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Professional and Elite Young Soccer Players: Differences in Functional Movement Screen™ Values

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Abstract

Background: Soccer is a sport that requires very complex movements performed at high speeds: running, jumping, decelerating, changing direction or running direction, and kicking are complex movements that require high control and significant joint stability at all ages. Control of the body and individual body districts becomes important for both performance and injury prevention.

Objective: This study aims to verify the Functional Movement Screen (FMS™) values in different categories of players, from the youth leagues to professional soccer players.

Methods: A sample of soccer players (n=112) took part in the study. The sample was subdivided according to their category, resulting in the following subgroups: a) professional soccer players (PSP, n=56,), Under 19 - Primavera (U19, n=29), Under 17 (U17, n=27). The FMS protocol was used to assess the seven functional movements and the associated risk of non-contact injury.

Results: Statistically significant differences emerged in the total scores between the U17 group and the PSP group (14.8±2.9 vs 19.1±1.4, $p<0.01$), between the U17 group and the Under 19 - Primavera group (14.8±2.9 vs 16.2±2.1, $p<0.05$) and between the Under 19 - Primavera group and the PSP (16.2±2.1 vs 19.1±1.4, $p<0.01$).

Conclusion: The values obtained show that young soccer players have a very different qualitative control of movement than highly qualified players. This study shows significant differences not only between the total scores, but more importantly between the individual 7 assessment tests that the FMS protocol includes: these values provide insight into which movements should receive more attention in athletic conditioning in the youth sector.

Keywords: functional movement screen, young soccer player, soccer, movement.

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INTRODUCTION

The growth of young soccer players is a very topical issue in the literature and uses very heterogeneous analyses to address the different factors involved (Fernández-Galván et al., 2022; Lloyd et al., 2020; Read et al., 2019). The growth path of young soccer players ends in Italy with the '*Primavera*' category (Under 19) and goes through 4 years of competitive competitions and about 8 years of non-competitive grassroots activities. The basic training is very heterogeneous because each youngster chooses at what age to start training for soccer in a systematic way.

Soccer is a sport that requires very complex movements performed at high speeds (Caldbeck & Dos'Santos, 2022; Novak et al., 2021): running, jumping, decelerating, changing direction or running direction, and kicking are complex movements that require high control and significant joint stability at all ages (Yang et al., 2022). It is for this reason that technical staff continually search for tools to assess and control these complex movements. These movements become even more complex when observing what happens on the pitch during a match (Novak et al., 2021; Caldbeck & Dos'Santos, 2022; Dinç & Arslan, 2022).

Some short periods of high intensity explosive sprinting actions occur in soccer, and despite their reduced frequency and distances, high intensity runs and sprints are linked to crucial moments and performance, such as goal scoring or defensive scenarios during official matches (Caldbeck & Dos'Santos, 2022). Even sudden jumps and changes of direction can determine the outcomes of a defensive/offensive situation or an entire match. Control of the body and individual body districts becomes important for both performance and injury prevention (Yang et al., 2022; Thorborg et al., 2017). In this regard, for example, the literature suggests that trunk control in change of direction is a relevant prerequisite for the prevention of non-contact trauma to the anterior cruciate ligament (Fryer et al., 2019; Hron et al., 2020) or that correct biomechanics of running under acceleration allows reducing the risk of hamstring injury (Edouard et al., 2019).

There are multiple evaluaton methods to assess these aspects of human movement control. However, concepts that evaluate these movement components together and the body as a whole give better and applicable results (Dinç & Arslan, 2022). One of the assessment protocols that has become more popular in recent years in team sports is the Functional Movement Screen or FMS™ (Silva et al., 2017; Christopher et al., 2021; Dinç

& Arslan, 2022). The test protocol consisted of seven movement patterns. These seven movement patterns are observed and scored between zero and three (Cook et al., 2006a & 2006b). The test has been validated and has a predictive value: it allows the scores obtained to be related to the potential risk of injury. By observing the tests in which the athlete obtains the lowest score, staff can prepare specific scheduling for each individual athlete/player. An open problem in the literature is the understanding of how these functional movements may develop (and if they do) during the young soccer player's development. The transition from the Under-19 "Primavera" category to professional soccer imposes a series of questions and reflections on the soccer player's state of maturation, not only physically but above all in terms of coordination.

In the literature, this remains an open and modestly investigated problem: individual populations of soccer players have been analysed (elite soccer players, young soccer players, female soccer players, etc.); however, the values of young soccer players have never been compared with those of professional soccer players.

Monitoring FMS values becomes useful and indispensable if one wants to know which movements require more attention from the athletic and medical staff. The player must be introduced into a highly qualified competitive context that requires new performance demands: a few months after the end of the Under-19 championship he will be placed in a more complex, more intense competitive context, which is in any case different from what he experienced before.

This study aims to verify the FMS values in different categories of players, from the youth sector to professional soccer players. The study also aims to verify whether there are differences in the qualitative control of fundamental movements at different levels of sporting qualification in soccer.

METHOD

Study Design and Participants

A sample of Italian soccer players (n=112) took part in the study. The sample was subdivided according to their category, resulting in the following subgroups: a) professional soccer players (PSP, n=56, average age: 26.82 ± 4.34 years, weight: 78.26± 4.51 kg; height: 179. 7± 6.2 cm), b) Primavera-Under 19, (U19, n=29, average age: 18.42 ± 0.26 years, weight: 71.56± 3.96 kg; height: 176.8± 5.7 cm); Under 17 (U17, n=27, average age: 16.54

± 0.39 years, weight: 71.45± 5.12 kg; height: 176.4± 8.4 cm). All players belonged to a professional club.

Exclusion criteria of the test protocol were as follows: having any musculoskeletal injury at the time of assessment, have suffered a musculoskeletal injury or concussion within the previous 6 months, having conducted high-intensity training within 48 hours prior to assessment, having consumed alcohol within 48 hours prior to the protocol assessment.

The study was approved by the club's manager, by FIGC (Federazione Italiana Giuoco Calcio) regional ethics committee and was performed according to the principles expressed in the Declaration of Helsinki. The written informed consent was obtained from the parents, while the young soccer players have signed the informed assents.

Research Instruments

The players' anthropometric data were taken before the test and the inclusion criteria of the test battery were asked. All evaluations were conducted after all participants had taken two days off from training. The soccer players previously participated in a familiarization session with the protocol tests.

The soccer players were evaluated according to the FMS testing protocol and the data were recorded. The testing protocol was performed using the official FMS kit. The experienced FMS coach explained each test and the participants performed the tests three times. The tests were video recorded to achieve greater assessment accuracy. The participants' best scores for each test were recorded.

The movements were evaluated on a scale of 3, 2, 1 and 0, represented according to the relevant criteria: 3—performs the movement correctly without any compensation, complying with standard movement expectations associated with each test; 2—able to complete the movement but must compensate in some way to perform the fundamental movement; 1—unable to complete the movement pattern or is unable to assume the position to perform the movement; 0—pain anywhere in the body. For tests performed bilaterally, as defined by the FMS protocol, the lowest left- and right-sided score was accepted as the test score. The total score was obtained by collecting the score of seven tests. Deep squat, hurdle step and inline lunge, shoulder mobility, active straight leg raise, trunk stability pushup and rotatory stability test scores were added to calculate the FMS total score (Dinç & Arslan, 2022).

Data Analysis

The descriptive statistics (mean, standard deviation, confidence interval) were determined for all test data. The Shapiro-Wilk test was used to examine the fit for normal distribution. The One-way Anova test was used in the analysis of the data that met the parametric test assumptions, and the Kruskall-Walli's test was used in the analysis of the data that did not provide the parametric test assumptions. $p<0.05$ was considered significant. The statistical package SPSS 22.0 for windows (SPSS Institute, Chicago, IL) was used to analyse all data.

RESULTS AND DISCUSSION

Table 1 shows the values obtained by the three groups in each of the seven tests and in the total score of the FMS protocol. Statistically significant differences emerged in the total scores between the U17 group and the PSP group (14.8±2.9 vs 19.1±1.4, $p<0.01$), between the U17 group and the Under 19 - Primavera group (14.8±2.9 vs 16.2±2.1, $p<0.05$) and between the Under 19 - Primavera group and the PSP (16.2±2.1 vs 19.1±1.4, $p<0.01$). In Table 1 statistically significant differences emerge in the total score and in the comparison of the individual tests of the FMS protocol between the 3 observed groups.

Table 1. Values of FMS protocol in the 3 soccer players subgroups. In tha table also there are the distribution of sample in the score of the FMS protocol

Test	Score	Professional Soccer players, PSP (n)	U19 - Primavera (n)	U17 (n)	p (U17 vs PSP)	p (U17 vs U19)	p (U19 vs PSP)
Deep squat	0	0	0	0	-	-	-
	1	1	4	19	0.05	0.01	0.07
	2	14	17	4	0.01	0.01	0.14
	3	41	8	4	0.001	0.08	0.001
Hurdle step	0	0	0	0	-	-	-
	1	0	15	18	0.001	0.13	0.01
	2	21	11	6	0.01	0.05	0.01
	3	35	3	3	0.001	0.43	0.001
Inline lunge	0	0	0	0	-	-	-
	1	1	4	16	0.001	0.01	0.09
	2	14	15	8	0.01	0.01	0.08
	3	41	10	3	0.001	0.01	0.001
Shoulder mobility	0	0	0	0	-	-	-
	1	0	0	0	-	-	-
	2	8	12	14	0.06	0.36	0.05
	3	48	17	13	0.01	0.09	0.001
Active straight leg raise	0	0	0	0	-	-	-
	1	1	2	7	0.05	0.05	0.49
	2	42	20	18	0.01	0.38	0.01
	3	13	7	2	0.05	0.05	0.001

Continued Table 1.

Trunk stability pushup	0	0	0	0	-	-	-
	1	0	7	14	0.001	0.05	0.01
	2	11	17	10	0.09	0.05	0.05
	3	45	5	3	0.001	0.24	0.001
Rotatory stability	0	0	0	0	-	-	-
	1	31	22	19	0.05	0.08	0.01
	2	12	4	6	0.05	0.14	0.01
	3	13	3	2	0.01	0.18	0.01
FMS total score		19.1±1.4	16.2±2.1	14.8±2.9	0.01	0.05	0.01

DISCUSSION

The aim of the study was to verify FMS values in different categories of soccer players, from youth sector to professional footballers. Furthermore, the study wanted to verify whether there are differences in the qualitative control of fundamental movements between the last two categories of the youth sector and professional soccer.

The qualitative control of movements is a prerequisite for high qualification in soccer, so much so that some researchers have classified these movements and analysed them during performance (Caldbeck & Dos'Santos, 2022). The values obtained from the FMS protocol in the three groups of players evaluated showed significant differences when comparing U17 and U19-Primavera ($p<0.05$), between U17 and PSP ($p<0.01$) and between Primavera-U19 and PSP ($p<0.01$). The values obtained from the study are consistent with what has already been identified in the literature with young elite soccer players of the same age (Silva et al., 2017) and young elite sportspeople (Fitton Davies et al., 2022).

This study, unlike others that have already been conducted, shows significant differences not only between the total scores, but more importantly between the individual 7 assessment tests that the FMS protocol includes: these values provide insight into which movements should receive more attention in athletic conditioning in the youth sector.

The differences found in the evaluation with the FMS protocol are consistent with other analyses that have addressed the differences in motor abilities between these three categories of players (Sannicandro et al., 2015). The comparison between the last two categories in the youth sector and the professional soccer players is useful in order to understand a) what prerequisites the young soccer players must present in order to transition into professional qualification, b) what additional or supplementary training must be scheduled in the youth soccer.

In particular, the recognised relationships between scores obtained in the FMS protocol and the risk of injury in sport should direct the attention of technical staff and medical staff towards the assessment of qualitative movement control (Kraus et al., 2014; Monaco & Schoenfeld, 2019; Newell, 2020). In fact, the Under-17 group shows a score just above the cut-off of the FMS protocol, which identifies a very high injury risk. In particular, the frequent transition of young soccer players from youth categories to the top qualification teams often refers to technical and tactical skills: on the contrary, this delicate transition should also be assessed in relation to the prerequisites that depend on the qualitative control of fundamental movements.

Especially since the young player will be performing training sessions and official matches in a competitive context where the execution speeds will be much higher than in the youth match and training (Aksum et al., 2021; Goto & Saward, 2020; Di Salvo et al., 2013).

CONCLUSION

In conclusion, the literature provides staff with easy-to-implement and practical movement quality assessment protocols. Movement control monitoring allows for the identification of gestures that potentially increase the risk of non-contact injuries. This monitoring becomes indispensable especially when the soccer player must transition from youth categories and leagues to professional soccer leagues.

CONFLICT OF INTEREST

The author officially certifies that there are no conflicts of interest with any party with respect to this research.

AUTHOR'S CONTRIBUTION

Sannicandro contributed to preparing concepts, formulating methods, conducting research, interpreting data, and editing the final version. Cofano contributed to conducting research. D'Onofrio contributed to formulating methods and drawing conclusions. Piccinno contributed in statistical analysi and interpreting data.

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