62.04	5.812	44

Based on table, the mean mental toughness score of international athletes was slightly higher than that of national athletes, although the difference was relatively small. The mean mental toughness scores of male and female athletes were also nearly identical. The spiker group had the highest mean score among the playing positions, followed by middle blockers, setters, and liberos. Although variations in scores were observed across groups, the differences in mean scores were generally relatively small. Statistical assumption testing was conducted before the ANOVA, including tests of normality and homogeneity of variance.

Table 10. Results of Assumption Tests (Normality and Homogeneity)

Variable	Category	N	Shapiro–Wilk	p	Interpretation
Achievement Level	National	228	0.874	<.001	Not Normally Distributed
	International	92	0.926	<.001	Not Normally Distributed
Gender	Male	180	0.842	<.001	Not Normally Distributed
	Female	140	0.941	<.001	Not Normally Distributed
Playing Position	Middle Blocker	60	0.971	0.169	Normal
	Spike	145	0.942	<.001	Not Normally Distributed
	Setter	69	0.738	<.001	Not Normally Distributed
	Libero	46	0.909	0.002	Not Normally Distributed
Homogenitas Varians	Levene's Test	–	F = 1.397	0.147	Homogeneous

The Shapiro–Wilk normality test showed that most data groups were not normally distributed, except for the middle blocker group. This finding can be considered acceptable because the sample size in this study was relatively large ($n = 320$), with most data groups containing more than 25 participants. Based on the central limit theorem, as the sample size increases, the distribution of sample means increasingly approximates a normal distribution regardless of the shape of the underlying population distribution. Therefore, the F-test in ANOVA can remain reasonably robust even when the individual-level data are not normally distributed.

Table 11. Results of Three-Way ANOVA of Mental Toughness among Volleyball Athletes

Source	F	df1	df2	p	η^2
Achievement Level	0.288	1	304	0.592	0.001
Gender	1.811	1	304	0.179	0.005
Playing Position	2.148	3	304	0.094	0.019
Achievement Level $\times$ Gender	3.580	1	304	0.059	0.011
Achievement Level $\times$ Position	2.154	3	304	0.093	0.019
Gender $\times$ Position	1.649	3	304	0.178	0.015
Achievement Level $\times$ Gender $\times$ Position	2.380	3	304	0.070	0.021

The analysis showed no significant main effects of any of the three factors on mental toughness: performance achievement level, $F(1, 304) = 0.288$, $p = .592$, $\eta^2p = .001$; gender, $F(1, 304) = 1.811$, $p = .179$, $\eta^2p = .005$; and playing position, $F(3, 304) = 2.148$, $p = .094$, $\eta^2p = .019$. Two-way and three-way interaction effects among the three factors were examined next. The two-way interactions were also non-significant: achievement level $\times$ gender, $F(1, 304) = 3.580$, $p = .059$, $\eta^2p = .011$; achievement level $\times$ playing position, $F(3, 304) = 2.154$, $p = .093$, $\eta^2p = .019$; and gender $\times$ playing position, $F(3, 304) = 1.649$, $p = .178$, $\eta^2p = .015$. The three-way interaction among achievement level, gender, and playing position was likewise non-significant, $F(3, 304) = 2.380$, $p = .070$, $\eta^2p = .021$. Although conventionally classified as non-significant at $\alpha = .05$, the achievement level $\times$ gender interaction ($p = .059$) and the three-way interaction ($p = .070$) were both close to the significance threshold and may be more appropriately interpreted as trends approaching significance rather than as straightforward null effects. This possibility warrants particular caution given the highly unbalanced cell sizes across some combinations of the three factors (e.g., $n = 3$ for international male liberos, compared with $n = 67$ for national male spikers), which reduces statistical power and increases the risk of failing to detect a true effect (Type II error) in the smaller cells. The effect sizes indicated by partial eta squared (η^2p) were within the very small to small range, following the benchmark criteria proposed by Cohen (1988), in which values around .01, .06, and .14 correspond to small, medium, and large effects, respectively. These findings suggest that the contributions of performance achievement level, gender, and playing position to the variation in mental toughness were relatively limited. Therefore, differences in mental toughness among volleyball athletes cannot be significantly

explained by these three variables, either independently or through their interactions.

Discussion

The findings showed no significant differences in mental toughness based on playing position, performance achievement level, or gender, either independently or through the interactions among the three variables. This finding indicates that mental toughness levels among the volleyball athletes in the sample were relatively homogeneous, suggesting that these individual characteristics were not sufficient to significantly differentiate athletes' levels of mental toughness. The finding is consistent with the view that mental toughness is a psychological capacity that develops through long-term adaptation to the demands of training and competition and may not necessarily differ according to demographic or sport-specific characteristics (Cowden, 2017; Stamatis et al., 2020). The relatively similar levels of mental toughness observed in this study may also have been influenced by similarities in training systems, training intensity, and competitive experiences among athletes within the same club environment. Mental toughness development should therefore consider not only individual characteristics but also the quality of psychological development programs and training environments that support athletes' mental capacity.

Based on playing position, this study showed no significant differences in mental toughness across volleyball playing positions. Although spikers had a slightly higher mean mental toughness score than the other positions descriptively, the difference was not statistically significant. This finding is consistent with (Pulungan et al., 2023), who reported that the psychological skill characteristics of Indonesian volleyball athletes were relatively similar across different playing positions. Research by Asamoah & Grobbelaar (2016) on team sport athletes also showed that although each playing position involves different game demands, differences in psychological characteristics are not necessarily significant across all psychological constructs measured. These findings indicate that differences in the technical and tactical demands of each playing position do not necessarily produce substantial differences in mental toughness. In training and development settings, all players are exposed to relatively similar competitive pressures, participate in similar training programs, and are required to maintain concentration, regulate emotions, and make decisions during competition. These conditions may contribute to relatively homogeneous levels of mental toughness among players despite differences in their roles within the team. This interpretation is supported by a systematic review by Rebelo et al. (2026), which indicated that although physical demands and match workloads differ across playing positions, all players experience high levels of competitive pressure and therefore require relatively similar psychological capacities.

Theoretically, these findings can be explained through the concept of mental toughness proposed by Clough et al. (2002), which views mental toughness as an individual's ability to maintain optimal performance under pressure. In team sports such as volleyball, competitive pressure is experienced collectively by all players, so the mental capacities required to cope with such pressure may develop relatively evenly across playing positions. Playing position is

more closely related to technical specialization and tactical roles within the team, whereas mental capacity develops as an internal psychological resource that can be possessed by athletes across different playing positions.

Nevertheless, several studies have indicated that differences in psychological characteristics among athletes may be more likely to emerge in specific dimensions of mental toughness rather than in the overall score. Gucciardi (2020) explained that mental toughness is a multidimensional construct encompassing various psychological aspects, meaning that variation among athletes may occur in specific components without producing significant differences at the overall construct level. Based on this perspective, the absence of significant differences in total mental toughness scores in the present study does not necessarily indicate that all psychological characteristics of the athletes were identical. Instead, variations may exist in specific aspects, such as self-confidence, emotional regulation, or the ability to maintain focus, which were not examined separately in this study. Future research is therefore recommended to examine the dimensions of mental toughness in greater detail to obtain a more comprehensive understanding of the psychological characteristics of volleyball athletes across different playing positions.

This study showed that performance achievement level did not produce significant differences in mental toughness among volleyball athletes. This finding indicates that an increase in competitive level is not necessarily accompanied by an increase in mental toughness. The result is consistent with (Crust & Swann, 2011), who stated that the relationship between mental toughness and competitive level is not always linear because it is influenced by various psychological and training-environment factors. Gucciardi (2020) also explained that mental toughness develops through continuous adaptation to training demands, competitive experiences, and psychological learning, meaning that it is not determined solely by athletes' performance achievement level. A systematic review by (Farnsworth et al., 2021) further indicated that mental toughness is a complex and multidimensional construct, with its variation influenced more by measurement quality and individual characteristics than by competitive category alone. The absence of significant differences in mental toughness across performance achievement levels in this study therefore suggests that mental toughness may develop through the accumulation of training experiences and ongoing psychological adaptation. Nevertheless, because this study did not directly measure competitive experience or the quality of psychological training and development, this interpretation requires further examination through longitudinal research.

This finding can also be explained through the stress appraisal framework proposed by (Lazarus & Folkman, 1984). The theory suggests that individuals who are accustomed to experiencing pressure develop more adaptive evaluation abilities and coping strategies. Athletes with sufficient competitive and training experience tend to perceive competitive pressure as a manageable challenge rather than a threat. Differences in formal competitive levels therefore do not necessarily produce significant differences in mental toughness capacity. The results also showed no significant difference in mental toughness between male and female athletes. This

finding reinforces the view that mental toughness is a psychological construct that is not determined solely by demographic characteristics but is also associated with athletes' experiences and training and competitive contexts (Hsieh et al., 2024; Stamatis et al., 2020).

Several recent studies have shown that the relationship between gender and mental toughness has not produced a consistent pattern. Tangkudung et al. (2022) found that gender was associated with mental toughness among martial arts athletes, while Şimşek et al. (2023) specifically compared mental toughness levels between male and female football athletes. A study involving 344 track and field athletes by (Yarayan et al., 2024) indicated that gender differences should be considered alongside performance context and other psychological characteristics. More recent research has also shown that mental toughness is associated with social contexts and sport experiences, suggesting that demographic characteristics alone may not adequately explain its variation (Clark et al., 2023; Karabulut & Akinci, 2025). Consistent with these findings, this study found no significant interaction effects among playing position, performance achievement level, and gender on mental toughness, indicating that the combination of these three characteristics does not automatically produce differences in mental toughness among athletes.

Overall, the findings of this study indicate that mental toughness among volleyball athletes is more strongly influenced by psychological experiences, adaptation to pressure, and coping strategies developed throughout training and competition. Experiences involving failure, injury, team conflict, and pressure from coaches' expectations may play an important role in shaping athletes' mental toughness. Mental toughness can therefore be understood as the outcome of a long-term psychological learning process that develops through competitive experiences and social dynamics within the sporting environment.

The practical implications of these findings indicate that mental toughness development in volleyball training does not need to be rigidly differentiated based on playing position, performance achievement level, or gender. Mental development programs should focus more on individualized approaches that emphasize experiences in dealing with competitive pressure, strengthening emotional regulation, and developing adaptive coping strategies. Such approaches may be more effective in enhancing athletes' mental capacity than training programs based solely on athletes' demographic characteristics.

This study has several limitations that should be considered when interpreting the findings. First, the distribution of participants across the combined categories of playing position, performance achievement level, and gender was highly unbalanced, ranging from as few as 3 athletes (international male liberos) to 67 athletes (national male spikers) in a single cell; such imbalance reduces statistical power, particularly for detecting interaction effects, and may partly explain why some interactions approached but did not reach conventional significance. Second, the cross-sectional design captured mental toughness at a single point in time, which limits the ability to draw causal or developmental conclusions about how playing position, performance achievement level, or gender may influence mental toughness over time. Third, this study analyzed mental toughness as a single total score rather than examining its four

constituent dimensions (thrive through challenge, sport awareness, tough attitude, and desire for success) separately, which may have obscured differences that exist at the dimension level even though the overall score did not differ significantly across groups. Fourth, the sample was drawn exclusively from volleyball athletes in East Java, so the findings may not generalize to volleyball athletes in other regions or countries with different training systems and competitive structures. Future research is encouraged to recruit larger and more balanced samples across groups, employ longitudinal designs, examine mental toughness at the dimension level, and include athletes from more diverse regions in order to address these limitations.

Conclusion

Based on the research findings, it can be concluded that there were no significant differences in mental toughness among volleyball athletes based on playing position, performance achievement level, or gender. Athletes playing as setters, spikers, middle blockers, and liberos demonstrated relatively similar levels of mental toughness, indicating that differences in technical roles and responsibilities within the team do not directly produce differences in mental toughness. Athletes across different performance achievement levels also showed relatively similar levels of mental toughness, suggesting that mental toughness is not determined solely by formal competitive level but is more closely related to the training process and psychological experiences of individual athletes. The study also found no significant difference in mental toughness between male and female athletes. This finding suggests that mental toughness can develop relatively similarly among athletes regardless of gender. The analysis further showed no significant interactions among playing position, performance achievement level, and gender in relation to athletes' mental toughness. Overall, the findings indicate that mental toughness among volleyball athletes was relatively consistent across the demographic groups examined. Variations in mental toughness may be more strongly influenced by individual factors, such as experiences in dealing with competitive pressure, emotional regulation strategies, and the psychological development processes experienced by athletes. Mental toughness development in sports training should therefore focus more on individualized approaches that emphasize psychological experiences, coping abilities, and emotional regulation rather than approaches based primarily on athletes' demographic categories.

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