

## Investigation of mental endurance levels of canoe athletes in sport: a cross-sectional study

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### Abstract

**Background and Study Aim** Mental endurance is considered a key psychological component that influences athletic performance, particularly in sports that demand high levels of focus and persistence. The aim of the study was to investigate the level of mental endurance in athletes engaged in canoeing.

**Material and Methods** The sample of the study consisted of 163 voluntary canoe athlete students who were studying in the faculties of sport sciences and doing canoeing as licensed students, selected by simple random sampling method. In order to collect the necessary data in the study, the 'Mental Endurance Scale in Sport' was used. The scale consists of the sub-dimensions 'Trust', 'Continuity', and 'Control'. In the analyses of the data, t-test and ANOVA test were used. Statistically, the level of error  $p < .05$  was accepted as Alpha ( $\alpha$ ).

**Results** As a result of the study, it was determined that there was a significant difference in the control sub-dimension according to the gender variable of the students in the sample. It was found that there was a significant difference in terms of age variable. The students aged between 18–20 years were more self-confident, while the students aged between 21–23 years showed more control and continuity. In the sport branch variable, it was found that there was a significant difference in the 'Trust' and 'Control' sub-dimensions, and the effect value was at a moderate level. It was determined that there was a significant difference in the sub-dimension of confidence in the variable of years of doing sports, and the effect value was at a moderate level. The self-confidence of the students who had been doing sports between 1 and 3 years was higher.

**Conclusions** In addition to the physical training and technical skills-enhancing practices of student athletes in sports schools, it will give positive results to carry out actions to increase mental endurance in order to be ready for sportive activities (competitions, recreative activities, etc.). Especially female students or younger students can be less affected by the negativities that may develop instantly within the framework of the difficulties of the sports branch.

**Keywords:** sport sciences faculties, students, mental endurance, whitewater canoeing, backwater canoeing.

### Introduction

Mental resilience is a psychological characteristic that enables individuals to display a stable, focused, and determined attitude in the face of difficulties. This concept is defined as the ability of individuals to maintain their performance by using internal resources effectively despite negative external factors such as stress, pressure, and uncertainty [1, 2]. Mental resilience is not only a reaction to challenging situations but also includes the tendency to actively confront these situations and learn from the process [3].

The basic components of resilience include challenge, commitment, control, and confidence.

While *challenge* refers to the individual's openness to new experiences and seeing them as opportunities rather than threats, *commitment* refers to the determination to achieve goals. *Control* defines the individual's capacity to manage both life events and emotions. *Confidence* refers to the belief in one's own abilities and social relationships [4, 5]. The concept of mental resilience has often been addressed in relation to mental health and psychological well-being. For example, it has been shown that interventions to improve mental resilience can enhance individuals' mental health outcomes [6]. In this context, mental resilience plays a critical role in improving the quality of life not only of athletes but of all individuals [7].

In recent years, the role of mental toughness in improving athletic performance, especially in competitive sports, has been emphasised [8].

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In today's sports world, the difference between winning and losing is gradually decreasing, and increasing performance expectations create serious psychological pressure on athletes [9]. In this context, mental training and endurance have become as important as physical training [10].

Mental toughness enables athletes to sustain their performance under pressure, cope with negative emotions, and maintain motivation [11, 12]. Athletes with this ability not only achieve sporting success but also maintain socially accepted behaviours [13]. Indeed, research shows that athletes with high levels of mental toughness are more successful in both subjective (achievement of personal goals) and objective (competition success) performance indicators [14, 15].

The fact that mental endurance can be developed through deliberate training has led to this characteristic being considered a strategic advantage in sports [16]. The ability of athletes to remain calm, maintain attention, and preserve self-confidence under stressful competition conditions becomes a determining factor in their success. Therefore, mental endurance should be considered not only an innate characteristic but also an ability that can be strengthened through systematic training [17, 18].

In conclusion, mental toughness is a multifaceted concept that positively affects not only athletes' sporting performance but also their general psychological well-being [19]. Mental toughness, which is one of the common psychological characteristics of high-level athletes, has become one of the cornerstones of success in sports by incorporating combativeness, strong dedication, intrinsic motivation, and problem-solving skills [20]. In this context, it is very important for athletes to demonstrate not only their physical and technical skills but also their psychological performance in both competitions and training in order to achieve success. Therefore, this study aims to contribute to a deeper understanding of the psychological dimensions of performance in water sports by examining the mental toughness levels of canoe athletes, who must cope with challenging natural conditions as well as competitive pressure.

## Materials and Methods

### *Participants*

The population of the study consists of licensed canoe athletes studying in sports sciences faculties. The sample consists of 163 voluntary student athletes selected by the simple random sampling method from this population. Considering that in descriptive research the minimum required sample size for small populations is 20%, it can be said that the sample size adequately represents the population [21].

### *Ethics Committee Permission Information*

All procedures performed in this study complied with the principles of the relevant national and/or institutional ethics committees, as well as the 1964 Declaration of Helsinki and its later amendments. Informed consent (if applicable) was obtained from all participants. The data presented in this article were collected, analysed, and reported in accordance with ethical standards and academic integrity.

### *Research Design*

In order to reveal the current state of students' mental resilience levels, data were collected using the general survey model. The survey model is defined as "a type of survey applied to the entire population or a group, sample, or sub-sample drawn from it in order to reach a general opinion about the population, especially when it consists of a large number of elements" [22]. The 'Mental Endurance Scale in Sport' was used to collect the data. The scale consists of 14 items and includes three sub-dimensions: Confidence, Control, and Persistence, along with general mental endurance. Among the sub-dimensions, 'Confidence' refers to belief in one's abilities, 'Control' refers to maintaining composure under all conditions, and 'Persistence' refers to continuing the struggle and taking responsibility [23]. Cronbach's Alpha internal consistency coefficient for the 'Mental Endurance Scale in Sport' was found to be 0.77 for the entire scale, 0.84 for Confidence, 0.79 for Control, and 0.51 for Persistence.

### *Statistical Analysis*

The responses of the student athletes in the sample to the scale items, based on demographic variables, were analysed using a statistical software package. The Shapiro-Wilk test was used to assess the normality of the data. The skewness and kurtosis values in the sub-dimensions of the scale were found to be between +1.5 and -1.5, indicating that the data met the assumption of normal distribution [24]. Therefore, parametric analyses were applied. In addition to descriptive analysis, the t-test was used for pairwise comparisons, and one-way ANOVA was used to compare three or more groups. The Tukey test was applied to identify between which groups significant differences occurred. In the study, the significance level (Alpha,  $\alpha$ ) and error level were set at  $p < .05$ .

## Results

This section presents the findings regarding the mental endurance levels of canoe athletes based on demographic variables. The results are organised by variable groups, beginning with gender.

Table 1 presents the analysis of the relationship between gender and the sub-dimensions of mental endurance. It was determined that canoe athletes

did not show a statistically significant difference in the sub-dimensions of Confidence and Persistence according to gender. However, in the Control sub-dimension, a significant difference was observed in favour of male athletes.

Ages of the canoe athletes were examined in relation to their levels of mental endurance (Table 2). A statistically significant difference was found in all sub-dimensions. Specifically, athletes aged 18–20 demonstrated higher levels of self-confidence, while those aged 21–23 showed greater control and persistence.

The relationship between the type of canoe sport practiced by the athletes and their levels of mental endurance was examined (Table 3). A statistically significant difference was found in the sub-dimensions of confidence and control according to the sport branch. However, no statistically significant difference was observed in the persistence sub-dimension.

The relationship between the number of years athletes have been involved in sports and their mental endurance levels was examined (Table 4). A statistically significant difference was found in

**Table 1.** T-test results for the sub-dimensions of mental endurance by gender.

Components	Gender	N	%	Mean	SD	df	t	p
Confidence	Woman	76	46.6	1.98	.51	161	1.821	.071
	Male	87	53.4	2.11	.40			
Control	Woman	76	46.6	2.11	.64	161	-2.797	.006
	Male	87	53.4	2.36	.52			
Persistence	Woman	76	46.6	2.37	.32	161	.004	.997

**Table 2.** T-test results for mental endurance and its sub-dimensions according to age.

Components	Age Group	N	%	Mean	SD	df	t	p
Confidence	18-20	97	59.5	2.11	.46	161	2.231	.027
	21-23	66	40.5	1.94	.46			
Control	18-20	97	59.5	2.14	.56	161	-2.735	.007
	21-23	66	40.5	2.39	.61			
Persistence	18-20	97	59.5	2.31	.30	161	-3.065	.003
	21-23	66	40.5	2.45	.29			

**Table 3.** T-test results for mental endurance and its sub-dimensions according to canoe sport type.

Components	Sport Type	N	%	Mean	SD	df	t	p
Confidence	Stream	78	47.9	1.93	.47	161	-3.093	.002
	Still Water	85	52.1	2.15	.43			
Control	Stream	78	47.9	2.35	.63	161	2.147	.033
	Still Water	85	52.1	2.15	.53			
Persistence	Stream	78	47.9	2.39	.29	161	1.053	.294
	Still Water	85	52.1	2.34	.31			

**Table 4.** ANOVA results for mental endurance and its sub-dimensions according to years of sporting experience.

Components	Experience Group (years)	N	%	Mean	SD	df	F	p	Tukey
Confidence	1) 1-3	87	53.4	2.12	.45	2.160	3.202	.043	1-3
	2) 4-6	43	26.4	2.00	.54				
	3) 7 and above	33	20.2	1.89	.31				
Control	1) 1-3	87	53.4	2.19	.57	2.160	.941	.392	-
	2) 4-6	43	26.4	2.27	.75				
	3) 7 and above	33	20.2	2.35	.34				
Persistence	1) 1-3	87	53.4	2.35	.31	2.160	2.754	.067	-
	2) 4-6	43	26.4	2.31	.28				
	3) 7 and above	33	20.2	2.47	.28				

the confidence sub-dimension according to years of sporting experience. In this context, it can be said that athletes with 1–3 years of experience have higher self-confidence.

## Discussion

The aim of this study was to examine the mental endurance levels of canoe athletes and to determine whether these levels vary according to demographic variables such as gender, age, sport branch, and years of experience.

In terms of the gender variable, a significant difference was found in favour of male students in the control sub-dimension. Across all sub-dimensions, male athletes were found to have higher perception scores than female athletes. This may be explained by the tendency of female athletes in water sports to become more easily excited or panicked in response to sudden events. Male athletes, on the other hand, may have a stronger perception of control in such situations.

Previous studies examining mental endurance levels by gender have concluded that male participants tend to score higher than female participants [25]. However, some research has also reported no significant gender-based differences in mental toughness [1, 26]. The literature presents contradictory findings on this issue, with some studies reporting significant differences based on gender [27, 28]. For example, one study conducted on high school and university athletes found that male athletes had higher mental endurance levels than female athletes [29].

Similarly, studies conducted with elite-level football players have shown a significant difference in favour of male athletes [30]. Some researchers have associated this with the fact that males tend to receive more social support from an early age and are introduced to more demanding physical activities earlier in life [31].

According to the findings of this study, significant differences were observed in all sub-dimensions of the scale based on age. Specifically, athletes in the 18–20 age group demonstrated higher levels of self-confidence, while those aged 21–23 and above exhibited stronger profiles in terms of control and persistence. In the literature, some studies suggest that age has no significant effect on mental toughness [32, 33].

On the other hand, some studies suggest that age is a factor influencing mental toughness, and that mental toughness may improve with increased athletic experience [34, 35]. To prevent sport-related anxiety that may arise during competitions, mental toughness should be developed in a controlled and consistent manner [36]. This is important because anxiety can lead to negative emotions and reduced performance in student athletes [37]. In this context, moving beyond descriptive studies and conducting

more theory-driven and systematic research may contribute significantly to the prevention of sport-related anxiety [38].

When the study analysed the mental endurance of whitewater and flatwater canoe athletes according to their sport branches, significant differences were found between the two groups in the confidence and control sub-dimensions, while no significant difference was observed in the persistence sub-dimension. Accordingly, it can be said that athletes who practise flatwater canoeing exhibit higher levels of confidence, while those who practise whitewater canoeing demonstrate greater control and persistence by continuing to struggle. This finding suggests that the training and competition dynamics of different sport branches may have varying effects on the mental endurance of student athletes.

Since whitewater canoe athletes are exposed to more unpredictable situations, they may develop more controlled and resilient behaviours. In the literature, it has been reported that there is no significant difference in the mental endurance of elite freestyle and gridiron wrestlers, which has been attributed to their exposure to similar training environments [39].

Mental development plays a key role in enhancing athletic performance, and it has been noted that four main dimensions contribute to this development: sport process, sport personnel, non-sport personnel, and environmental influences [40]. Coaches should therefore create training settings that include appropriate physical and psychological challenges aligned with these dimensions to help develop mentally strong athletes [41, 42].

Other studies in the literature generally categorise sports as individual or team-based, and it has been suggested that team sport athletes tend to have higher mental toughness, which is attributed to the presence of social support [31]. In contrast, individual athletes may lack social support due to the solitary nature of their disciplines, which may negatively impact their mental endurance [28]. Additionally, a study conducted in individual sports branches showed significant differences in mental endurance among athletes [43].

In the study, a significant difference was found in the confidence sub-dimension of mental toughness according to the variable of years of sporting experience, while no significant differences were observed in the control and persistence sub-dimensions. In the confidence sub-dimension, it was observed that students who had been doing sports for 1–3 years exhibited higher levels of self-confidence compared to those with more than seven years of experience. This may suggest that athletes with fewer years of experience feel more confident because they have not yet been exposed to the long-term challenges of sporting life.

In the literature, it is emphasised that the number of years of sporting experience is an important factor contributing to higher levels of mental toughness [44]. Other studies also indicate that experience is a determining factor in strengthening mental toughness in athletes [45]. This may be explained by the fact that athletes with longer sporting careers may have developed greater mental endurance through repeated exposure to challenging situations. Furthermore, it has been reported that mental endurance tends to increase as the number of years of participation in sport increases [46].

The findings of this study suggest that mental endurance among canoe athletes is shaped by a combination of demographic and sport-related factors. Male athletes and those engaged in whitewater canoeing showed higher levels of control and persistence, while younger and less experienced athletes demonstrated greater self-confidence. These results point to the importance of considering psychological factors alongside physical preparation, as mental endurance appears to develop differently depending on age, experience, and sport type.

#### *Limitations and Directions for Future Research*

This study has several limitations that should be acknowledged. First, the sample was limited to student athletes from sports sciences faculties, which may reduce the generalisability of the findings to broader athlete populations. Second, the data were collected using self-report measures, which may be influenced by social desirability or subjective bias. Additionally, the cross-sectional design of the study does not allow for causal interpretations.

Future research could address these limitations by including athletes from different educational and performance levels, applying mixed-method approaches (e.g., interviews or observations), and conducting longitudinal studies to examine how mental endurance evolves over time with training and experience.

### **Conclusions**

This study highlights the importance of psychological resilience, particularly mental toughness, as a key factor influencing athletic performance in canoe sports. The findings indicate that mental toughness is not uniform but varies depending on individual and sport-specific factors such as gender, age, and experience. These differences underscore the need for tailored mental training strategies that account for the psychological demands of athletes across different contexts. Supporting the mental development of athletes through structured psychological preparation may enhance both performance and well-being in competitive environments.

### **Recommendations**

Based on the findings and scope of the study, the following recommendations are offered:

- It is important to implement programmes that provide social and psychological support alongside physical training and technical education in schools and sports clubs. The inclusion of courses such as sportsmanship, ethics, and sports morality in the curriculum may strengthen athletes' personal development and team spirit.
- To enhance athletes' mental endurance, targeted training programmes should be developed, particularly during the preparation phase for competitions. Such programmes will improve athletes' ability to cope with stress and contribute to their overall performance.
- Mental resilience training delivered by experts in schools, clubs, and among younger age groups will support children's psychological development and reinforce their athletic identity. Early exposure to such training can foster greater mental strength and well-being in later stages of life.
- Recreational sport activities organised in educational settings can provide important opportunities to strengthen students' mental resilience. These activities may help develop stress management, teamwork, and leadership skills.
- Mental endurance training should be delivered consistently and under professional supervision. In addition to structured training programmes, psychological support is crucial to foster both the physical and mental development of athletes.
- Conducting further studies on mental endurance among students from different sports disciplines within faculties of sport sciences will contribute meaningfully to the literature and to the advancement of the field.

### **Contribution Rates of Researchers**

The introduction, methodology, and discussion sections of the study were prepared by the fourth and sixth authors. The data analysis and interpretation of the findings were conducted by the fourth and fifth authors. Data collection and funding processes were managed by the first, second, and third authors. In addition, the methodological procedures were specifically handled by the second author.

### **Conflict of interests**

The authors declare that there is no conflict of interests.

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