ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

DOI: 10.5336/sportsci.2025-113632

Investigation of the Relationship Between Posture Analysis, Functional Movement Screen and Football Skills of U18 Amateur Male Football Players: Descriptive Study

U18 Amatör Erkek Futbolcuların Postür Analizi, Fonksiyonel Hareket Taraması ve Futbol Becerileri Arasındaki İlişkinin İncelenmesi: Tanımlayıcı Çalışma

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This study was prepared based on the findings of Sultan Özdemir Erkek's thesis study titled "Investigation of the Effects of Pilates Mat Exercises on Some Football Skills, Posture, and Functional Movement Screen in Amateur Male Football Players" (İstanbul: İstanbul University-Cerrahpaşa; 2026).
This study was presented as a poster at the 22nd International Sports Sciences Congress, November 21-24, 2024, Ankara, Türkiye.

ABSTRACT Objective: This study aims to examine the relationship between posture, Functional Movement Screen (FMS), and football skill tests in U18 amateur male football players, and to compare the posture and skill outcomes of athletes grouped according to FMS asymmetry status. **Material and Methods:** A total of 47 football players (mean age: 16.64±0.76 years) participated in the study. Posture was assessed using the PostureScreen 13.7 application. The Functional Movement Screen (FMS) and skill tests, including the Yeagley juggling test and the Loughborough Football Passing Test (LSPT), were administered to all athletes. Data were analyzed using SPSS 29.0; relationships were examined with the Pearson correlation test, and between-group differences were analyzed using the Independent Samples t-test ($p \leq 0.05$). **Results:** No significant relationship was found between FMS and skill tests ($p > 0.05$). However, significant relationships were identified between certain posture and FMS parameters ($p \leq 0.05$). In the anterior view, head tilt, shoulder tilt, and total tilt values were positively correlated with the Yeagley juggling test ($p \leq 0.05$). When athletes were grouped according to functional asymmetry in FMS, a significant difference was found in the Yeagley test among those without asymmetry ($p \leq 0.05$), whereas no significant difference was observed in the LSPT ($p > 0.05$). **Conclusion:** The findings indicate that posture analysis and FMS may contribute to strategic planning for improving athletic performance. The relationship between FMS and posture suggests that enhancing movement quality and posture may represent an intervention area for improving football performance.

Keywords: Football; posture analysis; Functional Movement Screen; skill test; correlations

ÖZET Amaç: Bu çalışmada, U18 amatör erkek futbolcularda postür, fonksiyonel hareket taraması [functional movement screen (FMS)] ve futbol beceri testleri arasındaki ilişki ile FMS asimetri durumuna göre gruplandırılan sporcuların duruş ve beceri sonuçlarının karşılaştırılması amaçlanmaktadır. **Gereç ve Yöntemler:** Araştırmaya yaş ortalaması 16,64±0,76 olan 47 futbolcu katılmıştır. Postür analizi, PostureScreen 13.7 uygulamasıyla değerlendirilmiştir. FMS ile beceri testlerinden Yeagley top sektirme testi ve Loughborough Futbol Pas Testi [Loughborough Football Passing Test (LSPT)] tüm sporculara uygulanmıştır. Veriler SPSS 29.0 ile analiz edilmiş; ilişkiler Pearson korelasyon testi ve gruplar arası farklar Bağımsız T-testi ile incelenmiştir ($p \leq 0,05$). **Bulgular:** FMS ile beceri testleri arasında anlamlı ilişki bulunmamıştır ($p > 0,05$). Ancak bazı postür ve FMS parametreleri arasında anlamlı ilişkiler bulunmuştur ($p \leq 0,05$). Önden görünümde baş tilti, omuz tilti ve toplam tilt değerleri ile Yeagley top sektirme testi arasında pozitif ilişki bulunmuştur ($p \leq 0,05$). Sporcular FMS'de işlevsel asimetriye göre gruplandığında, asimetrisi olmayanlarda Yeagley testinde anlamlı fark bulunmuş ($p \leq 0,05$), LSPT'de bulunmamıştır ($p > 0,05$). **Sonuç:** Bulgular, postür analizi ve FMS'nin sportif performansın geliştirilmesinde stratejik planlamaya katkı sağlayabileceğini göstermektedir. FMS–postür ilişkisi ise hareket kalitesi ve postürün iyileştirilmesinin futbol performansı için müdahale alanı olabileceğini göstermektedir.

Anahtar Kelimeler: Futbol; postür analizi; fonksiyonel hareket taraması; beceri testi; korelasyon

TO CITE THIS ARTICLE:
Özdemir Erkek S, Coşkun O, Şahin M, İlhan Ö, Yücesir İ. Investigation of the relationship between posture analysis, functional movement screen and football skills of U18 amateur male football players: Descriptive study. Turkiye Klinikleri J Sports Sci. 2026;18(1):40-9.

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Peer review under responsibility of Turkiye Klinikleri Journal of Sports Sciences.

Received: 24 Jul 2025 ***Received in revised form:*** 26 Nov 2025 ***Accepted:*** 26 Nov 2025 ***Available online:*** 12 Feb 2026

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Football is a popular sport worldwide and in Türkiye, appealing to broad audiences and requiring technical skills, tactical thinking, and physical fitness.[1] The effective execution of skill-based movement patterns and the ability of players to adapt their cognitive, perceptual, and motor skills to changing conditions are critical components of football performance.[2] Training programs designed to enhance player performance, as well as football-specific assessment tests, are essential for athlete development. Football players with higher levels of motor skills tend to perform better in football-specific skill tests.[3]

Postural assessment has become an important area of study for many researchers to monitor athlete performance development, evaluate the effectiveness of training methods, and analyze body asymmetry.[4-7] A healthy body structure is expected to positively influence athletes' performance and reduce the risk of injury.[8] Considering that injury incidence is influenced by abnormalities in body mechanics, the use of methods such as posture analysis and the functional movement screen (FMS) for assessing postural deviations, predicting injury risk, and identifying conditions provides a significant contribution to the field.[9] Static posture analysis is an important tool for determining an athlete's overall movement characteristics and is recommended to be used alongside dynamic analyses prior to sport-specific loading.[10] Posture analysis supported by quantitative data facilitates the evaluation of athletes' physical structure and provides information about their development process through routine assessments.[4] The FMS is a tool designed to assess fundamental movement patterns in individuals, aiming to identify existing limitations or asymmetries in human movement patterns.[11] The FMS assessment includes not only the total composite score but also the scores obtained from each test component and the identification of compensatory movement patterns and left-right asymmetries through 5 bilateral tests. Impairments observed in functional movements may negatively affect athletes' physical performance and increase the risk of injury.[12]

In the literature, studies that comprehensively examine the relationship between posture, FMS, and football skills in amateur football players are limited. In this context, the present study aims to investigate the relationship between posture, FMS results, and football skill tests in U18 amateur male football players, as well as to compare the posture analysis and skill test results of athletes grouped according to their FMS asymmetry status. The findings obtained from this study are expected to make an important contribution to the literature by aiding the development of strategies for postural improvement and enhancing the understanding of how asymmetry affects football skills. In addition, the results are considered to provide guidance for coaches in developing individualized and effective training programs.

MATERIAL AND METHODS

This study was derived from a section of the corresponding author's doctoral dissertation and was approved by the Non-Interventional Clinical Research Ethics Committee of İstanbul University-Cerrahpaşa (date: May 8, 2024; no: 2024/114). An abstract titled "Investigation of the Relationship Between FMS and Football Skill Tests of 16-18 Age Group Amateur Male Football Players" which is also based on a section of the same dissertation, was presented orally at the 22nd International Sports Sciences Congress at Gazi University. This study was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from the participants and their guardians.

RESEARCH MODEL

The research employed a quantitative relational screening model, a method used to examine relationships between 2 or more variables.

Population and Sample

The study sample consisted of 47 male athletes playing for amateur football teams in the Başakşehir district of İstanbul, with an average age of 16.64±0.76, a minimum of 5 years of licensed football experience, and who volunteered to participate in the study. The sample was selected using a purposive sampling method, a type of non-probability sampling method.

DATA COLLECTION TOOLS

All athletes completed a participant information form. Posture analysis was conducted using the

PostureScreen 13.7 mobile application (PostureCo, Trinity, FL, USA), while FMS measurements were performed by a certified specialist. Football-specific skill tests, including the Yeagley Juggling Test and Loughborough Football Passing Test (LSPT) were administered.

Posture Analysis

Posture analysis was performed using the PostureScreen 13.7 mobile application, which has established validity and reliability.[13,14] PostureScreen is an analytical tool used by health and fitness professionals to develop intervention strategies based on postural assessment. The analyses were conducted from 2 perspectives: front and right side views. In the frontal plane, head, shoulder, and hip shifts along the x-axis and tilts along the y-axis were measured, while in the sagittal plane, forward/backward shifts along the z-axis were recorded in degrees.[13] Since posture screenings are recommended to be conducted with minimal clothing, all participants were photographed wearing shorts and without shirts.[15]

The ideal posture degree is considered zero, and values closer to zero are regarded as positive.[13] To standardize measurements, the device was fixed on a tripod, and the measurement distance was kept constant.

FMS Protocol

FMS is a test battery developed by Cook et al. to assess individuals' fundamental movement patterns.[11] It identifies asymmetries that may lead to functional movement deficiencies and provides a functional analysis of the musculoskeletal system related to athletic performance. Systematic reviews and meta-analyses have confirmed the validity and reliability of the FMS test.[16] The FMS consists of 7 movement tests and four clearing tests. The scored movements include deep squat, hurdle step, inline lunge, shoulder mobility, active straight-leg raise, trunk stability push-up, and rotary stability. Tests aimed at assessing functional asymmetry include hurdle step, inline lunge, shoulder mobility, active straight-leg raise, and rotary stability. The FMS score is rated on a scale from 0 to 3: a score of 0 is given if pain is present, 1 if the movement cannot be completed, 2 if the movement is completed with compensation, and 3 if the movement is performed correctly without compensation. In the clearing tests, the presence of pain is considered "positive" and the test is scored 0; absence of pain is considered "negative". Both the right and left sides are evaluated separately, and the lower score is added to the total. The maximum total score is 21.[17]

LSPT Protocol

The LSPT is conducted within a 12×9.5 meter area and is designed to evaluate football-specific skills such as short and long passing abilities, ball control, direction, decision-making speed, and environmental awareness.[18] Validity and reliability studies have been conducted.[18-20] In the evaluation of the LSPT, errors such as passing to the wrong target, inaccurate passes, handball, striking outside the passing area, touching cones, and exceeding the time limit are added as penalty seconds to the total time. Conversely, passes hitting the metal strip at the center of the target are deducted as bonus seconds from the total time.[18] The performance time is calculated as the raw time plus penalty seconds minus bonus seconds for successful passes, yielding the final assessment time.[18,19]

Yeagley Juggling Test Protocol

The Yeagley Juggling Test is a validated and reliable skill test used to assess ball control and juggling ability in football players.[21] The athlete stands with the ball in a 4×4 meter area; upon the "start" command, the ball is dropped to the ground and the player begins juggling using only the foot, knee, and head to keep the ball in the air after it bounces off the ground. Contacts with other body parts are considered invalid, and hand or arm touches result in a one-point deduction. No penalty is given if the ball touches the ground, but juggles that go outside the area are not counted. Valid juggles performed within 30 seconds are counted, and the best score from 2 attempts is recorded as the final score.[21]

DATA ANALYSIS

Data were analyzed using SPSS version 29 (IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for the obtained data. In the litera-

ture, it is stated that skewness and kurtosis values within the range of ±2 are sufficient to meet the assumption of normal distribution.[22] The normality of all test results was verified by examining the skewness and kurtosis values. Therefore, the use of parametric tests in the analyses was deemed appropriate. Relationships among posture analysis, FMS scores, and skill tests were evaluated using Pearson correlation analysis. Participants were divided into 2 groups: those with and those without functional asymmetry in at least one movement test based on FMS results. Differences in skill tests between these groups categorized according to functional asymmetry were analyzed with independent samples t-test and homogeneity of variance was confirmed using Levene's test. The significance level was set at $p \leq 0.05$.

RESULTS

This section examines the relationships between posture analysis, FMS, and football skills of the athletes in the study group, and interprets the results based on the findings. First, descriptive data regarding the athletes' posture analysis, FMS, and skill tests are presented, followed by the results of statistical analyses conducted to determine the relationships among variables (Table 1, Table 2, Table 3, Table 4). Finally, the postural analysis and skill test results of athletes grouped according to their FMS asymmetry status were compared, and the differences between the groups were statistically evaluated (Table 5, Table 6).

Table 1 presents the descriptive statistics of the athletes. In the literature, it is stated that skewness and kurtosis values within the range of ±2 are sufficient to meet the assumption of normal distribution.[22] The findings presented in Table 1 also indicate that the data conform to a normal distribution.

When the correlations between FMS parameters and skill tests were examined in Table 2, no significant relationship was found between the parameters ($p>0.05$). This finding indicates that athletes' functional movement competence does not have a distinct effect on football skills, or that this effect was not reflected at a statistically significant level within the examined sample.

Table 3 presents the relationship between posture analysis and FMS parameters. When examining the correlations between front posture analysis and

TABLE 1: Descriptive data

Parameters	n	Minimum	Maximum	$\bar{X}$	SD	Skewness	Kurtosis
Head tilt in front view (°)	47	0.00	14.4	2.04	2.88	-1.79	1.85
Shoulder tilt in front view (°)	47	0.00	4.7	1.76	1.36	0.16	-0.81
Hip shift in front view (cm)	47	0.00	3.31	0.95	0.83	-0.20	0.03
Hip tilt in front view (°)	47	0.00	6.8	2.55	2.08	0.15	-0.50
Total tilt in front view (°)	47	1.4	20.2	6.36	4.17	1.41	1.84
Head tilt in side view (°)	47	1.2	17.3	8.29	4.12	0.08	-0.30
Shoulder shift in side view (cm)	47	0.00	6.13	2.77	1.79	-0.06	-1.42
Hip shift in side view (cm)	47	0.22	7.08	2.70	1.90	0.17	-0.43
Hip tilt in side view (°)	47	1.0	9.07	3.94	2.62	0.03	-0.37
Deep squat score	47	0.00	3.00	1.60	0.61	-0.08	-0.21
Hurdle step score	47	1.00	3.00	1.79	0.72	0.30	-1.02
Inline lunge score	47	1.00	3.00	2.06	0.76	-0.04	-1.32
Shoulder mobility score	47	1.00	3.00	2.02	0.79	-0.04	-1.44
Active straight-leg raise score	47	1.00	3.00	1.60	0.54	-0.04	-1.10
Trunk stability push up score	47	0.00	2.00	1.28	0.50	0.36	-0.76
Rotary stability score	47	1.00	2.00	1.15	0.36	1.11	1.54
FMS total score	47	7.00	16.00	11.49	2.41	0.17	-0.88
Yeagley Juggling Test	47	32.00	88.00	63.14	14.09	-0.20	-0.68
LSPT (s)	47	39.45	123.00	67.08	18.91	1.24	1.51

SD: Standard deviation; FMS: Functional movement screen; LSPT: Loughborough Soccer Passing Test; s: Seconds

TABLE 2: Correlations between FMS parameters and skill tests

Parameters		Deep squat score	Hurdle step score	Inline lunge score	Shoulder mobility score	Active straight-leg raise score	Trunk stability push up score	Rotary stability score	FMS total score
Yeagley juggling test	r value	0.120	-0.030	0.120	0.040	0.060	0.000	-0.060	0.080
	p value	0.400	0.850	0.410	0.780	0.690	1.000	0.680	0.590
LSPT (s)	r value	-0.120	-0.250	-0.110	-0.040	-0.080	0.090	-0.130	-0.170
	p value	0.400	0.090	0.470	0.780	0.580	0.540	0.390	0.240

FMS: Functional movement screen; LSPT: Loughborough Soccer Passing Test; s: seconds

TABLE 3: Correlations between posture analysis and FMS parameters

Parameters		Deep squat score	Hurdle step score	Inline lunge score	Shoulder mobility score	Active straight-leg raise score	Trunk stability push up score	Rotary stability score	FMS total score
Front view head tilt (°)	r value	0.250	-0.080	0.000	-0.010	-0.060	0.170	-0.040	0.050
	p value	0.090	0.570	0.980	0.950	0.690	0.250	0.800	0.720
Front view shoulder tilt (°)	r value	**0.310**	0.100	0.020	0.010	0.020	0.140	0.040	0.150
	p value	**0.040**	0.510	0.900	0.960	0.900	0.350	0.800	0.300
Front view hip shift (cm)	r value	-0.100	-0.060	**-0.400**	-0.050	**-0.320**	0.000	-0.050	-0.260
	p value	0.520	0.670	**0.010**	0.750	**0.030**	0.980	0.750	0.070
Front view hip tilt (°)	r value	-0.190	-0.270	-0.140	-0.020	0.240	**-0.340**	0.240	-0.160
	p value	0.200	0.060	0.340	0.880	0.110	**0.020**	0.100	0.280
Front view total shift (cm)	r value	-0.060	0.020	**-0.320**	0.010	-0.210	0.150	-0.050	-0.130
	p value	0.700	0.920	**0.030**	0.940	0.150	0.330	0.740	0.380
Side view head shift (cm)	r value	-0.080	0.000	-0.060	0.130	0.010	**-0.290**	-0.060	-0.060
	p value	0.580	0.990	0.670	0.400	0.920	**0.050**	0.670	0.670
Side view head tilt (°)	r value	-0.100	-0.020	-0.090	0.140	-0.010	**-0.300**	-0.070	-0.090
	p value	0.520	0.880	0.560	0.360	0.950	**0.040**	0.620	0.550
Side view shoulder shift (cm)	r value	-0.110	-0.090	-0.170	-0.150	-0.200	-0.070	**-0.400**	-0.270
	p value	0.480	0.550	0.260	0.330	0.190	0.660	**0.000**	0.060
Side view shoulder tilt (°)	r value	-0.110	-0.130	-0.190	-0.200	-0.200	-0.050	**-0.350**	**-0.300**
	p value	0.460	0.380	0.210	0.180	0.170	0.740	**0.020**	**0.040**
Side view hip shift (cm)	r value	-0.230	**-0.290**	-0.160	-0.180	-0.260	-0.280	-0.100	**-0.390**
	p value	0.120	**0.050**	0.280	0.220	0.070	0.060	0.510	**0.010**
Side view hip tilt (°)	r value	-0.260	**-0.310**	-0.180	-0.180	**-0.290**	-0.250	-0.110	**-0.410**
	p value	0.080	**0.030**	0.230	0.220	**0.040**	0.090	0.460	**0.000**

FMS: Functional movement screen

FMS parameters, a positive relationship was found between shoulder tilt and deep squat, while negative relationships were observed between hip shift and both inline lunge and active straight-leg raise, hip tilt and trunk stability push-up, and total shift and inline lunge score ($p \leq 0.05$). Regarding side posture analysis, negative correlations were identified between head shift and tilt with trunk stability push-up; shoulder shift and tilt with rotary stability score; shoulder tilt and hip shift with hurdle step and total FMS score; and hip tilt with hurdle step, active straight-leg raise, and total FMS score ($p \leq 0.05$). No significant relationships were observed among other parameters ($p > 0.05$). These findings suggest that there may be significant relationships between postural alignment and functional movement performance, and that postural alignment may play an important role in FMS performance.

Table 4 presents the correlations between posture analysis parameters and football skill tests.

TABLE 4: Correlations between posture analysis parameters and skill tests

Parameters		Yeagley Juggling Test	LSPT
Front view head tilt (°)	r value	**0.460**	-0.220
	p value	**0.000**	0.140
Front view shoulder tilt (°)	r value	**0.290**	-0.110
	p value	**0.050**	0.470
Front view hip shift (cm)	r value	0.060	-0.150
	p value	0.690	0.310
Front view hip tilt (°)	r value	0.020	0.260
	p value	0.910	0.080
Front view total shift (cm)	r value	0.190	-0.070
	p value	0.200	0.650
Front view total tilt (°)	r value	**0.420**	-0.060
	p value	**0.000**	0.700
Side view head tilt (°)	r value	-0.170	-0.010
	p value	0.240	0.960
Side view shoulder shift (cm)	r value	-0.140	0.120
	p value	0.330	0.440
Side view hip shift (cm)	r value	-0.120	0.170
	p value	0.420	0.240
Side view hip tilt (°)	r value	-0.140	0.170
	p value	0.370	0.250

LSPT: Loughborough Soccer Passing Test; s: seconds

A significant positive correlation was found between head tilt, shoulder tilt, and total tilt values in the front view and the Yeagley Juggling Test ($p \leq 0.05$). No significant relationships were observed between side posture analysis parameters and skill tests ($p > 0.05$). These findings suggest that there may be a limited level of relationship between postural alignment and football skill performance.

Table 5 presents the comparison of posture analysis parameters between athletes with and without functional asymmetry based on their FMS results. According to FMS results, athletes without asymmetry showed significantly higher head tilt and total tilt values in the front view compared to those with asymmetry ($p \leq 0.05$). No significant differences were found among other parameters ($p > 0.05$). These findings indicate that the presence of functional asymmetry may have a limited effect on postural alignment and does not create significant differences in overall postural structure.

Table 6 presents the comparison of skill test performances between athletes with and without asymmetry based on their FMS results. When comparing skill test performances based on FMS results, athletes without asymmetry showed higher mean scores in skill tests, with a significant differ-

TABLE 5: Comparison of posture analysis parameters between athletes with and without functional asymmetry based on FMS results

FMS asymmetry	Parameters	n	$\bar{X}$	SD	t value	p value
Yes	Front view head tilt (°)	33	1.30	1.56	-2.93	**0.010**
No		14	3.79	4.31		
Yes	Front view shoulder tilt (°)	33	1.49	1.29	-1.32	0.190
No		14	2.40	1.36		
Yes	Front view hip shift (cm)	33	0.89	0.76	-1.40	0.170
No		14	1.08	0.99		
Yes	Front view hip tilt (°)	33	2.28	2.04	-1.27	0.210
No		14	3.19	2.10		
Yes	Front view total tilt (°)	33	5.08	2.62	-3.66	**0.000**
No		14	9.39	5.53		
Yes	Side view head tilt (°)	33	7.81	4.19	-0.09	0.930
No		14	9.43	3.84		
Yes	Side view shoulder shift (cm)	33	2.75	1.71	-0.33	0.740
No		14	2.80	2.03		
Yes	Side view hip shift (cm)	33	2.69	1.98	-0.03	0.970
No		14	2.71	1.76		
Yes	Side view hip tilt (°)	33	3.98	2.73	0.14	0.890
No		14	3.86	2.42		

FMS: Functional Movement Screen; SD: Standard deviation

TABLE 6: Comparison of skill test performances between athletes with and without functional asymmetry based on FMS results

FMS asymmetry	Parameters	n	$\bar{X}$	SD	t value	p value
Yes	Yeagley Juggling test	33	60.61	13.51	-1.99	**0.050**
No		14	69.43	14.78		
Yes	LSPT (s)	33	69.49	21.52	1.29	0.200
No		14	61.62	11.36		

FMS: Functional Movement Screen; SD: Standard deviation; LSPT: Loughborough Soccer Passing Test; s: seconds

ence observed in the Yeagley Juggling Test ($p \leq 0.05$). These findings suggest that athletes without functional asymmetry tend to have higher football skill performance.

DISCUSSION

This study examined the relationship between postural characteristics, FMS results, and football skill tests in U18 amateur male football players. In addition, the athletes were grouped according to their FMS asymmetry status, and their posture analysis and skill test results were compared. In the literature, it has been reported that postural disorders such as forward head posture, increased thoracic kyphosis, and increased lumbar lordosis are common among amateur football players aged 15 and above.[23] Similarly, it has been stated that football training can lead to noticeable motor asymmetries in the trunk region, which may increase the risk of injury.[24] In addition, it has been reported that young football players with a high level of performance exhibit notable functional deficiencies, particularly in movements involving deep squat and trunk stability, and possess a high degree of asymmetry between the right and left sides of the body.[25]

In our study, the average deep squat score of 47 football players with a mean age of 16.64±0.76 years was found to be 1.60, the trunk stability push-up score was 1.28 and the rotary stability score was 1.15. These findings indicate that the examined group of football players has certain deficiencies in terms of core stability and movement control, and that improvement is needed in these areas. The 3 main parameters of the FMS test -deep squat, rotary stability, and trunk stability push-up- are criteria that require the activation of core muscles and are designed to assess core stability. The inclusion of dynamic movements performed in the frontal, sagittal, and transverse planes in these tests provides important information about an individual's multidirectional postural control and stabilization capacity.[26] Therefore, the low scores obtained by football players in these tests indicate a need for training programs aimed at improving postural control mechanisms.

In the present study, no significant relationship was observed between the FMS parameters and football skill tests. This result suggests that functional movement competence in football players may not be directly related to football skills. Similarly, in the study conducted by Savaş et al. no significant relationship was found between FMS scores and football-specific skills such as passing, shooting, and dribbling.[27] In contrast, Güngör and Baydemir reported that athletes with higher FMS scores demonstrated better performance in football skill tests.[28] This difference may stem from variables such as the age, experience, or training background of the study groups. These conflicting findings indicate that the influence of FMS parameters on football skills should be examined in different sample groups and through more comprehensive research.

In our study, relationships in different directions were identified between postural alignment parameters and FMS parameters. In the front view, a positive relationship was found between shoulder tilt and deep squat score, whereas negative relationships were observed between hip shift and inline lunge and active straight-leg raise scores, between hip tilt and trunk stability push-up score, and between total shift and inline lunge score. In the side view, negative rela-

tionships were identified between head shift and tilt and trunk stability push-up; between shoulder shift and tilt and rotary stability; between shoulder tilt and hip shift and both hurdle step and total FMS score; and between hip tilt and hurdle step, active straight-leg raise, and total FMS score. No significant relationships were found among the other parameters. These results suggest that postural alignment may have an influence on functional movement performance. Similarly, Makaracı et al. reported significant correlations between postural sway parameters and deep squat, hurdle step, in-line lunge, rotary stability, and total FMS scores.[29] This result suggests that the relationship between functional movement capacity and postural stability may be asymmetrical and supports the findings of the present study. In contrast, Mitchell et al. found no significant relationship between postural angle parameters (e.g., trunk angle, neck angle, gaze angle, head-on-neck angle, lower limb angle) and the total FMS score.[30] Similarly, Molina-Garcia et al. reported that, except for the thoracic flexion angle, the craniocervical angle, trunk angle, and tragus-to-plumb distance measurements were not associated with the FMS score.[31] In general, the literature shows that studies examining the relationship between posture and FMS parameters are limited. Although no study has been found that evaluates exactly the same parameters as the posture analysis methods used in the present research, the results of studies conducted using different methods indirectly support our findings.

In our study, positive relationships were identified between head tilt, shoulder tilt, and total tilt values in the front view and Yeagley Juggling performance. This finding suggests that head and shoulder alignment may be associated with skills that require ball control. Since no studies directly examining the relationship between posture analysis parameters and football skill tests were found in the literature, it was not possible to make a direct comparison between the present findings and previous research. However, in a study conducted on balance, which is one of the similar components of motor performance, no significant relationship was found between static and dynamic balance levels and LSPT skills in amateur football players.[32] These results suggest that postural parameters may not have a direct effect on football-specific motor skills.

In our study, athletes without asymmetry, based on their FMS results, were found to have higher head tilt angles and total tilt values in the front view compared to those with asymmetry, and this difference was statistically significant. No significant differences were observed in the other posture analysis parameters. The present findings suggest that functional movement asymmetry may be associated with certain postural alignment parameters. Since no studies directly examining the relationship between functional movement asymmetry and posture analysis parameters were found, the comparison of the obtained results with the existing literature has remained limited, indicating that this topic requires more comprehensive research.

In the present study, it was determined that athletes without asymmetry, based on their FMS results, scored higher in the skill tests, and this difference was statistically significant in the Yeagley Juggling Test. This finding is generally consistent with the studies reported in the literature. Indeed, Marques et al. stated that pronounced asymmetries in elite young football players may lead to functional deficiencies and an increased risk of injury, which in turn may negatively affect technical performance.[25] Similarly, Edis et al. reported that high levels of postural control are an important factor supporting technical skill performance during sudden directional changes and under opponent pressure in gameplay.[33] In this context, the findings suggest that functional asymmetry and postural control may play an important role in the sustainability of technical performance in football players. However, they also indicate that this relationship should be supported by studies with larger samples and different performance variables.

The study has certain limitations. It is limited to 47 male football players aged 16 to 18, each with at least 5 years of licensed football experience, from 2 different amateur sports clubs located in the Başakşehir district of İstanbul. The findings obtained are limited solely to the measurements used in this study. It is assumed that the participants in this study performed at their best during the tests.

CONCLUSION

In this study, the relationships between posture, FMS results, and football skill tests were examined in amateur male football players in the U18 category. The athletes were grouped according to their FMS asymmetry status, and their posture analysis and football skill test results were compared. The findings revealed no significant relationship between overall FMS scores and football skill performance; however, some postural parameters showed significant correlations with specific FMS parameters. This indicates that postural alignment and functional movement quality are complementary factors contributing to the execution of sport-specific motor skills. Furthermore, the negative correlations observed between FMS and posture analysis demonstrate that the combined use of these 2 assessment tools allows for a more comprehensive evaluation of athletes' movement competence and postural integrity. By directly addressing the relationship between postural analysis parameters and FMS results, this study examined a relatively underexplored topic in a holistic manner and provided an original contribution to the literature.

However, the research was conducted with a limited sample group, and the generalizability of the findings is restricted in this regard. The homogeneous structure of the participant group reduces its ability to represent different ages, genders, or performance levels. Therefore, future research with larger and more diverse samples will help validate and expand the current findings. In addition, longitudinal studies monitoring postural and functional changes across different seasons will enable a clearer understanding of how these variables affect performance and injury risk.

Future studies are recommended to use FMS and posture analysis data together to investigate the interaction between movement competence, postural alignment, and sport-specific performance across different age and gender groups. Such research will contribute to the comparison of athletes at amateur and professional levels, the development of assessment methods, and the individualization of training programs. Moreover, posture analysis and FMS assessments can serve not only as diagnostic tools but also as guiding instruments in the planning of training and rehabilitation strategies aimed at improving movement quality and reducing injury risk.

Source of Finance

This study was supported way Scientific Research Projects Coordination Unit of Istanbul University-Cerrahpaşa (Project no: 2024/16).

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Sultan Özdemir Erkek, İlker Yücesir;* ***Design:*** *Sultan Özdemir Erkek, İlker Yücesir, Osman Coşkun, Mustafa Şahin;* ***Control/Supervision:*** *Sultan Özdemir Erkek, İlker Yücesir, Osman Coşkun, Mustafa Şahin;* ***Data Collection and/or Processing:*** *Sultan Özdemir Erkek, Osman Coşkun, Ömer İlhan;* ***Analysis and/or Interpretation:*** *Sultan Özdemir Erkek, İlker Yücesir, Mustafa Şahin, Osman Coşkun, Ömer İlhan;* ***Literature Review:*** *Sultan Özdemir Erkek;* ***Writing the Article:*** *Sultan Özdemir Erkek;* ***Critical Review:*** *Sultan Özdemir Erkek, Osman Coşkun, İlker Yücesir;* ***References and Fundings:*** *Sultan Özdemir Erkek, Osman Coşkun, Ömer İlhan;* ***Materials:*** *Sultan Özdemir Erkek, Osman Coşkun, Ömer İlhan.*

REFERENCES

1. Günay M, Ocak Y, Yüce Aİ. Futbol-Futsal Antrenmanının Bilimsel Temelleri. 1st ed. Ankara: Gazi Kitabevi; 2018.
2. Ali A. Measuring soccer skill performance: a review. Scand J Med Sci Sports. 2011;21(2):170-83. [Crossref] [PubMed]
3. Aktuğ ZB, İri R, Çelenk Ç. Çocuklarda motor beceri ile futbola özgü teknik beceriler arasındaki ilişkinin incelenmesi [The investigation of the correlation between motor skills and soccer related technical skills of children]. Spor Performans Araştırmaları Derg. 2019;10(1):13-23. [Crossref]
4. Karakuş S, Kılınç F. Postür ve sportif performans [Posture and sportive performance]. Kastamonu Educ J. 2006;14(1):309-22. [Link]
5. Kilinç F, Yaman H, Atay E. Investigation of the effects of intensive one-sided and double-sided training drills on the postures of basketball playing children. Journal of Physical Therapy Science. 2009;21(1):23-8. [Crossref]
6. Jurjiu NA, Pantea C. Evaluation of posture in sports performance. Timisoara Physical Education and Rehabilitation Journal. 2018;11(21):22-7. [Crossref] [PubMed]
7. Tokgöz G, Gür Y, Gür E. Amatör futbolcuların müsabaka öncesi ve sonrası vücut postür yapılarının değerlendirilmesi [Evaluation of the pre-match and post-match body posture structures of amateur footballers]. Spor Eğitim Derg. 2021;5(3):53-60. [Link]
8. Cengizhan Ö, Eyuboğlu E. Farklı branşlardaki müsabık sporcuların fiziksel özellikleri ile fonksiyonel hareket analizleri arasındaki ilişki [The relationship between physical characteristics and functional movement analysis of athletes of various sports]. Uluslararası Kültürel Sosyal Araştırmalar Derg. 2017;3(SI):365-71. [Link]
9. Watson AW. Sports injuries in footballers related to defects of posture and body mechanics. J Sports Med Phys Fitness. 1995;35(4):289-94. [PubMed]
10. Kritz MF, Cronin J. Static posture assessment screen of athletes: benefits and considerations. Strength Cond J. 2008;30(5):18-27. [Crossref]
11. Cook G, Burton L, Hoogenboom B. Pre-participation screening: the use of fundamental movements as an assessment of function-part 1. N Am J Sports Phys Ther. 2006;1(2):62-72. [PubMed] [PMC]
12. Vehrs PR, Uvacsek M, Johnson AW. Assessment of dysfunctional movements and asymmetries in children and adolescents using the functional movement screen-a narrative review. Int J Environ Res Public Health. 2021;18(23):12501. [Crossref] [PubMed] [PMC]
13. Hopkins BB, Vehrs PR, Fellingham GW, George JD, Hager R, Ridge ST. Validity and reliability of standing posture measurements using a mobile application. J Manipulative Physiol Ther. 2019;42(2):132-40. [Crossref] [PubMed]
14. Szucs KA, Brown EVD. Rater reliability and construct validity of a mobile application for posture analysis. J Phys Ther Sci. 2018;30(1):31-6. [PubMed] [PMC]
15. Boland DM, Neufeld EV, Ruddell J, Dolezal BA, Cooper CB. Inter- and intra-rater agreement of static posture analysis using a mobile application. J Phys Ther Sci. 2016;28(12):3398-402. [Crossref] [PubMed] [PMC]
16. 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. [Crossref] [PubMed]
17. Cook G, Burton L, Hoogenboom B. Pre-participation screening: the use of fundamental movements as an assessment of function-part 2. N Am J Sports Phys Ther. 2006;1(3):132-9. [PubMed] [PMC]
18. Ali A, Williams C, Hulse M, Strudwick A, Reddin J, Howarth L, et al. Reliability and validity of two tests of soccer skill. J Sports Sci. 2007;25(13):1461-70. [Crossref] [PubMed]
19. Le Moal E, Rué O, Ajmol A, Abderrahman AB, Hammami MA, Ounis OB, et al. Validation of the Loughborough Soccer Passing Test in young soccer players. J Strength Cond Res. 2014;28(5):1418-26. [Crossref] [PubMed]
20. McDermott G, Burnett AF, Robertson SJ. Reliability and validity of the Loughborough Soccer Passing Test in adolescent males: implications for talent identification. Int J Sports Sci Coach. 2015;10(2-3):515-27. [Crossref] [PubMed]
21. Strand BN, Wilson R. Assessing Sport Skills. 1st ed. Champaign, IL: Human Kinetics Publishers; 1993.
22. George D, Mallery P. IBM SPSS Statistics 29 Step by Step: A Simple Guide and Reference. 18th ed. New York: Routledge; 2024. [Crossref] [PubMed]
23. Snodgrass SJ, Ryan KE, Miller A, James D, Callister R. Relationship between posture and non-contact lower limb injury in young male amateur football players: a prospective cohort study. Int J Environ Res Public Health. 2021;18(12):6424. [Crossref] [PubMed] [PMC]
24. Siwecka G, Wodka-Natkaniec E, Niedźwiedzki Ł, Świtoń A, Niedźwiedzki T. Relationship between the hip range of motion and functional motor system movement patterns in football players. J Sports Med Phys Fitness. 2022;62(7):904-9. [PubMed]
25. Marques VB, Medeiros TM, de Souza Stigger F, Nakamura FY, Baroni BM. The functional movement screen (FMS™) in elite young soccer players between 14 and 20 years: composite score, individual-test scores and asymmetries. Int J Sports Phys Ther. 2017;12(6):977-85. [PubMed] [PMC]
26. Johnson CD, Whitehead PN, Pletcher ER, Faherty MS, Lovalekar MT, Eagle SR, et al. The relationship of core strength and activation and performance on three functional movement screens. J Strength Cond Res. 2018;32(4):1166-73. [Crossref] [PubMed]
27. Savaş S, Gülşen Eşkil K, Türkmen İ, Yılmaz SH, Fakazlı AE. 10-12 yaş grubu erkek futbolculara uygulanan kor antrenmanın teknik beceri düzeylerine ve FMS skorlarına etkilerinin incelenmesi [Investigation of the effects of core training on technical skill levels and FMS scores in 10-12 year-old male soccer players. Gazi Beden Eğitimi Spor Bilimleri Derg. 2020;25(4):349-64. [Link]
28. Güngör E, Baydemir B. Functional movement analysis in 11-13 age group football players: total score, asymmetries, and technical skill tests. Int J Disabil Sports Health Sci. 2023;6(Special Issue 1):274-83. [Crossref]
29. Makaracı Y, Nas K, Gündüz K, İleri M. Relationship between functional movement screen scores and postural stability in football players: an asymmetrical approach. Balt J Health Phys Act. 2024;16(1):6. [Crossref]
30. Mitchell UH, Johnson AW, Adamson B. Relationship between functional movement screen scores, core strength, posture, and body mass index in school children in Moldova. J Strength Cond Res. 2015;29(5):1172-9. [Crossref] [PubMed]
31. Molina-Garcia P, Plaza-Florido A, Mora-Gonzalez J, Torres-Lopez LV, Vanrenterghem J, Ortega FB. Role of physical fitness and functional movement in the body posture of children with overweight/obesity. Gait Posture. 2020;80:331-8. [Crossref] [PubMed]
32. Özyayla Ş. Amatör futbolcuların statik ve dinamik denge düzeylerinin pas ve şut özellikleri üzerine etkileri [Yüksek lisans tezi]. İzmir: Ege Üniversitesi Enstitüsü; 2019. [Link]
33. Edis Ç, Vural F, Vurgun H. The importance of postural control in relation to technical abilities in small-sided soccer games. J Hum Kinet. 2016;53:51-61. [Crossref] [PubMed] [PMC]