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CHANGES IN FUNCTIONAL MOVEMENT SCREEN SCORES OF SLOVAK WOMEN´S NATIONAL FOOTBALL TEAMS

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Abstract. The aim of this study was to assess movement patterns by using Functional Movement Screen in three categories of Slovak women´s national football teams during two occasions interpressed with one year. The reason for this was to answer the questions: 1. if there is a tendency to perform better in the screen with respect to age category, and 2. if the players who did the screen more times and recieve recommendations, perform better after a year, irrespective to age category. Our results showed that every category achieved significant improvements ($p<0.10$) in total test score when compared the two occasions (2013 vs. 2014), except WU17, where significant decrement was found ($p<0.01$). These results probably represent the fact, that the WU17 is the less experienced category regarding FMS^{TM,} and the group where the most turbulence occurs in the nomination list. However, when we assessed the group of players who were present at both occasions of screening, irrespectively to age group they belong, results revealed significant overall improvements ($p<0.05$). In conclusion, we would suggest FMS^{TM} as a useful tool to reveal potentially weak links in player's movement and therefore determine injury risk. Our results suggest that professional recommendations to remove these are effective and at least as much important as the screening scores alone.

Key words: Functional Movement Screen^{TM}, women´s football, age categories

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Introduction

The key tool of this study was the Functional Movement Screen (FMS^{TM}). We could define it as one of the new generation of screening assessments, which evaluates functional movement patterns to determine potentially risk of injury. In contrast with other/older types of "screens" or prevention programs (like nordic hamstring curls as eccentric strength training or proprioreception programs); it is not a training tool to solve the problem by itself or with practicing it. It is rather a tool/screen to catch fundamental movement pattern compensations and then quickly rank the quality of the movements. The FMS^{TM} was therefore developed as a comprehensive pre-participation and pre-season screen, and consists of seven movements, which challenge an individual's ability to perform basic movement patterns that reflect combinations of muscle strength, flexibility, and range of motion, coordination, balance and proprioception (Cook 2006).

The recommendations based on the scores achieved in every test are at least as much important as the overall result of the screening. As the goal of the screening is to identify weak links in the given movements and therefore determine risk potential, the screen has a hierarchy in the tests by which the appropriate solution can be designed. With respect to this hierarchy, the examinator is firstly looking for asymmetries and than for symmetries in the movements where it is possible. Some studies also investigate intrarater reliability of the FMS^{TM} (Smith et al. 2013; Gribble et al 2013). Findings of these studies show a good intraclass correlation (ICC = 0.89 and 0.87) respectively. Few studies also investigated intrarater reliability in the way, how clinical experience plays a role in the reliability in FMS^{TM}. These studies found, that athletic trainers with at least 6 month of experience using the FMS^{TM} had the strongest reliability (ICC = 0.946), while athletic trainers without any experience showed a moderate reliability (ICC = 0.771).

For these reasons the FMS^{TM} is widely considered as a useful tool, what helps in designing individual training programs and player care procedures with respect to individual limitations, age and performance level/category, and therefore allows to reach maximal performance potential and decrease injury risk. This is probably even more important in women football, where the risk of injuries in some segments of the body is higher than in males. The average injury incidents in professional football were investigated by Ekstrand et al. (2011). They found that the average rate of injury is 8.0/1 000 h and the players are injured 2-times per season. It is also well documented that female athletes participating in jumping and cutting sports demonstrate a four-to sixfold higher incidence of knee injury than do male athletes participating in the same sports. Most of the studies therefore investigate knee injuries (ACL), because of the relatively long rehabilitation time, regardless if the injury needs a non-operative treatment, surgery or both (Hewit et al. 1999). Majority of these occur via non-contact mechanism during landing from jump. According FIFA Medicine Group (Tscholl et al. 2007; Junge-Dvorak 2007), the most common injuries in women´s football are mostly associated with ankle (24 %), head (16 %) and thigh (12 %).

Aim

The aim of our study was to determine the level of FMS^{TM} in the meaning of total score within three age categories of national women´s football teams:

a) regarding the age category, to find out, if there is a tendency between the consecutive years to perform better in the required movement tasks (to demonstrate a given picture of the players who are invited to join the national team, according to total score achieved in FMS^{TM}),
b) to demonstrate the usefulness of the screening and the positive effect of the recommendations on the group of players, who were at both screenings and therefore receive correction program in 2013.

Methods

Participants of our study were Slovakia women´s national football team players. The screening was carried out in three national women´s football categories (Women´s A-team - WA, Women´s under 19 - WU19, Women´s under 17 - WU17) at two different events interpressed with one year. Both procedures were made during official team meetings at the end of November in the years 2013 and 2014. More detailed characteristics of the players/categories with respect to the year of screening are reported in Table 1 (2013) and 2 (2014).

Table 1

Number of subjects within each category with their average ± SD age, height and weight in the year 2013

2013	Subjects [no.]	Age [yr]	Body height [cm]	Body weight [kg]
WA	19	20,84 ± 2,8	171,4 ± 6,9	63 ± 8,3
WU19	20	16,35 ± 0,49	167,5 ± 5,7	59,05 ± 6,6
WU17	19	14,42 ± 0,5	163,8 ± 4,7	55,16 ± 5,2

Table 2

Number of subjects within each category with their average ± SD age, height and weight in the year 2014

2014	Subjects [no.]	Age [yr]	Body height [cm]	Body weight [kg]
WA	17	22,53 ± 2,8	170,24 ± 5,55	62,94 ± 7,24
WU19	20	16,15 ± 0,67	168,5 ± 5,61	58,2 ± 5,34
WU17	22	14,77 ± 0,43	165,52 ± 7,23	58 ± 7,85

As the goal of our study was not just to monitor the progression of the total score which was achieved during FMS™ in each category, but also their progression during one year in the group of players who participated in both occasions of the screening procedure. Therefore, to examine the effectiveness of prescribed recommendations, we have also assessed the players irrespectively to which group they belonged. Table 3 presents the characteristics of these players.

Table 3

Characteristics of the group of players, who perform the screening in both occasions (2013 and 2014)

Year	Subjects [no.]	Age [yr]	Body height [cm]	Body weight [kg]
2013	30	17,17 ± 3,58	168,1 ± 5,85	58,5 ± 7,91
2014	30	18,1 ± 3,53	169,57 ± 5,46	60,33 ± 6,85

The Functional Movement Screen™, developed by Cook and Burton, was used in this study. The standardized version of the testing procedures, instructions and the scoring process were followed in order to ensure the scoring accuracy. The FMS™ consists of seven movement tests, described by Cook et al. (2006) that include Deep Squat, Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-Up, and Rotary Stability. Each participant was given three attempts on each of the seven tests. The participants did not do any warm up procedure before testing. Each attempt was scored on a scale from 0 to 3. The score 0 indicated that pain was reported during the movement. The score 1 indicated the failure to complete the movement or loss of balance during the movement. The score 2 completing the movement with compensation and the score 3 performing the movement without any compensation. For each test, the highest score from the three attempts was recorded and used to generate an overall total FMS™ score with a maximum value 21. For the tests, that were assessed bilaterally, the lowest score was used. Three of the tests (shoulder mobility, trunk stability push-up and rotary stability) also have associated clearing exams that are scored as either positive or negative, with a positive response indicating that pain was reproduced during the examination movement.

Both screening procedures were performed at the end of November (2013 vs. 2014) in the National Training Centre of the SFA in Senec. Teams were tested after three consecutive days, in the following order: WA, WU19 and WU17. Participants wore their usual clothing and footwear. The fitness coach of Women´s national football team, who passed the Level 1 Certification of FMS^{TM} collected the data, and then designed the corrective exercise program for the players.

To provide sufficient description of our sample/participants, descriptive statistic methods of location (average) and dispersion (standard deviation) were used. Mann-Whitney´s non-parametric test was used to compare the same age category at 2013 and 2014, because the composition of the teams changed during the year. To answer our second question, thus, whether the prescribed corrective exercises were effective or not (according total score), T-Test for 2 dependent means (Paired Samples t-test) and Cohen's d (effect size) was used. All calculations were performed using SPSS (version 16.0), where the level of significance was set at $p < 0.05$, $p < 0.01$ and to reveal even a tendency in total score to increase or decrease, we also use significance level at $p < 0.10$. Cohen´s d was also used to determine effect size.

Results and Discussion

Total score for all teams together was 14.91±2.15 in 2013, and in 2014, it was 15.04±1.88, however these improvements do not express any level of statistical significance. To clarify this situation, we also assessed each team separately. In this case we found out significant improvements in the group of WA (14.84±2.61 vs. 15.94±1.29) and WU19 (14.35±2.08 vs. 15.4±2.04) at the significance level p<0, 10, what should be qualified just as a tendency to increase (Figure 1). However if we put together these two teams, we get the results at the higher level of significance (p<0, 05). On the other hand significant decrement (p<0, 01) was found in the group of WU17 (15.58±1.54 vs. 13.84±1.57).

To clarify this situation could help just simple view on the list of nominated players in WU17 category between the two testing occasions. After this it is clear, that exactly the WU17 category was the group in which the most players moved forward (n = 8) to the next/older category, or simply dropped out (n = 5) of nominations. These facts also mean that WU17 was the category where the most novice players come. These players did not meet

FMS™ procedure, and that is why they did not recieve recommendations before, which was probably the major reason of given results.

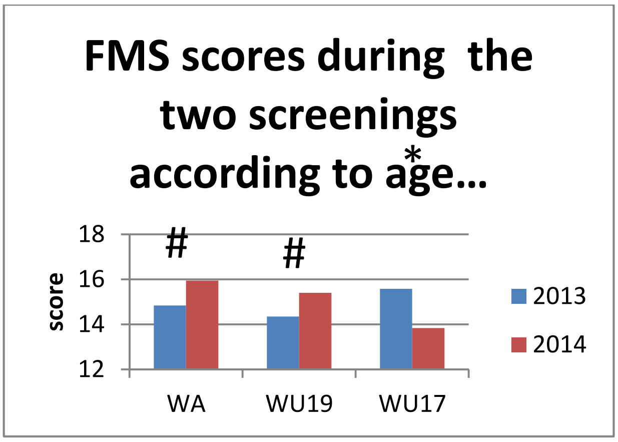

***Figure** 1*

*Level of statistical significance in total FMS™ scores between the screenings in 2013 and 2014, respectively to age category (p<0.10); * (p<0.01)*

We have examined the effect of prescribed/recommended corrections throughout the monitored year in the group of players, who received the program in 2013, and we have compared the results of these subjects. Firstly irrespective to the category they belong. In this group (n = 30) we found significant improvements ($p<0.05$), where the total average score was 14.43±2.30 vs. 15.5±2.11 in 2013 and 2014, respectively. Cohen´s d was calculated as 0.50 what suggests a moderate effect size, probably because of the need of larger sample size. Similar findings were also reported by Kiesel et al. (2011), where the screening scores improved after a standardized 7-week long off-season intervention program in professional football players. The main positive effect of the program was associated with more players above the cut-off score (14 points) at post test (41 vs. 31).

Our program, or the time between the two screenings lasted more than 7-weeks, so our players worked with the correction program for a longer time, what includes not just a period of off-season, but also pre- and competitive season. Competitive season could be an important factor alone when deals with FMS™. Sprague et al. (2014) examined the effect of complete competitive season in soccer and volleyball on FMSTM scores. The study shows significant changes during the season, with respect to individual tests scores and to the number of asymmetries. The participants of this research were males at collegiate level what are inconsistent with our study. However, according Schneiders et al. (2011) there are no significant differences in total scores between males and females in FMS™. The results of the screening are therefore probably more related to sport specialization than gender.

When we separate this group again, but this time according to the age category, they belong, we get different results. The two older/higher categories (WA, WU19) achieved significant improvements ($p<0.05$), while the youngest (WU17) decrement (15.36±1.50 vs. 15±2.57) although on non-significant level (Figure 2).

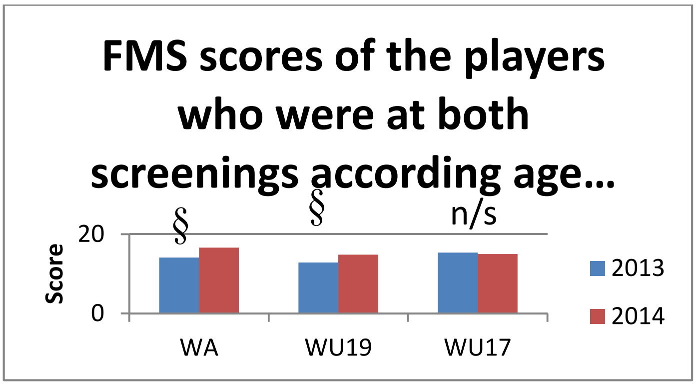

Figure 2

Level of statistical significance of total FMS™ scores in the group of players who took part in both screening procedures, respectively to their age category. is § (p<0.05); n/s (non-significant)

In this case it is important to note, that despite the non-significant decrement in the WU17, their average total score was still above the total score of WU19 and also the crucial cut-off score (14<). It is also possible, that because of the higher average initial scores, which were higher than at WA and WU19, the players probably do not respect the prescribed correction in extent as the players from older categories, although this may be considered just as a speculation. It is more important to note, that the average age of our youngest category was under the age of 15, despite the possibility to have older players in the team (nearly more than 2 years). In this case, it is likely, that the relatively high initial scores of this group were also associated with their age related biological advantages, like higher flexibility and relative strength (Teyhen et al., 2014).

In addition Grygorowicz et al. (2013) found differences in FMS™ scores between female soccer players from different sports level, where the professional players had significantly higher total score, than players from the first division (16.0±0.46 vs. 15.5±0.58, respectively). In our study, we could consider the older age category as a higher sports level. In this case, there is an agreement with our results, where the oldest category performs at the second screening better than the two younger categories.

Similarly Minthorn et al. (2014) also emphasize the importance of appropriate movement patterns in sports and mainly during high intensity activities, which could be improved by individualized training program based on FMS^{TM} results.

Conclusion

The findings of this study show, that there are significant differences between the given categories of national women´s football teams in the meaning of total score achieved in FMS^{TM} during two screening occasions through one year. Statistical analysis revealed, that in the older categories (WA, WU19) the tendency is to perform better during the required movement tasks of the screening, while the youngest category (WU17) had tendency to perform worse. The cause of this is probably, that some players drop-out or move up to the higher categories, so the composition of the teams changed during the year. This is the most evident in the group of the youngest players, where the new players never met FMS^{TM} and although does not recieve recommendations from the fitness coach before. This could mean that some of the FMS^{TM} experienced players moved to the older categories or drop-out, while the novices were tested in 2014 for a first time. This was supported with our statistical findings that show improvement in every category (WA, WU19) except WU17. To isolate this effect and to demonstrate the effectiveness of prescribed correction program, we compared the results of players, who were on both occasions of screening procedures. These result showed significant improvements ($p<0, 05$), what confirmed our assumption, that the prescribed program will be effective. For these reasons, we could recommend using FMS^{TM} during the year as a useful tool to detect injury risk, while the specifically designed individual corrections can effectively affect the screening results, and therefore remove weak links of the players and decrease injury potential. During this process the same emphasis must be imposed on the specificities of given categories, regarding to their calendar, biological and sport age, performance level or FMS^{TM} experience, what could help to incorporate it to the process of player selection/care in a more reliable manner.

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