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Keywords

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Cover Page Footnote

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Article

Relationship between functional movement screen scores and postural stability in football players: An asymmetrical approach

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Keywords: balance, body sway, movement, rehabilitation, soccer.

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1. Introduction

Postural stability is defined as controlling the body position to move and ensure balance [1]. For changes in the dynamic position, it is required to maintain the static position and enable body coordination [2]. Actions that require skills are possible when the previously acquired movements are supported and improved with postural balance [3]. In this context, ensuring and controlling postural balance are considered as the basic conditions for sportive actions [4]. Maintaining performance and reducing possible sport-specific injury risks are also concepts characterized by postural stability [5]. Football is a sport requiring a high level of motor coordination. Balance and postural control are the most basic components of this coordination [6]. In football, where intense and explosive movements are often used, many actions are performed with an effective use of a single leg [7]. Elements such as maintaining the balance against a challenging external factor within the dynamics of football, power generation, and minimizing the possible injury risks seem to be associated with sportive performance [8, 9].

Musculoskeletal system-based functional movement screening tools are used to determine the weak spots of the body, predict a possible injury, and identify the movement capacity [10, 11, 12]. The Functional Movement Screen (FMS) is a common measurement method performed by using a unique test kit and using certain forms of movement and basically applied to determine the quality of movement [13, 14]. FMS measurements require error-free movement patterns that involve the coordination of stability and mobility during the body movement from the center to a distant point [15, 16]. The test consists of a series of movements defined as deep squat (DS), hurdle step (HS), in-line lunge (ILL), shoulder mobility (SM), active straight leg raise (ASLR), trunk stability push-up (TSPU), and rotary stability (RS). Measurement scoring is based on a 4-point scale ranging from 0 to 3 points [17]. Among these movements, DS, HS, and ILL are considered as measurements involving high-level (functional) movement patterns, and SM, ASLR, TSPU, and RS are considered as measurements involving low-level (basic) movement patterns [18]. It is reported in the literature that the FMS method which is used by researchers with the participation of athletes from different levels [19] can also be used as an indicator of sports-specific motor skills [12, 20, 21, 22] and athletic injuries [23, 24]. Playing football at any performance level is associated with an increased risk of injury compared to other sports, particularly in the youth group [25]. There is a certain knowledge about weakness or strength imbalances in the lower limbs as a risk factor in professional football [26]. Thus, the FMS could be considered a mobility-based test to determine an injury risk among football players.

In fact, most of the FMS movements (item) are suitable for unilateral evaluation allowing for making a clearer inference by analyzing the functional movement limitations of athletes from an asymmetrical perspective (side-to-side movement asymmetry) [27, 28]. Asymmetry, being a variable concept, depends on the symmetrical development process of both sides of the body [29]. Basic motor tasks are classified into unilateral or bilateral formats [30]. Concepts such as force, jump, and sprint are expressed as elements of the relationship between asymmetry and athletic performance [31]. Center of pressure (CoP)-based stability measurements, which have gained popularity in recent years, provide reliable data in terms of identifying an orientation toward the antero-posterior and mediolateral sides of the body [32]. This type of static body sway analysis is carried out on a unilateral or bilateral stance [33]. It is clear that this situation will enable an asymmetrical examination of postural sway. Body sway analyses (with open or closed eyes) performed statically, especially using a force platform, are accepted as a valid method to determine postural control in athletes [34].

The movement intensity in sport determines how much the asymmetrical mechanism will affect an athlete. In this respect, football is evaluated in the categorization where unilateral preference is dominant due to the intensive use of movements such as shooting, changing direction, and approach run [35]. Thus, one can expect that unilateral FMS scores and postural sway measures will be correlated. It is assumed that the FMS measurement, which is more easily applicable in the case of a possible correlation, may be an indicator of asymmetrical postural sway evaluation. Furthermore, it is thought that the evaluation of a sample group which will consist of male and female participants in terms of gender will contribute to the literature, which lacks this assessment. Thus, the main aim of this study is to examine the correlation between FMS and postural stability in football players from an asymmetrical perspective. The secondary purpose is to reveal the FMS and postural sway differences between the dominant and non-dominant sides. We hypothesized that there would be a significant relationship between unilateral FMS scores and postural sway parameters in football players, and that no significant difference would exist between the dominant and non-dominant sides of FMS and postural sway parameters.

2. Materials and Methods

2.1. Participants

Fifty professional football players (male n=25; age 21.40±1.94 years; 20 with the dominant right leg, 5 with the dominant left leg; female n=25; age 21.04±1.24 years; 22 with the dominant right leg, 3 with the dominant left leg) volunteered for this study (Table 1). The selection criteria of the athletes were as follows: being older than 18 years old, regularly participating in team (football) training, and volunteering to participate in this study. The elimination criteria included the following: having any kind of orthopedic or cardiovascular problem, somatosensory disorder that affects balance, and current musculoskeletal pathology that restricted normal movement capabilities. Table 1 reports descriptive statistics of the male and female athletes.

Table 1. Demographic variables of the athletes.

Variables	Group	n	$\bar{X}$	SD
Age (year)	Male	25	21.40	1.94
	Female	25	21.04	1.24
Body mass (kg)	Male	25	68.84	6.46
	Female	25	55.37	6.08
Height (m)	Male	25	1.77	0.06
	Female	25	1.65	0.04
BMI (%)	Male	25	21.94	2.16
	Female	25	20.35	1.90
Sports experience (yr)	Male	25	7.94	1.87
	Female	25	6.59	2.26

This research was approved by the Ethical Review Board of a local university (approval ID=2021/19/158). Written informed consent was obtained from all participants.

2.2. Study Design

To date, relationships between unilateral FMS scores and single-leg postural sway performance of male and female football players have not been verified in the same study. This study was primarily designed to examine the correlation between FMS and postural stability in football players from an asymmetrical aspect. A correlational study design was used to assess the study hypotheses [36, 37]. Dominant and non-dominant side item/total FMS scores and postural sway parameters were recorded and analyzed to identify potential relationships between the screening tools and postural sway measures from an asymmetrical perspective.

All subjects completed standardized FMS test including seven items and postural sway measures under two different conditions: (a) dominant leg stance open eyes (OE), and (b) non-dominant leg stance closed eyes (CE) on a piezoelectric force plate device detailed below. Prior to the study measurements, the subjects performed a 10-min warm-up consisting of jogging at a self-selected pace on a treadmill. The subjects did not perform any training session during the study period. To reduce the interference of uncontrolled variables, all subjects were instructed to maintain their usual way of life and routine diet program intake before and during the study.

The measurements were taken at the same time of day, with one-hour between FMS and postural sway measures by the same researchers to control the effects of the circadian rhythm and potential fatigue effects.

2.3. *Procedures*

Demographic and anthropometric data (age, height, weight, BMI) were collected before the testing session. All subjects first completed a FMS test. Following at least one-hour resting period subjects then completed single-leg postural sway measures.

2.3.1. Functional Movement Screen (FMS)

The FMS comprises seven movements to assess the functional movement [40, 41]. The FMS tests were: (1) DS: a dowel was held overhead with arms extended, and the subject squatted as low as possible; (2) HS: a dowel was held across the shoulders, and the subject stepped over a hurdle in front of them level with their tibial tuberosity; (3) ILL: with a dowel held vertically behind the subject so it contacted the head, back and sacrum, and with the feet aligned, the subject performed a split squat; (4) SM: the subject attempted to touch their fists together behind their back; (5) ASLR: lying supine on the ground, the subject raised one leg as high as possible; (6) TSPU: the subject performed a push-up with their hands shoulder-width apart; and (7) RS: the subject assumed a quadruped position and attempted to touch their knee and elbow, ipsilaterally and contralaterally [38]. All tests but DS and RS were tested unilaterally.

Subjects watched a demo video that explained and showed all FMS movements before the testing session. Subjects performed three trials with five-second intervals for each movement [39, 40]. The subjects were instructed to return to the initial position between each trial. FMS performance was scored according to Cook's guidelines [41]. One-minute rest was given between each test. The best score from three trials was recorded.

Each subject's performance of the screen was videotaped (positioned anteriorly and laterally) by two cameras (SONY DCR-SR15E, Japan). Two raters, experienced with the FMS, analyzed subjects live and also reviewed all videos and scored each of the FMS movements individually from 0 to 3 for each movement. Scores of 3, 2, 1, and 0 represented, according to the relevant criteria: 'performed without compensation', 'performed with compensation', 'could not perform', and 'pain', respectively [38, 39, 40]. In case of any contradiction in FMS scores between the raters, they reviewed the video and decided on the final score until an agreement was reached [20]. The scores from each of the seven test items were summed to generate a total FMS score (range, 0–21).

2.3.2. Postural stability assessment

The CoP-based single-leg postural stability measures were conducted using a force plate (Kistler, Winterthur, Switzerland; type 9260AA6; 600 × 500 × 50 mm; natural frequency ≈ 400 Hz) in CE condition, following the protocol used by Makaracı et al. [42]. Briefly, during the single-leg postural stability measurements, a subject was standing on one leg in the center of the force plate. The foot was oriented in the anterior-posterior direction (along the Y-axis of the force plate), with the toes pointing anteriorly (+Y). During the measurement, the subjects were instructed to stand as motionless as possible, maintain their hands on the iliac crests and their non-dominant limb in 30° of hip and knee flexion [43]. All measurements were conducted in CE conditions. A 10-sec duration was selected during dominant and non-dominant stance tests due to the difficulty of testing [44]. During the testing process trial, subjects were urged to, when necessary, touchdown on the force plate with their opposite limb.

The CoP-based single-leg body sway parameters including sway velocity-total (SVT), sway velocity-anterior-posterior (SVAP), sway velocity-medial-lateral (SVML), sway area-total (SAT), sway area-anterior-posterior (SAAP), sway area-medial-lateral (SAML), and ellipse area (ELPSA) were used for statistical analysis. The selected parameters were obtained from the Kistler's Measurement, Analysis & Reporting Software (MARS, v4.0.2.99, S2P, Ljubljana, Slovenia) and have been commonly used in similar studies [42, 45].

2.4. *Statistical analysis*

All statistical analyses were computed using the SPSS (Version 21.0; IBM Corporation, New York, USA). Male and female groups were not combined for data analyses. Descriptive statistics were calculated for athletes' demographics that included age, body mass and height, body mass index (BMI), sports experience, and reported using mean ($\bar{X}$), standard deviation (SD), and median. Due to the sample size, performance test data distribution was checked with the Shapiro-Wilk test. Spearman's correlation was used to establish relationships between the dominant and non-dominant FMS scores and postural sway parameters. The significance was indicated as $p \leq 0.05$. The correlation coefficient strength was designated with the following thresholds: ≤ 0.1, trivial; > 0.1–0.3, small; > 0.3–0.5, moderate; > 0.5–0.7, large; > 0.7–0.9, very large; and > 0.9–1.0, almost perfect [46]. Scatter plots were produced for selected FMS screening and postural sway parameters. The Mann-Whitney U-test was conducted to compare differences in the mean values of FMS item scores and postural sway parameters between the athletes' dominant and non-dominant sides. Effect sizes (ES) are reported based on Cohen's recommendations: where 0.2–0.49 is a small effect, 0.5–0.79 is a moderate effect, and ≥0.8 is a large effect [47].

3. Results

A negative correlation was found between dominant and non-dominant FMS scores and postural sway parameters in both male and female groups ($p < .05$). RS and HS were determined as strong predictors of postural stability for the both groups ($p < .001$). No significant differences were observed between dominant and non-dominant side FMS items and postural sway parameters in both groups ($p > .05$).

Table 2. Correlations between FMS (item scores and total score) and dominant leg postural sway parameters.

Parameters	Gender	Deep squat	Hurdle step	In-line lunge	Shoulder mobility	Active straight-leg raise	Trunk stability push-up	Rotary stability	FMS total
SVT	Male	**-.404***	**-.645*****	**-.470***	-.204	-.226	-.393	**-.715*****	**-.561****
[mm/s]	Female	-.383	**-.705*****	**-.504***	-.174	-.045	-.369	**-.740*****	**-.592****
SVAP	Male	**-.520****	**-.611****	**-.470***	-.343	-.173	**-.398***	**-.592****	**-.537****
[mm/s]	Female	-.311	**-.498***	-.280	-.263	-.136	-.357	**-.670*****	**-.412***
SVML	Male	-.347	**-.611****	**-.437***	-.125	-.267	-.382	**-.704*****	**-.535****
[mm/s]	Female	**-.426***	**-.727*****	**-.601****	-.097	-.121	-.421*	**-.705*****	**-.724*****
SAT	Male	-.370	**-.577****	**-.396***	.144	-.214	-.371	**-.693*****	**-.565****
[mm²]	Female	**-.437***	**-.733*****	**-.514****	-.066	-.136	**-.418***	**-.716*****	**-.708*****
SAAP	Male	-.266	**-.498***	-.304	-.050	-.186	-.297	**-.603****	**-.491***
[mm*s]	Female	-.343	**-.739*****	**-.419***	-.021	-.106	**-.398***	**-.624****	**-.604****
SAML	Male	.220	**-.422***	.057	-.742	-.258	.127	**-.457***	**-.478***
[mm*s]	Female	**-.550****	**-.756*****	**-.524****	-.130	-.257	**-.559****	**-.728*****	**-.892*****
ELPSA	Male	-.266	**-.532****	-.322	-.099	-.219	-.319	**-.603****	**-.482***
[mm²]	Female	**-.527****	**-.764*****	**-.495***	-.068	-.197	**-.473***	**-.705*****	**-.792*****

SVT: Sway velocity-total; SVAP: Sway velocity-anterior-posterior; SVML: Sway velocity-medial-lateral; SAT: Sway area-total; SAAP: Sway area-anterior-posterior; SAML: Sway area-medial-lateral; ELPSA: Ellipse area; *$p < .05$; **$p < .01$; *** $p < .001$.

Table 3. Correlations between FMS (item scores and total score) and non-dominant leg postural sway parameters.

Parameters	Gender	Deep squat	Hurdle step	In-line lunge	Shoulder mobility	Active straight-leg raise	Trunk stability push-up	Rotary stability	FMS total
SVT	Male	-.383	**-.705*****	**-.504***	.174	-.045	-.369	**-.740*****	**-.592****
[mm/s]	Female	-.256	**-.594****	-.280	-.051	-.091	-.191	**-.411***	**-.540****
SVAP	Male	-.311	**-.498***	-.280	-.263	.136	-.357	**-.670*****	**-.412***
[mm/s]	Female	**-.449***	**-.446***	-.014	-.141	-.000	-.188	**-.410***	**-.607****
SVML	Male	**-.426***	**-.727*****	**-.601****	-.097	-.121	**-.421***	**-.705*****	**-.724*****
[mm/s]	Female	-.169	**-.584****	-.326	-.059	-.121	-.165	**-.444***	**-.524****
SAT	Male	**-.437***	**-.733*****	**-.514****	-.066	-.136	**-.418***	**-.716*****	**-.708*****
[mm²]	Female	-.157	**-.585****	-.270	-.005	-.045	-.075	**-.445***	**-.497***
SAAP	Male	-.343	**-.739*****	**-.419***	-.021	-.106	**-.398***	**-.624****	**-.604****
[mm*s]	Female	-.078	**-.500***	-.133	-.068	-.106	-.119	**-.456***	**-.422***
SAML	Male	**-.550****	**-.756*****	**-.524****	-.130	-.257	**-.559****	**-.728*****	**-.892*****
[mm*s]	Female	.033	**-.485***	-.188	-.116	-.061	-.026	**-.533****	**-.467***
ELPSA	Male	**-.527****	**-.764*****	**-.495***	-.068	-.197	**-.473***	**-.705*****	**-.792*****
[mm²]	Female	-.044	**-.558****	-.292	-.092	-.091	-.090	**-.455***	**-.405***

SVT: Sway velocity-total; SVAP: Sway velocity-anterior-posterior; SVML: Sway velocity-medial-lateral; SAT: Sway area-total; SAAP: Sway area-anterior-posterior; SAML: Sway area-medial-lateral; ELPSA: Ellipse area; *$p < .05$; **$p < .01$; *** $p < .001$.

A correlation was observed between the DS, HS, ILL, LAPU, RS of the dominant and non-dominant sides, total FMS, and all postural sway parameters in both groups ($p < .05$) (Table 2 and Table 3). RS, HS, and total FMS were found to be correlated with all postural sway parameters. The findings revealed an asymmetrical correlation between functional movement capacity and body stability. No correlation was seen between SM and ASLR and postural sway parameters ($p > .05$).

The correlations between the dominant-side FMS-RS and HS and SVT, and FMS-HS and SAT and SVML were found to have high statistical significance in both male and female athletes ($p < .001$; $r = .645 – .740$). The scatter plots for the correlation of FMS of these dominant sides and postural sway parameters are presented in Figure 1.

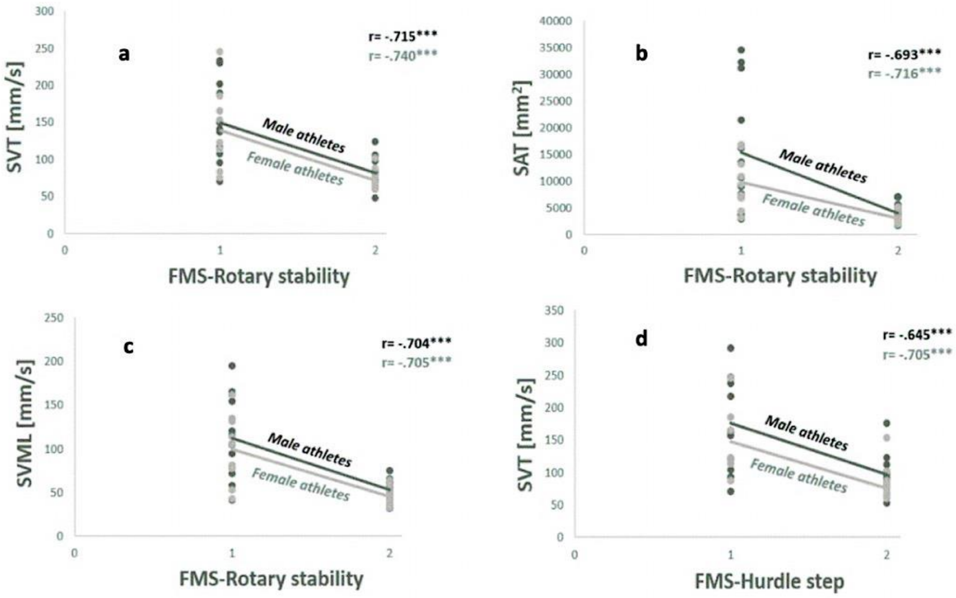

Figure 1. Scatter plots (n = 4) for correlations between (a) FMS-Rotary stability (RS) and SVT; (b) FMS-RS and SAT; (c) FMS-RS and SVML; (d) FMS- Hurdle step and SAT for dominant sides in male and female athletes.

As seen in Figure 1, there was a negative correlation between FMS-RS and SVT and SVML in male and female athletes, and this correlation had a high effect ($p < .001$; $r \geq .7$). The correlation between FMS-RS and SAT, FMS-HS and SVT had a high negative effect in female athletes ($p < .001$; $r \geq .7$), while this correlation had a moderate effect in male athletes ($p < .001$; $> 0.5–0.7$).

The Mann-Whitney U results of dominant and non-dominant side FMS scores of male and female athletes are shown in Table 4.

Table 4. The Mann-Whitney U results of dominant and non-dominant side FMS item scores (except for deep squat and trunk stability push-up) of male and female athletes.

Parameters	Group	Male					Female				
		X̄	SD	Median	*P*	ES(†)	X̄	SD	Median	*P*	ES
Hurdle step	Dom-leg	1.60	0.50	2	.777	0.07	1.76	0.52	2	.063	0.50
	Non-dom leg	1.56	0.51	2			1.48	0.59	1		
In-line lunge	Dom-leg	2.24	0.60	2	.847	0.07	2.16	0.62	2	.131	0.42
	Non-dom leg	2.28	0.54	2			1.92	0.49	2		
Shoulder mobility	Dom-leg	2.20	0.65	2	.397	0.24	2.16	0.47	2	.137	0.43
	Non-dom leg	2.04	0.68	2			1.88	0.78	2		
Active straight-leg raise	Dom-leg	2.12	0.67	3	.866	0.06	2.84	0.37	3	1.000	NA
	Non-dom leg	2.16	0.55	3			2.84	0.37	3		
Rotary stability	Dom-leg	1.44	0.51	1	1.000	NA	1.64	0.49	2	.395	0.23
	Non-dom leg	1.44	0.51	1			1.52	0.51	2		

ES: Cohen's d effect size. where ≤ 0.2 = small. ≤ 0.5 = medium. and ≤ 0.8 = large; NA: Not available.

As seen in Table 4, no statistical difference was observed between the dominant and non-dominant sides in the asymmetrical comparison between the FMS scores of male and female athletes ($p > .05$).

The Mann-Whitney U results of dominant and non-dominant side postural sway parameters of male and female athletes are shown in Table 5.

Table 5. The Mann-Whitney U results of dominant and non-dominant side postural sway parameters of male and female athletes.

Parameters	Group	Male					Female				
		X̄	SD	Median	*P*	ES(†)	X̄	SD	Median	*P*	ES
SVT [mm/s]	Dom-leg	119.44	51.46	106.9	.621	0.20	95.82	46.48	76.13	.204	0.20
	Non-dom leg	131.76	66.26	100.8			105.24	46.11	87.51		
SVAP [mm/s]	Dom-leg	63.28	20.24	63.36	.720	0.12	52.91	17.11	45.86	.357	NA
	Non-dom leg	65.78	19.67	64.52			52.93	9.68	51.62		
SVML [mm/s]	Dom-leg	85.90	44.85	70.76	.541	0.23	64.81	35.83	48.73	.184	0.31
	Non-dom leg	98.64	61.69	70.42			78.16	47.17	58.8		
SAT [mm^2]	Dom-leg	10351.80	6757.45	6928	.778	0.07	5457.00	1447.22	3545	.233	1.06
	Non-dom leg	10821.40	6515.32	6274			7497.04	2290.92	4782		
SAAP [mm*s]	Dom-leg	129.37	64.65	105	.915	0.18	97.00	53.71	83.68	.225	0.31
	Non-dom leg	118.41	50.88	106.4			117.09	71.10	87.68		
SAML [mm*s]	Dom-leg	131.85	58.04	108.1	.541	0.08	113.53	56.00	93.71	.839	0.06
	Non-dom leg	136.71	58.64	106.4			117.23	62.19	98.95		
ELPSA [mm^2]	Dom-leg	1084.88	667.57	539.6	.884	0.14	527.49	239.13	347.2	.282	1.04
	Non-dom leg	995.16	560.06	592.6			837.10	345.05	405.9		

SVT: Sway velocity-total; SVAP: Sway velocity-anterior-posterior; SVML: Sway velocity-medial-lateral; SAT: Sway area-total; SAAP: Sway ar-ea-anterior-posterior; SAML: Sway area-medial-lateral; ELPSA: Ellipse area; ES: Cohen's d effect size. where ⩽ 0.2 = small.

As seen in Table 5, no statistical difference was observed between the dominant and non-dominant legs in the asymmetrical comparison between the single-leg CE postural sway parameters of male and female athletes ($p > .05$)

4. Discussion

Considering that motor coordination is at the forefront in many football-specific movements, a possible correlation is assumed between postural stability and functional movement capability. The correlation revealed between FMS and athletic performance in previous studies [12, 19, 48] supports this assumption. The main purpose of this study was to examine the correlation between FMS and postural stability in football players from an asymmetrical aspect. The secondary purpose was to explore the FMS test and postural sway differences between the dominant and non-dominant sides. Furthermore, this is the first study investigating the aforementioned correlation in the context of gender.

According to the study results, a negative correlation was identified between FMS movements (except SM and ASLR) and postural sway parameters regarding dominant and non-dominant sides ($p < .05$) (Table 2). RS and HS seem to be the FMS movements that best reflect this correlation in both male and female groups ($p < .001$). FMS evaluation is considered a reflection of the movement capability of the body along with the concepts of stability and mobility [22]. Accordingly, the correlation between FMS and postural stability revealed in our study is parallel to previous studies in some aspects. Kelleher et al. [12] reported a correlation between the parameters of the Y-Balance Test such as posterolateral reach, normalized posteromedial reach, and Total Y and the total FMS score. The correlation between the FMS score, which refers to the sum of the scores obtained from seven movements in total, and the balance data revealing the body's movement on different axes seems noteworthy. Similarly, Pourheydari et al. [22] reported a correlation between the FMS score and core endurance and balance in volleyball players, but this correlation should be interpreted on the basis of gender. On the other hand, Armstrong [16] expressed that FMS scores correlated with the star excursion balance test values, which define the body's movement patterns and indicate imbalance. Although the current results confirm the correlation between the FMS score and balance/postural stability, the difference of the sample group in the studies should be considered an important issue because long-term training in the same sport could affect the movement dynamics and postural control negatively [49]. Hence, the sport-specific interpretation of FMS, a measurement method based on movement capability, should provide more objective data.

Previous studies have indicated that lateralization is a factor to be taken into account in professional football due to its effect on actions such as dribbling, changing direction, and shooting [50, 51, 52]. In their review study, Virgile and Bishop [53] reported that functional asymmetry and limb dominance were correlated. The asymmetrical correlation (dominant and non-dominant) between FMS and postural sway revealed in our study indicates the importance of body lateralization. In this correlation, HS and RS items were determined as strong predictors of postural stability (especially sway velocity) in both male and female groups (Figure 1). Moreover, HS and RS were revealed to be the FMS movements with the lowest average score in both groups (Table 4). It seems a significant finding that RS movements which refer to the mobility of hip, spine, core and shoulder movements when the lower and upper extremities move together with HS, which represents the asymmetrical mechanics of the body in step movement, are correlated with postural sway [39]. In parallel, Harshbarger et al. [54] reported a negative correlation between the asymmetrical FMS score and star excursion balance test. Mitchell et al. [21] mentioned a positive correlation between core strength, which refers to body asymmetry, and the FMS score. In these studies, the emphasis was on the asymmetrical aspect of FMS, but the fact that not all movements are evaluated unilaterally limits the interpretation of this correlation [21]. In our study, the separate association of FMS movements, except DS and TSPU, with medio-lateral and antero-posterior-based body sway parameters limits the revealed correlation. Furthermore, the fact that the participant group consists of males and females also supports the evaluation of the existing correlation on the basis of gender.

Body asymmetry imbalance exceeding 10% in football players is evaluated as an increase in postural sway and an indicator of injury [51, 55]. The difference between the lower extremities may limit optimal performance in basic football-specific movements (e.g., shooting, changing direction). In the FMS and postural sway measurements performed in our study, no statistical difference was observed between the dominant and non-dominant sides (p >.05) (Tables 4 and 5). According to these results, it can be interpreted that there is no asymmetrical imbalance in both male and female groups in terms of functional movement capability and body sway. This also confirms the correlation between FMS and postural sway, which the present study mainly focuses on and is evaluated asymmetrically. Regarding the results on postural sway, male and female football players have different results in dominant and non-dominant leg parameters. This situation reveals that sports-specific development can create different reflections in the use of the dominant leg on the basis of gender.

5. Conclusions

According to the study results, a correlation was found between the dominant and non-dominant FMS scores and postural sway parameters in both male and female groups. RS and HS among FMS movements were determined as strong indicators particularly of sway velocity-based postural stability. Our study findings regarding FMS test, which is one of the most used functional screening tools, may be useful in terms of identifying possible asymmetrical postural problems. Besides, the FMS test may be preferred more compared to the other laboratory-based tests difficult to perform by practitioners and physiotherapists to identify postural problems of football players. The unilateral assessment of FMS movements may also be particularly beneficial in the context of functional capacity after lower-limb injury. Furthermore, it is assumed that the analyses conducted by considering the gender variable in our study may contribute to the current gap in the literature. In future studies, it is recommended to examine postural stability in a dynamic aspect and focus on the reflections of the FMS-postural sway correlation in different sports disciplines.

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