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RESEARCH ARTICLE

Comparison of Mental Toughness Levels in Racquet Sports

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Abstract

The aim of this study is to compare mental toughness levels in racket sports according to various variables. The sample of the study consisted of 415 volunteer athletes (206 females and 209 males). The Mental Toughness Inventory in Sports was used to collect the data. The scale used is a 4-point likert type. In addition, the Cronbach Alpha reliability coefficients of the scale are control 0.66, continuity 0.71, and confidence 0.72. SPSS 21.0 package program was used to analysis of data. Skewness and kurtosis values were used to test the normality distribution of the data, then parametric tests were applied. Independent Groups T-Test and One-Way ANOVA were used to compare variables and Tukey Post Hoc test was used to test between which groups the difference existed. Data were evaluated at a 95% confidence interval and a significance level of 0.05. As a result of the research, no significant difference was found between the mental toughness level and gender variable ($p>0,05$). There were significant differences in all sub-dimensions between the groups according to the sport type variable, sport age variable, and the number of training days ($p<0,05$). As a result, it can be said that the mental toughness levels of athletes are affected by the variables of training day, sport age and sport type, and increasing the level of mental toughness is important for athlete performance.

Keywords

Mental Toughness, Racquet Sports, Tennis, Badminton, Table Tennis

INTRODUCTION

The concept of sports emerges as a social phenomenon that regulates the behavior of the individual, develops them physically and mentally, and brings them to a certain level in the cognitive and psychomotor fields. Sports have a very important place in the development of both the body and the soul and play an important role in the socialization of the individual (Yetim, 2014).

Athletes may encounter some psychological and mental loads while performing. In order to minimize this situation, it is necessary to benefit from sports psychology (Ardahan, 2013).

In recent years, the psychological aspects of athletic performance have attracted increasing attention. This interest has brought about many studies (Wang et al., 2021; GuoJie, 2021; Lochbaum et al., 2022). The majority of these studies have been related to the mental toughness and mental health of athletes (Gucciardi et al., 2017). In this case, it is normal for people who have a regular sports life to experience some physical and mental changes in their lives (Skoryatina & Zavalishina, 2017; Zavalishina et al., 2021; Kryazhev et al., 2021). The vast majority of these changes in the athlete are positive for the athlete. Today, the positive effects of sports on human health are now obvious. Exercise contributes to

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reduced inflammation and improved body composition (Clauss et al., 2021). Moreover, engaging in regular physical activity may play a preventive role against cardiovascular and metabolic diseases, various mental and cognitive disorders, and even certain types of cancer (Wegierska et al., 2022). The source of motivation and goals are very important factors for the athlete to continue in sports. One of the most important factors to ensure the athlete's continuity is the level of mental toughness. In addition, a good level of mental toughness, which is effective in continuing sports, benefits the athlete in many ways. These have very important effects such as motivation, being able to continue without deterioration, being able to recover in the face of setbacks, and being able to pay better attention (Yilmaz, 2021). In addition, just as athletes can increase their physical capacity through training, they can also develop their mental toughness through various mental trainings (Konter, 2006).

When we consider the concept of mental toughness, the first person to mention it in sports literature was sports psychologist James Loehr and he talked about the requirements of the concept of mental toughness (Peke, 2020).

Athletes need to develop themselves mentally and physically and to make some preparations to achieve the desired performance. Individuals who prepare themselves mentally and physically for many negative situations adapt to these situations over time (Guszkowska et al., 2021). In other words, the factor that facilitates adaptation in this situation and minimizes the negative situation can be expressed as mental toughness (Jacelon, 1997).

The concept of mental toughness can be explained as a psychological capacity that includes the process of the athlete recovering and returning to their old selves when faced with negative situations such as stress, adversity, and failure (Altuntaş, 2015). Luthans (2002) defined the concept of mental toughness as the effort of the athlete or individual to recover as quickly as possible and return to their previous performance in the face of adversities.

Athletes with high levels of mental toughness are more careful and can look at many negative situations they encounter in their daily work and lives more positively and can create these situations as opportunities for themselves (Jackman et al., 2016; Dagnall et al., 2021). Individuals with low mental toughness become pessimistic in the face of

these situations, experience conflicts and are unable to show any resistance (Altuntaş, 2015).

In these cases, athletes need to keep their motivation at the highest level possible against negative emotions such as stress and failure that they encounter during competition or training, and they need to resist despite the similar situations being faced. Such situations highlight the athlete's ability to withstand adversities and the athlete's mental toughness (Doğan, 2015).

Based on these explanations, mental toughness is an indispensable factor and very important for performance athletes and elite level athletes. Many studies show that mental toughness and physical performance must be developed together to achieve optimal performance (A. Yilmaz, 2021).

Mental toughness is especially essential for some sports. Many racket sports can be given as examples. The concept of racket sports is based on the athletes using equipment (rackets) to hit a ball or another object over a net and score points. In addition, the rules of all racket sports are different from each other. It can be played with two or four players. Although these sports are similar to each other, they are also different from each other in many ways. Table tennis, badminton, court tennis, speedminton, padel, squash and many other racket sports can be given as examples of racket sports (Vicente-Salar, 2020).

When it comes to racket sports in our country, there are three branches that come to mind (Court tennis, Badminton, Table tennis) and these branches are sports that people of all ages (Yilmaz, 2021) and genders can do and follow safely, both professionally and as a leisure activity. In addition, racket sports are sports that can be easily learned in open sports areas and indoor halls. Such sports are seen as an opportunity for countries to introduce themselves in the international arena and provide benefits (Demirci, 1990; Demir, 1999; Kuter et al., 2006). To attain success in racket sports, athletes must demonstrate a comprehensive set of attributes, integrating technical proficiency, tactical awareness, physiological efficiency, and psychological fortitude through a dynamic and interrelated system of skills (Lees, 2003). Players must focus their attention on tracking the trajectory of the ball or shuttlecock, anticipating its movement, and accurately directing their response (Tran et al., 2020). Such sustained cognitive engagement is frequently linked to the mental

fatigue in racket sports (Mizuno et al., 2011; Noé et al., 2021; Ding et al., 2024).

After the above explanations and literature review, it is obvious that physical performance alone is not enough for athletes to reach high-level performance due to the intense competition in the sports world in today's conditions. In racket sports, both athletes and coaches widely acknowledge the significance of the mental aspects, emphasizing that it should be developed with the same rigor as physical and technical components (Cece et al., 2020). Based on this reasoning, in order for athletes to reach peak performance, they need to improve mental performance as well as physical performance (Gould et al., 1987; Butt et al., 2010; Koç & Gençay, 2021). Given the competitive nature of racket sports and the need to persist despite errors or suboptimal performance, self-confidence has been identified as a critical factor in studies focusing on disciplines such as badminton (Bebetsos & Antoniou, 2003) and tennis (Covassin & Pero, 2004). Moreover, the inherently stressful nature of racket sport competitions has drawn considerable attention to the development of athletes' emotional regulation skills (Cece et al., 2020). In line with this, Le Mansec et al. (2018) indicated that mental fatigue negatively affected stroke performance in table tennis by reducing ball speed and accuracy. Similarly, the findings of Habay et al. (2021) suggest that mental fatigue in table tennis may impair athletes' efficiency in tasks requiring precise visuomotor coordination, as indicated by slower reaction times observed under fatigued conditions. Van Cutsem et al. (2019) reported that mental fatigue impairs the visuomotor performance of badminton players, leading to slower response times. In addition, tennis players are required to devote increased attentional resources to maintain both the speed and accuracy of their second serve, which may result in a decline in performance accuracy under cognitively demanding conditions (Van Cutsem et al., 2017; Filipas et al., 2024; Ding et al., 2024).

Studies in the literature on mental toughness reveal the importance of the subject. In this context, our research aims to compare the mental toughness levels of top-level athletes in racket sports (court tennis, badminton, table tennis), to examine them according to the determined variables and to contribute to the literature in this field.

MATERIALS AND METHODS

Participants

The universe of the study consists of athletes who are over the age of 18 and have at least a 3-year license in the fields of court tennis, badminton and table tennis in Turkey. The sample of the study consists of a total of 415 athletes, 206 female and 209 male, who optionally filled out the mental toughness inventory and personal information form. The sample size was calculated using G*Power version 3.1.9.4 (effect size = 0.15, α = 0.05, and power = 0.80), and it was concluded that the sample size was sufficient (Rahman, 2023).

Study Design

The survey method was used as the data collection technique (Arkan, 2018) because it is an effective approach for determining individuals' feelings, opinions, and thoughts (Taherdoost, 2021). The data were collected through face-to-face interviews conducted by the researchers.

Ethical Implications

The ethical approval of the research was approved by Mardin Artuklu University Scientific Research and Publication Ethics Committee with the number 11/09/2023-109960. In this study, the scanning method was used. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Data Collection Tools

The "Mental Toughness Inventory in Sports" was used to collect data. In addition to this inventory, a personal information form was used. This inventory was developed by Sheard et al. (2009). The Turkish version of this inventory was edited by Altıntaş and Bayar-Koruç (2017). The reliability and validity study of the scale has been conducted. The mental toughness scale also consists of 14 items and 3 sub-dimensions. Confidence, control and continuity constitute the sub-dimensions of the scale. The scale used is a 4-point Likert type. In addition, the Cronbach's alpha reliability coefficients of the scale in the current study were as follows: control = 0.66, continuity = 0.71, and confidence = 0.72.

Data Analysis

The analysis of the data collected in the study was done using the SPSS 21.0 package program.

Skewness and kurtosis values were used to test the normality distribution of the data. Since the results obtained were distributed in the range of +1 and - 1, parametric tests were applied (Uysal & Kılıç, 2022). Independent Groups T-Test was used to compare the mental toughness levels of the participants according to the gender variable, One-

Way ANOVA was used to compare them according to the sports type, sports age and training day variables and Tukey Post Hoc test was used to test between which groups the difference was. Data were evaluated at a 95% confidence interval and a significance level of 0.05.

RESULTS

Table 1. Distribution of participants according to demographic variables

		f	%
Gender	Women	206	49,3
	Men	209	50
Sport Type	Court tennis	171	40,9
	Badminton	125	29,9
	Table tennis	122	29,2
Sport Age	3-5	124	29,7
	6-8	155	37,1
	9-12	89	21,3
	12+	50	12
Training Day	1-2	70	16,7
	3	60	14,4
	4	115	27,5
	5	129	30,9
	6+	44	10,5

The distribution of the participants in the study according to their demographic variables is shown in Table 1.

Table 2. According to Gender Variable

Dimension	Gender	n	Average	SS	t	p
Confidence	Men	209	3,26	0,56	-1,06	,29
	Women	206	3,32	0,57		
Control	Men	209	2,78	0,79	-,65	,51
	Women	206	2,83	0,81		
Continuity	Men	209	3,49	0,49	,21	,83
	Women	206	3,48	0,49		

No significant difference was found according to the gender variable.

Table 3. According to Sport Type Variable

Dimension	Sport Type	n	Average	SS	F	p	Significant difference
Confidence	Court tennis	171	3,37	0,57	10,441	,000	1-3 2-3
	Badminton	125	3,35	0,51			
	Table tennis	122	3,10	0,57			
Control	Court tennis	171	2,85	0,80	6,963	,001	1-3 2-3
	Badminton	125	2,94	0,73			
	Table tennis	122	2,58	0,81			
Continuity	Court tennis	171	3,57	0,50	6,543	,002	1-3
	Badminton	125	3,50	0,43			
	Table tennis	122	3,36	0,50			

It was found that there were significant differences between the groups in all sub-

dimensions according to the sport type variable, and in the confidence sub-dimension, there was a

significant difference between court tennis and table tennis and between badminton and table tennis ($p<0.05$). In the control sub-dimension, a significant difference was found between court tennis and table tennis and between badminton and

table tennis ($p<0.05$). In the continuity sub-dimension, a significant difference was observed only between court tennis and table tennis branches ($p<0.05$).

Table 4. According to Sport Age Variable

Dimension	Sports Age	n	Average	SS	F	p	Significant difference
Confidence	3-5	124	3,05	0,56	20,516	0,00	1-2,3
	6-8	155	3,29	0,54			2-3
	9-12	89	3,63	0,47			3-4
	12+	50	3,24	0,49			
Control	3-5	124	2,54	0,74	17,326	0,00	1-2,3
	6-8	155	2,83	0,77			2-3
	9-12	89	3,25	0,75			3-4
	12+	50	2,54	0,73			
Continuity	3-5	124	3,40	0,48	,843	0,013	
	6-8	155	3,48	0,47			1-3
	9-12	89	3,62	0,51			
	12+	50	3,50	0,47			

It was found that there were significant differences in all sub-dimensions according to the sports age variable ($p<0.05$). In the confidence sub-dimension, there were significant differences between 3-5 years and 6-8 years, 6-8 years and 9-12 years, 3-5 years and 9-12 years, and 9-12 years and 12 and above years ($p<0.05$). In the control sub-

dimension, significant differences were observed between 3-5 years and 6-8 years, 3-5 years and 9-12 years, 6-8 years and 9-12 years, and 9-12 years and 12 and above years ($p<0.05$). In the continuity sub-dimension, a significant difference was found only between 3-5 years and 9-12 years ($p<0.05$).

Table 5. According to Trainin Day Variable

Dimension	Training Day	n	Average	SS	F	p	Significant difference
Confidence	1-2 days (1)	70	2,97	0,54	12,741	0,00	1-3,4
	3 days (2)	60	3,21	0,54			2-3
	4 days (3)	115	3,48	0,45			3-5
	5 days (4)	129	3,38	0,57			4-5
	6+ (5)	44	3,10	0,61			
Control	1-2 days (1)	70	2,43	0,69	18,010	0,00	1-3,4
	3 days (2)	60	2,55	0,72			2-3,4
	4 days (3)	115	3,15	0,64			3-5
	5 days (4)	129	2,95	0,83			4-5
	6+ (5)	44	2,36	0,77			
Continuity	1-2 days (1)	70	3,25	0,52	1,982	0,00	1-3,4
	3 days (2)	60	3,40	0,47			2-3
	4 days (3)	115	3,63	0,41			3-5
	5 days (4)	129	3,57	0,45			
	6+ (5)	44	3,40	0,55			

It was found that there were significant differences in all sub-dimensions according to the training day variable ($p<0.05$). In the confidence sub-dimension, there were significant differences between 1-2 days and 4 days, between 1-2 days and 5 days, between 3 days and 4 days, between 4 days and 6 and more days, and between 5 days and 6 and

more days ($p<0.05$). In the control sub-dimension, significant differences were found between 1-2 days and 4 days, 1-2 days and 5 days, 3 days and 4 days, 3 days and 5 days, 4 days and 6 or more days, and 5 days and 6 or more days ($p<0.05$). In the continuity sub-dimension, significant differences were found between 1-2 days and 4 days, between

1-2 days and 5 days, between 3 days and 4 days, and between 4 days and 6 or more days ($p<0.05$).

DISCUSSION

In this study, which compared mental toughness levels in racket sports, a total of three branches were compared. The branches were evaluated according to the variables of training day, gender, sport age and sport type. As a result of the analysis, significant differences were found in all sub-dimensions with respect to the sport type, sports age, and training day variables. When the literature is examined, it is seen that in many studies on mental toughness; the mental toughness levels of athletes have been investigated in many variables such as nationality, age, sports age, gender and sports year, and their relationships with each other have been examined and studies have found contradictory and parallel results in the literature (Marchant et al., 2009; Nicholls et al., 2009; Crust 2009; Güvendi et al., 2018; Kalkavan et al., 2020; Tasever & Kıyıcı, 2023).

Our study derives its importance from the fact that it will contribute to the literature by comparing three popular racket sports for the first time. When the results of our current study are examined, no significant difference was found according to the gender variable. When looking at the literature, Koç & Gençay (2021) examined the gender variable in their study on badminton athletes as in our study, and according to the results of this study, they reported that there was a significant difference in the total score and control and confidence sub-dimensions in favor of men in the gender variable. This significant difference was found in favor of men. In our study, the gender variable was compared in three branches and no significant difference was found. In the study, which examined the mental toughness of athletes according to different variables, including table tennis, badminton and tennis athletes, it was found that there was no significant difference between the mental toughness of the participants according to their gender status, and this study was parallel to our research (Şahinler & Ersoy, 2019). Similarly, Clough et al. (2002) and Crust (2009) reported in their studies that there was no significant difference between men and women in the gender variable. In the literature, there are also studies in which no significant difference was found in terms of gender variable on mental toughness. Based on this, it can

be said that when many studies are examined, different results are revealed when mental toughness and gender variables are examined. The answer to the question of why these differences may arise can be said to be affected by many factors such as sports branch, economic level, and the duties that society culturally assigns to genders (Gucciardi et al., 2009).

When the sport type variable was examined in our research, it was found that there was a significant difference between the groups in all sub-dimensions. When the literature was examined, studies conducted separately in badminton, court tennis and table tennis sports were examined. In these studies, significant differences were found in the control sub-dimension, confidence sub-dimension and continuity sub-dimension (İlhan, 2020; Koç & Gençay, 2021; Çakır & Kalkavan, 2022).

Our study found that there was a significant difference in all sub-dimensions according to the sports age variable. Again, when the literature was examined, it was determined that the sports age variable was examined in many studies, but there was a limited number of studies in the field of racket sports and these studies were conducted on only one branch. When the studies were examined, parallel results were obtained with our research. For example, İlhan (2020) reported a significant difference in the variable he examined as the year of playing tennis in the control sub-dimension in his study on court tennis. When the studies in the literature on court tennis are examined, it has been reported that many studies have obtained a significant difference in the control sub-dimension in terms of the variable of years of playing tennis. As a result of these studies, we can say that sports age and sports year are very important factors in the high mental toughness levels of athletes (Connaughton et al., 2008; Nicholls et al., 2011).

In study conducted by Koç & Gençay, (2021) on badminton athletes, similar results were reported with our research. According to the results of the research, while there was no significant difference in the continuity sub-dimension of the athletes, it was stated that there was a significant difference in the mental toughness total score and confidence sub-dimensions. In a study conducted by Çakır & Kalkavan (2022) on table tennis, the sports age variable and its sub-dimensions were examined, and no significant difference was found in the control, confidence and continuity sub-dimensions.

According to the results of the sports year of the study, no statistically significant difference was found in the control, confidence and continuity sub-dimensions. In addition, in this study, stated that the difference between the total scores was not significant.

According to the findings of the studies examined, it can be said that as the years of doing sports increase, the confidence of the athletes in themselves and their abilities also increases. In addition, it has been observed in studies that individuals who have been involved in sports for many years have high mental toughness due to the experience they have gained from performing these sports. The reason for this is that these athletes have encountered many different situations in the past years and are preparing for future competitions, which gives rise to the idea that they will be able to cope with similar situations more easily.

Finally, in our study, the Training Day variable was examined and according to the analysis, it was found that there were significant differences in all sub-dimensions. The results of the study conducted by İlhan (2020) showed a result contrary to our research. According to the results of İlhan's (2020) research, no significant difference was found in terms of the training day variable in all three of the mental toughness sub-dimensions. Our study, unlike this study, examined 3 sports and showed significant differences in all 3 sports. It is normal that as the quantity of training increases, its quality will also increase with correct programming. In racket sports, training frequency is considered a potential risk factor (Lees, 2003) and it is recommended that training be limited to three sessions per week (Liu et al., 2024).

As a result, in this study conducted to compare mental toughness levels in racket sports, badminton, court tennis and table tennis sports were examined because they are the most preferred sports and were presented with the findings of the current study. In this study, gender, sport type, sports age and training day variables were evaluated together with the studies in the literature.

Conclusion and Recommendations

According to the results of our current research, it has been revealed both in our research and in the studies conducted those experiences, namely the sports year or the sports age, are very important for athletes and are an important factor in increasing their mental toughness levels. It can be said that with increasing sports age, athletes become

more self-confident and can remain calm and determined in many different situations (Crust & Clough, 2011). When athletes were examined in terms of gender variable, no statistically significant difference was found in all sub-dimensions of mental toughness. Increasing the number of training days and ensuring training quality through proper programming may enhance athletes' mental toughness. However, findings indicated a decline in mental toughness beyond the fourth training day, which may be attributed to mental fatigue resulting from overtraining. Furthermore, significant difference was identified in all sub-dimensions of mental toughness based on sport type, and table tennis athletes were identified as having the lowest scores.

Based on the findings of this and previous studies, it can be concluded that combining mental training with a balanced approach to physical preparation can enhance performance in racket sports. With this correct programming, athletes will be able to develop their ability to play comfortably, calmly and under control in different and difficult situations. Some variables and physical performance can be combined with psychological factors to improve mental toughness levels and performance.

This study has several limitations: (i) only three racket sports tennis, table tennis, and badminton were included in the comparison; (ii) the sample consisted solely of athletes aged 18 and above with a minimum of three years of sports experience; and (iii) the comparison of mental toughness levels was limited to the variables of gender, sport type, sport age, and training day.

Ethics Committee Approval

Ethics committee approval for this study was obtained from Mardin Artuklu University (Date 13.09.2023, Decision No: 10, "Document Date and Number: 11/09/2023-109960). Informed Consent: Written informed consent was obtained from all participants in the study. Peer Review: External independent

Author Contributions

Research Design, M.N.K*; Research Data Input, M.N.K., B.C; Statistical Data Analysis, M.N.K., M.A., B.C; Data Processing, NU, ÖŞ, BDH; Manuscript Preparation, NU, ÖŞ, BDH; Journal Literacy, NU, ÖŞ, BDH. Each author has reviewed the final draft of the manuscript and given their approval.

Conflict of Interest

The authors declare that there is no conflict of interest.

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