Malaysian Journal of Sport Science and Recreation
Vol. 22 . No. 1. 163-175, 2026.

MJSSR
MALAYSIAN JOURNAL OF SPORT SCIENCE AND RECREATION

MENTAL TOUGHNESS AND MOOD STATES IN MALE UNDER-18 FIELD ATHLETES: EVENT-SPECIFIC DIFFERENCES AT THE 2024 SABAH CHAMPIONSHIP

*Nanthakumar Mariappan[1] , Hasnol Noordin[2] & Md Safwan Samsir[3]

[1,2,3]Faculty of Education and Sport Studies,
Universiti Malaysia Sabah
Sabah

*Corresponding author's email: nanthu200783@gmail.com

ABSTRACT

Mental toughness, which refers to the athlete's strength to stay concentrated, confident, and resilient under pressure circumstances, and mood states, since they are temporary emotional states, are effective predictors of performance in competitive sport. Mental toughness and mood states were tested in this study among 105 male under-18 field athletes participating at the 2024 Sabah School Sports Council Championship, across differences in event type, achievement rank, and age. Mental toughness was also measured using the Mental Toughness Questionnaire (MTQ18) and mood states were measured using the Profile of Mood States (POMS). The findings revealed the negative correlation of mental toughness with negative mood states, particularly tension, and the suggestion that stronger athletes will presumably cope better with the pressure of competition. Event-based differences were uncovered with javelin throwers demonstrating greater mental toughness and lower negative mood levels than high and long jumpers. Statistical differences were not discovered between achievement rank or age levels. Malay-translated MTQ18 was low on reliability, but structural validity was acceptable, whilst POMS was highly reliable. Overall, the research indicates the necessity for event-specific psychological preparation alongside culturally appropriate testing practice in Malaysian youth sport. Imagery and stress management skills may be utilized to enhance psychological readiness among athletes to perform during competition.

Keywords: *Mental Toughness, Mood States, Youth, Athletes, Sabah School Sports Council Championship*

INTRODUCTION

Mental toughness and mood state are crucial psychological components that assist athletes in maintaining attention, regulating emotions, and performing under pressure. Mental toughness encompasses characteristics such as control, commitment, confidence, and challenge that facilitate resilience in competitive sporting (Clough & Strycharczyk, 2012; Liew et al., 2019). Mood states, including tension, depression, and confusion, affect performance, with negative mood states tending to undermine success (Lochbaum et al., 2021; McNair et al., 1992). This study explores these constructs among 105 male under-

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18 field athletes at the 2024 Sabah School Sports Council Championship, examining differences by event type, achievement rank, and age, with a focus on event-specific psychological demands.

Field events, like javelin throw, shot put, and long jump, require athletes to perform alone under scrutiny, making mental toughness and stable mood states essential (Connaughton et al., 2008; Galli & Gonzalez, 2014). The 4C model comprising control (emotion and behavior management), commitment (goal persistence), confidence (self-belief), and challenge (embracing obstacles) underpins mental toughness (Clough et al., 2002; Crust & Swann, 2011). The Mental Toughness Questionnaire (MTQ18) measures these traits, though cultural translations can pose challenges (Dagnall et al., 2019). The Profile of Mood States (POMS) assesses negative moods, which, when reduced, enhance performance consistency (Lane et al., 2017; Terry & Lane, 2011). Good mental resilience usually relates to lower negative moods, better performances, particularly among adolescents developing emotional control (Chen & Mok, 2024; Cowden, 2016). Task-specific demands, e.g., javelin's accuracy or long jump's explosiveness, also influence psychological needs (Nicholls et al., 2009).

There is little research on mental toughness and mood states among Malaysian young athletes, especially Sabah, with most studies targeting physical abilities (Ponnusamy et al., 2018). The 2024 Sabah Championship, featuring events like javelin throw (merejam lembing), shot put (lontar peluru), and long jump (lompat jauh), provides a unique context for studying male athletes aged 16–18. Malaysia's collectivist culture, prioritizing group harmony, may influence athletes' control and challenge perceptions differently than in individualistic settings (Ruoxi et al., 2023). Social support, like that of Malaysian footballers, can help boost mental toughness, while field events may require different characteristics because of their individualistic demands (Crust & Clough, 2005; Dahlan & Muhamad, 2017). Age and success levels also influence the psychological profile, which may be seen to be more resilient in older or more successful athletes (Karim et al., 2019; Tangkudung et al., 2021).

This study examines mental toughness (MTQ18) and mood states (POMS) in 105 male under-18 field athletes comparing event types, ranks of achievement, and age groups. It hypothesizes that: (1) mental toughness will inversely relate to negative mood states, lowering competition stress (Beedie et al., 2000); (2) mental toughness and mood profiles will differ between events due to the specific demands, such as javelin's concentration (Gucciardi, 2017); and (3) higher ranks of achievement will correspond with higher levels of mental toughness, indicating performance advantage (Jones et al., 2007). Relevant to Malaysian male youth, these exploratory hypotheses take into account cultural and psychometric considerations with the results intended to inform coaching methods, including visualization, and validate culturally adapted measures for Malaysian youth sport.

METHODS

Study design

The quantitative comparative design was utilized for this study to make a comparison of mental toughness and mood states of male under-18 field athletes who took part in the 2024 Sabah School Sports Council Championship. The independent variables were the type of event (ACARA), rank of achievement (PNCPN), and age (UMUR), while mental toughness, based on the Mental Toughness Questionnaire (MTQ18), and mood states, based on the Profile of Mood States (POMS), were the dependent variables. Data analyses were conducted using R for EFA/CFA exploratory and confirmatory factor analyses to confirm instrument structures, and SPSS for descriptive statistics, reliability analyses, Pearson correlations, Welch's ANOVA, MANOVA, and ordinal logistic regression. The design was to explore differences in mental toughness and mood profiles by events, achievement ranks, and age groups, with cultural and psychometric sensitivities in a Malaysian youth sports context (Dagnall et al., 2019).

Participants

105 male players of field sports between 16 to 18 years old (M = 16.9, SD = 0.46) were purposively sampled from the 2024 Sabah School Sports Council Championship. All seven track and field events (ACARA) were attempted by all the participants as triple jump (lompat kijang), high jump (lompat tinggi), long jump (lompat jauh), shot put (lontar peluru), javelin throw (merejam lembing), discus throw (lempar cakera), and hammer throw (baling tukul besi), with 15 participants in each activity for proper representation. Achievement rankings (PNCPN) were categorized as high (1–5, n = 35), medium (6–10, n = 35), and low (11–15, n = 35) based on end of season championship finishes. The age distribution was 19 players aged 16 years (18.1%), 81 players aged 17 years (77.1%), and 5 players aged 18 years (4.8%), showing a typical Malaysian secondary school age structure of athletes. All the participants were Malay-speaking Sabah students who were physically and mentally capable to enable participation and provided informed consent. Ethical clearance was granted by the Department of Education in Sabah, and a permission from parents was obtained in children as per conventional research ethics (Weinberg & Gould, 2023).

Measures

Mental Toughness Questionnaire (MTQ18)

The MTQ18, a questionnaire comprising 18 items derived from the 4C model: control, commitment, commitment, and challenge (Clough et al., 2002), was employed for assessing mental toughness. Items (e.g., "Biasanya dapat mengawal diri" for control) were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree), with a total score (MTQ18_Total) of 18 to 90. The greater the score, the greater the mental toughness. Nine items (KWL3–KWL6, KYK1–KYK2, CBR1–CBR3) were reverse-scored to align with positive traits (e.g., KWL3: "Sering berharap hidup lebih mudah diramal"). Subscales were computed as: Control (KWL1–KWL6, average of 6 items), Commitment (KMT1–KMT3, average of 3 items), Confidence (KYK3, single item), and Challenge (CBR4–CBR6, average of 3 items). MTQ18 was translated into Malay from past cross-cultural studies, but a pilot study (N=27) revealed understanding issues for items like KWL3 due to abstract language, which prompted slight rewording for clarity (Denovan et al., 2021).

Profile of Mood States (POMS)

Mood states were measured with a 30-item sports-adapted POMS, excluding the vigor subscale, to favor negative affect (McNair et al., 1992). Items (e.g., "Berasa gementar" for tension) were rated on a 5-point Likert scale (1 = Not at All, 5 = Extremely), and a total score (POMS_Total) could vary from 30 to 150. The higher the score, the more negative mood. EFA-derived subscales were Depression (LTH5, TGG2, MRH3, MRH2, MRG6, LTH4; mean of 6 items), Tension (TGG5, MRH4, TGG7, TGG4; mean of 4 items), Mixed (TGG8, TGG7; mean of 2 items), and Confusion_Fatigue (TGG8, KLR1, TGG6, TGG1; mean of 4 items). The Malay POMS was piloted (N=27) for linguistic accuracy, with minor changes to items like "Berasa keliru" for cultural resonance.

Procedure

Data collection was conducted during the 2024 Sabah championship, following ethical clearance from the Sabah Education Department. Permission was obtained from school principals and event organizers. A pilot study of 27 athletes tested the Malay MTQ18 and POMS, identified comprehension issues (e.g., ambiguous phrasing in KWL3), and clarified instructions. Athletes completed questionnaires in Malay in quiet, designated areas at the championship venue to minimize distractions. Participants received standardized instructions emphasizing anonymity and voluntary participation and completed the MTQ18 and POMS in approximately 20–25 minutes. Researchers conducted sessions to help ensure compliance and checked responses for completeness, resolving missing data at the time. Data were entered into a secure database with double-entry verification to encourage accuracy (Tabachnick et al., 2019).

Data Analysis

Analyses were conducted using R (version 4.3.1) and SPSS (version 29.0). In R, EFA (psych package) examined MTQ18 and POMS factor structures, followed by CFA (lavaan package) to ascertain model fit. In MTQ18, EFA revealed a two-factor structure, while CFA supported a one-factor model (RMSEA=0.040, CFI=0.737, TLI=0.679), but with low reliability (α=0.351) (Dagnall et al., 2019). The POMS EFA validated a four-factor structure (Depression, Tension, Mixed, Confusion_Fatigue), in line with sports literature (Cowden, 2016). CFA fit indices were sufficient, substantiating subscale use despite borderline reliabilities.

Descriptive statistics (means, standard deviations, frequencies) in SPSS described the sample and variables. Reliability was ascertained using Cronbach's alpha, with item-total correlations examined for subscale validity. Pearson correlations examined MTQ18_Total, POMS_Total, and subscales for relationships, presuming normality from histogram inspection. Welch's ANOVA examined MTQ18_Total differences between ACARA, due to variance heterogeneity (Levene's test, p=0.008). MANOVA assessed MTQ18_Total and POMS_Total differences across ACARA, PNCPN, and UMUR, using Pillai's Trace for robustness against covariance heterogeneity (Box's M, p=0.038). Ordinal logistic regression (PLUM) modeled PNCPN with MTQ18_Total, POMS subscales, and UMUR as predictors, using a logit link function. Sparse data were noted (Tabachnick et al., 2019). Significance was set at α=0.05, and effect sizes (η^2, Nagelkerke's R^2) were reported to contextualize findings (Cohen, 1988).

Ethical Considerations

The research was conducted following ethical guidelines, providing informed consent, confidentiality, and voluntary participation. Consent forms were signed by athletes and parents (if under the age of 18) following comprehensive study explanation. Data were de-identified through unique identifiers, kept on encrypted servers, and only accessible to the research team. Participants had the ability to withdraw without penalty, and no rewards were provided to prevent coercion. The research followed Malaysian research ethics guidelines, with participant well-being as the priority.

RESULTS

Descriptive Statistics

There were 105 male under-18 track and field athletes who participated in the study, proportionately allocated to seven track and field events and three ranks of achievement, the majority being 17 years old. The descriptive statistics on mental toughness (MTQ18) and mood states (POMS) with their respective subscales are as shown in Table 1. Overall, MTQ18 scores indicated moderate mental toughness and POMS scores produced a range of negative mood states in the sample. Event-specific effects existed in that javelin throwers showed greater mental toughness and less negative moods than high jump and long jump event athletes. Achievement rank and age differences were trivial and showed relatively comparable psychological profiles between groups.

Table 1. Descriptive Statistics for Mental Toughness and Mood State Measures

Variable	M	SD	Range	N
MTQ18_Total	54.45	6.36	41–82	105
POMS_Total	84.81	14.12	32–109	105
Control	3.03	0.55	1.83–4.67	105
Commitment	3.15	0.76	1.00–5.00	105
Confidence	2.93	1.29	1.00–5.00	105
Challenge	3.15	0.80	1.00–5.00	105
Depression	2.78	0.71	1.00–4.17	105

Tension	2.90	0.81	1.00–4.75	105
Mixed	3.00	0.94	1.00–5.00	105
Confusion_Fatigue	2.90	0.73	1.00–4.50	105

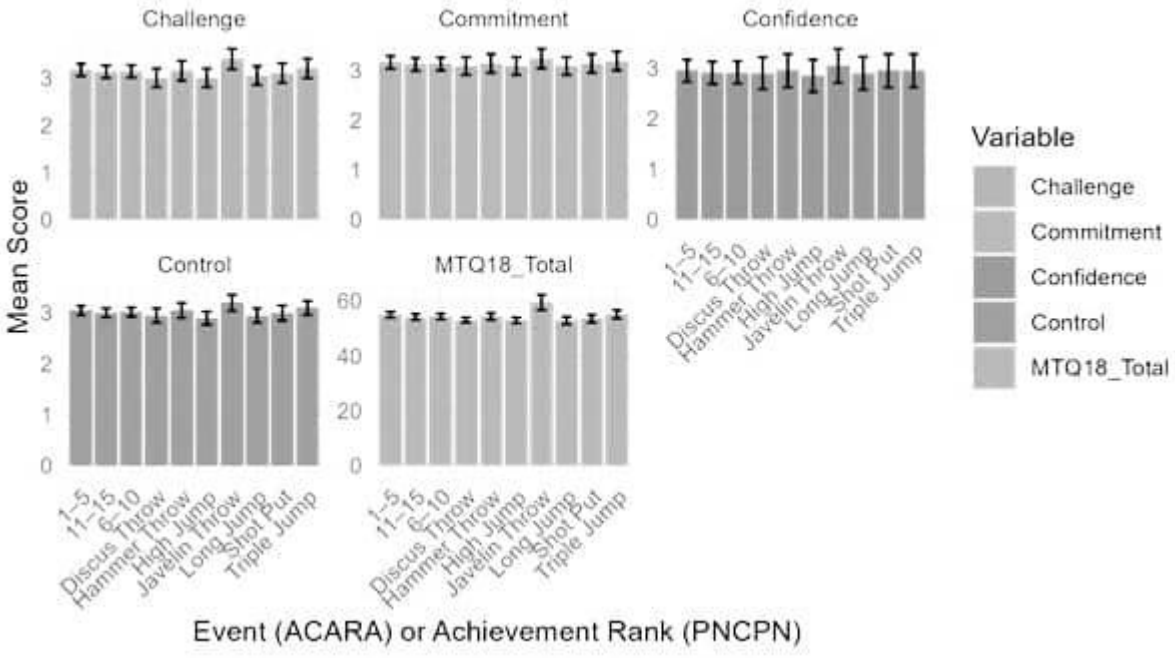

Figure 1: Mean Mental Toughness (MTQ18_Total) and Subscale Scores by Event (ACARA) and by Achievement Rank (PNCPN)

Reliability Analysis

Cronbach's alpha assessed internal consistency. For MTQ18_Total, α = 0.351 (SPSS), below R's estimate (α = 0.42), indicating poor reliability, likely due to Malay translation issues (e.g., KWL3: "Sering berharap hidup lebih mudah diramal"). Item-total correlations were weak (e.g., KWL3_rev = 0.035, KWL4_rev = 0.281), with negative values (CBR1_rev = -0.071), suggesting item misalignment. Subscale reliabilities were low: Control (α = 0.193, 6 items), Commitment (α = 0.212, 3 items), Challenge (α = 0.273, 3 items), and Confidence (single item, no α), precluding their use. For POMS_Total, α = 0.786 (SPSS), matching R (α = 0.79), with item-total correlations of 0.2–0.5 (e.g., MRH3 = 0.42 for Depression, TGG5 = 0.45 for Tension). Subscale alphas were marginal: Depression (α = 0.555), Tension (α = 0.557), Mixed (α = 0.258, two items), and Confusion_Fatigue (α = 0.432). Mixed's low α reflected limited items, but POMS_Total and subscales were retained cautiously (Dagnall et al., 2019).

Factor Structure Validation

EFA in R (psych package) explored the MTQ18 structure suggesting a two-factor model but CFA (lavaan) confirmed a single-factor model (RMSEA = 0.040, 90% CI [0.000, 0.072]; CFI = 0.737; TLI = 0.679; Figure 2). Loadings ranged from 0.794 (KYK3) to 0.024 (KWL6_rev), with low R^2 (e.g., KWL6_rev = 0.000). Residual correlations (e.g., KWL4_rev–KWL6_rev = 0.536) indicated item overlap, explaining low reliability. POMS EFA supported four factors (Depression, Tension, Mixed, Confusion_Fatigue). CFA showed adequate fit, with Depression loadings strongest (e.g., LTH5 = 0.65), validating subscales despite marginal alphas. Model fit comparisons (e.g., AIC = 4451.090 for MTQ18) favored the single-factor MTQ18 over alternatives (Cowden, 2016).

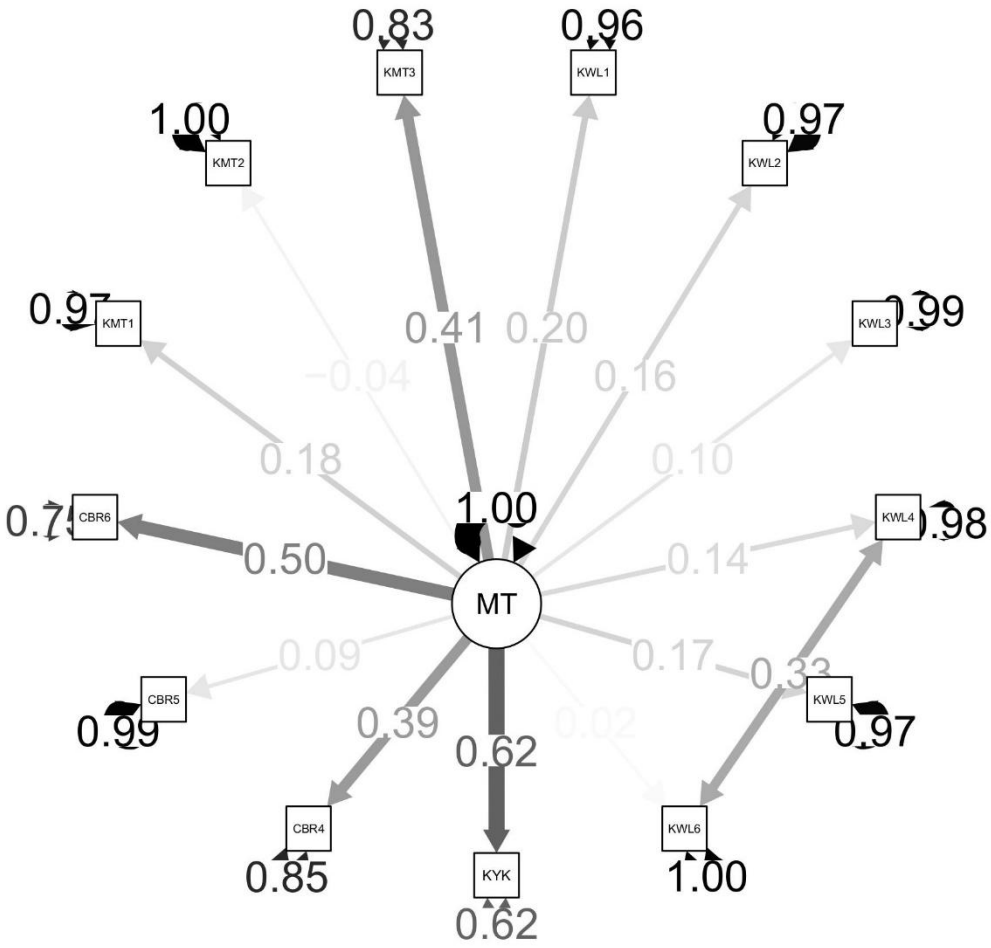

Figure 2: CFA Path Diagram for MTQ18 Single-Factor Model

Correlations

Pearson correlations (Table 2) showed MTQ18_Total negatively correlated with POMS_Total ($r = -0.371$, $p < 0.001$), indicating higher mental toughness reduced negative mood. MTQ18_Total correlated with Tension ($r = -0.251$, $p = 0.010$) but not Depression ($r = -0.181$, $p = 0.065$), Mixed ($r = -0.165$, $p = 0.092$), or Confusion_Fatigue ($r = -0.179$, $p = 0.067$). POMS_Total correlated strongly with subscales: Depression ($r = 0.723$, $p < 0.001$), Tension ($r = 0.630$, $p < 0.001$), Mixed ($r = 0.511$, $p < 0.001$), and Confusion_Fatigue ($r = 0.434$, $p < 0.001$). Inter-subscale correlations were moderate (e.g., Mixed–Confusion_Fatigue, $r = 0.473$, $p < 0.001$; Depression–Tension, $r = 0.369$, $p < 0.001$), confirming distinct constructs.

Table 2. Pearson Correlations Between Mental Toughness and Mood State Measures

Variable	1	2	3	4	5	6
1. MTQ18_Total	—					
2. POMS_Total	-.371***	—				
3. Depression	-.181	.723***	—			
4. Tension	-.251**	.630***	.369***	—		
5. Mixed	-.165	.511***	.432***	.471***	—	
6. Confusion_Fatigue	-.179	.434***	.104	.176	.473***	—

Note: N = 105. **p < 0.01, ***p < 0.001.

Welch's ANOVA

Welch's ANOVA tested MTQ18_Total differences across ACARA, addressing variance heterogeneity (Levene's test, $p = 0.008$). A significant effect emerged, $F(6, 44.75) = 3.320$, $p = 0.009$, $\eta^2 = 0.104$ (Table 3). Post-hoc Tukey tests showed javelin throw ($M = 59.47$, $SD = 10.81$) had higher mental toughness than high jump ($M = 52.87$, $SD = 4.02$, $p = 0.046$) and long jump ($M = 52.87$, $SD = 5.37$, $p = 0.046$). Discus throw ($M = 53.00$, $SD = 3.46$) and others showed no differences. The moderate η^2 suggests a meaningful but not dominant effect. Standard ANOVA ($F(6, 98) = 2.216$, $p = 0.048$) was less robust, validating Welch's use (Field, 2024).

Table 3. Welch's ANOVA for *MTQ18_Total* by *ACARA*

Source	Sum of Squares	df	Mean Square	F	p	η^2
Between Groups	502.762	6	83.794	3.320	0.009	0.104
Within Groups	3705.200	98	37.808			
Total	4207.962	104				

Note: Welch's test used because of variance heterogeneity (Levene's $p = 0.008$).

MANOVA

MANOVA assessed MTQ18_Total and POMS_Total across ACARA, PNCPN, and UMUR (Table 4). A significant multivariate effect for ACARA was found (Pillai's Trace = 0.529, $F(12, 188) = 5.634$, $p < 0.001$, $\eta^2 = 0.265$), but not for PNCPN (Wilks' Lambda = 0.989, $F(4, 186) = 0.252$, $p = 0.908$, $\eta^2 = 0.005$) or UMUR (Wilks' Lambda = 0.936, $F(4, 186) = 1.559$, $p = 0.187$, $\eta^2 = 0.032$). Univariate tests showed ACARA affected POMS_Total ($F(6, 94) = 15.840$, $p < 0.001$, $\eta^2 = 0.503$), with javelin throw ($M = 60.67$, $SD = 16.09$) lower than others ($M = 86.07$–90.07, $p < 0.001$). Post-hoc tests confirmed javelin's distinct profile (e.g., vs. shot put, $p < 0.001$; vs. triple jump, $p = 0.002$). MTQ18_Total was non-significant for ACARA ($F(6, 94) = 1.817$, $p = 0.104$, $\eta^2 = 0.104$), PNCPN, and UMUR ($p > 0.172$), possibly due to multivariate dilution. Assumptions were met (Levene's $p > 0.096$), despite slight covariance heterogeneity (Box's M, $p = 0.038$) (Tabachnick et al., 2019).

Table 4. MANOVA Univariate Results for *MTQ18_Total* and *POMS_Total*

Source	Variable	Sum of Squares	df	Mean Square	F	p	η^2
ACARA	*MTQ18_Total*	412.456	6	68.743	1.817	0.104	0.104
	POMS_Total	10245.687	6	1707.614	15.840	<0.001	0.503
PNCPN	*MTQ18_Total*	35.084	2	17.542	0.464	0.630	0.010
	POMS_Total	0.726	2	0.363	0.003	0.997	0.000
UMUR	*MTQ18_Total*	135.507	2	67.754	1.791	0.172	0.037
	POMS_Total	179.354	2	89.677	0.832	0.438	0.017

Note: N = 105. Pillai's Trace for *ACARA*: $F(12, 188) = 5.634$, $p < 0.001$, $\eta^2 = 0.265$.

Ordinal Logistic Regression

Ordinal logistic regression modeled PNCPN with MTQ18_Total, Depression, Tension, Mixed, Confusion_Fatigue, and UMUR (Table 5). The model was non-significant ($\chi^2 = 3.992$, $df = 6$, $p = 0.678$, Nagelkerke $R^2 = 0.042$). No predictors were significant ($p > 0.205$), with Depression closest ($\beta = 0.376$, $SE = 0.297$, $p = 0.205$, 95% CI [-0.206, 0.958]). Fit was adequate (Pearson $\chi^2 = 210.425$, $p = 0.328$; Deviance $\chi^2 = 226.716$, $p = 0.112$), but 66.7% zero-frequency cells indicated sparse data, likely due to small N (105) and PNCPN's ordinality. Variance inflation factors (VIF < 5) ruled out multicollinearity. An alternative model excluding ACARA yielded similar results ($p = 0.974$), reinforcing limitations (Hosmer et al., 2013).

Table 5. Ordinal Logistic Regression for *PNCPN*

Predictor	β	SE	Wald	p	95% CI Lower	95% CI Upper
MTQ18_Total	-0.022	0.030	0.528	0.468	-0.081	0.037
Depression	0.376	0.297	1.606	0.205	-0.206	0.958
Tension	-0.284	0.268	1.117	0.290	-0.810	0.242
Mixed	-0.061	0.261	0.055	0.815	-0.573	0.451
Confusion_Fatigue	0.021	0.291	0.005	0.944	-0.550	0.592
UMUR	-0.428	0.405	1.116	0.291	-1.222	0.366

Note: N = 105. Model: $\chi^2(6) = 3.992$, $p = 0.678$, Nagelkerke $R^2 = 0.042$.

DISCUSSION

105 male under-18 field athletes from the 2024 Sabah School Sports Council Championship's mental toughness (MTQ18) and mood states (POMS) were examined by variation by event (ACARA), achievement rank (PNCPN), and age (UMUR). Partial validation of hypotheses was obtained from the results, finding a negative relationship between mental toughness and adverse mood states, identifying a unique psychological profile for javelin throwers, and failing to identify differences based on achievement rank or age. These results, circumscribed by psychometric limitations (e.g., MTQ18 reliability) and methodological challenges (e.g., sparse regression data), contribute to sports psychology via the establishment of event-specific psychological demands and cross-cultural measurement issues in Malaysian young athletes. This discussion contextualizes the findings in the 4C model (Clough et al., 2002) and POMS paradigm (McNair et al., 1992), compares them to existing studies, and explores implications, limitations, and future directions.

Interpretation of Findings

The negative correlation between mental toughness and negative mood states is in line with the hypothesis that higher mental toughness reduces affective disturbances, consistent with findings linking psychological resilience with reduced anxiety and depression in competitive sport (Beedie et al., 2000; Cowden, 2016). The strongest correlation with Tension suggests that psychological resilience, defined as control (management of one's emotions), protects against competitive stress, a key predictor of events on the field requiring precision under stress (Gucciardi, 2017). The 4C model speculates that control and confidence help manage arousal, whereas challenge enhances adaptive coping with stress (Clough et al., 2002). In Malaysia's collectivist culture, where group harmony and social expectation influence conduct, competitors can leverage commitment to team goals in limiting disturbance in mood, enhancing focus on competition. This finding underscores the interaction between cognitive and affective factors in adolescent sport performers, whose emotional regulation is still developing (Nicholls et al., 2009).

The event-specific psychological demands hypothesis is supported by the profile of javelin throwers. Their higher mental toughness and lower negative affect encapsulate javelin's technical and individualistic nature of focused attention, precise coordination, and resilience against failure (Singh et al., 2022). The challenge component of the 4C model, adversity as possibility, may be particularly applicable, as javelin athletes face repeated trials with visible outcomes (Clough & Strycharczyk, 2012). Descriptively, javelin throwers displayed elevated Control and Challenge, suggesting event-differentiated psychological strengths, though unreliability of subscales limits conclusions. It can be a product of selection bias, with psychologically stronger athletes choosing javelin, or specialized coaching emphasizing psychological preparation (Gucciardi, 2017). As opposed to high jump and long jump with lower mental toughness, both involve explosive, high-risk action, which could raise anxiety and reduce confidence (Nicholls et al., 2009). These contrasts highlight the need for psychological training specific to events.

The absence of contrasts by achievement level ranking (PNCPN) or age (UMUR) refutes the hypothesis of greater mental toughness among higher achievers, contradicting studies linking mental toughness with elite performance (Jones et al., 2007; Karim et al., 2019). This may be a sign of the homogeneity of young players, whose limited competitive experience yields similar psychological profiles (Tangkudung et al., 2021). PNCPN's ordinal categories (1–5, 6–10, 11–15) likely concealed nuanced differences in performance, as opposed to continuous measures (e.g., distance thrown) (Weinberg & Gould, 2023). The skewed age range (77.1% 17 years) and narrow 16–18-year band also limited variability, as older adolescents have not yet potentially acquired distinct psychological maturity (Nicholls et al., 2009). These non-significant findings demonstrate that psychological differences can be less differentiated in school-level championships, where technical and physical competence dominate (Aditya et al., 2024).

The MTQ18 low reliability ($\alpha = 0.351$) and subscale alphas (0.193–0.273) demonstrate psychometric challenges, perhaps facilitated by Malay translation nuances (e.g., KWL3: "Sering berharap hidup lebih mudah diramal") and cultural dissonance with Malaysia's collectivist disposition, which emphasizes group over individual agency (Dagnall et al., 2019; Denovan et al., 2021). The one-factor solution of the CFA was acceptable but evidence of poor loadings (e.g., KWL6_rev = 0.024) suggests item redundancy along with cultural nuances. Conversely, POMS ($\alpha = 0.786$) and four-factor structure (Depression, Tension, Mixed, Confusion_Fatigue) were robust, but Mixed's two-item format limited its alpha (0.258) (Cowden, 2016). These contrasts reveal the cross-cultural sport applicability of the POMS and MTQ18's need for its adaptation.

The lack of significant regression and sparse data (66.7% zero-frequency cells) reveal methodological constraints. The small sample ($N = 105$) and PNCPN's ordinality reduced power, as coarse ranks obscured performance gradients (Hosmer et al., 2013). Variance heterogeneity (Levene's $p = 0.008$) and minor covariance issues (Box's M, $p = 0.038$) complicated analyses, though Welch's ANOVA and Pillai's Trace mitigated these (Tabachnick et al., 2019). The championship's uniform competitive environment may have homogenized psychological profiles, masking rank-based differences (Tangkudung et al., 2021).

Comparison with Previous Work

Hsieh et al. (2023) conducted a systematic review that revealed a moderate to high correlation between mental toughness and sports performance ($r = 0.36$), with higher strength in individual sports ($r = 0.73$) such as field events, as compared to the non-significant effects of this study's PNCPN. Their 16 studies (2000–2022) meta-analysis, using different measures (e.g., MTQ48, PPI-A), identified larger effect sizes for subjective performance ($r = 0.62$) compared with objective measures ($r = 0.33$), potentially diminishing PNCPN's effect somewhat given that it is ordinal. Compared with this study's MTQ18 ($\alpha = 0.351$), Hsieh et al. (2023) noted that MTQ48 was more reliable ($\alpha \approx 0.80$), and thus culturally adapted instruments were necessary outside Western contexts.

Clark et al. (2022) examined mental toughness in women's Australian rules football, identifying situational demands (context intelligence, attentional regulation) related to acceptance-commitment therapy (ACT). Their qualitative study contrasts with the current quantitative design but contributes to javelin throwers' profile, where attentional regulation may be the foundation of control. Clark et al.'s team sport context, however, limits direct comparison, considering that individual events like javelin demand individual resilience, thus potentially supporting mental toughness's role (Singh et al., 2022).

Powell and Myers (2017) studied mental toughness of Paralympians and concluded that there were certain characteristics of defiance and pragmatic optimism that emerged from overcoming challenges. With their interpretative phenomenological analysis (IPA), they discovered a multi-faceted MT construct, alongside this study's 4C model but contrary to MTQ18's single-factor CFA structure (RMSEA = 0.040). Emphasis on adaptive development suggests that javelin throwers' profile can be a result of training environments building resilience, albeit not something this study's cross-sectional design could explore.

Gumusdag (2023) explored mental toughness's performance impact, noting its multidimensionality (e.g., self-efficacy, emotional control) between sports. Compared to this study's MTQ18 issues, Gumusdag noted the Psychological Performance Inventory-A (PPI-A) endorsing model fit but criticized its revalidation of error-prone constructs, suggesting alternative measures like the Mental Toughness Index (MTI) for cross-cultural research. This supports the need for a Malay-adapted MTQ18 as cultural nuances likely compromised reliability.

Bédard-Thom et al. (2024) presented the Goal-Expectancy-Self-Control (GES) model as mental toughness being self-efficacy, self-control, and goal-setting under pressure. The self-efficacy focus of their model accords with javelin throwers' confidence but is opposite to the non-significant regression in this study, potentially resulting from low-frequency data that limits predictor impact. Experimental evidence for the GES model among cyclists suggests methodological rigor that this study's observational design lacks, emphasizing the need for controlled experiments.

Critically, the studies note measurement inconsistencies. Hsieh et al. (2023) and Gumusdag (2023) highlight better psychometric properties of the MTQ48 and MTI, proposing this study's MTQ18 ($\alpha = 0.351$) might have underestimated mental toughness effects. Clark et al. (2022) and Powell and Myers (2017) place qualitative findings first, which identify contextual factors (e.g., situational demands, disability) missing within this quantitative study. Strength for the POMS is paralleled by the findings of Bédard-Thom et al. (2024) in emotional regulation, validating its use. Combined, these studies affirm mental toughness's event dependency and cultural specificity, necessitating more advanced measurement and mixed-method designs.

Implications for Coaching and Sports Psychology

The extremely high mental toughness of javelin throwers reflects coaching interventions (e.g., visualization, focus training) that could be transferred to other events, including high jump and long jump, where the lower mental toughness was recorded (Aditya et al., 2024). The reverse mood–mental toughness relationship promotes interventions like stress management and mindfulness to reduce tension to enhance performance consistency (Gucciardi, 2017). Physical conditioning should include psychological skills to develop control and challenge, and prepare athletes for competition (Weinberg & Gould, 2023). Group-oriented intervention (e.g., team building, support from peers) in Malaysia's collectivist culture can enhance mental toughness, contributing to individual resilience. Mental toughness programs could be implemented by schools and sports councils with the 4C model to deliver adolescent development (Clough & Strycharczyk, 2012). The POMS strength predicts its capability to track states of mood, guiding individualized interventions (Cowden, 2016).

Limitations

Even though this study provided unique strengths, it did present some limitations. Low reliability of MTQ18 ($\alpha = 0.351$) limits its validity through requiring culture-adapted instruments (Dagnall et al., 2019). Small sample size ($N = 105$) and age skewness (77.1% aged 17 years) limited statistical power, particularly regression analyses (Hosmer et al., 2013). PNCPN ordinality masked performance variation, and sparsity of data (66.7% zero-frequency cells) restricted model fit. The male-only sampling limits generalizability, given gender differences in mental toughness (Nicholls et al., 2009). Findings are context-specific to Malaysian male adolescent field athletes in Sabah, limiting applicability to female athletes, other age groups, or non-Malaysian contexts due to cultural differences, such as collectivism. Equally stringent conditions at the championship could have equalized psychological profiles, mitigating rank-based differences (Tangkudung et al., 2021).

Future Research Directions

Future studies will need to adopt a Malay version of MTQ18 with greater reliability based on qualitative comment on item salience (Denovan et al., 2021). Bigger gender-mixed samples and continuous measures (e.g., event distances) can add precision (Weinberg & Gould, 2023). Mixed-method designs, combining interviews with quantitative data, can elucidate cultural factors like collectivism (Ponnusamy et al., 2018). Longitudinal designs can trace psychological development across adolescence, investigating age effects (Nicholls et al., 2009). Team versus individual sport comparison may be used to account for event-specific needs, whereas coach and peer roles exploration may be employed to guide training interventions (Crust & Clough, 2005; Dahlan & Muhamad, 2017). Cross-cultural studies may compare Malaysian to Western athletes and examine mental toughness model enhancements (Gucciardi, 2017).

CONCLUSION

This study of 105 male under-18 track and field athletes at the 2024 Sabah School Sports Council Championship highlighted key findings on mental toughness and mood states in Malaysian youth sport. The inverse relationship between mental toughness and negative moods supports the buffering role of psychological resilience, primarily in managing competitive tension. Greater mental toughness and lower negative moods exhibited by javelin throwers highlighted event-specific psychological demands of technical track and field events. No variations existed between achievement ranks or between age levels, possibly because adolescent athletes were homogeneous and ordinal performance measures had limitations. Psychometric limitations, such as the Malay version of MTQ18 having low reliability but not the greater reliability of POMS, emphasized the requirement for culturally adapted instruments. Despite these methodological constraints, findings warrant the use of mental toughness interventions in school sport, with collectivist models working more effectively within Malaysia's collectivist-based culture. Psychological development must receive equal priority to physical development from policymakers and coaches. Future research has a duty to utilize mixed methods, large representative samples, and longitudinal designs to explore cultural and developmental effects on mental toughness. Closing these loopholes will help Malaysia build its sports psychology system and contribute to the world in the study of psychological determinants of sporting success.

AUTHORS' CONTRIBUTION

Nanthakumar Mariappan: Designed the study under supervision, collected and analyzed data, performed statistical analyses, interpreted results, and wrote the first draft of the manuscript.

Hasnol Noordin: Provided conceptual guidance, supervised the research design and methodology, reviewed and edited the manuscript for critical intellectual content, and ensured academic rigor.

Md Safwan Samsir: Assisted in study coordination, supported data validation and analysis, contributed to manuscript revisions, and ensured adherence to ethical guidelines.

All authors reviewed and approved the final manuscript, taking responsibility for its content.

CONFLICT OF INTEREST

The authors declare no financial or non-financial conflicts of interest. No funding was received for this study, and no organizational or personal relationships influenced the research.

ACKNOWLEDGEMENTS

We extend our gratitude to the Sabah Education Department for ethical clearance, school principals, and event organizers for facilitating data collection. Special thanks to the athletes who participated in this study and to colleagues who provided feedback during manuscript preparation. No external funding was received for this research.

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