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Examination of Functional Movement Screening Scores of Athletes in Different Branches*

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Research Article
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Abstract

This study was conducted to investigate the functional movement screening scores of athletes in three different branches (volleyball, soccer, basketball). 35 male athletes participated in the study. Age, height, body weight, Body Mass Index (BMI) and Functional Movement Screening (FMS) were analyzed. As a result of the study, it was found that the average total FMS test scores of the volleyball group was 16.88±3.05, the football group was 17.66±2.09, the basketball group was 18.00±2.56 and the average total FMS test scores of the three groups was 17.57±2.47. When the FMS test scores of the groups were compared, a statistically significant difference was found in favor of the basketball group in the Deep Squat score ($p<0.05$), while no significant difference was found in other scores and total score ($p>0.05$). It was also found that the highest number of players showing asymmetry was in the Hurdle Step (20%) and the lowest number of players showing asymmetry was in the Active Straight Leg Raise (2.8%). In addition, 42.8% of the athletes showed asymmetry, branches while 57.2% did not show asymmetry. In line with these findings, it was seen that the FMS total scores of the athletes in the three branches were above the threshold value (14 points) and basketball players had better total scores than volleyball and soccer players. In addition, since more than half (57.2%) of the athletes in the three branches did not have asymmetry, it can be said that the injury risk rate is relatively lower in these players.
Keywords: Functional movement screen, Volleyball, Football, Basketball, Injury prevention

Farklı Branşlardaki Sporcuların Fonksiyonel Hareket Taraması Skorlarının İncelenmesi

Öz

Bu çalışma üç farklı branştaki (voleybol, futbol, basketbol) sporcuların fonksiyonel hareket taraması skorlarının incelenmesi amacıyla yapılmıştır. Çalışmaya 35 erkek sporcu katılmıştır. Çalışmaya katılan sporcuların yaş, boy uzunluğu, vücut ağırlığı, beden kitle indeksi (BKİ) ve fonksiyonel hareket taraması (FHT) incelenmiştir. Çalışma sonucunda voleybol takımının 16,88±3,05, futbol takımının 17,66±2,09, basketbol takımının 18,00±2,56 ve üç takımın ortalama toplam FHT test skorları 17,57±2,47 olduğu bulunmuştur. Takımların FHT test skorları karşılaştırıldığında, Deep Squat skorunda basketbol takımı lehine istatistiksel olarak anlamlı farklılık tespit edilirken ($p<0,05$), diğer skorlarda ve toplam skorda anlamlı bir farklılık bulunamamıştır ($p>0,05$). Ayrıca en fazla asimetri gösteren oyuncu sayısının Hurdle Step (%20) hareketinde ve en az asimetri gösteren oyuncu sayısının Active Straight Leg Rasise (%2,8) hareketinde olduğu bulunmuştur. Buna ek olarak sporcuların %42,8'i asimetri gösterirken, %57,2'sinde asimetri gözlenmemiştir. Bu bulgular doğrultusunda üç takımdaki sporcuların FHT toplam skorlarının eşik değerinin (14 puan) üstünde olduğu ve basketbol oyuncularının voleybol ve futbol oyuncularına göre daha iyi toplam skora sahip olduğu görülmüştür. Ayrıca üç branştaki sporcuların yarısından fazlasında (%57,2) asimetri görülmemesinden dolayı bu oyuncularda yaralanma risk oranının görece daha düşük olduğu söylenebilir.
Anahtar Kelimeler: Fonksiyonel hareket taraması, Voleybol, Futbol, Basketbol, Yaralanmaların önlenmesi

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INTRODUCTION

In all sports branches, athletes work more intensively to increase their performance during the season. This intensity is realized through training, which is a requirement of sports branches. As a result of these trainings, the athlete reaches the physical fitness required to display both technical and tactical skills on the field in the best way (Özer, 2005). During this period, the health of the athlete is critical in achieving sporting success (Smith et al., 2017). Due to this importance, sports experts have turned to corrective exercises to increase the range of motion of athletes and protect them from injuries. Corrective exercises have been reported to improve movement quality and reduce the risk of injury (Kiesel et al., 2011).

Performance tests such as endurance, speed, agility, balance and strength are used to evaluate the physical performance of athletes (Çiçek & Türkeri, 2023; Jiménez Rubio et al., 2025). The main purpose of applying these tests is to reduce the risk factors that will cause injuries and to prevent situations that will affect injuries. However, it has been stated that performance tests are insufficient to achieve these goals (Metzl, 2000). For this reason, athletes, coaches and sports specialists have searched for different ways to prevent injuries and protect themselves from risk factors that may lead to injury and have turned to tests that show neuromuscular control. Functional Movement Screening (FMS), one of these tests, was developed by Cook et al. in 1988 (Cook et al. 1988). This test is a reliable method used in the evaluation of functional movements of athletes (Aktuğ et al., 2023). It is also a field-based measurement method used by athletic performance coaches, sports physicians and physiotherapists to evaluate functional performance during the return to the field after injury (Asgari et al., 2021). After this measurement, FMS detects asymmetries and weak links in basic movement patterns and informs the practitioner about possible injuries (Clark et al., 2022). Through these movement patterns, the athlete's basic motor skills and stabilizing movements are observed. These movements can evaluate the body as a whole or each segment separately. As a result of the evaluation, deficiencies in the athlete's muscle strength ratio bilaterally are determined. The deficiencies provide information to the athlete and the coach, so that the deficiencies of the athlete can be identified and corrected with corrective exercises and the injury risk rate can be minimized (Cook, 2001). In addition, the test is preferred by many clubs due to its low cost and easy implementation (Perry & Koehle, 2013).

Functional movement is defined as the production and maintenance of balance between stability and mobility. It consists of the harmony between muscular strength, flexibility and motor control and this harmony is critical for the athlete's performance (Cook et al., 2010). Conversely, incompatibility in movement patterns leads to increased athletic injuries (Mills et al., 2005). FMS is an assessment method consisting of 7 basic movements (deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, rotary stability) that require mobility, balance and stability, scored in the range of 0-3. A score of 3 indicates that the movement was performed correctly, 2 indicates that the movement was partially performed, 1 indicates that the movement was not completed and 0 indicates that pain occurred when the movement was performed (Cook et al., 2006; Cook et al., 2014). The maximum score for all movements is 21. In addition, in movements performed bilaterally, the lowest score is recorded in the final score of that movement. The analysis is an easy and reliable method to identify functional limitations and asymmetries. FMS not only requires functional mobility and continuity during the execution of basic movements, but also reveals deficits in functional movement (Chimera et al., 2015; Cook et al., 2010).

Many studies have examined changes in anthropometric, performance and physiological adaptations of athletes during the season (Carling & Orhant, 2010; Gonzalez et al., 2011; Gonzalez et al., 2013; Kiesel et al., 2007; McGill et al., 2012; Rousanoglou et al., 2013; Shanley et al., 2012). Although there are studies examining the physiological and performance changes of athletes, studies on the effects on functional movement screening are limited in the literatüre (Kocak & Unver, 2020; Keil et al., 2021). This study was conducted to examine the functional movement screening of athletes in three different branches (volleyball, soccer, basketball).

METHOD

Research Model

This research was designed within the scope of the comparative screening model, which is one of the quantitative research methods. The comparative screening model is a model that determines the current status of two or more groups in terms of certain variables and reveals the similarities and differences between these groups. (Karasar, 2007)

Research Group

G-Power power analysis was performed to determine the sample size in the study. FMS test scores (volleyball: 10 mean: 14.8, women's soccer: 27 mean: 16.48, men's soccer: 20 mean: 16.19), a calculation was made to obtain an effect level = 0.63 a = 0.05 power = 0.80 power index (Table 1). According to the results of the analysis, it was determined that there should be 27 people in the study. In our study, it was decided that the sample should consist of 35 people in order to increase reliability (Faul et al., 2007).

Table 1. G-Power power analysis test

Ftests-Anova:	Fixed effects, omnibus, one-way		
Analysis:	A priori: Compute required sample size		
Input:	Effect size f	=	0.63
	α err prob	=	0.05
	Power (1-β err prob)	=	0.80
	Number of groups	=	3
Output:	Noncentrality parameter λ	=	10.96
	Critical F	=	3.40
	Numerator df	=	2
	Denominator df	=	24
	Total sample size	=	27
	Actual power	=	0.80

A total of 35 male athletes (volleyball=9, football=15, basketball=11) aged 16 years and actively participating in competitions in Sanlıurfa province participated in the study.

Ethical Approval

All students and their parents signed an informed consent form. In addition, before starting the study, approval was obtained from Çukuroava University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee with the letter dated 02/12/2022 and numbered 128/55. The demographic information of the athletes (age, height, weight, years of sport) was recorded on the information form prepared beforehand. The demographic characteristics of the athletes are given in Table 2.

Data Collection Procedure

Before the data was collected, the researcher met with the club coaches and athletes in advance to determine the day the data would be collected. In January 2023, appointments were made for athletes from 3 clubs for different days (Monday, Tuesday, Wednesday). On the day of data collection, athletes were present in the specified area and time (14:00). One of the research members who had previous experience with the FMS protocol applied the tests to all athletes in the clubs. During the application, athletes only applied the given instructions with video support. The athletes were not informed about the given points.

Data Collection Tools

Height and Body Weight Measurement: A wall-mounted Mesilife brand (PT810A) height scale was used for height measurement. The participants were measured with bare feet. While taking the measurement, the body and head of the participant were taken and recorded in an upright position with their feet together. Their weights were taken using a Tanita brand (BC-730) digital scale. Care was taken to ensure that the participants were not wearing clothes that would affect their weight.

Functional Movement Screening (FMS): FMS is a measurement tool that includes 7 basic movement abilities that require a balance between mobility and stability. Clearing test is applied in 3 of these 7 movements. Each movement is scored between 0-3. According to the status of performing the movement, 3 points indicate that the movement is performed completely and correctly, 2 points indicate that the movement is partially performed, 1 point indicates that the movement is not completed and 0 points indicate that pain occurs in the athlete. The maximum score at the end of 7 movements is 21. In addition, 5 of the 7 movements (hurdle step, ın-line lunge, shoulder mobility, active straight leg raise, rotary stability) are scored independently for the right and left sides of the body. The lowest score of the movements performed bilaterally is recorded in the final score of that test. Participants were shown visuals of how the test was performed and were given 2 attempts to understand the test. After the trial, the participants were given 3 repetitions for each movement and the best value was recorded on the form (Cook et al., 1998).

Movements Evaluated

1. Deep Squat

2. Hurdle Step

3. In-Line Lunge

4. Shoulder Mobility

5. Active Straight Leg Raise

6. Trunk Stability Push Up

7. Rotary Stability

Data Analysis

Before starting the data analysis, it was checked whether the data were normally distributed. Since the number of samples was less than 50, Shapiro-Wilk test, one of the normal distribution tests, was applied. As a result of the test, it was determined that the data did not show normal distribution and non-parametric tests were applied. Therefore, Kruskal-Wallis and Mann-Whitney U Tests were used for comparison between groups. Significance level was accepted as p<0.05. Statistical analysis were performed using SPSS 23. package program.

FINDINGS

Table 2. Demographic characteristics of athletes

Demographic Characteristics	Volleyball n=9	Football n=15	Basketball n=11
	(X̄ ± SD)	(X̄ ± SD)	(X̄ ± SD)
Age (year)	16±0,00	16±0,00	16±0,00
Height (cm)	180,77±7,67	172,20±6,01	178,45±7,72
Weight (kg)	69,88±8,66	60,40±8,44	75,00±18,24
BKI (kg/m^2)	21,42±2,73	20,29±1,93	23,40±4,79
Sports Age (year)	1,22±0,66	3,00±1,19	2,81±2,48

Table 2 shows the demographic characteristics of the athletes participating in the study such as age, height, body weight, body mass index and years of sport.

Table 3. Comparison of FMS test scores of the groups

Movements	Volleyball (n:9)	Football (n:15)	Basketball (n:11)	Total (n:35)	
	(X̄ ± SD)	(X̄ ± SD)	(X̄ ± SD)	(X̄ ± SD)	p
Deep Squat	2,55±0,52	2,26±0,59	2,81±0,40	2,51±0,56	0,04*
Hurdle Step	2,22±0,66	2,46±0,51	2,45±0,52	2,40±0,55	0,63
In-Line Lunge	2,44±0,52	2,46±0,74	2,36±0,80	2,42±0,69	0,91
Shoulder Mobility	3,00±0,00	2,93±0,25	2,81±0,40	2,91±0,28	0,34
Active Straight Leg Raise	2,44±0,88	2,66±0,48	2,36±0,50	2,51±0,61	0,36
Trunk Stability Push-Up	2,11±0,60	2,26±0,79	2,45±0,82	2,28±0,75	0,45
Rotary Stability	2,11±0,78	2,53±0,51	2,72±0,46	2,48±0,61	0,12
Total	16,88±3,05	17,66±2,09	18,00±2,56	17,57±2,47	0,60

*p<0,05

Table 3 shows the comparisons of FMS test scores of Volleyball, Football and Basketball groups as a result of Kruskal-Wallis and Mann-Whitney U tests. While a statistically significant difference was found in Deep Squat score in favor of the basketball group (p<0.05), no significant difference was found in other scores and total score (p>0.05).

Table 4. Number and percentages of players showing asymmetry

Movements		Volleyball (n:9)	Football (n:15)	Basketball (n:11)	Total (n:35)	(%)
		Asymmetry				
Hurdle Step	Yes	2	2	3	7	20
	No	7	13	8	28	80
In-Line Lunge	Yes	1	2	2	5	14,3
	No	8	13	9	30	85,7
Shoulder Mobility	Yes	0	1	1	2	5,7
	No	9	14	10	33	94,3
Active Straight Leg Raise	Yes	0	1	0	1	2,8
	No	9	14	11	34	97,2
Rotary Stability	Yes	2	4	0	6	17,1
	No	7	11	11	29	82,9
Total	Yes	3	7	5	15	42,8
	No	6	8	6	20	57,2

Table 4 shows the total number and percentages of players showing asymmetry in 5 basic movement abilities (Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, Rotary Stability) and in each group.

Table 5. Pairwise comparison of teams FMS test scores

Teams	*N*		Deep Squat	Hurdle Step	In-Line Lunge	Shoulder Mobility	Active Straight Leg Raise	Trunk Stability Push-Up	Rotary Stability	Total
Volleyball	9	*U*	50,50	54,50	62	63	62,50	57,50	47	57
Football	15	*Z*	-1,15	-0,88	-0,36	-0,77	-0,35	-0,64	-1,36	-0,63
		p	0,24	0,37	0,71	0,43	0,71	0,51	0,17	0,52
Volleyball	9	*U*	36,50	40,50	49,50	40,50	41,50	34	27	36
Basketball	11	*Z*	-1,24	-0,77	0,00	-1,31	-0,67	-1,28	-1,92	-1,04
		p	0,21	0,43	1,00	0,18	0,50	0,20	0,05	0,29
Football	15	*U*	41,50	81,50	77	73	57,50	70,50	66,50	76
Basketball	11	*Z*	-2,42	-0,06	-0,32	-0,89	-1,50	-0,68	-0,98	-0,34
		p	0,01	0,95	0,74	0,37	0,13	0,49	0,32	0,73

*p<0,05

Table 5 shows the FMS test score comparisons of Volleyball-Football, Volleyball-Basketball and Football-Basketball groups. As a result of the pairwise comparison, a significant difference was found only in the Deep Squat test score of the Football and Basketball groups in favor of the Basketball groups (p<0.05).

DISCUSSION AND CONCLUSION

FMS is a reliable, low-cost and effective method used to evaluate basic movement patterns and to determine the probability of sports injury (Butler et al., 2012; Cook et al., 2010; Kiesel et al., 2011). This study was conducted to examine the functional movement screening of volleyball, football and basketball athletes. A total of 35 male athletes (volleyball n=9, football n=15, basketball n=11) aged 16 years participated in the study.

As a result of the study, when the FMS test scores of the athletes in three groups (volleyball, football, basketball) were compared, no statistically significant difference was found in the total test scores, but no statistically significant differences were found in all other scores except the Deep Squat score among the individual test scores. In the comparison of the Deep Squat test scores of the groups, a significant difference was found in favor of basketball athletes. As a result of the pairwise comparison, no significant difference was found between basketball and volleyball athletes, while a statistically significant difference was found between basketball and football players (Table 5). In a similar study, Öztürk (2020) compared the FMS test scores of individual (Athletics, Kick Boxing, Taekwondo) and group athletes (Volleyball, Football, Basketball, Handball) and found no statistically significant differences in both total and individual scores. In this study, considering the sport-specific movements of the basketball branch, it can be thought that the deep squat test score differs from other branches due to the fact that the athletes perform movements that involve intense squats such as low dribbling, changing hands from front and back, changing direction under pressure such as reverse while on offense and slide, stance, dny, close out, box out while on defense.

When the FMS total test scores of the three groups were analyzed, it was found that the volleyball group had 16,88±3,05, the football group had 17,66±2,09, the basketball group had 18,00±2,56 and the average total score of the three groups was 17,57±2,47. In general, FMS test scores of basketball players were better than volleyball and football players. In addition, an important point that draws attention in our study is that all of the volleyball players scored full score (3.00±0.00) in the Shoulder Mobility test (Table 3). This may be due to the fact that volleyball players continuously perform movements that require shoulder flexibility such as dunking and serving, in which forearm extension is frequently used in volleyball sport, and they include shoulder flexibility exercises in their training. In the literature, it has been reported that athletes with a total FMS score below 14 points have a higher risk of injury (Chorba et al., 2010; Kiesel et al., 2011). Letafatkar et al. (2014) stated that the injury threshold score was 17. According to Chorba et al. (2010), it can be said that all three groups in our study were above the threshold point. However, according to the study findings of Letafatkar et al. (2014), it can be said that the volleyball group in our study was below the threshold, while the football and basketball groups were above the threshold. The reason why the volleyball group was below the threshold was that two athletes scored low in certain tests (Active Straight Leg Raise, Rotary Stability) during the test and this result affected the total score of the group. There are many studies in the literature examining the FMS test scores of groups. Chorba et al. (2010) found the mean FMS test scores of women's volleyball, football and basketball groups to be 14.3±1.77. Şahin et al. (2018) found the mean FMS test score of athletes to be 14.40 in a study conducted with 92 young football players. Lloyd et al. (2015) found the mean FMS of football players to be 16.00 ± 2.00, Portas et al. (2016) found it to be between 15-16, and Kürklü et al. (2019) found it to be 16.75 ± 1.87. In another study, Aka et al. (2019) found the average FMS total score of volleyball athletes to be 15.77±1.39. Although these results support our study findings, they are below our mean score. The mean test scores in our study were higher than other studies in the literature. This may be considered normal since approximately 92.5% of the players in the three groups scored above the threshold (14 points) in total test scores. In addition, considering the effectiveness of FMS in preventing sports injuries, a study conducted in China found that the total score of FMS showed a moderate relationship in predicting sports injuries (Liu et al., 2023). Another study reported that regular application of injury prevention exercises for 12 weeks increased FMS scores and reduced injuries at the end of 24 weeks (Suzuki et al., 2022). In a similar study, it was reported that athletes with a modified FMS test score of 22 points or less were at higher risk of injury in 527 male athletes (Wei et al., 2024). Contrary to these studies, Tondelli et al. (2024) found no relationship between FMS total scores and injury, but they stated that athletes who showed asymmetry in the Active Straight Leg Raise test were at higher risk of injury. These results demonstrate the applicability of FMS in predicting injuries.

During the FMS test, asymmetries are observed in 5 of the 7 movement abilities. These 5 movements are Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise and Rotary Stability tests. In the research findings, it was found that the highest number of players showing asymmetries was in Hurdle Step (20%) and the lowest number of players showing asymmetries was in Active Straight Leg Raise (2.8%). In addition, 42.8% of the athletes showed asymmetry, while 57.2% showed no asymmetry (Table 4). In a study conducted on football players, 61.96% of the participants showed asymmetry, while the remaining 38.04% did not show asymmetry (Şahin et al., 2018). This result does not coincide with our study findings. Because in our study, the majority of the participants (57.2%) did not have asymmetry. Kiesel et al. (2014) stated that the presence of asymmetries is associated with the frequency of injury. In addition, Chorba et al. (2010) stated that the risk of injury is higher when any of the FMS movements is below 2 points, the total score is below 14 points, or right and left asymmetries are observed. In our study, the number of players who scored below 2 points in any movement was 3 in volleyball, 3 in football and 2 in basketball. It can be said that these players have high injury risk rates because they scored below the threshold (below 2 points). In addition, 3 players in volleyball, 7 players in football and 5 players in basketball showed asymmetry in any FMS test movement (Table 4). These findings indicate a high risk of injury. In general, when the total score of the players was analyzed, it was found that 2 athletes in volleyball (13 points) and 1 athlete in football (13 points) out of 35 athletes scored below the threshold. These results show that most of the athletes we studied were not at risk of injury. In addition, considering the relationship between the necessary parameters of strength, power, endurance and speed with injury, it can be said that the athletes in the three groups fulfilled these requirements during the season and therefore the majority of the athletes were not at risk of injury.

Conclusion and Recommendations

As a result, there was no difference between the three groups in all test scores and total test scores except Deep Squat test among the individual tests. It can be argued that the difference in the Deep Squat test score was in favor of basketball and this difference was due to the intensive use of movements involving squat exercises in training and competitions due to the branch of basketball sport. In addition, basketball players were found to have better total scores than volleyball and football players. In addition, since the FMS total scores of the athletes in the three groups in the study were above the threshold value (14 points) and more than half of the athletes (57.2%) had no asymmetry, it can be said that the injury risk rate in these players is low. It is suggested that the training programs of the groups should also be taken into consideration when performing FMS analysis for those who will conduct research in this field. In addition, our study is limited to 16-year-old male athletes. Future studies can be evaluated by considering different age groups. In addition, considering that female athletes are more sensitive to injury risk, it is recommended that this study be applied to female athletes.

Conflict of Interest: There is no personal or financial conflict of interest within the scope of the study.

Declaration of Contribution of Researchers: Research Design was carried out by CT, İÇ, MEŞ Statistical analysis was carried out by İÇ; Preparation of the manuscript was carried out by CT, İÇ, ; Data Collection was carried out by MEŞ.

Ethical Approval

Board Name: Çukurova University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee

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