Research Article

Lower limb strength asymmetry and Functional Movement Screen values in professional soccer players

Abstract

Aim: The Functional Movement Screen (FMS) protocol consists of 7 tests. At higher values mean higher quality of execution. The lower limb functional asymmetry (FA) is monitored to control the athlete's injury risk. This study aims to examine the correlation between the FMS score and strength asymmetry in professional soccer players (PSP).

Methods: n=31 PSP (age:22.2±4.6; weight:74.3±10,1kg; height:176.1±8.7cm), n=4 were excluded for joint or muscle injuryin the last 18 months. The FMS protocol identifies athletes at risk of injury when the total score is≤14. The Hop Test (HT), Side Hop Test (SH) and Crossover Hop Test (CH) are considered a valid assessment of the single lower limb FA.

Results: It revealed a significant inverse correlation between FMS score and HT (r = -0.56, p<0.01), between FMS score and SH asymmetry percentage (r =-0.74,p<0.01) and the CH asymmetry percentage (r=-0.60,p<0.01). Significant correlation were found between HT asymmetry and SH asymmetry (r= -0.54, p<0.01), CH asymmetry (r=-0.59, p<0.01);significant correlation were found between SH asymmetry and CH asymmetry (r= -0.76, p<0.001).

Conclusion: Low scores in the FMS test are correlated with high levels lower limb strength asymmetry in the soccer player; it can be assumed that movement accuracy influences jump performance. In the soccer players, the lower limb strength asymmetries are observed on the jumps performed in different planes and in different tasks.

Keywords: functional movement, jump, strength asymmetry

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Italo Sannicandro,[1,2,3] Cofano Giacomo,[2,3] Paolo Traficante[2,3]

[1]Clinical and experimental medicine department, University of Foggia, Italy
[2]Master's Degree of Preventive and Adapted Physical Activity, University of Foggia, Italy
[3]Professional Strength and Conditioning Soccer Coach, Italy

Correspondence: Italo Sannicandro, Clinical and experimental medicine department, University of Foggia, Italy, Email italo.sannicandr@unifg.it

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Introduction

In sports today, the attention of technical and medical staff is directed to performance improvementand to injuries prevention. Functional movement can be defined as the ability to produce and maintain a balance between mobility and stability along the kinetic chain while performing fundamental patterns with accuracy and efficiency.[1,2]Functional movement is the key to to performance and sports-related skills, and consists of the interaction between stability, flexibility, strength and motor control.[1] Dysfunction in fundamental movement patterns has been linked to an increased risk of athletic injury[3,4,5].

The functional movement screen (FMS) is a screening tool for injury risk that assesses the movementpatterns of individuals and evaluates mobility and stability.[6,7] The FMS assessment consists of 7 motor task (each of which is scored on a scale of 0-3 to yield a composite score out of 21;[6,7] each scored based on the movement patterns within the kinetic chain, asymmetries between the left and right side, and compensatory movements. The validity of the FMS as a predictor of injury risk has been confirmed inseveral studies.[4,8,9]

The functional asymmetry are a very significant topic in the Sport Science researches to reduce the injury risk in young and top level athletes.[10-20]

Many studies have investigated which methodologies are most effective in reducing the strength asymmetry in various sports.[11,12,21-30]

The lower limb strength asymmetry is measured by monopodalic jump tests in both healthy subjects and in athletes who follow a post-injury rehabilitation path.[17,31-33]

The effectiveness of the FMS as a predictor of injury risk has previously been demonstrated in many special and in physically active populations: this assessment has been used withprofessional American football players,[8,34] NCAA athletes,[4,35] rugby players,[36] runners[37] and military.[9,38,39]Furthermore, the presence of one of more asymmetries has been linked to a higher risk of injury in professional American football players.[34]

However, other Authors have shown limited FMS accuracy to predict sport injury risk[37,40-42]while others have asserted that the FMS may lack the accuracy required to effectively assess individualizedinjury risk.[43-47]

In literature, an open problem remains to understand the accuracy of the FMS test and the relationship with other validated tests that are useful to disclose lower limb strength asymmetry.Another open problem concerns the relationship between FMS and lower limb strength asymmetry.Therefore, this study aims to examine the correlation between the FMS score and strength asymmetry in professional soccer players.

Material and Methods

Participants

The sample is composed of 31 professional soccer players age:22.2±4.6; weight:74.3±10,1kg; height:176.1±8.7cm); n=4 were excluded for joint or muscle injuryin the last 18 months. All participants were informed about the assessment risks associated. The study was conducted in compliance with the Helsinki Declaration principles.

Measures

The FMS tools were used to evaluate movement patterns and any asymmetries in professional soccer players. This assessment protocol uses seven motor task that combine major muscle groups; while a screener assigns points (0-3) based on how well the movements were performed. FMS scoring is quantitative, a higher score relates to increased functional movement, and a lower score point identifies dysfunctional body movement along with a prescription for the necessary exercises needed to restore proper movement and build strength for individuals.

A score loweror equal to 14 indicates a potential risk of injury.

Jump test were performed on artificial grass field.Hop test, Side hop test and Crossover test were performed on left and right limb, as well as protocol.[17,32,33]

Hop test: the aim isto jump (as far as possible) on a single leg and landing on the same leg on sagittal plane: the distance is measured from the start line to the heel of the landing leg.

Side hop: test the aim isto jump (as far as possible) on a single leg and landing on the same leg on frontal plane: the distance is measured from the start line to lateral margin of the landing foot.

Crossover test: the aim is to jump as far as possible on a single leg three consecutive times; between each hop, the athlete has to jump across a midline, hence including side-to-side movement in this test. The distance is measured from the start line to the heel of the landing leg[17,32,33].

The degree of asymmetry between the dominant (D) and non-dominant (ND) leg in performance in each jump test was calculated applying the formula: (jump dominant-limb – jump non-dominant limb)/jump dominant-limb*100.[48]

A difference greater than 15% indicates a potential injury risk.[11,16,20,49]

Procedures

On the first day, the anthropometric variables were measured and the FMS assessment protocol was presented.The FMS tools assessment was performed in a gym at 22°C from 10 am to 1pm; after 24 hours all soccer players completed the jump tests in the following order: Hop test, Side Hop test, Crossover test.

Threerepetitions were performed for each jump and the best was evaluated; after each test was given 10 minutes of recovery to eliminate fatigue effects.

Analysis

Descriptive statistics (M ±SD) were calculated for all assessed variables; Pearson's correlations were performed totest the strength of the linear relationships between thefunctional asymmetries values obtained from the each jump test and the FMS values (SPSS 22.0, SPSS Institute Chicago, IL). Statistical significancewas set at $p \leq 0.05$.

Results

The FMS protocol tasks showed scores equal to 14,5±2,1 points.

The average values of Hop test, Side Hop test and Crossover test were respectively equal to 181,3±16,1cm for theleft limb, 178,4±18,8cm for the right limb, 154,1±14,7 for the left limb, 153,7±20,7cm for the right limb, 569,3±57,3cm for the left limb and 566,8±64,2cm for the right limb.

The mean asymmetry values of Hop test, Side Hop test and Crossover test were respectively equal to 4,1±4,9%, 8,9±8,1% and 5,6±5,5%.

The data are summarized in the table 1 and in the table 2.

Table 1 Test value (Hop L; hop test left limb, Hop R;hop test right limb,Asym: % Asymmetry value)

FMS score	Hop L (cm)	Hop R (cm)	Asym (%)
14,5±2,1	181,3±16,1	178,4±18,8	4,1±4,9

Table 2 Side L; Side Hop test left limb; Side R; Side Hop test right limb, CrOv L; Crossover test left limb,CrOv R; Crossover test right limb,Asym; % Asymmetry value

Side L (cm)	Side R (cm)	Asym (%)	CrOv L(cm)	CrOv R (cm)	Asym (%)
154,1±14,7	153,7±20,7	8,9±8,1	569,3±57,3	566,8±64,2	5,6±5,5

The correlation value are showed in the table 3.

Table 3 Correlation between FMS value and asymmetry values

	FMS	Hop As	Side As	CrOv As
FMS	-	-0,56**	-0,74***	-0,60**
Hop As		-	0,54**	0,59**
Side As			-	0,76***
CrOv As				-

FMS; value of FMS assessment, Hop As; Hop test asymmetry, Side As; Side test asymmetry,CrOv As; Crossover test asymmetry **$p<0.01$; ***$p<0.001$

Discussion

This is the first study that tries to understand the relationship between the FMS test and the unilateral jump test.

Both the FMS protocol and unilateral jumps are used to detect any asymmetries, both in the athletes and in active populations.[37,49-51]

The attention to the quality of the movements is very high in professional sport; only physical and technical training cannot change the effectiveness of the movement.[2]

The presence of asymmetries, can result in health, and ultimately athletic performance compromise.[15,21,22,52]

The Hop test asymmetry is well below the cut off value identified in the literature.

The average values asymmetry and above standard deviation values highlighted in the Side test and in the Crossover test are more relevant: it emerges a very heterogeneous scenario that exposes to a potential injury risk.

The asymmetry values identified in this study agree with similar studies conducted with professional footballers and recreational players.[49]

The FMS score also indicates a potential injury risk and the need to provide supplementaryand integrative training.

The FMS values agree with the data present in the soccer players literature.[43,50]However, the literature does not agree on this point: some Authors do not consider needful a supplementary training because, in soccer, they have not identified a relationship between lower FMS scores and non-contact injuries;[53] other Authors who monitored a professional footballers sample for 9 months, did not find that the cut-off of the 14 points is necessarily associated with an injury risk;[5]conversely, some Authors have observed that athletes with an asymmetry[36,37,43] or individual score of 1 were 2.73 times more likely to sustain an injury (p=0.001) than those without.[51]

The correlation between FMS asymmetry and jump asymmetry has various values in the different jumps: the correlation between FMS asymmetry and jump asymmetry is higher for the Side test and Crossover test: in fact, the lateral jump (frontal plane) presents greater difficulties in lower limb stabilization.[54]

On the frontal plane, the control and stability movements, due to the knee joint biomechanical characteristics, are more complex.

The correlation between the FMS values and the jump test results lead to think thatthe seven motor tasks quality execution have an important relevance in the unilateral jump skill; moreover, the significant correlations between FMS scores and the asymmetry values seem to indicate that the deficit in some movements may influence some sport-specific skill, such as the unilateral jump.

At last, the correlations between the asymmetry values in the different jump tests show that the strength deficits observed in the every jump assessment.

Conclusion

In conclusion, this is the first study that tries to understand the relationships between FMS and unilateral jump assessment: both evaluations are useful for understanding strength deficits and asymmetry in soccer players to structure individualized prevention training sessions. Low scores in the FMS test are correlated with high levels lower limb strength asymmetry in the soccer player; it can be assumed that movement accuracy influences jump performance. In the soccer players, the lower limb strength asymmetries are observed on the jumps performed in different planes and in different tasks.

Conflicts of interest

The authors of the following article have not received any funding and have no contractual relationship with the companies that produce the products mentioned in the text.

Authors' contribution

Italo Sannicandro contributed to research conception and design, data acquisition, data analysis and interpretation, writing and critical review of the manuscript. Giacomo Cofano contributed to data acquisition and interpretation. Paolo Traficante contributed to data acquisition.

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