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ORIGINAL ARTICLE

A Study on the Relationship between Functional Movement Screen Scores and Short Lane Freestyle Swimming Degrees in Student Swimmers

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ABSTRACT

Aim: This study aims to investigate the relationship between the Functional Movement Screen (FMS) scores of students taking swimming lessons and their 25-meter freestyle swimming degrees.

Methods: A total of 12 male volunteering swimmers studying at Yozgat Bozok University Faculty of Sport Sciences were included in the study. The participants were aged 22.00±0.85, 79.05±11.63 kg in body weight and 178.91±5.03 cm in height. The FMS, a screening test to evaluate functional movement patterns, was applied to the students taking swimming lessons. The short lane freestyle degrees of those students were measured in a 25-meter swimming pool. Pearson Correlation analysis was used to examine the relationship between FMS scores and 25m swimming degrees, as the data showed a normal distribution.

Results: When the relationship between the FMS scores of the students who took swimming lessons and the 25-meter freestyle swimming degrees was examined, a negative correlation and statistically significant relationship was found between the swimming degrees and the left hurdle step score (r=-0.656, p=0.021) and the FMS total score (r=-0.694, p=0.012).

Conclusion: As a result, the FMS total scores of all the students who took swimming lessons participating in the study are above the critical limit of 14 points, and therefore it is safe to state that the participants have a low risk of injury. With the correct application of movement patterns with the help of FMS of the athletes, an increase in swimming performance can be achieved through developing swimming techniques. FMS can be a performance determinant.

Keywords: Swimming, Functional Movement Screen, Swimming Degrees, Swimming Performance

INTRODUCTION

Swimming is a popular sport for people of all ages. Unlike other sports, swimming requires athletes to move as fast as possible in an environment much denser than air. The density of the water makes the accuracy of each movement important, as the additional resistance of a movement that is not in the correct form greatly reduces the swimming speed[1]. The excellence and sustainability of biomechanical repetitions in swimming is an important factor in determining performance[2].

Competitive swimming is a specific activity to cover the target distance in the shortest possible time. Swimming performance depends on optimizing the propulsion actively produced by muscle contractions and minimizing the resistance forces (hydrodynamic resistance) associated with the movement of the body in water. Body composition and anthropometric characteristics are related to minimizing hydrodynamic resistance and improving competitive sports performance[3,4]. Therefore, aerobic-anaerobic capacity, technique (leg propulsion and arm pull technique, coordination, starts and turns), physical fitness level (flexibility, strength and power), psychological characteristics (stress control, motivation) and anthropometric characteristics are essential factors in the success of swimming performance. It is important to note that factors such as (height, body weight and body mass index) are important, as well[5].

The Functional Movement Screen (FMS) is recommended as a reliable test to evaluate the functional movement patterns of athletes in regular sports practice. In addition, FMS total scores below 14 were determined as the

critical point for predicting the musculoskeletal injury risk of athletes. Although the FMS has been used by sports professionals to evaluate functional movement patterns in various sports, only a few have applied it to swimmers[6].

In the literature, studies examining the relationship between FMS and physical, athletic and swimming performance reported a significant relationship between FMS total scores and performance and that FMS may determine the performance[6,7,8,9,10,11,12]. However, there are few studies examining the relationship between FMS scores and swimming performance[2,6,7,8]. The good level of movement patterns of swimmers with FMS total scores >14 may pave the way for the correct performance of swimming techniques and their technical degrees in freestyle swimming. From this point of view, the aim of the study is to investigate the relationship between the FMS scores of the students taking swimming lessons and their short lane freestyle degrees.

MATERIAL AND METHODS

Study Group: 12 male students volunteered to participate in the study, who attended swimming lessons two days a week at the Faculty of Sports Sciences of Yozgat Bozok University, and who had not been diagnosed with any sports injury in the last 6 months. The participants were informed about the possible risks of this study and they signed a consent form. The descriptive characteristics of the students taking swimming lessons are given in Table 1.

Table 1: Descriptive characteristics of student-swimmers participating in the study

Descriptive Characteristics	n	M	SD
Age (year)	12	22.00	0.85
Body Weight (kg)	12	79.05	11.63
Height (cm)	12	178.91	5.03
Body Mass Index (kg/m^2)	12	24.69	3.38

Data Collection Tools

Height and Body Weight Measurements: The height of the students was measured with a tape measure attached to the wall. Body weight was measured barefoot and wearing a swimsuit on a digital scale[13]. The data obtained were recorded in the athlete information form.

Body Mass Index Calculation: Body Mass Index (BMI) was calculated with the formula Body weight (kg) / Height (m^2)[14].

Functional Movement Screen (FMS): The Functional Movement Screen was applied to the students taking swimming lessons with the Functional Movement Screen Test kit[15].

25-meter Swimming Performance Measurements: The 25-meter swimming performance degrees of the students were measured using a Casio hand stopwatch.

Data Collection

Functional Movement Screen (FMS): The Functional Movement Screen, developed by Dr. Gray Cook[16], consists of seven tests designed to determine the quality of basic movement patterns that require a combination of stability, mobility, strength, and coordination of all relevant muscle groups, as well as appropriate neuromuscular control[17]. Seven tests of FMS are deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability[15,18].

Student-swimmers were evaluated on a 4-point scale, where it is possible to score ranging 0-3 in a test from which the maximum score that can be obtained is 3. The evaluation criteria

are as follows: 3 points are given when the student performs the movement pattern perfectly without needing any correction, 2 points when he completes the movement pattern with some observed corrective movements, 1 point when he cannot complete the movement pattern, and 0 point when the student feels pain in performing any part of the movement during the test. In the asymmetrical tests (are deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability), a lower score was taken into account when the right and left sides were given different scores. The maximum score that can be obtained in FMS is 21[16,19]. It is known that athletes with an FMS total score <14 are more likely to suffer a serious injury in a season[20]. The tests were performed in three replicates, and the best performed repetition was recorded. Rest was provided for five seconds after each exercise and for one minute between tests[21].

FMS was applied to students taking swimming lessons in the gym of Yozgat Bozok University. Just before the FMS testing, the students who took swimming lessons were given a two-minute warm-up run and warm-up exercises in order to

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prevent any sports injuries. Afterwards, students were watched a video on how to do the movement patterns in order to perform them in the correct form. The data obtained were recorded in the athlete information form.

25-meter Swimming Performance Measurements: The swimming performance degrees of the students who took swimming lessons were measured at the Semi-Olympic Indoor Swimming Pool of the Yozgat Provincial Directorate of Youth and Sports. The size of the pool is 25 meters long, 12.5 meters wide and 2 meters deep. Students were included in the test after the warm-up protocol (10 minutes of running and 10 minutes of low-speed swimming in the pool)[22]. The starting signal was taken as the reference point for onset of the duration for the 25-m swimming degrees.

Data Analysis: The data obtained for the statistical analysis and evaluation of the study were analyzed using the SPSS 22.0. Shapiro-Wilk Test was used to determine if the data showed normal distribution. Then, means and standard deviations were calculated for all variables. Pearson Correlation analysis was used to examine the relationship between FMS scores and 25-m swimming degrees. The level of significance in the study was accepted as $p<0.05$.

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RESULTS

Table 2: Correlation values between student-swimmers' FMS scores and 25-meter freestyle swimming degrees

Performance Variable		Deep Squat	Right Hurdle Step	Left Hurdle Step	Right In-line Lunge	Left In-line Lunge	Right Shoulder Mobility	Left Shoulder Mobility	Right Active Straight Leg Raise	Left Active Straight Leg Raise	Trunk Stability Push Up	Right Rotary Stability	Left Rotary Stability	FMS Total Score
Swimming Degrees (N=12)	r	-0.426	-	-0.656	-	-	0.567	0.184	-0.562	-	-0.210	-	-0.265	-0.694
	p	0.168	-	0.021*	-	-	0.055	0.566	0.057	-	0.512	-	0.404	0.012*

*p<0.05

When the relationship between the FMS scores and the 25-meter freestyle swimming degrees is examined in Table 2, it is seen that the swimming degrees a negative, moderate and statistically significant relationship with the left hurdle step score ($r=-0.656$, $p=0.021$) and the FMS total score ($r=-0.694$, $p=0.012$).Swimming degrees produced no statistically significant relationship with deep squat ($r=-0.426$, $p>0.05$), right shoulder mobility ($r=0.567$, $p>0.05$), left shoulder mobility ($r=0.184$, $p>0.05$), right active straight leg raise ($r=-0.562$, $p>0.05$), trunk stability push-up ($r=-0.210$, $p>0.05$) and left rotary stability ($r=-0.265$, $p>0.05$). The r and p values for right hurdle step, right in-line lunge, left in-line lunge, left active straight leg raise and right rotary stability are not given in Table 2 because the students who took swimming lessons achieved the highest score that can be obtained from a movement pattern.

DISCUSSION

The FMS is designed to assess mobility, efficiency and balance by observing basic movement patterns and techniques. FMS can be used to test all physically active individuals and to determine possible muscle weakness, movement restrictions or anatomical and muscular asymmetries[23]. From this point of view, the study investigated the relationship between the FMS scores of the students who took swimming lessons and their 25-meter freestyle degrees.

Basar et al.[7], in his study with 14 female and 12 male swimmers in the 12-14 age group, divided the swimmers into two groups according to their FMS scores as those with below and above14 points, and compared the 50-meter different style degrees of the swimmers. As a result, it was concluded that the group with FMS scores below 14 points had a higher risk of injury, lower efficiency in terms of sportive performance, and worse swimming scores compared to the group with FMS scores above 14 points In this study, the total FMS score of 12 male students who constituted the research group was above the critical limit of 14 points and the probability of having a sports injury is low. In the study of Bond et al.[8] investigating the relationship between anthropometric variables, FMS scores and 100-meter freestyle swimming performance of 21 male and 29 female professional swimmers between the ages of 11-16, it was found that anthropometric variables significantly explained the variance in 100-meter freestyle swimming performance in young swimmers, with faster swimmers having lower skinfold and better functional movement pattern than slower swimmers. In the study of Lucas et al.[6], in which 32 elite and 17 non-elite swimmers participated, the FMS scores between elite and non-elite swimmers were compared and it was examined whether FMS scores were associated with 100-meter freestyle performance. It was concluded that the elite swimmers had higher total FMS, deep squat, right hurdle step, left hurdle step and trunk stability push-up scores. A positive correlation was found between FMS total scores and 100 meters freestyle performance. In the study of Gunay et al.[2], in which 93 elite swimmers participated, the relationship between FMS and swimming performance was examined. No significant correlation was found between the FMS total score of the female and male swimmers and the 200-meter swimming performance. It was concluded that active straight leg raise, rotary stability and FMS total scores of female swimmers were significantly higher than male swimmers.

When studies with similar research designs in the literature were examined, it has been investigated if there is a relationship between FMS scores and swimming performance, and it was found that there was a relationship between FMS scores and swimming performance. In this study, Table 2 shows a negative relationship between swimming degrees and left hurdle step and FMS total scores. As the FMS total scores and left hurdle step scores increase, the 25 meter freestyle swimming degrees decrease. Unlike similar studies, it is thought that the reason why there is a relationship between swimming degrees and left hurdle step scores is because students with good swimming degrees

have better hip, knee and ankle stability. Compared to the study of Gunay et al.[2], the reason why there was a relationship between FMS total score and swimming degrees in this study may be due to the short distance covered and the higher FMS total mean score (18.75±0.86) of students participating in the study.

Chapman et al.'s[9] study involving 121 elite athletes examined whether FMS injury risk factors were based on longitudinal performance results in elite athletes. It was concluded that functional mobility, which is known to be

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associated with the possibility of future injury, is also associated with the ability to improve longitudinal performance results, and the determination of FMS scores and bilateral asymmetry in elite track and field athletes is associated with the magnitude of longitudinal performance changes. In this study, the FMS test was used to determine the risk of injury, deficiencies in movement patterns, muscle weakness and asymmetry. It is thought that FMS may be one of the determinants of sportive performance.

Kramer et al.[10] investigated the relationship between dynamic balance and physical performance tests measured by FMS and Y Balance Test (YBT) of 56 high school athletes. It was found that they could evaluate similar basic structures, and there were moderate correlations between FMS and YBT tests and physical performance tests in both men and women. It was also concluded that women outperformed men in FMS and YBT tests, and men outperformed women in physical performance measures. In the study by Krkeljas et al.[11], in which 20 karate players aged 10-15 years participated, the relationship between the functional movements of karate players and their physical and karate-specific performances was evaluated. It has been stated that a combination of functional and athletic tests can be used to evaluate the karate predisposition of young athletes, and that the training focus in young karate athletes should focus on developing basic movement capacity along with sport-specific basic skills to ensure the physical development of the athlete. In Lee et al.'s[12] study, which compared the differences in physical performance of 20 elite male football players studying at university according to their FMS total scores and investigated the relationship between FMS total score and physical performance, it was found that a higher FMS total score in players may have a positive effect on their physical performance. For this reason, it has been concluded that coaches should conduct FMS measurements and evaluations on the field in order to closely follow the FMS total scores of the players. It was stated that training programs should be designed with corrective work on functional deficits or asymmetric movement patterns to help the players with low FMS total scores improve physical performance.

When the studies investigating the relationship between FMS and physical performance and athletic performance in branches other than swimming are examined in the literature, it is seen that there is a significant relationship between FMS total scores and performance and FMS is likely to be a performance determinant in athletes, and at the same time, corrective exercise forms can be included in the training programs of athletes.

CONCLUSION

As a result, a negative and statistically significant relationship was found between 25-meter swimming degrees and the parameters of left hurdle step scores (r=-0.656, p=0.021) and FMS total score (r=-0.694, p=0.012). The correlation coefficient values of these parameters were seen to have a moderate relationship with swimming degrees. The FMS total scores of all the students who took swimming lessons participating in the study are above the critical limit of 14 points, and therefore it is safe to state that the participants have a low risk of injury. With the correct conduct of movement patterns with the help of FMS of the

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athletes, an increase in swimming performance can be achieved with the development of swimming techniques. Therefore, it is safe to conclude that FMS test can act as a performance determinant.

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