EXAMINATION OF THE EFFECTS OF 8-WEEKS CORE STABILIZATION TRAINING ON FMS (FUNCTIONAL MOVEMENT SCREEN) TEST SCORES APPLIED TO A 12-14 AGE GROUP OF MALE BASKETBALL PLAYERS

Özgür Doğan¹, Seyfi Savaş², Ali Zorlular³
¹Gazi University, Health Science Institute Training and Movement Science and Istanbul Gelisim University, Exercise and Sports Science, Turkey
²Gazi University, Sports Science Faculty, Turkey
³Gazi University, Health Science Faculty, Turkey

Abstract:
The core area is made up of muscles, which surrounds the human body like a corset and acts in the stabilization of the body. Core stabilization training can strengthen muscles in this area and provide better stabilization. The purpose of this study is; investigate of the effect of 8-weeks core stabilization training on the FMS (Functional Movement Screen) test scores of 12-14 age group male basketballs. 27 healthy athletes (Experiment Group n=14, 13.14±0.663 ages – Control Group n=13, 13.15±0.801 ages) participated in the study. The experimental group was given 8 weeks to core stabilization training. Before the training, the Functional Movement Screen test was applied to the Pre-post test and the scores were evaluated. Statistical analysis SPSS 22 software package was performed taking into account the confidence parameter (p<0.05). Median and IQR values were used in the descriptive statistics because the data were not normally distributed. Statistical significance was analyzed between FMS (Functional Movement Screen) pre-post test scores according to the analysis results. There was no significant difference (r:0.59; p<0.05) in the pre-post FMS values for the Control Group. When the FMS values were compared for the Experimental Group, a significant difference was found (r:0.42; p<0.05). This study has achieved the result that FMS developed the movement patterns and the performance of the performance athletes increased the quality of the functional movements. Results that are more accurate can be achieved with a study conducted with a larger sample group.

The article has been presented with the same name at 15th International Sport Sciences Congress on November 15-18, Antalya, Turkey.

¹Correspondence: email ozgurdogan90@gmail.com, ozgdogan@gelisim.edu.tr

Copyright © The Author(s). All Rights Reserved.
© 2015 – 2018 Open Access Publishing Group
Keywords: basketball, core, stabilization, functional movement screen

1. Introduction

The core stabilization is lumbar spine and the ability to stabilize the pelvis area are a function of strong, well-synchronized trunk muscles (Kong, Cho and Park, 2013). A stable spine forms the basis of functional movements, is important for athletic performance (Kong et al., 2013; Leetun, Ireland, Willson, Ballantyne, and Davis, 2004), and is a postural control and balance aids (Oliver and Adams-Blair, 2010).

Typically, a coach or physical educator would define core stability as a level of strength or endurance of the abdominal musculature. But the core, described as the lumbopelvic-hip complex, comprises many more muscles than just the abdominals (Wilson, Dougherty, Ireland and Davis, 2005).

One of the most important priorities for all athletes should be to ensure adequate conditioning of the core musculature. In recent years, there has been considerable literature in both the popular media and scientific journals on the importance of these muscles for effective movement and sports performance (Willardson, 2014).

One of the key issues in prescribing appropriate exercises for the core musculature is establishing a person’s level of core muscle function, including the ability to stabilize the trunk and to move the trunk (Willardson, 2014).

Functional Movement Screen (FMS), an increasingly popular test battery, is designed to evaluate body and core strength. It consists of 7 basic patterns of motion; Each of the 7 movements is scored between 0 and 3 based on specific objective criteria (Cook, Burton and Hoogenboom, 2006; Cook, Burton, Kiesel Rose and Bryant, 2010).

2. Methods

The experimental method was included in the research. Twenty-seven healthy male athletes participated in the study (Experimental Group n=14, 13.14 ± 0.663 years old - Control Group n=13, 13.15 ± 0.801 years old). The research population: 12-14 age group basketball in Turkey, the sample of the Iståbol Sports Club in Istanbul actively playing basketball 12-14 age group constitutes 27 volunteer basketball players.

Experimental method; 8 weeks of core stabilization training was given to the experimental group. Scores were assessed by performing Functional Movement Screen test before and after training. SPSS 22 data program was used for statistical analysis.

The difference between pre-test and post-test arithmetic mean of experiment and control groups (p <0.05) was evaluated by taking the confidence coefficient into account. Median and IQR values were used in the descriptive statistics because the data were not normally distributed. The Wilcoxon analysis was used to examine the difference between pre-test and post-test.
2.1 FMS Scoring Method
A. Scoring
The FMS is comprised of seven separate tests, and each test is ranked with a score from zero to three with a high score corresponding to proper movement. A score of three indicates the movement is complete, a score of two demonstrates some level of compensation, a score of one suggests the pattern is incomplete, and a score of zero indicates pain is present (Cook et al., 2010).

B. Equipment
The required equipment includes a four-foot dowel rod, two smaller dowel rods, a two-by-six board, and an elastic band. A picture of the equipment is provided in Figure 1.

![Figure 1: The four-foot dowel rod, two smaller rods, two-by-six board, and elastic band are pictured to the left](image)

C. The Seven Tests
The following explains the purposes and implications of each of the seven FMS tests. A written description is provided for the tests and clearing exams. A scoring rubric is listed in Table 1.

| Table 1: A Rubric Containing the Written Descriptions of Scoring Guidelines for the Individual FMS Tests |
|---------------------------------------------|-----------------|-----------------|
| II                                         | I               | I               |
| Deep Squat                                 | *Upper Torso is parallel with tibia or towards vertical | *Upper Torso is parallel with tibia or towards vertical | *Upper Torso and tibia are not parallel |
|                                             | *Femur below horizontal | *Femur below horizontal | *Femur is not below horizontal |
|                                             | *Knees aligned with the feet | *Knees aligned with the feet | *Knees are not aligned over the feet |
|                                             | *Dowel aligned within footprint | *Dowel aligned within footprint | *Lumbar flexion is noted |
| Hurdle Step                                | *Alignment is lost between hips, knees and ankles | *Contact between and hurdle | *Contact between and hurdle |
|                                             | *Movement is noted in lumbar spine | *Loss of balance is noted | |
|                                             | *Dowel and hurdle do not | | |
noted in the lumbar spine
*Dowel and hurdle remain parallel
In-Line Lunge
*Dowel contacts remain with L-spine extension
*No torso movement is noted
*Dowel and feet remain in sagittal plane
*Knee touches board behind the heel of the front foot
*Loss of balance is noted

Shoulder Mobility
*Fists are within one hand length

Active Straight Leg Raise
*Ankle/dowel reside between mid-thigh and ASIS
*Fists are within one and a half hand lengths
*Fists are not within one and a half hand lengths

Trunk Stability Push-Up
*Males perform 1 repetition with thumbs aligned with the top of the forehead
*Males perform 1 repetition with thumbs aligned with the chin
*Males are unable to perform 1 repetition with thumbs aligned with the chin

Rotary Stability
*Performs 1 correct unilateral repetition while keeping spine parallel to board
*Knee and elbow touch in line over the board
*Inability to perform diagonal repetition

*0 - The athlete will receive a score of zero if pain is associated with any portion of these tests or clearance tests. A medical professional should perform a thorough evaluation of the painful area.

2.2 Validity
Test validity must be discussed to know that the results of a measurement are meaningful. Validity is the “soundness of the interpretations of test scores” or the degree to which a test measures what it is supposed to measure (Wood, 2011). In order for a measurement to be valid, it must be both relevant and reliable. This section will investigate the relevance and reliability of the FMS by examining existing research. Since the FMS is a fairly new screen (Cook and Burton, 2012), limited research is currently available. However, the current literature seems to indicate the screen’s degree of relevancy and reliability (and therefore its validity).
2.3 Reliability
Reliability is the ability of a test to detect consistent and precise differences between subjects across test occasions (Wood, 2011). In other words, if the FMS is administered multiple times, reliability is the consistency of scoring over repeated tests. A screen cannot be reliable if scores are not consistent from one rater (intra-rater reliability) or between raters (inter-rater reliability).

3. Results

### Table 2: Demographic Information and Standard Deviations of Participants

<table>
<thead>
<tr>
<th>Working Group</th>
<th>Parameter</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>X± Sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Age</td>
<td>14</td>
<td>12</td>
<td>14</td>
<td>13.14±0.663</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>14</td>
<td>150</td>
<td>180</td>
<td>165.50±8.206</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td>14</td>
<td>41.0</td>
<td>66.0</td>
<td>53.42±7.0897</td>
</tr>
<tr>
<td></td>
<td>Bmi</td>
<td>14</td>
<td>16.9</td>
<td>22.1</td>
<td>19.43±1.4566</td>
</tr>
<tr>
<td>Control</td>
<td>Age</td>
<td>13</td>
<td>12</td>
<td>14</td>
<td>13.15±0.801</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>13</td>
<td>140</td>
<td>161</td>
<td>150.77±7.293</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td>13</td>
<td>39.0</td>
<td>53.0</td>
<td>44.07±4.5728</td>
</tr>
<tr>
<td></td>
<td>Bmi</td>
<td>13</td>
<td>17.4</td>
<td>22.9</td>
<td>18.02±4.9361</td>
</tr>
</tbody>
</table>

In Table 2, when the demographic information and standard deviations of the participants are examined, it is seen that the Experimental Group has significant improvement in the pre-test and post-test scores.

### Table 3: Participant’s Functional Movement Analysis (FMS) Scores and Standard Deviations

<table>
<thead>
<tr>
<th>Working Group</th>
<th>FMS</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>X± Sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Ön test</td>
<td>14</td>
<td>9</td>
<td>19</td>
<td>13.50±3.368</td>
</tr>
<tr>
<td></td>
<td>Son test</td>
<td>14</td>
<td>9</td>
<td>19</td>
<td>15.14±3.110</td>
</tr>
<tr>
<td>Control</td>
<td>Ön test</td>
<td>13</td>
<td>9</td>
<td>16</td>
<td>12.31±2.057</td>
</tr>
<tr>
<td></td>
<td>Son test</td>
<td>13</td>
<td>9</td>
<td>16</td>
<td>12.69±2.097</td>
</tr>
</tbody>
</table>

Table 3 shows that when the standard deviations of the participants’ Functional Movement Analysis pretest and posttest scores were examined, there was a significant improvement in the pre-test and post-test scores of the Experimental Group.

### Table 4: Difference Analysis of Participants’ Performance Measures

<table>
<thead>
<tr>
<th>Working Group</th>
<th>FMS</th>
<th>N</th>
<th>X± Sd</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Pre-test</td>
<td>14</td>
<td>13.50±3.368</td>
<td>-2.032</td>
<td>0.042*</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>14</td>
<td>15.14±3.110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Pre-test</td>
<td>13</td>
<td>12.31±2.057</td>
<td>-1.890</td>
<td>0.059</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>13</td>
<td>12.69±2.097</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Table 4, the standard deviations of the participants’ Functional Movement Analysis pretest and posttest scores were tested by the Wilcoxon Difference Analysis test. A
significant difference was found in the pre-test post-test results (r: 0.042; p <0.05) for the experimental group.

Table 5: Difference Analysis between FMS Preliminary and Final Test Measurements

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Pre-test X±SD</th>
<th>Post-test X±SD</th>
<th>f</th>
<th>p</th>
<th>Time f</th>
<th>Group Time p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>13</td>
<td>12.31±2.057</td>
<td>12.69±2.097</td>
<td>8.408</td>
<td>*</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>14</td>
<td>13.50±3.368</td>
<td>15.14±3.110</td>
<td>718.17</td>
<td>*</td>
<td>0.000</td>
<td>3.488* 0.006</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>12.93±2.827</td>
<td>13.96±2.902</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When FMS values were examined in Table 5, a significant difference was found between the groups (f = 8.408; p <0.05) and over time (f = 718.17; p <0.05). There was a significant difference in time in both groups. There was the statistically significant difference between group and time interaction (f = 3.488, p <0.05). This difference appears to be due to significant improvement in the experimental group in the 8-weeks period.

4. Discussion

The main purpose of this study was to examine the effect of core stabilization training on FMS scores and the second purpose was to examine the development of FMS scores between experimental and control groups at the end of 8 weeks of training. When the pretest and posttest results of the control and experimental groups were examined with the 8 weeks core stabilization training, the experimental group showed a significant increase in the FMS scores at the end of the 8-week training session (Pre-Test: 13.50 ± 3.368, Post-Test: 15.14 ± 3.110, p <0.05) (Table 4).

Contrary to this study, in a study conducted by Frost et al. (2012), surprisingly, the mean FMS scores did not change after 12 weeks of training and there was no difference between the 3 groups. At first glance, it was understood that supervised exercise programs did not simply affect the quality of movement. If the control group did not change and the interventions had no effect on the scores, the only plausible explanation was that training was not transferred to non-exercise performance (ie, FMS score) (Frost, Beach, Callaghan, and McGill, 2012).

When the literature is examined, it is seen that Mitchell and colleagues found positive correlations both in the study they performed and in the study done by Okada and colleagues in both total FMS scores and core strength scores (Mitchell, Johnson, and Adamson, 2015; Okada, Huxel, and Nesser, 2011).

Perry and Koehle (2013) found on their study, college sports (n=13) or professional footballers, where mean FMS scores of (16.9±3.0) have been reported suggesting that active sports participation is indeed reflected in the FMS outcome score. In our study, the FMS scores were found (15.14 ± 3.110, p <0.05) in the experimental
group after training (Table 4). It was possible for 12-14 age group athletes to reach the FMS score at the elite athlete level after 8 weeks of training.

Cowen found in his study observed a large positive impact on the total FMS scores (+3.2), with significant improvements in trunk flexibility, but also a reduction in musculoskeletal pain reported postintervention (Cowen, 2010). In our study, there was a positive increase in FMS total scores after training (+ 1.64 ± 3.110, p <0.05) (Table 4).

5. Conclusion

Kiesel et al. researched that in their study has concluded that corrective strategies can increase FMS scores (Kiesel, Plisky, and Butler, 2009). Four recent studies have suggested a cutoff score of 14 (Chorba, Chorba, Bouillon, Overmyer, and Landis, 2010; Kiesel, Plisky, and Voight, 2007; Kiesel et al. 2009, Wieczorkowski, 2010). Other studies have suggested a different cutoff score (Peate, Bates, Lunda, Francis, and Bellamy, 2007) or the cutoff score of 14 should be used with caution (Schneiders, Davidsson, Horman, Sullivan, 2011). In our study, it shows that 8-weeks core training which we planned progressing the FMS scores as much as the suggested cutoff score (Pre-Test: 13.50±3.368; Post-Test:15.14±3.110, p<0.05) (Table 5.)

However, due to the litany of variables in the literature and the lack of depth on the subject, more research is needed to suggest that the FMS should be used for pre-competition screening in basketball

References


Özgür Doğan, Seyfi Savaş, Ali Zorlular

EXAMINATION OF THE EFFECTS OF 8-WEEKS CORE STABILIZATION TRAINING ON FMS (FUNCTIONAL MOVEMENT SCREEN) TEST SCORES APPLIED TO A 12-14 AGE GROUP OF MALE BASKETBALL PLAYERS

Creative Commons licensing terms
Authors will retain the copyright of their published articles agreeing that a Creative Commons Attribution 4.0 International License (CC BY 4.0) terms will be applied to their work. Under the terms of this license, no permission is required from the author(s) or publisher for members of the community to copy, distribute, transmit or adapt the article content, providing a proper, prominent and unambiguous attribution to the authors in a manner that makes clear that the materials are being reused under permission of a Creative Commons License. Views, opinions and conclusions expressed in this research article are views, opinions and conclusions of the author(s). Open Access Publishing Group and European Journal of Physical Education and Sport Science shall not be responsible or answerable for any loss, damage or liability caused in relation to/arising out of conflict of interests, copyright violations and inappropriate or inaccurate use of any kind content related or integrated on the research work. All the published works are meeting the Open Access Publishing requirements and can be freely accessed, shared, modified, distributed and used in educational, commercial and non-commercial purposes under a Creative Commons attribution 4.0 International License (CC BY 4.0).