ORIGINAL ARTICLE

Nr 2023;13 (1):103-108

Determination of Functional Movement Screening Scores in Wrestlers and Examination in terms of Some Variables

Gülşah Ünver[1], Hikmet Kocaman[2]

[1] *Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Osmaniye Korkut Ata University, Osmaniye, Turkey*

[2] *Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Karamanoglu Mehmetbey University, Karaman, Turkey*

CORRESPONDING AUTHOR:
Gülşah Ünver
Department of Physiotherapy and Rehabilitation
Faculty of Health Sciences
Osmaniye Korkut Ata University
Karacaoğlan Campus - D Block
Osmaniye, Turkey
E-mail: g.unver70@hotmail.com

DOI:
10.32098/mltj.01.2023.11

LEVEL OF EVIDENCE: 3

SUMMARY

Objective. The aim of this study was to determine functional movement screening (FMS) scores in wrestlers to examine FMS scores in terms of years of sport experience and wrestling weight, and to determine the relationship between FMS score and body mass index (BMI).

Materials and methods. Forty-four male wrestlers were included in this study. Functional movement analyses were performed of the wrestlers. In addition, the wrestlers filled out a personal information form which contains information such as age, years of sport experience, wrestling weight, and height.

Results. The FMS scores of the wrestlers have been found to be 16.07 ± 1.87. A statistically significant difference has been found in terms of FMS scores according to years of sport experience and wrestling weight ($p < 0.05$). A statistically significant correlation has been found between the FMS score with BMI ($p < 0.05$).

Conclusions. It has been concluded that the FMS scores of the wrestlers with more years of sport experience are higher, the FMS scores of the wrestlers with low body weight are lower, and the FMS score increases as the BMI increases. It is thought that the functional movement levels of the wrestlers should be evaluated regularly at certain intervals and interpreted according to their characteristics.

KEY WORDS
Wrestling; functional movement; sport experience; weight.

INTRODUCTION

Wrestling is one of the oldest combat sports. It can be defined as the struggle of two people on a mat of certain size using their technique, skills and strength without using a vehicle in accordance with the rules of wrestling (1, 2). It is among the sports with a substantial risk of injury. Wrestlers can be exposed to physical forces in competitions and training. These situations can result in injuries to the wrestlers (3, 4).

Functional movements are performed in accordance with the function according to some criteria. The level of functional movements gives information about the functional performance levels of individuals (5). Athletes should be able to perform sports activities at the level required by the sports branches they are engaged in and at the expected quality. Otherwise, movements are tried to be made with some compensatory mechanisms and movement patterns. These conditions may also cause a decrease in sportive performance and occurrence of some musculoskeletal injuries. By performing functional movement analyses on athletes, information is obtained about limitations in movements and risk situations for musculoskeletal injuries (6-8). Analysis of functional movement is necessary to determine whether athletes have the necessary abilities to perform move-

ments. Stability, mobility and asymmetry are examined in functional movement analysis. Functional movement analyses include evaluations of factors such as muscle strength, flexibility, range of motion, coordination, balance, and proprioception. These parameters are among the components that are taken as a basis for the implementation of techniques in wrestlers, the planning of training, and the provision of better performance. The level of functional movements is important for the wrestlers to maintain their position against their opponents, as the level of movements such as pushing and pulling, and the development of wrestling-specific techniques and skills. In this context, functional movement analysis of wrestlers should be done regularly. It can be done by some methods. Functional Movement Screening (FMS) is a movement analysis method that has been widely used recently (9-12).

When the literature was examined, it was seen that there were studies that determine the FMS scores of athletes in various branches and examine the FMS scores in terms of some variables. Loudon *et al.* (13) determined FMS values in long-distance runners. They found that there were differences in scores for the squat, hurdle step, and in-line lunge tests in the athletes under and over the age of 40. They determined that young runners scored higher. Toselli and Campa (14) found that in volleyball players, optimal flexibility and mobility were closely related to anthropometric characteristics with particular emphasis on body fat. Uzer *et al.* (15) investigated the effect of posture on FMS scores in wrestlers in their study. They found significant weak correlations between FMS sub-parameters and postural analysis total score. In the literature review, it has been understood that the number of scientific studies in which FMS scores of wrestlers are determined and examined in terms of year of sport experience and wrestling weight, and in which the relationship between FMS scores and BMI are investigated is not sufficient. The current study is unique in these aspects. The aim of the current study was to determine FMS scores in wrestlers, to examine FMS scores in terms of year of sport experience and wrestling weight, and to determine the relationship between FMS score with BMI.

MATERIALS AND METHODS

The current research is a cross-sectional study. The ethics committee approval was obtained for the study from the Medical Research Ethics Committee of Kahramanmaras Sutcu Imam University (Date of approval: May 24, 2022, Session no: 2022/17, Decision no: 02). Permission was also obtained from the Ministry of Youth and Sports in Turkey. The criteria for inclusion in the study were being between the ages of 18-25, being male and an athlete in the wrestling branch, but not having any injuries related to the lower extremities and any neurological problems. Exclusion criteria from the study were being younger than 18 or older than 25 years old, being female, being from other branches other than wrestling, and having undergone any surgical operation in the last 6 months. For the current study, 48 wrestlers who have met the inclusion criteria are reached. Four of the wrestlers are excluded from the study because they have not fully agreed with the evaluations. Forty-four wrestlers are included in the study. Before starting the study, all participants filled out and signed the informed consent form. Firstly, the form containing information such as age, years of sport experience, wrestling weight, and height was filled out by the wrestlers. Body mass indexes were calculated according to the height and body weight of the wrestlers. Subsequently, functional movement analyses of the wrestlers were performed by FMS and the scores of the wrestlers were determined.

FMS is a non-invasive, easy-to-apply, and reliable analysis method that allows the application of basic physical movements for the evaluation of functional movement (16, 17). FMS consists of 7 movement patterns, which are deep squat, hurdle step, inline lunge, shoulder mobility, active straight-leg raise, trunk stability, push-up, and rotary stability. In FMS, it is essential to score seven movement patterns according to certain criteria. Each movement pattern is scored between 0 and 3 points, and the scores of the 7 movement patterns are summed up for the total score. Each individual participating in the evaluation can get a total of 0 to 21 points. An evaluation can be made on the total score, or the score of each test can be evaluated within itself. A high score indicates good movement (18-21). Evaluations were made at Batıpark gym in Kahramanmaras province. Evaluations were made at 18-20 °C, in an indoor gym, and before the season.

The G*Power program (version 3.1.9.4, Franz Faul, Universität Kiel, Germany) was used to calculate the sample size before the study. According to the calculation based on the one-way analysis of variance, the sample size was found to be 48 with an effect size of 0.5, an error level of 0.05, and a power of 0.85. The analysis of the obtained data was done with the SPSS program (version 25, SPSS Inc., Chicago, IL, USA). The normality distribution of the data was examined in order to determine the tests to be used as parametric or non-parametric tests. Kolmogorov-Smirnow test was applied. The compliance with the normal distribution was also checked with Kurtosis-Skewness values and histogram graphs. It was determined that the data were in accordance with the normal distribution. One-way analysis of variance and Bonferroni correction were used for comparisons. The relationship between the variables was examined by Pearson correlation analysis. The statistical significance level was accepted as $p < 0.05$.

RESULTS

Forty-four male wrestlers were included in the study. The wrestlers' age was 20.77 ± 2.28, the years of wrestling experience were 8.68 ± 3.03, body weight was 65.93 ± 13.50 kg, body mass index (BMI) was 22.46 ± 2.37 kg/m², and the FMS score was 16.07 ± 1.87. Wrestlers were classified as 1-4 years, 5-8 years, and 9 years and older based on their wrestling experience. There were 12 (27.3%) wrestlers with 1-4 years of experience, 18 (40.9%) wrestlers with 5-8 years, and 14 (31.8%) wrestlers with 9 years or more. Wrestlers were classified as light, middle, and heavyweight based on the weight they wrestled in. Those with a body weight of up to 60 kg were included in the lightweight category, those with a body weight between 61-75 in the middleweight category, and those with a body weight of 76 and over were in the heavyweight category. According to the weight they wrestled, there were 14 (31.8%) light-weight wrestlers, 18 (40.9%) middle-weight wrestlers, and 12 (27.3%) heavyweight wrestlers.

The comparison of the FMS scores of the wrestlers according to the categories of years of sport experience are given in **table I**. It has been determined that there is a significant difference in terms of FMS scores among the wrestlers, who are divided into 3 groups according to the year of sport experience ($p < 0.001$). It has been determined that the FMS scores of the wrestlers with 9 years or more of wrestling experience are higher.

The comparison of the FMS scores of the wrestlers according to the wrestling weight categories is given in **table II**. It has been determined that there is a significant difference in terms of FMS scores among the wrestlers who are divided into 3 groups according to the weight they wrestle ($p < 0.001$). The FMS scores of the lightweight wrestlers are found to be lower.

The correlation analysis findings between the FMS scores of the wrestlers and their BMI values are given in **table III**. A statistically significant, moderate correlation has been found between the FMS score and BMI ($p < 0.001$; $r = 0.51$).

DISCUSSION

It has been found in the current study that the wrestlers' FMS scores varies in terms of some traits. The current study indicates that the FMS scores of the wrestlers increase as their years of wrestling experience and wrestling weight increase, and the FMS scores increase as the BMI values increases.

The FMS scores of the wrestlers who participated in the current study have been found to be 16.07 ± 1.87. In their study, Alper

Table I. Comparison of FMS scores by years of sport experience categories.

	Years of sport experience categories			F		
	1-4 years[a] Mean ± SD	5-8 years[b] Mean ± SD	9 years and above[c] Mean ± SD	Test value	P-value	Bonferroni
FMS Score	15.08 ± 1.44	15.61 ± 1.61	17.64 ± 1.45	10.86	< 0.001	c > a c > b

FMS: Functional Movement Screen; F: One-way analysis of variance; $p < 0.05$.

Table II. Comparison of FMS scores according to the wrestling weight categories.

	Wrestling weight categories			F		
	Light[a] Mean ± SD	Medium[b] Mean ± SD	Heavy[c] Mean ± SD	Test value	P-value	Bonferroni
FMS Score	14.21 ± 0.80	16.42 ± 1.38	17.39 ± 1.42	26.09	< 0.001	a < c a < b

FMS: Functional Movement Screen; F: One-way analysis of variance; $p < 0.05$.

Table III. The relationship between the FMS score and BMI.

	BMI	
FMS Score	r	0.51
	p	< 0.001
	n	44

FMS: Functional Movement Screen; BMI: Body Mass Index; $p < 0.05$.

and Kolayiş (22) observed the relationship between wrestling performance and trunk stability, dynamic balance, and functional mobility values in star wrestlers. Thirty-three male wrestlers participated in their study, and they found the FMS score of the wrestlers participating in the study to be 14.64 ± 2.86. FMS provides insight into the risk of injury. It is reported that people with an FMS score of ≤ 14 are more likely to be injured than those with an FMS score of more than 14 (6). In the current study, the FMS scores of the wrestlers in the sport experience year categories and the weight categories are not lower than 14. Therefore, it is difficult to interpret the injury risks in terms of categories.

In the current study, it has been found that there is a significant difference in favor of wrestlers with 9 years or more in terms of FMS scores according to the years of sport experience. Bulğay *et al.* (23) determined normative values according to FMS in long-distance runners in their study and found that there was a statistically significant difference in rotational stability according to sports experience. They also found a significant difference in athletes according to their years of sport experience, which supports the result of the current study. These results suggest that engaging in sports for a longer period provides more improvement in parameters such as muscle strength, balance, and flexibility and the improvement in parameters is also reflected in the level of functional movement.

In the current study, it has been found that there is a significant difference in terms of FMS scores according to the weight they wrestle. It has been understood that the FMS scores of the lightweight wrestlers are significantly lower than the middle and heavyweight wrestlers statistically. In other words, it has been determined that the FMS scores of the wrestlers with a body weight of less than 60 kg are lower. This result may be since wrestlers with lower body weight may have less muscle mass, and this affects muscle strength because muscle strength is effective at the functional movement level. In the study of Alper and Kolayiş (22), no statistically significant difference was found between the groups when the FMS results were evaluated according to the weights. This result is not similar to the result of the current study. Basar *et al.* (24) found that heavyweight Greco-Roman wrestlers had more postural control in all directions than light and medium-weight Greco-Roman wrestlers. In terms of the difference between the weight categories in their study, it can be evaluated that it is parallel to the result of the current study. Postural control is an effective factor at the functional movement level. In this context, it can be interpreted that the FMS scores of individuals with different levels of postural control may also differ.

According to the correlation analysis findings in the current study, a statistically significant correlation has been found between the FMS scores and BMI values in wrestlers. It has been understood that as the FMS score increases in wrestlers, the BMI also increases. Campa *et al.* (25) found significant relationship between movement patterns and several body composition variables in their study on athletes. In particular, they found large negative correlations between fat mass percent, upper arm fat area, and FMS total score. They reported that the functional movement patterns and body compositions of the athletes differ according to the sports, and it is essential to reach an optimal body composition for the quality of the movements. Nicolozakes *et al.* (26) in their study, tried to find whether there is a relationship between body mass index, body fat percentage, and FMS scores in football players. In their study, a significant negative correlation between FMS score and body mass index revealed. The negative correlation between the FMS score and body fat percentage was found to be significant. Increased body fat percentage and body mass index were associated with lower FMS scores. In a study conducted by Cengizhan and Eyuboğlu (27), twenty-two male athletes from different branches, including wrestlers, participated in the study. They found a moderately negative significant correlation between the participants' FMS scores and their body weight. In the current study, there is a positive relationship between the FMS score and BMI value. An increase in body weight causes an increase in BMI values. The direction of the relationship makes us think that it is necessary to look at the status of the components in the body composition in the body weight increase. Because body composition includes fat weight, lean body weight, and total fluid amount, it can be thought that changes in body composition component amounts affect balance, postural control, and thus functional movement level.

CONCLUSIONS

In the present study, it has been concluded that functional movement levels differ according to the characteristics of the wrestlers. It has also been concluded that the FMS scores of the wrestlers with more years of experience are higher, the FMS scores of the wrestlers with low body weight are lower, and the FMS score increases as the BMI increases. The results obtained can provide reference values for planning training, avoiding performance losses, increasing performance, and taking preventive measures for sports injuries. The results obtained can provide information to sports professionals for the evaluation and guiding the athletes. It is recommended that functional movement analyzes be performed regularly in wrestlers and interpreted according to their characteristics. There is a need for studies with more wrestlers in which different parameters are evaluated together with the FMS score.

FUNDINGS

None.

DATA AVAILABILITY

Data are available under reasonable request to the corresponding author.

CONTRIBUTIONS

GÜ, HK: conceptualization, data collection and/or processing, analysis and interpretation, literature review, writing, critical reviews. GÜ: design, supervision, materials.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

REFERENCES

1. Chaabene H, Negra Y, Bouguezzi R, et al. Physical and physiological attributes of wrestlers: an update. J Strength Cond Res. 2017;31(5):1411-42. doi: 10.1519/JSC.0000000000001738.
2. Philippe T. Wrestling styles and the cultural reinterpretation process. Int J Hist Sport. 2014;31(4):492-508. doi: 10.1080/09523367.2013.869218.
3. Thomas RE, Zamanpour K. lnjuries in wrestling: systematic review. Phys Sportsmed. 2018;46(2):168-96. doi: 10.1080/00913847.2018.1445406.
4. Myers RJ, Linakis SW, Mello MJ, Linakis JG. Competitive wrestling-related injuries in school aged athletes in US emergency departments. West J Emerg Med. 2010;11(5):442-9. Available at: http://escholarship.org/uc/item/57n1z0d2.
5. Boyle M. Functional training for sports. Champaign, IL: Human Kinetics; 2004.
6. Bonazza NA, Smuin D, Onks CA, Silvis ML, Dhawan A. Reliability, validity, and injury predictive value of the functional movement screen: a systematic review and meta-analysis. Am J Sports Med. 2017;45(3):725-32. doi: 10.1177/0363546516641937.
7. Kiesel K, Plisky PJ, Voight ML. Can serious injury in professional football be predicted by a preseason functional movement screen? N Am J Sports Phys Ther. 2007;2(3):147-58. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/pmid/21522210/.
8. Okada T, Huxel KC, Nesser TW. Relationship between core stability, functional movement, and performance. J Strength Cond Res. 2011;25(1):252-61. doi: 10.1519/JSC.0b013e3181b22b3e.
9. Smith CA, Chimera NJ, Wright NJ, Warren M. Interrater and intrarater reliability of the functional movement screen. J Strength Cond Res. 2013;27(4):982-7. doi: 10.1519/JSC.0b013e3182606df2.
10. Bayati R, Shamsi Majelan A, Mirzaei B, Barbas I. The effect of 12 weeks of wrestling+ warm-up program on functional movement screen scores in cadet wrestlers. Ann Appl Sport Sci. 2019;7(1):39-47. doı: 10.29252/aassjournal.7.1.39.
11. Tabasi SR, Norasteh AA, Mirzaei B, Zarei H. Proprioception and dynamic balance performance in wrestlers: Freestyle vs. Greco-Romana. Sci Sports. 2022;37(5-6):494.e1-494.e7. doi: 10.1016/j.scispo.2021.06.011.
12. Kraus K, Schütz E, Taylor WR, Doyscher R. Efficacy of the functional movement screen: a review. J Strength Cond Res. 2014;28(12):3571-84. doi: 10.1519/JSC.0000000000000556.
13. Loudon JK, Parkerson-Mitchell AJ, Hildebrand LD, Teague C. Functional movement screen scores in a group of running athletes. J Strength Cond Res. 2014;28(4):909-13. doi: 10.1097/JSC.0000000000000233.
14. Toselli S, Campa F. Anthropometry and functional movement patterns in elite male volleyball players of different competitive levels. J Strength Cond Res. 2018;32(9):2601-11. doi: 10.1519/JSC.0000000000002368.
15. Uzer O, Yıldırım NU, Soylu C, Ozal M. The posture of high-level wrestlers affects their functional movement patterns: an observational study. Sci Sports. 2022. doi: 10.1016/j.scispo.2022.03.009. In press.
16. Minick KI, Kiesel KB, Burton LEE, Taylor A, Plisky P, Butler RJ. Interrater reliability of the functional movement screen. J Strength Cond Res. 2010;24(2):479-86. doi: 10.1519/JSC.0b013e3181c09c04.
17. Perry FT, Koehle MS. Normative data for the functional movement screen in middle-aged adults. The Journal of Strength & Conditioning Research. 2013;27(2):458-62. doi: 10.1519/JSC.0b013e3182576fa6.
18. Beardsley C, Contreras B. The functional movement screen: a review. Strength Cond J. 2014;36(5):72-80. doı: 10.1519/SSC.0000000000000074.
19. Cook G. Movement: Functional movement systems: Screening, assessment. Corrective Strategies. Aptos, CA: On Target Publications; 2010.
20. Cook G, Burton L, Hoogenboom BJ, Voight M. Functional movement screening: the use of fundamental movements as an assessment of function-part 1. Int J Sports Phys Ther. 2014a;9(3):396-409. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/pmid/24944860/.
21. Cook G, Burton L, Hoogenboom BJ, Voight M. Functional movement screening: the use of fundamental movements as an assessment of function-part 2. Int J Sports Phys Ther. 2014b;9(4):549-563. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/pmid/25133083/.
22. Alper E, Kolayiş İ. The relationship between wrestling performance and core stability, dynamic balance, functional movement. CBU J Phys Edu Sport Sci. 2020;15(1):48-66. doi: 10.33459cbubesbd.697636.
23. Bulğay C, Zorlular A, Kafa N, Çetin E, Cengizhan PA. Functional movement screen TM – normative values in healthy distance runners. Gazi J Phy Edu Sports Sci. 2019;24(4):189-98. Available at: https://dergipark.org.tr/en/pub/gbesbd/issue/49196/508229.
24. Basar S, Duzgun I, Guzel NA, Cicioğlu I, Çelik B. Differences in strength, flexibility and stability in freestyle and Greco-Roman wrestlers. J Back Musculoskelet Rehabil. 2014;27(3):321-30. doi: 10.3233/BMR-130451.
25. Campa F, Piras A, Raffi M, Toselli S. Functional movement patterns and body composition of high-level volleyball, soccer, and rugby players. J Sport Rehabil. 2019;28(7):740-5. doi: 10.1123/jsr.2018-0087.

26. Nicolozakes CP, Schneider DK, Roewer BD, Borchers JR, Hewett TE. Influence of body composition on functional movement Screen™ scores in college football players. J Sport Rehabil. 2018;27(5):431-7. doi: 10.1123/jsr.2015-0080.

27. Cengizhan Ö, Eyuboğlu E. The relationship between physical characteristics and functional movement analysis of athletes of various sports. IntJCSS. 2017;3(S1):365-71. Available at: https://dergipark.org.tr/en/pub/intjcss/issue/33182/369806.