

RELATIONSHIP BETWEEN FUNCTIONAL MOBILITY AND AGILITY TESTS IN FEMALE HANDBALL PLAYERS

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Abstract

Handball is one of the most popular sports worldwide. Although it's highly popular, there is a lack of knowledge about functional movement capacity, especially for female players. The aim of this study is to determine the relationship between functional mobility (Functional Movement Screening - FMS) and performance in agility tests (T-test, 505 test and 6x4 test) in female handball players. The sample of participants consisted of 15 healthy handball players from the "Hrasnica" female handball club. The mean FMS scores of handball athletes were 15.67 ± 2.44 . The results of this study showed that there was a statistically significant moderate and large correlation between the FMS and agility (from $r = -.632$, $P = 0.038$). Handball is a risky sport for injuries; therefore, FMS can be used to detect deficiency (functional) before performance training

Keywords: FMS; asymmetry, movement; movement quality; athletes

1. Introduction

Today, handball is one of the most popular and widespread sports games. Today's handball implies a set of fast and extremely complex movements and actions, solving problems in a given situation, which together indicate the level of activity intensity (Bulava et al. 2013). For this reason, coaches need tests to easily but effectively determine the condition of athletes and assess the quality of movement. This type of testing refers to functional movement, which is defined as the ability to perform locomotor, manipulative and stabilizing actions while maintaining control along the kinetic chain (Čaušević et al. 2017). Functional Movement Screening (FMS) was designed by Gray Cook and Lee Burton to assess movement functionality consisting of a total of 7 tests (Cook et al., 2014). Due to the growing interest of researchers in the use of FMS tests, the question arises as to whether they are related to the performance in agility tests in handball players. Given that agility as an ability is crucial for success in a large number of team sports, including handball, this study aims to determine the relationship between functional mobility and performance in agility tests in female handball players.

2. Materials and methods

Participants

The sample of respondents consisted of 15 female handball players from ŽRK "Hrasnica", which plays in the Premier League of Bosnia and Herzegovina. The handball players are aged 18-23 and have at least 4 years of experience in handball. The criteria for including players in the testing were that all players were healthy and that there were no injuries that could affect the achievement of FMS results and agility.

FMS protocol

In total 7 FMS test werw analyzed (deep squat, hurdle step, in-line lunge, shoulder mobility, active straight.leg reise, trunk stability push-up and rotary stability) (Džeko and Milanović, 2010). FMS scoring was very simple and was performed using the ordinal scale from 0 to 3, which means that ordinal scale containde 4 values, 0 (pain was reported during the movement), 1 (the inability to perform the movement), 2 (minor deficits or perfect performance with modifications) and 3 (perfect performance) (Čaušević et al. 2017). The maximun score was 21. Three experienced evaluators gave grades and the result was an average of three grades. The higher the score the better the result.

Agility measurements

Agility tests (T-test, 6x4 test and 505 test) were done according to the recommendations by Grbović, 2013 and Čaušević et al. 2021. In order to be very objective and reliable test fordetermination subjects had 2 attempts interceptedby 3-minute rest between attempts.

Statistical Analysis

Results are presented as means and standard deviations (M and SD). All data analyses were done using SPSS 22.0 (IBM Corp., Armonk, New York, US). The relationships between agility and individual FMS tests ere analyzed usingthe Pearson Correlation Analysis (r), with the level of statistical significance set at $p \leq 0.05$.

Results

Descriptive parameters of FMS tests and agility tests are shown in Table 1. Within Table 2, the results of the correlation matrix are noticeable, which shows moderate and large values of correlations within FMS tests and agility tests in handball players.

Table 1. Results of FMS and Agility tests

Tests	N	Mean	Std. Deviation
Deep squat	15	2.20	.414
Hurdle Step	15	1.93	.704
In-Line Lunge	15	1.93	.704
Shoulder mobility	15	2.33	.617
Active Straight-Leg Raise	15	2.67	.488
Trunk Stability Push-Up	15	1.80	.414
Rotary Stability	15	2.33	.617
TOTAL	15	15.67	2.44
T-test	15	12.16	.868
505 test	15	5.06	.295
6x4 test	15	10.42	.970

Table 2. FMS and Agility correlation results

Tests	Deep squat	Hurdle Step	In-Line Lunge	Shoulder mobility	Active Straight-Leg Raise	Trunk Stability Push-Up	Rotary Stability	Total
T-test	-.386	-.530	-.644	-.063	-.515	-.028	-.266	-.635
505 test	-.470	-.583	-.487	-.017	-.538	-.128	-.187	-.632
6x4 test	-.432	-.772	-.637	-.015	-.663	-.144	-.034	-.638

p < 0,05

3. Discussion

This study aimed to determine the relationship between functional mobility and performance in agility tests in female handball players. The average total FMS score for female handball players was 15.67, while according to Schneiders et al. 2011, the average score for young active people is between 14.4 and 15.7. Such a finding is in line with expectations because they are still active athletes. Those female handball players who do not train so actively have weaker results. The FMS test is often used to assess the risk of injury, taking a score of ≤ 14 as an indicator of a person's poor fitness and body shape. Bonazza et al. 2017, found that a score of ≤ 14 posed more than twice the risk for musculoskeletal injuries. The weakest results were achieved in the test of the stability of the rotational muscles of the torso, where no handball player achieved the maximum score (all received less than 3 because they failed to raise the same arm and leg, but lifted, for example, left leg and right arm).

The stability test of the rotational muscles of the trunk is specific concerning the other six: Cook et al. 2010 in the FMS handbook state that it is extremely difficult to achieve a maximum score, commenting that when articulating the FMS protocol it was questionable whether the test would be in practical function of the overall score for the general population. Minick et al. In 2010, found that one in five of the 64 professional athletes on that test received a grade of three. Schneiders et al. 2011, proved a study on a sample of 209 active athletes who found that only two respondents achieved the maximum score on the said test. There is also a difference in FMS tests between different age structures. A significant difference between the age categories was obtained in the work of Loudon et al. 2014 on the sample of athletes, where the juniors achieved significantly better results in the step on the line, overstep and push-ups. In this paper, female handball players between the ages of 18 and 23 were tested, and no difference was shown between them, here it was even found that older players achieved better results than younger ones.

A study conducted by Grbović, V. M., 2013 on a sample of 162 adults and physically active students of the Faculty of Sports and Physical Education aged 20-25, shows that the arithmetic mean of the T-test is 9.70 seconds, while in this study the average value of this test is 12.16 seconds, which can be explained by the fact that men who achieve better results than girls also participated in Grbović's research.

Based on the analysis of the obtained results, it can be concluded that tests for assessing shoulder mobility are not so important in agility tests. In almost all-female handball players, it was noticed that there is a difference between the left and right hand, not the shooting hand had lower values. A low result of shoulder mobility for handball players can be expected because they have a characteristic adaptation of the shooting arm called glenohumeral deficit of internal rotation (GRID), which is also characteristic of throwing and shooting sports (Almeida et al., 2013).

When analyzing the results of deep squat, the length of the femur has a great influence. If a person has a longer femur, it will be very difficult for him to maintain an upright position, regardless of the number of mobility exercises you give him. The femur averages 26% of total body height and is measured from the great trochanter to the lateral epicondyle of the femur. If the value is lower, the person leans toward the longer torso, and if it is higher toward the longer femur (Nuckols, 2013).

In general, the authors recommend FMS as a reliable method of assessing the dynamic stability of athletes in a particular sport. This may benefit therapists working in sports to reduce the possibility of injury (Kiesel et al., 2007). However, some authors warn that it is not justified to use FMS as the only method of assessing injury risk in specific groups, such as high school athletes (Bardenett, et al., 2015). FMS can serve as a measure of evaluation of individual and targeted training and as an index of the quality of athlete performance (Slodownik et al., 2014).

FMS is not only a good method of assessment but also a good set of exercises that work to improve dynamic stability and thus prevent injury. The limitation of the conducted research is primarily an insufficiently large sample of respondents, given that only 15 female players were tested. A large number of agility tests were also not used, and the tests used tested only rectilinear motion.

In further research, it is recommended to involve more participants to make the results more relevant and to apply specific tests that would indicate potential and existing problems of athletes.

4. Conclusion

The results show that there is a statistically significant association between joint mobility and performance in agility tests in handball players because it was found that mobility of the lower extremity joints achieved high correlation values with agility tests, which indicates that the overall set of agility tests depends on performance in joint mobility tests. Shoulder mobility tests have not shown much association with agility tests. In female handball players, the more dominant hand is always more developed, while in the lower extremities it usually depends on the playing position as well as morphological characteristics. The FMS test is used to assess the condition of athletes, as well as to prevent the risk of injury. The greatest association between mobility and agility was demonstrated in overstep test. This test assesses the bilateral functional stability and mobility of the hips, knees and ankles, which are most important for handball. The worst results were achieved in the test of the stability of the rotational muscles of the torso, where no female handball player achieved the maximum score.

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