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# Profesyonel Futbolcuların İzokinetik Diz Kuvveti ile Denge Performanslarının Mevkisel Olarak İncelenmesi

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ORIGINAL RESEARCH

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**Öz**

Bu çalışmanın amacı, profesyonel düzeyde futbol oynayan futbolcuların izokinetik diz kuvveti ve denge performanslarının mevkisel olarak incelenmesidir. Araştırmanın çalışma grubunu 2023-2024 sezonu T.F.F. Trendyol 1. Lig 2023-2024 sezonunda mücadele edecek olan Erzurumspor F.K. takımının profesyonel futbolcuları oluşturmuştur. Çalışmaya defans (n:13) ve hücum (n:13) olmak üzere 26 futbolcu katılmıştır. Futbolcuların, vücut kompozisyonlarını belirlemek için BODPOD Gold Standard takip sistemi, statik ve dinamik denge testleri SPORTKAT 4000 marka cihaz, diz fleksiyon-ekstansiyon kuvvetlerinin belirlenmesinde ISOMED 2000 İzokinetik sistem kullanılmıştır. Ölçülen parametrelerin normallik dağılımı Skewness, Kurtosis ve Shapiro-Wilks testleriyle sınandıktan sonra verilerin normal dağılım gösterdiği tespit edilmiştir. Veriler normal dağılım gösterdiğinden mevkiler arasındaki farklılıkların tespit edilmesinde Bağımsız Örneklem t testi uygulanmıştır. Bu çalışmada anlamlılık düzeyi $p<0.05$ olarak alınmıştır. Araştırmadan elde edilen sonuçlara göre, savunma oyuncularının hamstring kuvvet değerinin her iki ayakta, quadriceps kuvvet değerinde ise sol ayakta hücum oyuncuları lehine fark olduğu belirlenmiştir. Statik denge değerlerinde savunma oyuncuları lehine, dinamik denge değerinde ise hücum oyuncuları lehine istatistiksel olarak anlamlı fark olduğu belirlenmiştir. Sonuç olarak yaptığımız çalışmada, mevkiler arası futbolcuların farklılıkları olduğu görülmektedir. Bu durumun futbolcuların fiziksel ve fizyolojik gereksinimlerinin birbirinden farklı özellik gerektirmesinden kaynaklandığı düşünülmektedir.

***Anahtar kelimeler:*** İzokinetik diz kuvveti, Denge, Futbol,Profesyonel

# Examination of the Isokinetic Knee Strength and Balance Performance of Professional Football Players by Position

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**Abstract**

The aim of this study is to investigate the isokinetic knee strength and balance performance of professional football players by position.The study group of the research consisted of professional football players from Erzurumspor F.K. who will compete in the T.F.F. Trendyol 1st League during the 2023-2024 season. A total of 26 players participated in the study, with 13 defenders and 13 attackers. To determine the players' body compositions, the BODPOD Gold Standard tracking system was used. Static and dynamic balance tests were conducted using the SPORTKAT 4000 device, and the ISOMED 2000 Isokinetic system was used to determine knee flexion-extension forces. After testing the normality distribution of the measured parameters using Skewness, Kurtosis, and Shapiro-Wilks tests, it was determined that the data showed a normal distribution. Independent Samples t-tests were applied to identify differences between positions. The significance level for this study was set at $p<0.05$.According to the results obtained from the research, it was found that there was a significant difference in hamstring strength values in favor of the attacking players in both legs, and in the quadriceps strength values in favor of the attacking players in the left leg. Statistically significant differences were also identified in static balance values in favor of defenders and in dynamic balance values in favor of attackers.In conclusion, our study revealed differences between football players in different positions, likely due to the varying physical and physiological requirements of their respective roles.

***Keywords:*** Isokinetic Knee Strength, Balance, Football, Professional

## Introduction

In today's world, it is widely accepted that sports are a combination of physical and mental abilities (Stone and Kilding, 2009). In this context, professional football stands out as one of the most popular and competitive disciplines in the world of sports. Football not only requires athletes to possess running and ball control skills but also demands endurance, speed, agility, and physical strength. Therefore, the development and examination of football players' physical abilities are crucial to understand the competitive nature of this sport and enhance performance effectively (Casajús, 2001).

The physical requirements of professional football players can vary depending on their positions and playing styles. For example, attacking players need to have quick running abilities and shooting skills, while defensive players should have a strong physical build and tackling ability. Midfielders, on the other hand, need to excel in endurance, passing skills, and ball retention. However, fundamental factors such as physical endurance, speed, agility, and balance are critical for all football players (Little and Williams, 2007).

Football requires players to use their bodies effectively on the field. This involves using their physical strengths effectively when striking the ball, competing with opponents, or gaining an advantage in aerial duels (Boraczyński et al., 2020). A good level of strength helps players last longer in the game, make quick runs, and surpass their opponents with sudden accelerations. The importance of strength in football becomes even more pronounced when dealing with various situations on the field, including being able to take powerful shots, maintaining balance when facing opponents, and gaining an advantage in aerial battles (Bishop et al., 2022).

Isokinetic knee strength refers to a testing method where the leg works at specific angles and speeds. Since football involves high-speed running, sudden speed changes, and strenuous physical contact, the strength of leg muscles can impact a football player's success. However, the complexity of the relationship between isokinetic knee strength and on-field performance in football players has not been fully understood (Clemente et al., 2019).

Balance ability in football players affects fundamental skills such as ball control, quick turns, making passes in tight spaces, and maintaining position during battles with opponents. Additionally, it plays a crucial role in reducing the risk of injuries because an unbalanced player is more likely to get injured (Mahmoudi et al., 2023).

The aim of this study is to examine whether there is a positional difference in the relationship between knee strength, which is a critical physical characteristic for football players, and balance performance.

## Method

### *Subjects*

The research group of the study consisted of professional football players from Erzurumspor F.K. who will compete in the 2023-2024 season of the T.F.F. Trendyol 1st League.A total of 26 players participated in the study, with 13 in the defense position and 13 in the attack position.

The participating players were provided with information about the measurements and were asked to wear appropriate clothing. Wet-signed consent forms were obtained from the players, and the measurement devices were introduced to them a day before the measurements, allowing them to practice.

The measurements of the study were conducted during the 6th week of the 2023-2024 season's preparation period. The players were not subjected to heavy training one day before the measurements to ensure that they would perform at their best during the measurements.The performance measurements of the study were conducted in the laboratory of the Atatürk University Sports Sciences Application and Research Center.

## Data Collection Techniques

### *Warm-up Procedure*

Before the measurements, standard general warm-up and specific warm-up for the lower extremity muscles were applied to the football players. For the general warm-up, a 10-minute warm-up with a Wattbike brand bicycle ergometer at a constant pace was performed. After the general warm-up, a brief stretching session that covered all joints was conducted, and the general warm-up was completed. Then, to ensure that the players could work at maximum efficiency during the tests and minimize the risk of injury, a 15-20 minute special dynamic warm-up was carried out, with a focus on the lower extremity muscles.

### *Body Composition Measurement*

To determine the football players' body compositions, the BODPOD Gold Standard tracking system, which provides high-accuracy, safe, comfortable, and fast test results, was used. The device provided data on body fat percentage, body mass index, body weight, lean body mass, and basal metabolic rate. Before the measurements, the players were briefed about the device and the rules to be followed during the measurements.

Prior to body composition measurements, the calibration of the device was performed following the necessary procedures. For the reliability of body composition measurements, football players were allowed to wear only athletic shorts and a cap during the measurements. They were instructed to remain still, not speak, and breathe calmly during the measurements.

***Balance Measurement***

Static and dynamic balance tests of the football players were conducted using the SPORTKAT 4000 brand device. Both static and dynamic tests were performed on the right foot, left foot, and both feet, totaling six different tests. During the single-leg static test, the other foot was kept at approximately 20° flexion, and during the double-leg static balance test, the players were required to stand comfortably on the platform with both feet. The test duration was set at 30 seconds.

***Isokinetic Knee Strength Measurement***

The ISOMED 2000 Isokinetic system was used to determine the knee flexion-extension strengths of the football players participating in the study. Warm-up procedures were completed before isokinetic measurements. After completing the warm-up procedure, the subjects were positioned in the device according to reference values for isokinetic knee extension/flexion measurements. The reference values for knee flexion-extension measurements are shown in Table 1.

Table 1

Reference Values for Isokinetic Knee Flexion/Extension Measurements (Yılmaz et al., 2023)

| **Reference Values for Knee Flex/Elex** | |
|---|---|
| **Dynamometer Direction** | 90 to the floor$^{o}$ |
| **Dynamometer Inclination** | Neutral - 0$^{o}$ |
| **Seat Orientation** | 90 to the floor$^{o}$ |
| **Seat Tilt** | 70 -85$^{oo}$ |
| **Axis of Rotation** | Lateral Femoral Condyle in the Sagittal Plane. |
| **Starting Position** | Full extension |

In the knee flexion/extension measurements, the participants were asked to perform 10 repetitions at a speed of 60 degrees per second. During the measurements, 60-second resting periods were applied between measurements of the right and left legs at the same speed. To facilitate rapid

adaptation to the movements during the measurements, the measurements started with the dominant side of the players at each test speed.

### Statistical Analysis

The SPSS for Windows 22.0 software package was used for the calculation and evaluation of the obtained data. After testing the normality distribution of the measured parameters using Skewness, Kurtosis, and the Shapiro-Wilks test, it was determined that the data followed a normal distribution. As the data showed a normal distribution, an Independent Samples t-test was applied to determine the differences between positions. In this study, a significance level of $p<0.05$ was considered.

## Results

Table 2

The subjects characteristics

| | **Defense** | **Attack** |
|---|---|---|
| **Variables** | (n=13) x±ss | (n=13) x±ss |
| **Age (years)** | 28,89±,54 | 29,01±,13 |
| **Height (cm)** | 178,54±11,54 | 177,54±8,43 |
| **Weight (kg)** | 81,54±6,67 | 76,54±5,54 |

Table 3

Comparison of Football Players' Isokinetic Peak Torque and Relative Torque Values

| **Variables** | **Athlete** | **n** | **X** | **SS** | **t** | **p** |
|---|---|---|---|---|---|---|
| **Flexion PT Right Leg (Nm)** | Defensive | 13 | 155,732 | 19,028 | 3,365 | **0,003*** |
| | Offensive | 13 | 135,363 | 10,694 | | |
| **Flexion PT Left Leg (Nm)** | Defensive | 13 | 153,118 | 20,718 | 2,856 | **0,009*** |
| | Offensive | 13 | 132,922 | 14,856 | | |
| **Extension PT Right Leg (Nm)** | Defensive | 13 | 272,385 | 33,355 | 1,847 | 0,077 |
| | Offensive | 13 | 251,269 | 24,204 | | |
| **Extension PT Left Leg (Nm)** | Defensive | 13 | 271,685 | 32,798 | 2,352 | **0,027*** |
| | Offensive | 13 | 242,923 | 29,459 | | |
| **Flexion Relative PT Right Leg (Nm/kg)** | Defensive | 13 | 1,965 | 0,205 | -1,283 | 0,212 |
| | Offensive | 13 | 2,070 | 0,214 | | |
| **Flexion Relative PT Left Leg (Nm/kg)** | Defensive | 13 | 1,870 | 0,142 | -2,084 | **0,048*** |
| | Offensive | 13 | 2,032 | 0,242 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Extension Relative Right Leg PT (Nm/kg)** | Defensive | 13 | 3,600 | 0,309 | 0,823 | 0,419 |
| | Offensive | 13 | 3,497 | 0,329 | | |
| **Extension Relative Left Leg PT (Nm/kg)** | Defensive | 13 | 3,522 | 0,358 | 0,979 | 0,337 |
| | Offensive | 13 | 3,378 | 0,386 | | |

*p<0,05 Nm: newton meter; PT: peak torque; SS: standard deviation; X: Average

Table 3 displays the peak torque and relative torque values of the football players according to the angular velocity variable of 60 degrees per second. The statistical analysis revealed that there was a statistically significant difference in the peak torque flexion right-left value and peak torque extension left value in favor of defensive players, while in the relative torque flexion left value, it favored offensive players. No bilateral difference was identified in the other motion phases.

Table 4

Comparison of Right/Left Difference in Football Players' Isokinetic Strength Values and H/Q Ratios

| **Variables** | **Athlete** | **n** | **X** | **SS** | **t** | **p** |
|---|---|---|---|---|---|---|
| **Right / Left Difference Flexion** | Defensive | 13 | 7,092 | 4,358 | 0,086 | 0,932 |
| | Offensive | 13 | 6,938 | 4,680 | | |
| **Right / Left Difference Extension** | Defensive | 13 | 4,233 | 3,089 | -1,239 | 0,227 |
| | Offensive | 13 | 5,926 | 3,838 | | |
| **Right H/Q** | Defensive | 13 | 52,587 | 6,601 | -2,417 | 0,024 |
| | Offensive | 13 | 59,658 | 8,228 | | |
| **Left H/Q** | Defensive | 13 | 51,795 | 5,467 | -2,755 | **0,011*** |
| | Offensive | 13 | 60,917 | 10,612 | | |

*p<0,05 , H: Hamstring ; Q:Quadriceps; SS: standard deviation; X: Average

Table 4 displays the right/left difference in isokinetic strength values and the Hamstring/Quadriceps (H/Q) muscle ratio for the football players. The average right/left difference in flexion for defensive players was determined to be 7.092±4.35, and the average right/left difference in extension was 4.23±3.09. For offensive players, the average right/left difference in flexion was 6.93±4.68, and in extension, it was 5.92±3.83. The average H/Q ratio for the right extremity of defensive players was 52.58±6.60, and for the left extremity, it was 51.39±5.46. For offensive players, the average H/Q ratio for the right extremity was 59.65±8.23, and for the left extremity, it was 60.91±10.61.

Table 5.

Comparison of Football Players' Static and Dynamic Balance Values

| Variables | Athlete | n | X | SS | t | p |
|---|---|---|---|---|---|---|
| **Right foot static balance** | Defensive | 13 | 387,385 | 84,789 | -3,483 | **0,002*** |
| | Offensive | 13 | 670,308 | 280,331 | | |
| **Left foot static balance** | Defensive | 13 | 399,154 | 74,776 | -3,001 | **0,006*** |
| | Offensive | 13 | 727,923 | 387,855 | | |
| **Both foot static balance** | Defensive | 13 | 358,923 | 104,896 | -2,621 | **0,015*** |
| | Offensive | 13 | 686,308 | 438,031 | | |
| **Right foot dynamic balance** | Defensive | 13 | 1342,231 | 420,820 | 4,947 | **0,001*** |
| | Offensive | 13 | 749,692 | 97,015 | | |
| **Left foot dynamic balance** | Defensive | 13 | 1458,846 | 559,190 | 4,099 | **0,001*** |
| | Offensive | 13 | 787,769 | 188,959 | | |
| **Both foot dynamic balance** | Defensive | 13 | 1302,538 | 481,624 | 3,873 | **0,001*** |
| | Offensive | 13 | 777,846 | 81,081 | | |

*p<0,05 , SS: standard deviation; X: Average

Table 5 displays the static and dynamic balance values of the football players. It was determined that there was a statistically significant difference in favor of defensive players in static balance values, while in dynamic balance values, the statistical difference favored offensive players.

## Discussion and Conclusion

The aim of this study is to investigate the positional comparison of professional football players' isokinetic knee strength and balance performance at the beginning of the season. A total of 26 professional football players, including 13 defenders and 13 attackers, participated in the study. Due to the limited research on the comparison of knee strength and balance performance in football players by position, this study was conducted.

When the findings of the study are examined, it is observed that defensive players have better values in peak torque flexion right/left foot and peak torque extension left foot values. The reason for this may be the significant relationship between the strength motor skills of defensive players and the positions they play. Additionally, one of the reasons for defensive players having better values may be their focus on positional work from the youth groups since they need to be more controlled and balanced in their positions.

Regarding the relative torque flexion left foot value, it is observed that offensive players have better values. This is thought to be because offensive players have better anaerobic values in their positions compared to defensive players and produce more power per kilogram (Davis et al., 1992).

In terms of balance values, when the findings of the study are examined, it is seen that defensive players have a better level in static balance values, while offensive players have a better level in dynamic balance values. The reason for this may be that defensive players need to be more controlled and balanced due to the positions they play, and they have been doing positional work from the youth groups starting with static positional work. On the other hand, offensive players tend to engage in dynamic play to score or gain an advantage over defensive players, which is why they perform better in dynamic balance.

In a study by Tourny et al. (2000) that examined the relationship between football players' knee strength and the positions they played, it was found that there was a positional difference between football players' peak torque angles (60) and a positive relationship with defensive players (Tourny et al., 2000).

In a study conducted by Vargas et al. (2020) on female football players of different age groups, it was stated that muscle development is observed in female football players after becoming professional and that the H/Q ratio is low in female football players, which increases the risk of injury (Vargas et al., 2020).

In a research examining the effects of the FIFA 11+ injury prevention program on the balance and knee strength of elite female football players, it was stated that the FIFA 11+ injury prevention program is effective on muscle strength and dynamic balance in posterior and postero-lateral directions and is a preventive factor in lower extremity injuries due to its ability to increase knee strength (Kerman et al., 2018).

In a study that examined the isometric strength of professional football players' knee extensors and flexors and fatigue index, it was found that there was no difference in terms of position, and the flexor fatigue index of football players was higher than the extensor fatigue index (Carvalhais et al., 2013).

In a study comparing the static and dynamic balance values of professional and elite football players, it was stated that the higher the level of the league they played in, the better their balance values were, and as a result, the injury rate was lower (Jadczak et al., 2019).

In a study that examined the effect of isometric strength training on dynamic balance in young football players, it was stated that as lower extremity strength values increased, there was a positive effect on balance values (Chtara et al., 2018).

In a study by Mahmoudi et al. (2023), which compared the static and dynamic balance values of football players by position, it was stated that goalkeepers and midfielders had better static and dynamic balance values compared to defensive and offensive players.

In conclusion, our study showed differences between football players by position. This is thought to be due to the different physical and physiological requirements of the players in different positions.

**Declaration of interests**

No potential conflict of interest was reported by the authors.

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**Ethics approval and informed consent**

Tests were conducted according to the principles expressed in the Declaration of Helsinki and were approved the entire study design by the ethics committee of the Atatürk University Faculty of Sport Sciences (No:146 Date: 06.10.2023)

**Authors Contributions Conclusion**

Design of the Research: GA , FK

Data Collection: GA

Statistical Analysis: FK , GA

Preparation of the Article: GA

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