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The effect of acute fatigue on balance ın soccer players

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ABSTRACT

In this study, the determination of the effect of acute fatigue on balance and the differences of acute fatigue among positions in soccer players was aimed. 43 soccer players were involved into the study whose ages were 23.39 ± 2.18 years, heights were 1.79 ± 0.06 cm, weights were 74.09 ± 7.37 kg, body mass indexes were [BMI] 22.94 ± 1.30, sport ages were 11.13 ± 3.18 years, maximal oxygen comsumption capacities [VO_2 max] were 52.27 ± 5.66, percantages of body fat were 11.78 ± 1.54. Multiple correspondence analysis was performed for the relationship between age and positions played of the subjects by Flamingo Balance Test before and after acute fatigue and after complete rest. The balance measurements before and after 20-meter shuttle run test of all subjects and after complete rest were evaluated by Flamingo Balance Test. Before 20-meter shuttle run test of all subjects, the balance was detected the best in the goalkeeper, at mid-level in the forward and defensive players and worse in the midfield players who had 10-years and less sport age. After 20-meter shuttle run test of all subjects, it was detected that the balance was at mid-level in midfield and defensive players and the worst in forward position and that it was not possible to declare a clear view for goalkeepers. According to results of Flamingo Balance Test performed by the subjects after complete rest, it was striking that the balance situations of defensive players and goalkeepers were generally quite similar. In general, the balance of the midfield and forward players were detected to be mid-level or lower. As a result, positions and sport age of the soccer players were found to affect the balance situations of them.

Key words: Fatigue, Balance, Soccer.

INTRODUCTION

Soccer have to be assessed from point of position depending on the requirements of physical and physiological due to the fact that soccer is played on a large area and tasks given to players differs [1].

Fatigue have been reported to be described as insufficiency of physiological mechanisms operating on continuation of functions of organism altogether on predetermined exercise intensity and/or during this specific working load [2]. As a result of physiological and psychological aspects of fatigue which is a quite complex concept, systems found in organism are exposed to different loadings. The most significant load among these is seen in the respiratory, circulatory, nervous and musculoskeletal systems [3]. Central fatigue is suggested to occur as a concequences of that the level of molecules in muscle of some of many reasons causing fatigue change and due to relationship with brain (neurologic) [2, 4].

Balance performance is one of the parameters providing performance to the sportsmans at a high level in terms of physiological and motor features. Balance is especially a capability producing solution to imbalance occuring due to change in the body's center of gravity [5]. Human's ability in providing stability is both the basic pre-requisite for the development of other motor systems and successful performance in sport [6] and also an important factor for sustaining the body composition which is essential [5].

In the studies, it was proposed that muscle fatigue adversely affects the balance while it is a very crucial factor in the sustainability of the vital activities [7]. Because performing motor movements at a high level during training or competitions means to controlling of both static and dynamic balance. Nowadays balance and coordination tests are also used for the detection of conformity to soccer besides other tests measuring motor skills. In order to get information about body functions of soccer players and develop measurable and comparable parameters, balance measurements are needed to be done too [8].

There are studies specifying that static balance increases the sports performance in the future in young soccer players [9] and there is a relationship between the ability to balance and the risk of injury [10, 11, 12].

The purpose of this study, as opposed to these studies, is to show how the acute fatigue occured using the 20-meter shuttle test protocol in male soccer players affects the balance and the differences between the positions.

MATERIALS AND METHODS

Subjects

In this study, 45 male soccer players were enrolled among healthy male students who are between 18 and 30 years old, study in School of Physical Education and Sports of Gaziantep University and play football in national and local teams. Two of subjects couldn't complete the test because of pain in the lower extremities and the results of 43 patients were evaluated. For this study, the necessary permission was obtained from Gaziantep University Clinical Research Ethics Committee. Information forms about the study were distributed to the subjects prior to joining the study and consent forms were obtained. Participants between the ages of 18-30 who have not neurological problem, systemic disease and respiratory disease were included to the study.

Data Collection

Physical and Physiological Measurements

After measurements of the age, body weight, height and body fat percentage of the subjects, they were informed about the flamingo balance test established in the gym and 20-meter shuttle run test. Balance test was applied to the subjects before and immediately after 20-meter shuttle run test and again after complete rest (heart rate 90-100) is achieved.

Determination of age of the subjects were based on credentials. Height was measured by the meter and body weight was measured by electronic scales and they recorded in cm and kg, respectively. Calculation of body fat ratio in percent (%) and measurements of skin fold thickness were done with ± 2 mm error using skinfold caliper (Holtan, UK) applying 10 gr pressure for 1 mm in each expansion. Measurements of skinfold thickness were realized from triceps, subscapularis, suprailiac and abdominal regions and the measurements were obtained from the right side of the subjects [9, 10]. Yuhasz formula used in the determination of fat percentage of the subjects.

Body Fat Percentage: 0.153x (triceps + subscapularis + abdomen + suprailiac) +5.788 [13, 14].

Flamingo Balance Test

In this test, wooden beam with 50 cm long, 4 cm in height and 3 cm in width was used. During the test, subjects tried to hold on to the long axis of the beam in a way like the flamingo stance with bare feet as long as possible. Other leg required to stand on balance leg in bent position contacting to the knee. Command was started with the chronometer. Time was stopped when the balance is lost and the time proceeded until the next loss of balance. Balance disorders within 1 min were counted. The test is terminated and said given zero points when more than 15 losses of balance occured within the first 30 sec [15].

Measurement of Maximal Oxygen Consumption Capacity [VO_2 max]

20-meter shuttle run test protocol was applied to measure VO_2 max of the subjects. 20-meter shuttle run test is a test in which running speed starts from 8.5 km.sec-1 (9 sec) and increases by 0.5 km.sec-1 in each minute and the round-trip distance of 20 meters is run. Running speed was checked with a tape recorder signaling periodically. The test was terminated when the student couldn't reach two signals over and over or gave up the test [16].

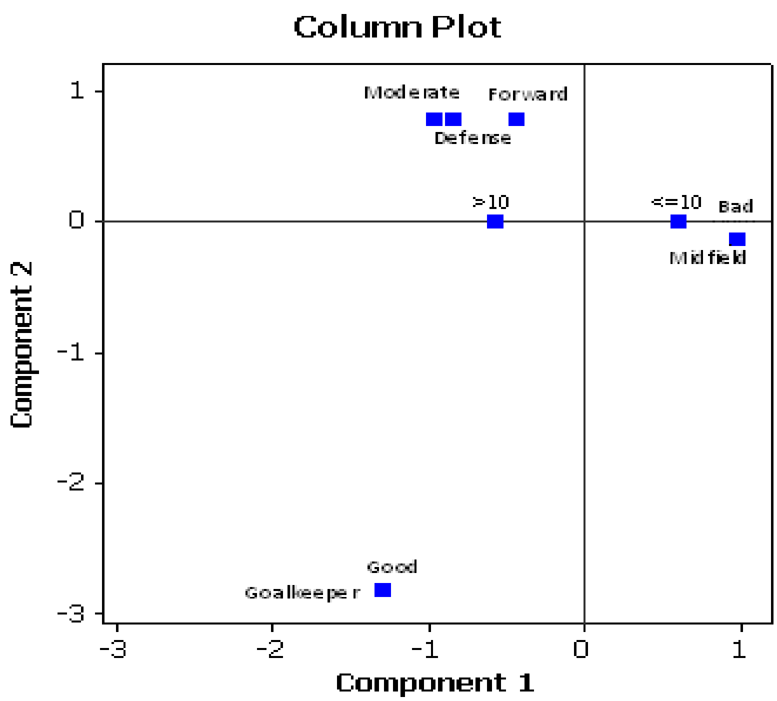
Statistical Analysis
For statistical analysis, SPSS statistical software was used (SPSS for Windows, version 16.0, 2008, SPSS Inc, Chicago, Illinois, and ABD). Multiple correspondence analysis was conducted for the relationship between Flamingo balance test and sport age and positions played before and after acute fatigue of the subjects and after complete rest.

RESULTS

Table 1. Physical and Physiological Characteristics of the Subjects

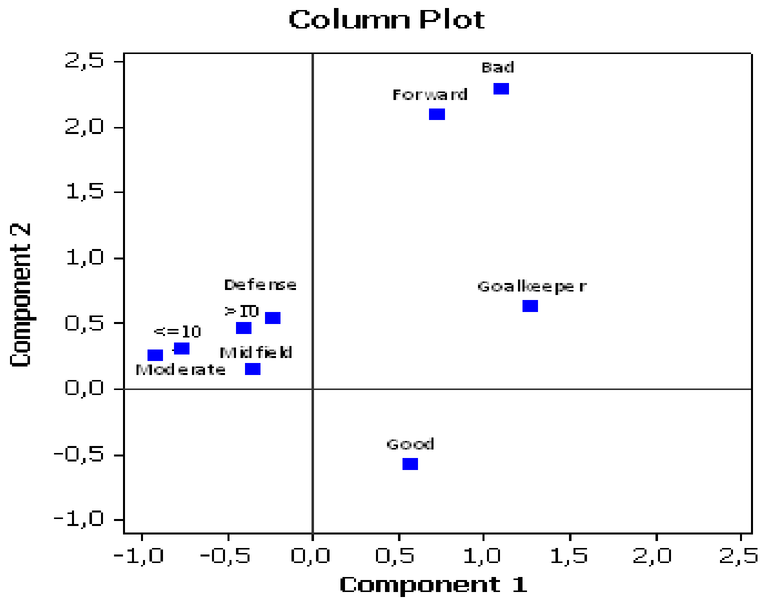
Variant	Mean ± SD	Min - Max
Age (years)	23.39 ± 2.18	20 - 29
Heigh (cm)	1.79 ± 0.06	1.62 - 1.93
Weight (kg)	74.09 ± 7.37	59 - 89
BMI (kg/cm^2)	22.94 ± 1.30	20.13 - 25.61
Sport Age (years)	11.13 ± 3.18	5 - 18
VO_2 max (ml/kg/min)	52.27 ± 5.66	38.8 - 63.2
Body Fat Percentage (%)	11.78 ± 1.54	9.1 - 15.48

According to the findings, it was detected that the age was 23.39 ± 2.18 years, height was 1.79 ± 0.06 cm., weight was 74.09 ± 7.37 kg, BMI was 22.94 ± 1.30, sport age was 13.11 ± 3.18 years, VO_2 max was 52.27 ± 5.66 , BF % was 11.78 ± 1.54 in the players surveyed (Table 1).



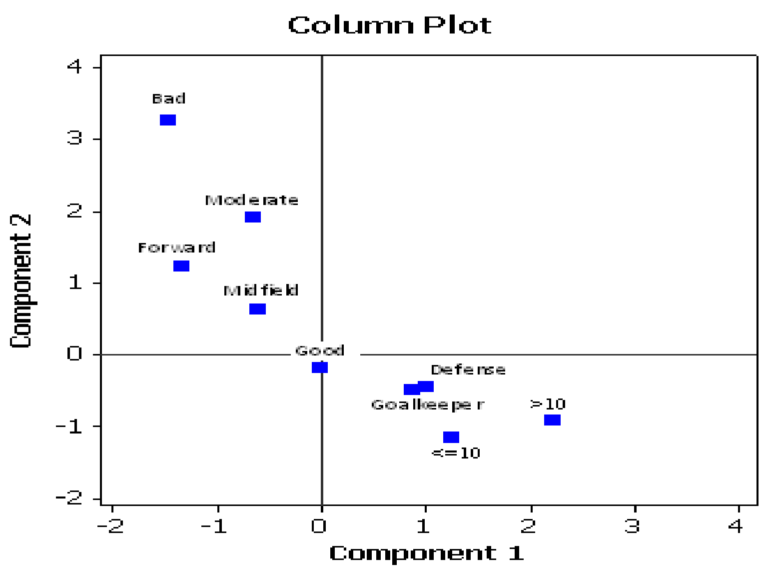
Graph 1. Multiple correspondence analysis showing the relationship between Flamingo balance test and sport age and positions before acute fatigue of the subjects

As a result of multiple correspondence analysis performed, the balance was detected the best [1-3] in the goalkeeper, at mid-level [4-6] in the forward and defensive players and bad [7-10] in the midfield players who had 10-years and less sport age.



Graph 2. Multiple correspondence analysis showing the relationship between Flamingo balance test and sport age and positions after acute fatigue of the subjects

After acute fatigue, it was detected that the balance was at mid-level in midfield and defensive players and the worst in forward position and that it was not possible to declare a clear view for goalkeepers regardless of sport age.



Graph 3. Multiple correspondence analysis graph showing the relationships between Flamingo balance test and sport age and positions after complete rest of the subjects

In the graph, it is remarkable that balance situations of the defenders and goalkeepers are quite similar in general regardless of sport age. It can be concluded that balance in midfield and forward players is mid-level or lower.

In general, upon evaluation of Flamingo balance test results together before and after acute fatigue and after complete rest, it was observed that positions played and sport ages of the sportsmans affected the balance situation however this effect was especially clearer in sportsmans whose sport ages were 10 years and less. The levels of variation for these results were described as 75 % for Figure 1, 68% for Figure 2 and 61% for Figure 3.

DISCUSSION

The research was conducted on 43 male soccer players playing in the national and local soccer leagues to investigate how the effect of the fatigue on balance varies according to the positions played in soccer.

According to the findings of the study, it was detected that the ages were 23:39 ± 2.18 years, heights were 1.79 ± 0.06 cm, weights were 74.09 ± 7.37 kg, body mass indexes were [BMI] 22.94 ± 1.30, sport ages were 11.13 ± 3.18 years, maximal oxygen comsumption capacities [VO_2 max] were 52.27 ± 5.66, percantages of body fat were 11.78 ± 1.54 of the players involved into the study.

In the literature, there are numerous studies investigating that injuries might occur as a result of decrease in knee function and delay in muscle responses after activities forming fatigue [10, 17, 18].

Ekiz and friends emphasized in their study that fatigue causes loss of muscle reflexes responsible for the dynamic joint stability and and this leads to problems related to the sense of position in the muscle receptors [18]. This view is supported by the study done by Helbston and friends [19]. Yaggie et al [2002] observed that there were significant differences in muscle fatigue created by the isokinetic device, and maintaining postural control to measure postural control in healthy men [20]. Ledin et al [2004] reported that there was no difference in times of balance on one foot in normal individuals after the fatigue of the legs [21].

It was proposed that power loss can be at least 25-30 % during maximal voluntary contraction with intensive and local exercise and exercise, which is not intensive but prolonged, would affect the postural control adversely [22].
In literature studies, it was reported that although isolated fatigue generated generally by isokinetic devices didn't reflect muscle fatigue occured during sporting activities exactly, it affected the balance performance of standing negatively [21, 23].

Due to the fact that this and similar methods used causes local fatigue, their compliance to daily life and physical activity are limited. Because of this, they cause less fatigue than activities such as running and cycling ergometer [18].

In our study, 20 meter shuttle run test protocol was used to create fatigue. In this test, the fatigue in the body is interested in general.

It was reported in the studies performed that the balance of the body may be damaged due to fatigue caused by possible physical exercises [24].

In our research, balance values on the dominant leg were measured by Flamingo balance test before and after acute fatigue and after complete rest. Special platform systems used in the balance analysises couldn't be used.

Additionally, because of the fact that it was known that more valuable result could be obtained in the assessment of the balance when applied with open and closed eyes and it was taken into account that lactic acid levels, which were effective in the formation of fatigue, reached normal levels quickly in application of balance test with both open and closed eyes, balance test was performed when running test finished [25]. Balance evaluation was performed with open eyes before and after acute fatigue and after complete rest in our study.

Balance values between general acute fatigue generated and positions of soccer players were compared. There were no studies on how balance changes in terms of positions in the literature. As a result of multiple correspondence analysis performed according to evaluation results before 20-meter shuttle run test of the subjects involved to the study, the balance was detected the best [1-3] in the goalkeeper, at mid-level [4-6] in the forward and defensive players and bad [7-10] in the midfield players who had 10-years and less sport age.After acute fatigue, it can be said that the balance is at mid-level in midfield and defensive players and the worst in forward position and that it is not possible to declare a clear view for goalkeepers because of the fact that number of the participants is low.

When balance measurements taken after complete rest are analyzed, it is striking that a full analysis of the rest defenders and goalkeepers in general equilibrium states that were found to be quite similar. It was striking that the balance situations of defensive players and goalkeepers were generally quite similar. In general, the balance of the midfield and forward players were expressed to be mid-level or lower.

Balance values on one foot were indicated to cause decreases in both sexes with the increase in age [26, 27 and 29]. In another study supporting these studies in the same way, the balance is emphasized to decrease with aging [30].

Mokhtar and Doman reported that trainings developing balance can be performed in training programs to improve the sense of static and dynamic balance [31, 32].

CONCLUSION

All in all, acute fatigue created with 20-meter shuttle run testin soccer players revealed that there were the balance differences between the positions. When Flamingo balance test results were evaluated together before and after acute fatigue and after complete rest, it could be said that positions played and sport ages of the sportsmans affected the balance situation however this effect was especially more specific in sportsmans whose sport ages are 10 years and less. The levels of variation for these results were detected as 75 % for Figure 1, 68% for Figure 2 and 61% for Figure 3. We think that these balance differences obtained between the positions in our study will be reference for the training programs that will be applied according to the positions.

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