PHYSICAL EDUCATION OF STUDENTS

ORIGINAL ARTICLE

The relationship between athletes' grit, mental toughness, and sport resilience

Bengie Mendizabal[ABCDE]

College of Sports, Exercise and Recreation, Bulacan State University, Philippines

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Abstract

Background and Study Aim: Several studies have been conducted on athletes' grit, mental toughness, and sports resilience. However, such studies have not been documented for athletes in the Higher Education sector in the Philippines. Therefore, this study aimed to determine the relationship between grit, mental toughness, and sports resilience among student-athletes at a selected state university.

Material and Methods: The respondents for this study were student-athletes from Bulacan State University in the Philippines. Data were collected from male and female university student-athletes who participated in regional and national competitions. Purposive sampling procedures were employed to select participants from among 358 student-athletes. A total of 264 participants (male, n = 162, 61.4%; female, n = 102, 38.6%) took part in the study. Data collection involved the use of a questionnaire consisting of four sections. Section A sought the student-athlete's demographic characteristics such as age, sex, and sports event. Section B consisted of the Grit Scale with 12 item questions. Section C comprised the Mental Toughness Questionnaire with 14 items to assess the student-athletes' mental toughness. Section D consisted of the Resilience Scale for Athletes with 27 items. Using SmartPLS4, a factor analysis was performed to determine if the questionnaires were applicable in the current cultural context. This statistical analysis also assessed the reliability and validity of the instruments. Lastly, the Statistical Package for Social Sciences (SPSS ver. 29) was used to perform multiple regression analysis.

Results: It was observed that grit and mental toughness predict sports resilience [$F(2, 261) = 62.553$, $p < .001$]. Furthermore, the $R^2 = .324$ indicates that the model accounts for 32.4% of the variance in sports resilience. The coefficients were also regressed to determine the direct influence of each independent variable. It was found that grit predicts sports resilience ($\beta = .250$, $t = 5.000$, $p < .001$), indicating a direct relationship. Moreover, it was observed that mental toughness predicts sports resilience ($\beta = .314$, $t = 5.325$, $p < .001$), suggesting that mental toughness directly influences sports resilience.

Conclusions: The results of this study highlight the vital role that mental toughness and grit play in helping athletes develop sports resilience. Future research should examine the differences in mental toughness and grit among athletes with different athletic statuses. Limitations and recommendations for further research are also presented.

Keywords: athletes, grit, mental toughness, sports resilience

Introduction

The development of sports resilience in athletes is a critical area of research, as resilience can significantly impact performance, recovery, and overall well-being. Despite the recognized importance of resilience, there is a gap in understanding how specific psychological traits, such as grit and mental toughness, contribute to resilience among athletes, particularly in the context of higher education in the Philippines. Addressing this gap is essential for designing effective training programs that enhance these traits and, consequently, sports resilience.

Grit is defined as tenacity and a strong will to accomplish long-term objectives. It involves laboring diligently toward goals, continuing to put forth effort, and showing interest over time despite setbacks, difficulties, and growth plateaus. A diligent person views success as a marathon. Their endurance gives them an advantage. Others may sense when you need to change course and cut losses if you are bored or disappointed. However, a determined person stays on course [1].

Higher-grit athletes practice more deliberately, which may affect their lives. They have to handle the extra pressure of their professional sport, a burden that ordinary students do not face. This makes them more vulnerable to emotional issues and pressure from various sources. Despite this, they continue to have higher retention rates. Their grit is also associated with higher levels of enjoyment, positive emotions, competency, and subjective well-being [2].

Nonetheless, high-grit athletes seem to be more resistant to the detrimental impacts of ego when

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it comes to feedback. This could be because they are passionate and persistent in pursuing long-term objectives. This passion supports their ability to remain focused, engaged, and productive in challenging situations. This result aligns with other sports research on protective factors in athletes, such as resilience and mental toughness. It has been found that athletes with higher levels of these psychological qualities adapt better to the demands of sports [3].

Meanwhile, according to Gould et al. [4], one of the psychological traits that most strongly predicts good performance is mental toughness. To stay resilient, an athlete must be able to manage the demands of training and competition [5, 6, 7]. Experts have often stated that one of the most crucial psychological traits associated with performance and success in professional sports is mental toughness. Nonetheless, according to Jones et al. [5], it is arguably one of the least understood terms in applied sports psychology. Research suggests that mentally tough athletes possess qualities such as courage, determination, commitment, self-belief, self-esteem, drive, willpower, control, high levels of optimism, and confidence [8, 9, 10]. According to Coutinho et al. [11], coaches, parents, teachers, and other individuals significantly impact the long-term development of mental toughness in elite athletes. It has also been suggested that the environment significantly affects how traits associated with mental toughness develop.

Furthermore, university athletes' mental toughness is influenced by their playing background and the sport they play. To maximize athletes' mental toughness, coaches, trainers, and sports psychologists must take these environmental aspects into account. Future research should examine how specific contextual factors affect training environments and outcomes. Additionally, it should explore how stakeholders can leverage the connections between mental toughness, sport type, and playing experience to enhance athletes' mental toughness and performance [12].

Meanwhile, resilience is an adaptive attitude toward adversity, involving interacting with and transforming its aspects. It also involves overcoming difficulties while changing them [13]. The greatest quality of Filipinos is their ability to bounce back from setbacks and "move on and rebuild easily" in the face of adversity [14]. Pedro [15] asserts that the resilience of athletes reveals innate abilities that protect them from the damaging effects of stressful circumstances. These skills allow athletes to react more swiftly to high-pressure situations, which often involve one-on-one interactions in their environment. Furthermore, as demonstrated by Garmezy's Resilience Theory [16], two factors contribute to achieving healthy emotional and psychological well-being: the development of one's abilities and useful resources that lessen or eliminate the negative effects of adversity and danger [17].

The purpose of this research is to examine the relationship between athletes' grit and mental toughness on sports resilience.

Hypotheses formulation

The present study is focused on testing the following hypotheses: H1: Grit and mental toughness predict sports resilience. H1a: Grit predicts sports resilience. H1b: Mental toughness predicts sports resilience.

Materials and Methods

Participants

A descriptive survey design was used in this study. The target population was student-athletes from a higher education institution in the Philippines. Data were collected from male and female university student-athletes who participated in regional and national competitions. Purposive sampling procedures were employed to select participants from among 358 student-athletes. The study included 264 university students, with 162 (61.4%) males and 102 (38.6%) females. The age distribution of the participants was as follows: 33 students (12.5%) were aged 16-18 years, 183 students (69.3%) were aged 19-21 years, and 48 students (18.2%) were aged 22-25 years. Participants were involved in various sports, which can be categorized into three main groups: team sports (Basketball, Football, Volleyball, Futsal, Baseball, and others), combat sports (Taekwondo, Karate, and others), and other sports (Athletics, Swimming, and others). A total of 157 students participated in team sports, 66 students in combat sports, and 41 students in other sports.

The conduct of the study was approved by the selected HEIs and the concerned sports office. Student-athletes were informed about the purpose of the study. They were also informed that their participation was voluntary and that they could withdraw from the study at any time without consequences. Informed consent forms were signed by those who agreed to participate. Questionnaires were administered to the student-athletes during the current academic year. A total of 264 respondents from the actual population of 385 student-athletes answered and processed the questionnaires.

Data collection involved the use of a questionnaire that consisted of four sections. Section A sought the student-athlete's demographic characteristics such as age, sex, and sports event. Section B consisted of the Grit Scale by Duckworth et al. [18], which included 12 items. The 12 items were rated by participants on a 5-point Likert scale ranging from 1 (not like me at all) to 5 (very much like me). Section C comprised the Mental Toughness Questionnaire by Clough et al. [19], which included 14 items to

assess the student-athletes' mental toughness. The 14 items were rated by respondents on a 5-point Likert scale ranging from 1 (not at all true) to 5 (very true). Section D consisted of the Resilience Scale for Athletes by Subhan and Tazvin [20], which included 27 items. Participants were asked to respond on a 4-point rating scale ranging from 1 (not at all true) to 4 (extremely).

Using SmartPLS4, a factor analysis was first performed to determine if the questionnaires were applicable in the current cultural context of the study. This specific statistical analysis also assessed the reliability and validity of the instruments. According to Hair et al. [21], it is recommended that the loading value of each item be greater than 0.70. By removing any items with a reliability score below 0.70 from the model, all the remaining items demonstrated acceptable reliability. Additionally, the Cronbach's Alpha value (α) and composite reliability score should be greater than 0.70. The assessment of constructs necessitates using the Average Variance Extracted (AVE) measure, which is calculated by taking the mean of the squared loadings of the items associated with the construct. This measure assesses the extent of convergent validity. Hair et al. [21] recommend that the AVE should be greater than 0.50 and the corresponding p-value should be less than 0.05. These criteria are required to establish convergent validity. A comprehensive evaluation of collinearity was also performed to confirm the absence of common method bias (CMB), with results needing to be less than 3.3 [21]. The Statistical Package for Social Sciences (SPSS ver. 29) was used to perform multiple regression analysis.

Results

Table 1 shows that grit (CA: 0.791, CR: 0.792, AVE: 0.615), mental toughness (CA: 0.754, CR: 0.761, AVE: 0.575), and sports resilience (CA: 0.927, CR: 0.931, AVE: 0.604) met the Cronbach's Alpha, composite reliability, and average variance extracted thresholds. This demonstrates convergent validity. Next, discriminant validity was assessed using the Fornell-Larcker criterion, cross-loadings, and the Heterotrait-Monotrait ratio. Table 2 shows that the square root of the AVE exceeds the correlation between latent variables.

Furthermore, Table 3 shows the cross-loading results. The findings indicate that each indicator exceeded the loadings of the indicators for the relevant constructs. Finally, Table 4 shows the HTMT ratio results, which should be less than 0.90. The result shows a value of less than 0.90. In line with all of this, discriminant validity has been established. Also, most items have VIF values of less than 3.3. Thus, the findings suggest that the model is not affected by common method bias (CMB).

Table 1. Item loadings

Constructs	Items	Loadings	CA (α)	CR	AVE	VIF
Grit	GRT1	0.775	0.791	0.792	0.615	1.575
	GRT6	0.792				1.654
	GRT9	0.815				1.763
	GRT12	0.753				1.409
Mental toughness	MT3	0.776	0.754	0.761	0.575	1.453
	MT6	0.748				1.426
	MT12	0.710				1.413
	MT14	0.795				1.603
Sports resilience	SR9	0.802	0.927	0.931	0.604	2.660
	SR10	0.774				2.302
	SR14	0.772				2.403
	SR17	0.826				2.626
	SR18	0.791				2.483
	SR20	0.760				2.365
	SR23	0.715				2.254
	SR24	0.728				2.381
	SR25	0.846				3.169
	SR26	0.747				2.052

Table 2. Fornell-Larcker criterion

Constructs	Grit	Mental toughness	Sports resilience
Grit	0.784		
Mental toughness	0.597	**0.758**	
Sports resilience	0.508	0.522	**0.777**

Table 3. Cross-loading

Items	Grit	Mental toughness	Sports resilience
GR1	**0.775**	0.408	0.375
GR12	0.753	0.405	0.417
GR6	**0.792**	0.415	0.387
GR9	**0.815**	0.637	0.410
MT12	0.345	**0.710**	0.320
MT14	0.436	**0.795**	0.395
MT3	0.603	**0.776**	0.442
MT6	0.395	**0.748**	0.410
SR10	0.425	0.401	**0.774**
SR14	0.289	0.289	**0.772**
SR17	0.403	0.539	**0.826**
SR18	0.339	0.323	**0.791**
SR20	0.412	0.404	**0.760**
SR23	0.394	0.391	**0.715**
SR24	0.293	0.418	**0.728**
SR25	0.400	0.383	**0.846**
SR26	0.409	0.509	**0.747**
SR9	0.521	0.314	**0.802**

Table 4. Heterotrait-Monotrait ratio

Constructs	Grit	Mental toughness	Sports resilience
Grit			
Mental toughness	**0.756**		
Sports resilience	**0.583**	**0.605**	

Moreover, a normality test was performed to determine the data distribution of the responses from the questionnaire. Table 5 illustrates that the skewness and kurtosis values of each construct met the threshold [−2, 2], indicating that the data are normally distributed.

Table 5. Normality estimates

Construct	Mean ± SD	Skew	Kurt
Grit	4.21 ± .60	-.806	.560
Mental toughness	3.23 ± .51	-.713	.942
Sports resilience	3.55 ± .48	-1.217	1.089

Table 6 presents the multiple regression analysis performed to determine the direct influence of grit and mental toughness on sports resilience. Based on the findings, it was observed that grit and mental toughness, when combined into one model, predict sports resilience [$F(2, 261) = 62.553$, $p < .001$]. Furthermore, the $R^2 = .324$ indicates that the model accounts for 32.4% of the variance in sports resilience. Hence, H1 has been supported. Additionally, the coefficients were also regressed to determine the direct influence of each independent variable. It was found that grit predicts sports resilience ($\beta = .250$, $t = 5.000$, $p < .001$), indicating that grit is directly related to sports resilience. Hence, H2 has been supported. Moreover, it was observed that mental toughness predicts sports resilience ($\beta = .314$, $t = 5.325$, $p < .001$), suggesting that mental toughness directly influences sports resilience. Therefore, H3 has been supported.

Discussion

The purpose of this research is to examine the relationship between athletes' grit and mental toughness on sports resilience. The study's results highlight a significant and consistent relationship between grit, mental toughness, and sports resilience, as demonstrated by thorough statistical analysis using the multiple regression technique. The combined model of grit and mental toughness predicted 32.4% of the variance in sports resilience, supporting the hypothesis that these factors are crucial for developing resilience in athletes.

Grit, defined as a balance of tenacity and unrelenting desire for long-term goals, plays a crucial role in an athlete's ability to handle and conquer challenges in competitive sports [22]. According to Cormier et al. [23], athletes with high levels of grit are more likely to show outstanding persistence when facing difficulties and hurdles in training or tournaments. This resilience, originating from grit, can be seen in a strong dedication to goals, a persistent resolve to conquer challenges, and a resilient mindset that views failure as a chance for progress rather than as a loss [24]. Our results confirm these findings, showing that grit ($\beta = .250$, $t = 5.000$, $p < .001$) is a significant predictor of sports resilience, highlighting the importance of tenacity in overcoming challenges and achieving success in competitive sports.

Furthermore, the study explains how mental toughness plays a crucial role in enhancing sports resilience, increasing an athlete's ability to endure and recover from the challenges of athletic activities. Mental toughness includes several psychological traits like resilience, self-confidence, attention, and emotional regulation [25]. These traits help athletes maintain high performance levels under pressure and bounce back stronger after failures. Athletes with strong mental toughness demonstrate adaptability, composure under pressure, emotional resilience in challenging situations, and a mindset that helps them persevere through setbacks and failures [26, 27]. Our findings support this, showing that mental toughness ($\beta = .314$, $t = 5.325$, $p < .001$) is a significant predictor of sports resilience. This underscores the importance of mental toughness in helping athletes adapt to and overcome the pressures of competitive sports.

These findings emphasize the need to develop

Table 6. Hypotheses testing and multiple regression analysis

Hypothesis	Regression weights	Beta Coefficient	R2	F	t-value	p-value	Decision
H1	GR x MT → SR	-	.324	62.553	-	<.001	Supported
H2	GR → SR	.250	-	-	5.000	<.001	Supported
H3	MT → SR	.314	-	-	5.325	<.001	Supported

Note: Significance p <.05.

GR- Grit, MT- Mental Toughness,
SR- Sports Resilience

grit and mental toughness in athletes to strengthen their resilience in the competitive world of sports [28, 29, 30]. Professionals such as coaches, trainers, and sports psychologists are tasked with creating specific strategies and training methods to develop these mental qualities [31, 32]. This helps athletes acquire the necessary skills to face and overcome obstacles in their sporting endeavors.

Our results further highlight this need, as both grit and mental toughness were shown to significantly predict sports resilience, with grit accounting for 25.0% ($\beta = .250$, $t = 5.000$, $p < .001$) and mental toughness for 31.4% ($\beta = .314$, $t = 5.325$, $p < .001$) of the variance in sports resilience. This underscores the importance of targeted training programs that focus on these psychological traits to enhance overall athlete performance and resilience.

This study underscores the critical role of grit and mental toughness in enhancing sports resilience among athletes. The significant predictive values of grit ($\beta = .250$, $t = 5.000$, $p < .001$) and mental toughness ($\beta = .314$, $t = 5.325$, $p < .001$) highlight the necessity of developing these psychological traits to improve athletes' ability to handle competitive pressures and recover from setbacks.

However, this study has several limitations. First, the sample was limited to student-athletes from a specific region in the Philippines, which may affect the generalizability of the findings. Second, the cross-sectional design of the study does not allow for causal inferences.

Future research should explore longitudinal studies to better understand the causal relationships between grit, mental toughness, and sports resilience. Additionally, examining these variables in diverse athletic populations and settings would provide a more comprehensive understanding of their impact. Continued investigation into the mechanisms linking these psychological traits with resilience will help in developing more effective, evidence-based interventions to support athlete performance and well-being.

Conclusions

This study underscores the critical role of grit and mental toughness in enhancing sports resilience among athletes. The significant relationship between these psychological traits and resilience highlights the necessity for targeted training programs to develop these qualities. Coaches, trainers, and sports psychologists should focus on strategies that foster tenacity, resilience, and mental strength to improve athletes' performance and ability to recover from setbacks.

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Information about the author:

Bengie Mendizabal; https://orcid.org/0009-0005-3258-1246; bengie.mendizabal@bulsu.edu.ph; College of Sports, Exercise and Recreation, Bulacan State University; Malolos, Bulacan, Philippines.

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