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Mental Toughness and Problem Solving Skills from a Psychological Perspective: A Study on Physically Disabled Athletes

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Abstract

The aim of the study was to examine the mental endurance and problem-solving skill levels of athletes with physical disabilities and whether there were differences between the variables. The study consisted of athletes with physical disabilities living in Istanbul, Antalya, and Ankara in 2021-2022. There were a total of 220 athletes, 66 women and 154 men, with physical disabilities in the national teams and camps. In the study, a personal information form, Mental Toughness in Sports Inventory Scale and Problem-Solving Skills Inventory Scale were applied to participants. Data were analyzed by SPSS 26.0 and AMOS 24.0 software packages. Information about the participants, inventory and scale averages, and frequency (f) and percentage (%) values were determined. Since the scales showed normal distribution, parametric tests were applied. As statistical procedures, Kolmogorov-Smirnov and Shapiro Wilk Test, Independent Sample T-Test, One-Way Anova analysis, Tukey test, Pearson Correlation Coefficient Analysis, Multiple Regression and Confirmatory Factor analysis were applied to determine the direction of significance. The significance level was determined as $p<0.05$. As a result of the analyses, no significant difference was detected between the mental endurance and problem-solving skill levels of physically disabled athletes and the variables of gender, age, sports year, and being a national athlete. However, a significant difference was detected in the variables of education level and branch. As a result of the correlation analysis, it was seen that there was a positive relationship between mental toughness and problem-solving skills of athletes with physical disabilities and that mental toughness also had an effect on problem-solving skills.

Keywords: *Sports, physical disability, mental endurance, problem solving*

Introduction

The World Health Organization (WHO) uses the concept of disability as loss of daily functioning due to mental deficiency, physical, congenital conditions, injuries and diseases (Dammeyer and Chapman, 2018). In the definition of disability, it is defined as the inability of individuals to fulfill the expected features due to deficiencies in their psychological, structural or anatomical structures (Kürkçüoğlu et al., 2021). This definition shows that disability is not only a physical condition, but also affects the psychological and social behavior of the individual.

Sport is an important tool for improving general health (Akil, 2012; Dyer & Deans, 2017) and improving social connections (Jobling, 2001). Sports have a very important place in increasing the participation of disabled individuals in social life. In addition, participation in sports or any physical activity enables the person to discover different identities and roles, provides the opportunity to change self-perception, stimulates group feeling and reduces awareness of disability (Groff et al., 2009). Psychologically, it improves mental endurance and helps with problem-solving skills (Durstine et al., 2000).

Mental resilience is the ability of an individual to overcome negative events throughout his life without losing himself. Mental toughness is defined as a personality trait that minimizes stress and situations caused by stress (Karharman, 2017). Connaughton and Hanton (2009) defined mental toughness with factors such as being able to recover from failures and mistakes, having self-control, staying away from pressure, being able to focus on all efforts, determination and self-confidence. At the same time, mental toughness is defined as a strong inner belief, being able to handle pressure and difficulties effectively. It can be defined as the ability to overcome, flexibility, strength under pressure, ability to connect and focus (Connaughton et al., 2010). Problem solving is defined as a mental process that extends from perception of a problem to its solution (Bingham, 2004). Problem-solving skills are the road map that an individual uses to overcome the difficulties encountered in the problem-solving process (Dixon, 2000).

Mental toughness and problem solving in sports is the athlete's ability to show his best performance under all kinds of conditions such as difficulties and obstacles during the competition. James Loehr, a sports psychologist, first mentioned the concept of mental endurance required in the sports environment (Peke, 2020). Gucciardi et al. (2015) defined mental toughness as an athlete's ability to respond to positive and negative pressures and challenges. Understanding the basis of mental toughness in athletes is an important issue, because

as athletes train, their mental toughness as well as physical characteristics develop. Additionally, overtraining can lead to injuries, burnout, or decreased performance in athletes with poor mental endurance (Slattery et al., 2015). Problem solving skill is a process that lasts from birth to death. This also applies to disabled athletes. The athlete must have the ability to adapt to his/her teammates throughout the match, predict the opponent's moves and find solutions to sudden movements. In order for disabled athletes to demonstrate their performance, it is not only about their physiological state. For this reason, the athlete must be able to find solutions to problems in order to achieve success and demonstrate his performance successfully (Konter, 2004). Based on these definitions, it is the purpose of this study to investigate the mental endurance and problem-solving skills of athletes with physical disabilities according to various variables. In addition, it is thought that this research we conducted will make a positive contribution to sports and disabled infrastructure sports.

Method

Sample

In 2021-2022, there were a total of 220 athletes, 66 women and 154 men, who were physically disabled and on the national team and camps, living in Istanbul, Ankara, and Antalya Provinces. Participants were informed about the study subject and scales, and the surveys were administered on a voluntary participation basis. Approval for this study was given by Dumlupınar University Ethics Commission. Produced from the doctoral thesis number 813337.

Data Collection Tools

The scales were filled in by the athletes via an online survey form and face-to-face. Participants were informed that there were no right or wrong answers and that their answers would be kept confidential. Participation was voluntary, and no incentives were offered to participate in the study. After approving the informed consent form, participants were asked to complete a survey containing basic demographic questions and the scales shown below. It took each participant 10-15 minutes to complete the survey. The data collection tool consists of four parts, three of which are scales, and one is a personal information form.

Personal Information Form: The form prepared by the researcher was created in a single format for athletes with physical disabilities consisting of seven demographic questions including physical disability status, gender, age, education level, how long have you been doing sports, the branch of sports you have done, and whether you are a national athlete.

Mental Toughness Inventory in Sports: Mental Toughness Inventory in Sports Sheard et al. (2009) and was adapted into Turkish by Altıntaş and Bayar Koruç (2015). Mental Toughness Inventory in Sports consists of 14 items based on a 5-point Likert classification. For this inventory, which consists of three sub-dimensions: scale, control, trust and continuity, the 2nd, 4th, 7th, 8th, 9th and 10th questions were reverse coded. Maintaining composure, control and relaxation in the face of pressure or unexpected situations. Continuity (Items 3, 8, 10, 12): Measures the ability to focus on goals, take responsibility and struggle.

Problem Solving Skills Inventory Scale (PÇBEÖ): Problem Solving Skills Inventory (PCSI), developed by Heppner (1982), was adapted into Turkish by Taylan (1990) and tested on Turkish athletes by Miçooğulları and Ekmekçi (2018). Problem Solving Skills Scale contains a total of 35 items, scores ranging from 1 to 6 are taken and items 9, 22, and 29 are not taken into account during the evaluation. Items 1, 2, 3, 4, 11, 13, 14, 15, 17, 21, 25, 26, 30, and 34 were evaluated reversely. These items are thought to have sufficient problem-solving ability. PCSI ranges from the lowest score of 32 to the highest score of 192. Lower scores are interpreted better.

Analysis of Data

The data obtained from the personal information form, mental toughness and problem solving scales were transferred to SPSS 26.0 and AMOS 24.0 package programs and tested.

In this regard, firstly, validity and reliability tests of the scales used in the study were conducted. Confirmatory factor analysis (AMOS 24.0 package program) for the validity of the study. Then, skewness-kurtosis and Kolmogorov-Smirnov test significance level results were examined. Descriptive statistics (means and standard deviations) were examined to determine relationships between data and variables. Since the data of the study showed normal distribution, parametric tests were applied. To test the research hypotheses, one-way ANOVA analysis, independent samples T-test, Multiple Regression analysis for the effect between variables and Tukey test to determine the direction of significance, Pearson Cor-



relation analysis to determine the relationship between variables were used.

Findings

Data regarding the demographic information of the participating athletes is shown in Table 1.

Table 1 provides information regarding the demographic information of 220 physically disabled athletes.

Table 2 shows the average scores of athletes with physical disabilities from the scales. Mental endurance score (χ = 40.3364) and problem solving skill scores (χ = 117.2545) of physically disabled athletes.

When the normal distribution curves of physically disabled athletes are examined in Table 3, it is seen that the skewness and kurtosis values of the mental toughness and problem-solving skill scales are within ±2 and the normality values are appropriate (Cooper, 2019).

When Table 4 is examined, it was determined that the highest score received by physically disabled athletes in mental endurance for the branch was wheelchair tennis (41.8000), and the highest score in problem solving skills (119.7049) was in the amputee football branch.

When Table 5 is examined, there is no significant difference between the mental endurance and problem solving abilities of physically disabled athletes and the gender variable (p>0.05).

When Table 6 is examined, no difference can be detected between the status of physically disabled athletes as national athletes and their mental endurance and problem-solving skills (p>0.05).

When Table 7 was examined, a significant difference was seen between the mental endurance and problem solving abilities of physically disabled athletes and the educational status variable (p <0.05). It has been determined that this difference is between disabled athletes who have primary school-secondary school, primary school-high school education in mental toughness, and secondary school and associate degree education in problem solving skills.

When Table 8 is examined, there is no significant difference between the problem-solving skills of physically disabled athletes and the branch variable, while a significant difference was detected between mental toughness and branch variables (p<0.05). It has been observed that these differences exist between wheelchair tennis and wheelchair basketball in mental endurance levels.

When Table 9 is examined, no significant difference was detected between the mental endurance and problem-solving skills of physically disabled athletes and the sport year variable (p>0.05).

When Table 10 is examined, no significant difference was detected between the mental endurance and problem-solving skills of physically disabled athletes and the age variable (p>0.05).

Table 1
Distribution of Athletes Participating in the Research According to their Demographic Characteristics (Physically Disabled N=220)

Personal İnformation	Variables	F	%
Gender	Female	66	30,0
	Male	154	70,0
Age	18-21 Age	20	9,1
	22-25 Age	146	66,3
	26-29 Age	36	16,4
	30 Age and over	18	8,2
Educational Status	Primary School	43	19,5
	Secondary School	37	16,8
	Lycea	32	14,6
	Associate degree	19	8,6
	Licence	77	35,0
	Master Degree	12	5,5
Branch of Sports	TS Tennis	40	18,3
	Amputee Football	61	27,7
	TS Table Tennis	65	29,5
	TS Basketball	54	24,5
National Athlete	Yes	122	55,5
	No	98	44,5
Year of Sports	1-3 Year	52	23,6
	4-6 Year	63	28,6
	7-9 Year	45	20,5
	10 and Over	60	27,3

Table 2
Average Scores of Athletes with Physical Disabilities from the Scales

Scales	N	X
Mental Toughness	220	40,3364
Problem Solving Skills	220	117,2545

Table 3
Results of Skewness and Kurtosis Significance Levels of Physically Disabled Athletes

Scales	N	Skewness	Kurtosis
Mental Toughness	220	-,436	,970
Problem Solving Skills	220	,246	-,451

Table 4
Average Scores of Physically Disabled Athletes for Their Branch

	Branch	N	X
Mental Toughness	Wheelchair Tennis	40	41,8000
	Amputee Football	61	41,1967
	Wheelchair Table Tennis	65	40,4154
	Wheelchair Basketball	54	38,1852
Problem Solving Skills	Wheelchair Tennis	40	117,1750
	Amputee Football	61	119,7049
	Wheelchair Table Tennis	65	116,6769
	Wheelchair Basketball	54	115,2407

Table 5
T-test Analysis Results of Mental Endurance and Problem-Solving Levels of Athletes with Physical Disabilities According to Gender Variable

Scales	Gender	N	X	Ss	T	P
Mental Toughness	Female	66	39,9091	5,90886	-,646	,519
	Male	154	40,5195	6,63248		
Problem Solving Skills	Female	66	117,6667	34,02819	,111	,912
	Male	154	117,0779	36,80802		

*P>0.05

Table 6
T-test Analysis Results of Mental Endurance and Problem-Solving Levels of Athletes with Physical Disabilities According to Their National Athletic Status

Scales	National Athlete	N	X	Ss	T	P
Mental Toughness	Yes	122	40,0328	6,30615	-,782	,435
	No	98	40,7143	6,56451		
Problem Solving Skills	Yes	122	115,1639	34,70236	-,963	,337
	No	98	119,8571	37,39701		

*P>0.05

Table 7
Anova Analysis Results of Mental Endurance and Problem-Solving Levels of Athletes with Physical Disabilities According to Their Educational Status

	Education	N	X	Ss	F	P	Significant Difference
Mental Toughness	Primary School[a]	43	42,3953	6,55795	5,116	,000	a-b a-c
	Secondary School[b]	37	37,9730	9,01075			
	Lycea[c]	32	39,9688	4,26905			
	Associate degree[d]	19	35,4737	5,57144			
	Licence[e]	77	41,5325	5,00942			
	Master Degree[f]	12	41,2500	5,17204			
Problem Solving Skills	Primary School[a]	43	129,1860	37,41483	2,555	,029	b-d
	Secondary School[b]	37	112,8378	40,52401			
	Lycea[c]	32	117,2500	31,45811			
	Associate Degree[d]	19	95,6316	36,24333			
	Licence[e]	77	117,4286	31,22517			
	Master Degree[f]	12	121,2500	42,97171			

*P<0.05

Table 8
Anova Analysis Results of Mental Endurance and Problem-Solving Levels of Athletes with Physical Disabilities According to Their Branch Status

	Branch	N	X	Ss	F	P	Significant Difference
Mental Toughness	TS Tennis[a] Amputee	40	41,8000	5,47348	3,178	**025**	**a-d**
	Football[b]	61	41,1967	6,00228			
	TS Table Tennis[c]	65	40,4154	5,42532			
	TS Basketball[d]	54	38,1852	8,03547			
Problem Solving Skills	TS Tenis[a]	40	117,1750	117,1750	155	926	-
	Ampute Futbol[b]	61	119,7049	119,7049			
	TS Masa Tenisi[c]	65	116,6769	116,6769			
	TS Basketbol[d]	54	115,2407	115,2407			

*P<0.05

Table 9
Anova Analysis Results of Mental Endurance and Problem-Solving Levels of Athletes with Physical Disabilities According to Sports Year

	Sports Year	N	X	Ss	F	P	Significant Difference
Mental Toughness	1-3 Year[a]	52	40,4423	5,36296	,084	968	-
	4-6 Year[b]	63	40,3968	5,98800			
	7-9 Year[c]	45	39,9111	6,50113			
	10 and Above[d]	60	40,5000	7,65462			
Problem Solving Skills	1-3 Year[a]	52	119,0385	33,72668	,161	922	-
	4-6 Year[b]	63	118,1746	35,31222			
	7-9 Year[c]	45	114,2444	31,77632			
	10 and Over[d]	60	117,0000	41,61730			

*P<0.05

Table 10
Anova Analysis Results of Mental Endurance and Problem-Solving Levels of Athletes with Physical Disabilities According to Sports Year

	Age	N	X	Ss	F	P	SignificantDifference
Mental Toughness	18-21 Age[a]	20	38,6500	4,60292	2,291	,079	-
	22-25 Age[b]	146	41,0616	6,06428			
	26-29 Age[c]	36	38,3333	8,23928			
	30 Age and Over[d]	18	40,3333	6,07793			
Problem Solving Skills	18-21 Age[a]	20	108,2000	33,22269	1,316	,270	-
	22-25 Age[b]	146	119,9315	37,01773			
	26-29 Age[c]	36	109,5556	34,04656			
	30 Age and Over[d]	18	121,0000	31,86368			

*P<0.05

Table 11
Pearson Correlation Test Results for the Mental Endurance Problem-Solving Skills of Physically Disabled Athlete

	Problem Solving Skills
Mental Toughness	,393**

Table 12
Mental Toughness, and Problem-Solving Skills Goodness-of-Fit Index

Model	$\chi 2_{(df)}$	χ2/df	CFI	SRMR	GFI	RMSEA
Mental Toughness	$40{,}055_{(91)}$	4,93	.93	.049	.93	.080
Problem Solving Skills	$34{,}016_{(65)}$	4,83	.92	.030	.91	.079

Table 13
Multiple Regression Analysis of Mental Toughness and Problem-Solving Skills of Physically Disabled Athletes

Independent variable	β	Sh	Beta	T	P	F	R^2	DurbinWatson
Steady	14,580	16,310	-	,894	**000**	21,574	,166	1,919
Mental Toughness	,361	,674	1,166	5,595	**,000**			

p<0,01**, p<0,05*

When Table 11 was examined, a positive relationship was observed between the mental endurance and problem-solving skills of physically disabled athletes (r=,393, p=,000) (p<0.05).

The results in Table 12 show that the scale has a good fit for analysis and the population also has reasonable approximation errors.

According to the regression analysis results in Table 13, it appears that the mental endurance of physically disabled athletes has a positive effect on their problem-solving skills (p<0.05). It is seen that mental toughness explains 16.6% of the change in problem-solving skills (0.166). A 1-unit increase in the mental toughness variable leads to a .361 increase in problem-solving skills (β=.361).

Discussion and Conclusion

In this research, the mental endurance and problem-solving skill levels of athletes with physical disabilities were examined and whether there were any differences between the variables was tested. In this section, the findings obtained as a result of testing the research questions were evaluated based on the results of the studies in the relevant literature.

According to the results of the research, there was no significant difference between the variables of gender, national athlete, sports year and age, and mental endurance and problem-solving skills of physically disabled athletes. However, there was a significant difference between the mental endurance and problem solving abilities of physically disabled athletes and their educational status and branch variables. It was observed that there was a positive relationship and effect between the mental endurance and problem-solving skills of physically disabled athletes (r=.393, p=.000) (p<0.05). We can say that these relationships are related to the performance of disabled athletes in the difficult struggles they face in competitions, the psychology of winning and losing, their quality of life and economic situation. The results of the tests are discussed below, along with relevant field studies. When examining the relationship between mental toughness and problem-solving skills from a psychological perspective, especially in the context of athletes with physical disabilities, it is essential to recognize the multifaceted nature of these constructsMental toughness is often characterized as a psychological edge that enables individuals to cope with the demands of sport better than their competitors, especially in challenging situations. This psychological resilience is crucial for athletes who face the additional challenges brought by physical disabilities, as it can significantly impact their performance and overall well-being (Gucciardi, 2016; Kumbar, 2024). Gucciardi and colleagues found that individuals with higher levels of mental toughness showed greater perseverance in rehabilitation settings; this is especially important for athletes with physical disabilities who may face long recovery periods (Gucciardi, 2016). According to a study conducted by Temel and Ayan (2015), there is no significant difference in problem solving levels among sports and physical education teachers according to gender. Nicholls et al. (2009), in their research on successful male and female athletes, discovered that there was a significant relationship between gender and mental toughness and that male athletes had higher levels of mental toughness than women due to the effect of various socialization processes. In a study conducted by Tekkurşun Demir and Güvendi (2022), it was found that physically disabled athletes playing sports at the national level had a strong athlete identity and had the strength and belief to overcome difficulties. Karabulut et al. (2009), it was found that there was no significant difference between the problem-solving skills scores of the participating students and the nationality variable. Sari et al. (2020), in their study, no difference was found between mental toughness and educational status. Sevindi et al. (2010) conducted a study examining the distribution of family process average scores according to the educational status of disabled people. They discovered that disabled individuals who did not go to school had problems solving problems, while disabled individuals who were university graduates had problems in other areas. In a study, it was found that judokas had significantly higher mental toughness scores than taekwondo players (Singh, 2016). In a study conducted by Şah (2005), it was examined whether the problem-solving skills of wheelchair basketball players and physically disabled individuals who do not do sports differ. It has been determined that both doing sports and having a high monthly income are factors that affect the problem-solving skills of physically disabled individuals. In their research, Canan and Ataoğlu (2010) found that playing team sports for a long time positively contributed to problem-solving skills. Statistically, there are studies showing that there is a correlation between mental toughness scores and years of doing sports (Nicholls et al., 2009; Şahinler & Beşler, 2021). In another study conducted with physically disabled people, it was observed that psychological health decreased as age increased (Ni et al., 2016). Demirtaş and Dönmez (2008) determined that there was no difference in teachers' problem-solving skills according to the age variable. A positive relationship was observed between the mental endurance and problem-solving skills of physically disabled athletes (r=.393, p=.000) (p<0.05). We can say that these relationships are related to the performance of disabled athletes in the difficult struggles they face in competitions, the psychology of winning and losing they experience at that moment, their quality of life and economic situation. Veysel and Birol (2017), in their study on physically disabled athletes, discovered that there was a negative (-2.253) and moderate (-0.508) relationship between problem-solving scores and panic decision-making scores. Duman et al. (2011) found that there was a positive relationship between the life satisfaction and self-confidence of physically disabled



athletes. In a different study, the interaction between mental toughness and problem-solving skills is further emphasized by the cognitive-emotional processes involved in athletic performanceProblem solving, defined as the cognitive and behavioral processes by which individuals determine effective ways to cope with challenges, is especially important for athletes with disabilities who may face unique obstacles (Kolayiş et al., 2014). Research has shown that mental toughness improves an athlete's problem-solving abilities and enables them to develop effective strategies to overcome both physical and psychological obstacles (Kumbar, 2024; Johnson et al., 2023). This relationship highlights the importance of developing mental toughness as a fundamental skill that can improve overall athletic performance and psychological health. In the context of athletes with physical disabilities, the psychological challenges they face may be exacerbated by societal perceptions and personal experiences of disability. In a study conducted by Şah (2005), he investigated whether there was a difference in the problem-solving skills of wheelchair basketball players and physically disabled individuals who did not do sports. It has been determined that this is one of the factors affecting the problem-solving skills of physically disabled individuals who do sports and have a high monthly income. Cote-Leclerc et al. (2017) showed that wheelchair user athletes positively affect society's attitude toward wheelchair users by doing sports. As a result of this study, it was seen that the mental endurance levels of athletes with physical disabilities had a positive effect on their problem-solving skills. It has been proven that playing sports improves the mental and psychological health of disabled people, and disabled people who have not yet started sports should be encouraged to participate in sports. This can enable disabled people to adapt to social life and society.

Suggestions

- ✓ It is thought that taking mental toughness, psychological resilience and other positive psychology concepts (motivation, concentration, and stress) into consideration in the regulation and development of policies for disabled athletes in our country will increase the quality of the measures to be taken, decisions and studies to be carried out regarding disabled athletes.

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