MJSS

Akdeniz Spor Bilimleri Dergisi

Mediterranean Journal of Sport Science

ISSN 2667-5463

Do Mental Training Level and Perceived Fatigue Affect Competition Outcome in Volleyball?

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DOI: https://doi.org/10.38021asbid.1312586

ORIGINAL ARTICLE

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Abstract

The aim of this study was to investigate the effects of mental training (MT) and perceived fatigue levels (PF) on the performance of volleyball players. A total of 225 athletes from 10 girls' and 11 boys' volleyball teams. Prior to the competitions, the athletes completed two surveys, namely the "Chalder Fatigue Scale" and the " Mental Training Qestionnaire-SMTQ," to assess their PF levels and MT proficiency, respectively. Following the conclusion of the championship, the competition scores of all teams. To examine the relationships among PF, MT levels, and competition scores, a Pearson correlation analysis was conducted. The results revealed a significant negative correlation between MT level and PF level ($r = -.305$, $p<.01$), indicating that higher levels of MT were associated with lower levels of PF. Additionally, a significant positive correlation was found between MT level and end-of-competition score ($r = .244$, $p<.01$), indicating that higher levels of MT were related to better performance outcomes. Conversely, a significant negative correlation was observed between PF level and end-of-competition score ($r = -.149$, $p<.05$), suggesting that higher levels of PF were associated with lower performance scores. Furthermore, a multiple linear regression analysis was conducted to determine the combined predictive power of MT and PF level on the end-of-competition score. The results demonstrated that the two variables together significantly predicted the end-of-competition score ($F(2, 222) = 7.811$, $p<.005$). In summary, incorporating mental toughness (MT) training into athletes' programs is recommended to enhance their overall performance in volleyball.

Keywords: Perceived Fatigue, Competiton Result, Mental Training.

Zihinsel Antrenman Düzeyi ve Algılanan Yorgunluk Voleybolda Müsabaka Sonucunu Etkiler Mi?

Öz

Çalışma voleybolcuların zihinsel antrenman ve algılanan yorgunluk seviyelerinin müsabaka sonucu puanlarını nasıl etkilediğini incelemek amacıyla, Gençler Voleybol Bölge Şampiyonası'na katılan 10 kız, 11 erkek voleybol takımından toplam 225 sporcuyla yapılmıştır. Müsabakalar öncesi sporculara "Chalder Yorgunluk Ölçeği" ve "Sporda Zihinsel Antrenman Envanteri" uygulanmıştır. Şampiyona sonrası tüm takımların maç skorları Okul Sporları Federasyonu'ndan alınmıştır. Sporcuların algılanan yorgunluk ve zihinsel antrenman düzeyleri ile müsabaka sonucu puanı arasındaki ilişkiyi incelemek için Pearson korelasyon analizi yapılmıştır. Analiz sonucu, algılanan yorgunluk ve zihinsel antrenman düzeyi ile maç sonucu puanları arasında ilişki olduğundan, bağımsız değişkenlerin maç sonucu puanını yordama gücünü belirlemek için çoklu doğrusal regresyon analizi yapılmıştır. Analizler SPSS25 kullanılarak $p<.05$ anlamlılık düzeyinde değerlendirilmiştir. Analiz sonucunda, zihinsel antrenman düzeyi ile algılanan yorgunluk düzeyi arasında negatif yönlü ilişki ($r=-.305$, $p<.01$) ve müsabaka sonucu puanı ile pozitif yönlü ilişki ($r=.244$, $p<.01$) görülürken, algılanan yorgunluk düzeyi ile müsabaka sonu puanı arasında negatif yönlü ($r=-.149$, $p<.05$) ilişki tespit edilmiştir. Regresyon analizi sonucuna göre zihinsel antrenman ve algılanan yorgunluk düzeyi birlikte müsabaka sonu puanının anlamlı bir yordayıcısıdır ($F(2.222)=7.811$, $p<.005$). İki değişken birlikte müsabaka sonu puanındaki varyansın %6'sını açıklamakla birlikte, yorgunluk düzeyinin müsabaka sonu puanı anlamlı yordamadığı görülürken, zihinsel antrenman düzeyinin müsabaka sonu puanı anlamlı yordadığı görülmüştür. Çalışma sonucunda zihinsel antrenman ve algılanan yorgunluk değişkenlerinin performansı etkilediği söylenebilir. Bu bağlamda sporcuların performansını artırmak için fiziksel antrenmanın yanında zihinsel antrenmanlara da yer verilmesi tavsiye edilmektedir.

Anahtar kelimeler: Algılanan Yorgunluk, Müsabaka Sonucu, Zihinsel Antrenman.

Received: 10.06.2023

Accepted: 20.09.2023

Online Publishing: 29.10.2023

Introduction

In order to enhance and sustain athletic success, various training programs are implemented, and scientific studies are conducted in this field. It is widely recognized that success in sports relies not only on physical and technical skills but also on a multidimensional approach to the human factor (Tohirjonovich, 2022). Yogi Berra famously stated that "Sport is 50% physical and 90% mental preparation" (Kahrović et al., 2014), emphasizing the significance of mental and psychological parameters in addition to physical and physiological aspects. These parameters encompass a range of variables, such as gender, age, anatomical structure, motor characteristics, hormones, stress, motivation, mental training level, fatigue, and recovery (Bayraktar and Kurtoğlu, 2009). In this study, we analyze perceived fatigue and mental training level as two crucial factors that can influence athletes' match outcomes. Mental training can enhance concentration, focus, and motivation, while perceived fatigue can lead to a decline in performance (Twist and Highton, 2013).

Fatigue is a clinically significant and commonly reported issue in the general population. It is a multidimensional symptom known to have significant associations with both physical and mental health (Ha et al., 2018). There are various definitions of fatigue in the literature, including physical and physiological fatigue, mental fatigue, objective fatigue, acute and chronic fatigue. Although no gold standard exists for measuring fatigue, it can be assessed through subjective or objective methods. Objective measurement of fatigue is considered a physical state accompanied by changes in blood pressure, hand strength, and heart rate, often evaluated through electroencephalography in medical research. Subjective measurement of fatigue encompasses more than 30 scales that can be utilized, with sub-dimensional scales being advantageous due to their brevity and ability to address various aspects of fatigue (Rahimian Aghdam et al., 2019).

Numerous studies have examined the relationship between fatigue, training load, performance, and recovery strategies in athletes. Both physical and mental fatigue have been found to impact performance (Russell et al., 2020). In a study by Cheung et al. (2016), it was revealed that the level of perceived fatigue significantly affects athletes' performance. Participants reporting higher levels of tiredness performed worse compared to those reporting lower levels, suggesting that fatigue can diminish concentration, focus, and motivation, thereby contributing to poor performance.

Mental training is one method employed to improve performance and mitigate the effects of fatigue in athletes. Although mental training is a psychological parameter, it is known to have positive effects on physical and physiological factors. The level of mental training is directly associated with athletic performance. Common mental training methods employed by athletes include goal setting, self-talk, self-confidence modeling, relaxation, and visualization (Mamassis and Doganis, 2004; Wolframm and Micklewright, 2011).

Previous studies have reported that the level of mental training and physical and mental fatigue are factors influencing performance in athletes across various sports (cyclist, soccer, cricket, tabel tennis) (Gantois et al., 2020; Pageaux and Lepers, 2018). Volleyball, being an intermittent sport involving short periods of exercise and rest, places significant demands on athletes' mental and physical training levels, as well as their perception of fatigue (Aslan et al., 2015; Gabbett et al., 2006; Horta Thiago et al., 2019).

Volleyball requires high physical and mental skills during competitions and pre-match preparations. It is a skill-based sport characterized by unpredictability, requiring athletes to adapt to constantly changing active and dynamic situations. It is a skill-based sport characterized by its unpredictable nature, requiring athletes to adapt and react to constantly changing, active, and dynamic situations. These circumstances necessitate strong cognitive abilities in terms of planning and strategy, which can contribute to increased mental and physical fatigue (Coimbra et al., 2021). Maintaining optimal levels of mental and physical performance and minimizing fatigue are crucial aspects in sports competitions. The fact that the study was conducted at the time of the competitions is important to determine the effect of the athletes on the match results due to the fact that they are mentally and psychologically in competition mode. Therefore, the objective of this study is to investigate the influence of mental training level and fatigue on the match outcomes of young volleyball players.

Method

Research Design

This study employs a quantitative research approach, specifically a correlational research, which aims to investigate the presence and extent of relationships between multiple variables (Karasar, 2022). The study was conducted with the approval decision of Erzincan Binali Yıldırım University Health and Sports Sciences Ethics Committee numbered E-88012460-050.01.04-250858. Since the data were collected in the competitions, permission was obtained from the coaches of the athletes under the age of 18.

Population and Sample

The study was conducted among volleyball players who participated in the Junior Volleyball Regional Championship organized by the School Sports Federation in Erzincan. The championship consisted of 24 teams, with 12 girls' teams and 12 boys' teams, ranging in age from 15 to 18. A total of 225 athletes, representing 10 girls' teams and 11 boys' teams, voluntarily participated in the study.

Data Collection Instruments

Fatigue Scale

Developed by Chalder et al. (1993), this scale assesses individuals' perceived physical and mental fatigue over the past month. The Turkish version of the scale, validated by Adın (2019), includes items measuring common symptoms of physical and mental fatigue. The scale comprises 11 items rated on a four-point Likert scale (ranging from "less than usual" to "much more than usual"). The total score ranges from 0 to 33, with higher scores indicating greater fatigue severity (α=0.84). For this study, the internal consistency reliability (Cronbach's alpha) of the fatigue scale was calculated as .675.

Mental Training Qestionnaire

This inventory, developed by Behnke et al. (2017), measures mental skills and techniques in the sport environment. The Turkish adaptation by Yarayan and İlhan (2018) consists of 20 items organized into five sub-dimensions. It employs a five-point Likert scale ranging from "Totally Disagree" (1) to "Totally Agree" (5). The total score on the inventory ranges from 20 to 100. The internal consistency reliability (Cronbach's alpha) of the inventory was calculated as .852 for this study.

Demographic Information Form

This form collects information on age, gender, team affiliation, and the number of years of participation in volleyball competitions as licensed athletes.

Data Collection Process

Scales and questionnaires were applied before the competitions to determine the mental training and perceived fatigue level of the athletes before the match and to determine the effect of the results obtained on the competition score.

Match Results

Information on match outcomes was obtained by contacting the School Sports Federation. The scoring system used in volleyball was employed to record match results: Winning teams received either 3-0 or 3-1 (3 points) for a victory and 3-2 (2 points) for a win. The losing team received 2-3 (1 point) for a loss and 1-3 or 0-3 (0 points) for a defeat (Türkiye Volleyball Federation).

Analysing Data

As a result of normality analysis in SPSS 25 programme, it was determined that the data showed normal distribution. Descriptive statistics were used to describe age, gender, sport age, mental training score and perceived fatigue scores. Pearson correlation analysis was performed to determine the relationship between athletes' perceived fatigue level, mental training level and competition result. Regression analysis was performed to determine the effect of mental training level and perceived fatigue level on competition score. The results were evaluated at p<.05 level.

Results

Table 1

Descriptive Analysis Result

Gender		**Min.**	**Max.**	**Mean±Sd**
GIRL (N=102)	Age	14	18	15.92±1.05
	Sport year	1	5	2.42±1.05
	Mental Training	42	94	73.04±11.5
	Perceived Fatique	0	25	10.89±4.64
BOY (N=123)	Age	14	18	16.12±1.04
	Sport year	1	5	2.57±1.18
	Mental Training	34	100	73.46±12.85
	Perceived Fatique	0	21	9.4±4.84
TOTAL (N=225)	Age	14	18	16.03±1.04
	Sport year	1	5	2.5±1.12
	Mental Training	34	100	73.27±12.23
	Perceived Fatique	0	25	10.08±4.79

Tablo 2

Pearson Correlation Analysis To Examine The Relationship Between Mental Training, Perceived Fatigue Level And Post-Competition Score

	1	**2**	**3**
Mental Training (1)	1	-.305**	.244**
Perceived Fatique (2)		1	-.149*
Post-competition score (3)			1

** p<.01; * p<.05

According to Table 2, there is a relationship between mental training, perceived fatigue level and end-of-competition score. There is a negative relationship between mental training level and perceived fatigue level (r=-.305, p<.01) and a positive relationship with end-of-competition score (r=.244, p<.01), while there is a negative relationship between perceived fatigue level and end-of-competition score (r=-.149, p<.05).

Table 3

The Result Of Multiple Linear Regression Analysis To Predict End-Of-Competition Score According To Mental Training And Perceived Fatigue Level

	B	Sh.	B	t	P	R	R^2	F	p
Mental Training	.057	.018	.219	3.214	.002	.256	.066	7.811	.001
Perceived Fatique	-.055	.045	-.082	-1.211	.227				

Multiple linear regression analysis was performed to predict end-of-competition score according to mental training and perceived fatigue level. Mental training and perceived fatigue level together were significant predictors of end-of-competition score (F(2.222)=7.811, p<.005). Together, the two variables explained 6% of the variance in the end-of-competition score. Separately, perceived fatigue level was not a significant predictor of end-of-competition score, whereas mental training level was a significant predictor of end-of-competition score. The order of predictive importance of the variables on the end-of-competition score is mental training (β=.219) and perceived fatigue (β=-0.82). According to the result of the analysis, the equation predicting the post-competition score: End of competition score=1.103+(Mental training*.057)+(Perceived fatigue*-.055).

Discussion and Conclusion

In the study, 102 female athletes with an average age of 15.92 and 123 male athletes with an average age of 16.12 participated in the Junior Volleyball Regional Championship. Before the competitions, scales were applied to determine the mental training level and perceived fatigue levels of the athletes. After the championship, the scores of the teams were determined by taking the match results. The effect of athletes' mental training and perceived fatigue levels on their success scores as a result of the competition was analyzed.

It was determined that mental training and perceived fatigue levels of the athletes explained 6% of the variance in the result of the competition, perceived fatigue levels were not significant predictors, while mental training level was a significant predictor.

These outcomes align with prior research in the field. For instance, Karaca and Gündüz (2021), as a result of their study with a total of 136 athletes (38 female and 98 male) participating in the Turkish Orienteering Championships, it was stated that there was a positive relationship between the participants' mental training level and their competition performances and that the mental training level predicted approximately 39% of the long-distance degrees and 24% of the sprint race degrees. As a result of the mental training program applied in swimmers, improvement was observed in their sportive performance as well as psychological development and it was stated that mental training is among the factors that will positively affect both psychological and physical performance (Boughattas et al.,2022; Bar-Eli and Blumenstein, 2004). Öner and Cankurtaran (2020), as a result of their study conducted with a total of 119 archers, 59 female and 60 male, who participated in the national team selection for the Indoor Turkey Championships, it was stated that there was a positive relationship between the mental training level of the athletes and their arrow shooting performance and that it explained 51% of the variance. Astuti et al. (2022), in their study with 5th grade primary school students, drew attention to the importance of using a mental training-based program for the development of students' volleyball basic technical skills.

The literature also supports the notion that a high level of mental training in athletes improves self-confidence, reduces anxiety and contributes positively to performance. (Kahrović et al., 2014; Mamassis and Doganis, 2004; Amar and Chéour, 2014; Glass et al., 2019). Similarly, there are studies indicating that the perceived level of physical and mental fatigue is also related to performance (Millet et al., 2004; Chaouachi et al., 2009; Russell et al., 2019; Sun et al., 2021). Weerakkody et al. (2021) investigated the effect of mental fatigue on Australian soccer-specific skills. As a result of the study, it was observed that mental fatigue had no effect on the results of standing vertical jump, running vertical jump and 20 m sprint test, while it negatively affected the results of goal kick test and Yo-Yo test. In a study in runners, in 3000 m running performances before and after being exposed to mental fatigue, it was observed that when mental fatigue levels were high, they performed lower in terms of time, while there was no difference in heart rate and blood lactate levels (MacMahon et al., 2014).

Pageaux and Lepers (2018) examined 29 articles between 2009 and 2018 on the relationship between mental fatigue and athletic performance. As a result of their review, they stated that the effects of mental training may vary branch-specific. Mental fatigue negatively affects endurance, motor skills, decision-making performance and maximal force production. These results indicate that mental fatigue impairs performance during submaximal intensity exercises due to an increase in the perception of effort, but not during maximal and supramaximal intensity exercises.

According to the results of our study and the literature, a general conclusion can be drawn that the level of mental training is directly proportional to performance. In terms of perceived fatigue,

while the results are partially similar to the literature, considering that volleyball is anaerobic energy-intensive and therefore performed at maximal and supramaximal intensity, it is in line with the research results of Pageaux and Lepers (2018).

In conclusion, physical training level and perceived fatigue level affect performance in athletes. It can be said that in addition to physical training, exercises should be done to increase the mental training levels of athletes, and the causes of mental and physical fatigue should be well determined by taking into account the characteristics of the branch, and applications and evaluations should be made.

Ethics Committee Approval Information

Ethics assessment board: Erzincan Binali Yıldırım University, Health and Sports Sciences Ethics Committee

Date/Session: 28.02.2023/02

Issue: E-88012460-050.01.04-250858

Declaration of Contribution Rates of Researchers

Authors contributed equally to the entire research process.

Conflict Statement

The authors do not declare any conflicts with the research.

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