Rev Andal Med Deporte.. ; **18(2)**: *49-53*

Revista Andaluza de
Medicina del Deporte

https://www.juntadeandalucia.es/deporte/ramd

Originales

Features of limitations of motor functions of russian football players of reserve teams. Seven-year longitudinal study

Denis Golubev Vyacheslavovich[a], Angel Aceña Rodríguez[b,*], Marina Schennikova Yurievna[c]

[a] *Sports researcher, Lesgaft National State University of Physical Education, Sport and Health, Russia.*
[b] *Professional physical training coach, Football Club Udinese, Italy.*
[c] *Associate professor, Lesgaft National State University of Physical Education, Sport and Health, Russia.*

ABSTRACT

A small amount of research related to the assessment of the limitations of the motor functions of Russian football players in the sports reserve has shaped the desire of the authors to provide detailed information about their work experience, observations and measurements. **Objective**: The aim of the study is to investigate the limitations of the motor functions of football players of different ages using functional movement assessment (FMS). **Methodology:** We studied football players from the North-Western region of the Russian Federation, representing the teams of the Department of Youth football development of football club Zenit, St. Petersburg, the regional football training center of football club Almaz-Antey, St. Petersburg. All subjects were divided into 3 age categories (10-12 years old n=140, 13-15 years old n=167, 16-18 years old n=112). The Functional Movement Screen (FMS), represented by 7 test exercises, was used in the study. **Results:** The results of the study showed the bi-directionality of the trend dynamics of the overall assessment of FMS testing. The positive dynamics reflects an increase in the number of players with significant motor function limitations (overall FMS score<14 points), while the negative dynamics of the overall score (FMS>14 points) demonstrates a downward trend in the number of players who do not experience dysfunction during the FMS test exercises. **Conclusions:** The functional disadvantages of the motor functions of the studied football players are represented by cumulative signs, primarily limited mobility of the trunk, upper girdle and thoracic spine. A low level of functional mobility of the hip joint and knee joint stability has been established. The asymmetrical position of the legs, pelvis and shoulders was revealed.

Keywords: football; sports reserve; functional assessment of movement; health; motor functions; motor limitations.

Características de las limitaciones de las funciones motoras de futbolistas rusos en equipos reserva. Estudio longitudinal de siete años

RESUMEN

Una pequeña cantidad de investigación relacionada con la evaluación de las limitaciones de las funciones motoras de los futbolistas rusos en la reserva deportiva ha dado forma al deseo de los autores de proporcionar información detallada sobre su experiencia laboral, observaciones y mediciones. **Objetivo:** El objetivo del estudio es investigar las limitaciones de las funciones motoras de jugadores de fútbol de diferentes edades mediante la evaluación funcional del movimiento (FMS). **Metodología:** Estudiamos a jugadores de fútbol de la región noroeste de la Federación de Rusia, representando a los equipos del Departamento de desarrollo de fútbol Juvenil del club de fútbol Zenit, San Petersburgo, el centro regional de entrenamiento de fútbol del club de fútbol Almaz-Antey, San Petersburgo. Todos los sujetos se dividieron en 3 categorías de edad (10-12 años n = 140, 13-15 años n=167, 16-18 años n = 112). En el estudio se utilizó la Pantalla de Movimiento Funcional (FMS), representada por 7 ejercicios de prueba. **Resultados:** Los resultados del estudio mostraron la bidireccionalidad de la dinámica de tendencias de la evaluación general de las pruebas de FMS. La dinámica positiva refleja un aumento en el número de jugadores con limitaciones significativas de la función motora (puntaje general de FMS<14 puntos), mientras que la dinámica negativa del puntaje general (FMS>14 puntos) demuestra una tendencia a la baja en el número de jugadores que no experimentan disfunción durante los ejercicios de prueba de FMS. **Conclusión:** Las desventajas funcionales de las funciones motoras de los jugadores de fútbol estudiados están representadas por signos acumulativos, principalmente movilidad limitada del tronco, cintura superior y columna torácica. Se ha establecido un bajo nivel de movilidad

* Corresponding Author: Angel Aceña Rodriguez, Professional physical training coach, Football Club Udinese, Italy, (0000-0002-7189-9581) – ORCID. acroan82@gmail.com (Angel Aceña Rodríguez)

https://doi.org/10.33155/ramd.v18i2.1205
ISSN-e: 1888-7546/

funcional de la articulación de la cadera y estabilidad de la articulación de la rodilla. Se reveló la posición asimétrica de las piernas, la pelvis y los hombros.

Palabras clave: fútbol; reserva deportiva; valoración funcional del movimiento; salud; funciones motoras; limitaciones motoras.

Características das limitações das funções motoras de futebolistas russos da reserva desportiva. Estudo longitudinal de sete anos

RESUMO

Uma pequena quantidade de pesquisas relacionadas à avaliação das limitações das funções motoras dos jogadores de futebol russos na reserva esportiva moldou o desejo dos autores de fornecer informações detalhadas sobre sua experiência de trabalho, observações e medições. **Obejetivo**: O objetivo do estudo é investigar as limitações das funções motoras de jogadores de futebol de diferentes idades usando a avaliação funcional do movimento (FMS). **Metodologia**: Estudamos jogadores de futebol da região noroeste da Federação Russa, representando as equipes do Departamento de desenvolvimento de futebol Juvenil do Clube de futebol Zenit, São Petersburgo, o centro regional de treinamento de futebol Do Clube de futebol Almaz-Antey, São Petersburgo. Todos os indivíduos foram divididos em 3 categorias etárias (10-12 anos n = 140, 13-15 anos n=167, 16-18 anos n = 112). No estudo foi utilizada a tela de movimento Funcional (FMS), representada por 7 exercícios de teste. **Resultados**: Os resultados do estudo mostraram a bidirecionalidade da dinâmica de tendências da avaliação geral dos testes de SFM. A dinâmica positiva reflete um aumento no número de jogadores com limitações significativas da função motora (Pontuação geral da SFM<14 pontos), enquanto a dinâmica negativa da Pontuação geral (SFM>14 pontos) demonstra uma tendência de queda no número de jogadores que não apresentam disfunção durante os exercícios de teste da SFM. **Conclusão**: As desvantagens funcionais das funções motoras dos jogadores de futebol estudados são representadas por sinais cumulativos, principalmente mobilidade limitada do tronco, cintura superior e coluna torácica. Um baixo nível de mobilidade funcional da articulação do quadril e estabilidade da articulação do joelho foi estabelecido. A posição assimétrica das pernas, pelve e ombros foi revelada.

Palavras-chave: futebol; reserva esportiva; avaliação funcional do Movimento; Saúde; funções motoras; limitações motoras.

Introduction

Functional movements are an integral part of human daily activities that involve multiple joints and a significant amount of body musculature[1,2]. Functional movements are theoretically precursors to more complex forms of bodily movements, and assessments usually include measurements of postural movement control, stability, flexibility, neuromuscular coordination, and balance[3].

Functional Movement Assessment (FMS) is a simple tool for monitoring motor function limitations among both youth and adults, proposed by American physiotherapists Gray Cook and Lee Burton. FMS is an affordable and promising method for detecting dysfunctional, asymmetrical and painful movements in football reserve players[4]. Earlier studies have shown that complex motor actions of football players performed during training or competitive activities cause a redistribution of loads in the links of the kinematic chain, forming a muscular imbalance of the body[5]. Australian researchers studying young football players have found that the dysfunctionality of the adductor muscles of the thigh strongly correlates with increased pain in the groin area[6]. It was found that football players who scored less than 14 points on the FMS were more likely to be injured than those who scored more than 14 points[7].

Given the small amount of research studies related to the assessment of the limitations of the motor functions of Russian football players in the sports reserve, this study sought to provide detailed information about their work experience, observations and measurements. The aim of the study is to investigate the limitations of the motor functions of football players of different ages using a functional assessment of movement.

Materials and methods

Participant

The sample consists of football players from the North-Western region of the Russian Federation, representing the teams of the Department of Youth football development of football club Zenit, St. Petersburg, the regional center for training young football players of football club Almaz-Antey, St. Petersburg. All the subjects competed in football competitions at the regional and federal levels under the auspices of the Russian Football Union for seven playing seasons. (2017-18, 2018-19, 2019-20, 2020-21, 2021-22, 2022-23, 2023-24).

The subjects were divided into 3 age categories (10-12 years old, body length 171±2.3 cm, body weight 51.6±2.71 kg, n=140, 13-15 years old, body length 169.72±1.5 cm, body weight 64.6±2.71 kg, n=167, 16-18 years old, body length 179.6±3.1 cm, body weight 74.6± 1.7 kg, n=112). All players have been notified of the purpose of this study. The written informed consent was signed by the players and their parents.

Test stimuli

The functional assessment of movement test is represented by 7 test exercises (Figure 1): Deep Squat, Hurdle Step, In-Line Lung, Shoulder Mobility, Active Straight Leg Raise, Push-up, Trunk Stability. The evaluation system was implemented according to the recommendations of the authors-developers[1]. Score 3 – absolutely correct motor performance, without compensatory movements, loss of balance, etc.; Score 2 – the test is performed with compensatory movements or in a light version; Score 1 – the test is not completed or incomplete; Score 0 – pain during the test. Note that the maximum possible score for this testing system is 21. The players completed three attempts in each test and recorded the worst result. In FMS testing, there are two verification tests that are evaluated using the binary system "positive/negative" (+/-); if the verification test is

positive (the athlete feels pain), the corresponding test is evaluated as zero (0).

Before performing the FMS test, the players performed a 10-minute warm-up:

5 minutes of low-intensity running with general preparatory exercises,

5 minutes of exercises aimed at dynamic flexibility.

Figure 1. Physical exercises used in Functional Movement Assessment (FMS)

The set of equipment for the FMS test is represented by a measuring board 150x10x3 cm, a bodyboard, a tape measure, and a height-varying barrier (Figure 2).

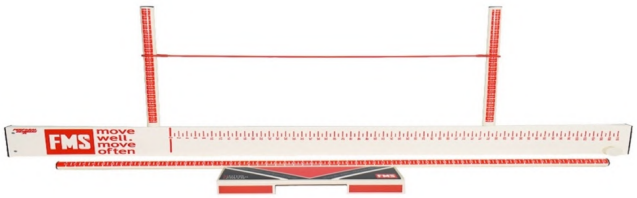


Figure 2. Functional Movement Assessment (FMS) equipment

Statistical analysis

The Kolmogorov-Smirnov test was used to determine whether a sample (sample size > 50 samples) corresponded to a normal distribution. ANOVA variance analysis was used to determine the difference in group averages between football players of different ages. The significance of the differences was determined using the Tukey criterion ($p<0.05$). All tasks were solved in the statistical application program "STATISTICA 12.0" and the program «Microsoft Excel 2017»[8].

Results

Figure 3 shows the results of the overall FMS assessment for seven test exercises, which show that the number of football players with pronounced motor function limitations is significantly higher than the number of football players without them. At the age of 10-12 years, this difference is 56% ($p=0.013$), at 13-15 years 38% ($p=0.638$), at 16-18 years 64% ($p=0.015$) (Figure 3). The trend lines (Figure 3) demonstrate the bi-directionality of the trend dynamics of the overall FMS assessment. Positive dynamic changes are defined by a gray trend, characterizing a progressive increase in the number of football players with significant motor limitations (overall FMS score < 14 points), in turn, negative dynamic changes in the overall FMS score > 14 points are a black trend, forming an idea of a downward trend in the number of players who do not experience dysfunctions during the FMS test exercises (Figure 3).

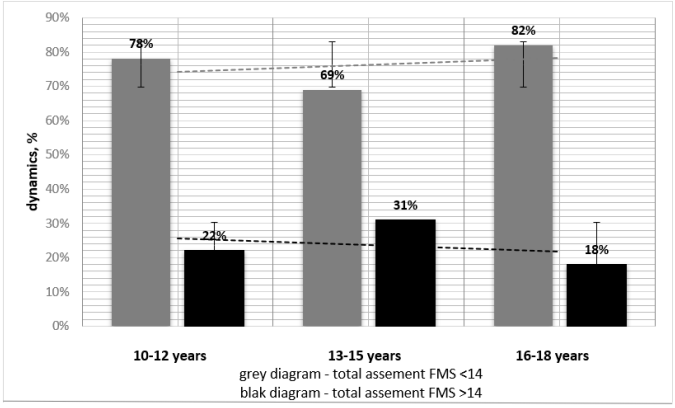


Figure 3. Comparative analysis of the limitations of the motor functions of football players of different ages according to the general FMS.

Figure 4 shows the graphical differences between the seven FMS test exercises. A comparative analysis of the scores in the "Deep Squat" test for football players of different ages determined the dynamics of their decline, namely, for 10-12-year-old players, the values decreased by 30%, 13-15-year-olds by 36%, 16-18-year-olds by 37.7%, the differences were not significantly significant ($p<0.05$). Analyzing the results of the FMS test exercise "Hurdle Step right and left side", it was revealed that the football players in this sample have a muscular imbalance, which is represented by a vector displacement of the body to the right relative to its vertical axis (Figure 4). At the age of 10-12 years, the performance of stepping over the barrier with the left foot compared with the right foot deteriorated by 3% ($p=0.011$), 13-15 years 7% ($p=0.604$), 16-18 years 4% ($p=0.013$). The effectiveness of the FMS test exercise "In-Line Lung right and left sides" diagnosed the motor limitations of the right side (Figure 4). Statistical calculations have established that football players aged 10-12, 13-15 and 16-18 perform this assessment task better when the right foot is in front of the left foot by 4.1% ($p=0.798$), 1.6% ($p=0.014$) and 3.7% ($p=0.015$). One of the most difficult FMS test tasks for the studied football players is "Shoulder Mobility right and left sides". This diagnostic tool detected a marked decrease in the scoring values in the test exercise when positioned from the top of the left hand, from the bottom of the right (Figure 4). Dysfunctionality in the right and left shoulder joints was recorded at the following levels: 1.1% ($p=0.472$) in football players aged 10-12 years, 7% ($p=0.634$) in football players aged 13-15 years, 4.3% ($p=0.011$) in football players aged 16-18 years. Examining the motor limitations in the FMS test "Active Straight Leg Raise (right and left side)", we came to the conclusion that in football players 10-12 years old, the height of the right leg is lower than the height of the left leg by 15.6% ($p=0.011$), and, conversely, in football players 13-15 and 16-18 years old, the height of the left leg is lower than the height of the left leg. lower than the right-hand elevation 2.5% ($p=0.644$) and 8.3% ($p=0.452$), respectively. When performing the "Trunk Stability Push-Up" task, significant decreases were detected in football players aged 10-12 (Figure 4), deviations from the estimated guideline were 23.2% ($p=0.018$), in football players aged 13-15 and 16-18, the score values differ slightly, 12.1% ($p=0.378$) and 13.4%. ($p=0.412$). In the test "Rotary Stability right and left sides", the deterioration of motor functions in football players aged 10-12 years was determined by 31.4% ($p=0.871$), 13-15 years 32.4% ($p=0.016$), 16-18 years 36.4% ($p=0.014$).

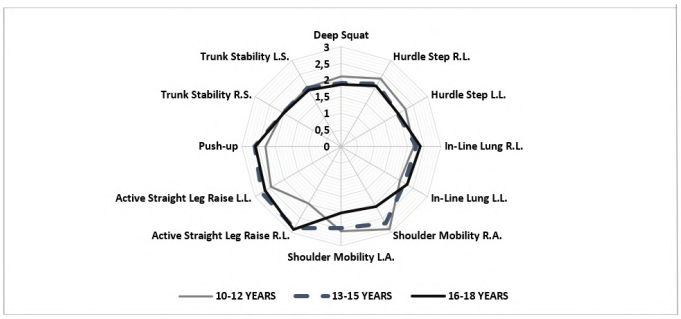


Figure 4. Comparative analysis of the limitations of the motor functions of football players according to 7 test exercises for functional movement assessment.

Discussion

Previous studies and a number of systematic reviews on the study of FMS have shown that a cumulative score below 14 can be identified as a criterion for an increased risk of acute and chronic injurie[2,3]. The age of football players aged 13-15 is destabilizing in the formation of basic motor functions, which is in some way consistent with the results of other authors, who associate an imbalance in flexibility, inefficiency of movement mechanics, and various compensations for motor functions with the phenomenon of "adolescent awkwardness" - a time period of physical development of an athlete, during which the musculature lags behind in size and development. strength, while the trunk and limbs have already increased significantly[9].

We have attempted to visualize the age-related limitations of the motor functions of football players aged 10-18, which are presented in Table 1. It is clearly seen that almost all FMS test exercises are performed by football players experiencing significant functional deficiencies, regardless of their age (Table 1). In the test exercise "Deep Squat", the age-related features of the limitations of motor functions in football players are similar and are determined by uncoordinated movements of the limbs, there is an excessive tilt of the upper body (Figures 1, Table 1), discomfort is noted in the lumbar (5 vertebrae L1-L5) and sacral regions (5 vertebrae S1-S5). Figures 2, Table 1 show the exercise "Hurdle Step right and left side", we came to the conclusion about the destabilization of the position on one leg and the tremor of the knee joint of the supporting leg. A low level of hip joint mobility was determined at the time of stepping over the barrier and an asymmetric pelvic position was observed (Figures 2, Table 1). The photographs of the "In-Line Lung right and left side" exercise (Figures 3, Table 1) demonstrate the forward tilt of the body and the separation of the heel zone of the foot in front of the standing leg from the surface of the measuring device when performing a downward movement during a lunge, which indicates low elasticity of the calf muscles and the anterior surface of the thigh. Note that the state of tremor is in maintaining the stability of a given pose and during leg extension in the knee and hip joints. The features of motor limitations during the exercise "Shoulder Mobility, right and left sides" are accompanied by a state of tension in the thoracic and anterior bundles of the deltoid muscles (Figures 4, Table 1). The subjects reported discomfort in the scapulocoracic joint and cervical spine (7 vertebrae, C-1-C7). Figures 5, Table 1 visualize the dysfunctions in the test exercise "Active Straight Leg Raise. Two unambiguous features of motor limitations were observed - a low degree of elasticity of the soft tissues of the posterior surface of the thigh and a state of overstrain of the hamstrings (Figures 5, Table 1). When the leg is in an upright position, most players experience unpleasant sensations (tightness, tightness) in the lower back, which, when palpated by sports medicine specialists, is defined as muscle tension. When performing the Trunk Stability Push-Up test exercise, the players observed a zigzag spine, which causes weakness of the stabilizer muscles, namely the deep core muscles (Figures 6, Table 1). Low results in the "Rotary Stability right and left side" test are characterized by a lack of coordination of the movement of the upper and lower extremities along the entire kinematic chain of the musculoskeletal system, indicating a functional weakness of the stabilizer muscles. During this exercise, an unstable position of the hip joint was observed with mixing in one side relative to the horizontal plane (figures 7, Table 1).

Conclusion

A comparative analysis of the performance of test exercises for functional assessment of movement in football players aged 10-18 revealed significant impairments in the motor functions realized by the musculoskeletal joints and bone structure of the musculoskeletal system. The functional disadvantages of the motor functions of football players are represented by cumulative signs, primarily limited mobility of the trunk, upper limb girdle and thoracic spine. A low level of functional mobility of the hip joint and knee joint stability has been established. The asymmetrical position of the legs, pelvis and shoulders was revealed. This evidence provides some practical recommendations; FMS in football players aged 10-18 should be carried out systematically 2-3 times a year, using photos and videos in order to track more accurate dynamics of progress / regression of players.

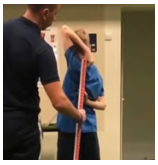
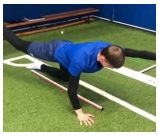
Authors' contributions

Golubev Denis Vyacheslavovich - idea, preparation and conduct of research, translation of the research into English, statistical analysis. Acena Angel Rodriguez - formation of research results, translation of the research into English, statistical analysis, interaction with the editorial board of the journal. Schennikova Marina Yurievna – idea, expert evaluation and preparation of the study.

References

1. Cook G, Burton L, Hoogenboom B Pre-participation screening: the use of fundamental movements as an assessment of function—part 1. North American journal of sports physical therapy, 2006; 1(2): 62–72.
2. Cook G, Burton L, Hoogenboom B Pre-participation screening: The use of fundamental movements as an assessment of function–Part 2. North American journal of sports physical therapy, 2006; 1(3): 132.
3. Duncan M, Stanley M., Leddington Wright, S The association between functional movement and overweight and obesity in British primary school children. Sports Medicine, Arthroscopy, Rehabilitation, Therapy Technology, 2013; 5: 1-8.
4. Chalmers S, Debenedictis T, Zacharia A et al. Asymmetry during Functional Movement Screening and injury risk in junior football players: A replication study. Scandinavian journal of medicine science in sports, 2018; 28(3): 1281-1287.
5. Daneshjoo A, Rahnama N, Mokhtar AH, et al. Bilateral and unilateral asymmetries of isokinetic strength and flexibility in male young professional soccer players. J Hum Kinet, 2013, 36: 45–53.
6. Fuller J, Chalmers S, Debenedictis T et al. High prevalence of dysfunctional, asymmetrical, and painful movement in elite junior Australian Football players assessed using the Functional Movement Screen. Journal of Science and Medicine in Sport, 2017; 20(2): 134-138.
7. Kiesel K, Plisky P, Voight M Can serious injury in professional football be predicted by a preseason functional movement

Table 1. Features of limitations of motor functions of football players aged 10-18 years when performing FMS test exercises.

N°	An estimated assessment	10-12 years	13-15 years	16-18 years
1				
2				
3				
4				
5				
6				
7				

screen? North American journal of sports physical therapy, 2007, 2: 147–158.

8. Hopkins WG, Marshall SW, Batterham AM et al. Progressive statistics for studies in sports medicine and exercise science. Medicine Science in Sports Exercise, 2009, 41(1): 3-7.
9. Clarke L The Effects of Physical Growth on Gait Stability in Adolescent Athletes. 2022.