



ORIGINAL RESEARCH ARTICLE

OPEN ACCESS

COMPARISON OF THE HIGHEST STRENGTH VALUE OF QUADRICEPS AND HAMSTRING LEG MUSCLE GROUPS AND SOME SELECTED PARAMETERS IN FOOTBALL PLAYERS

*Ömür GÜLFIRAT

Istanbul Gelisim University Vocational High School, Turkey

ARTICLE INFO

Article History:

Received 09th May, 2017
Received in revised form
10th June, 2017
Accepted 25th July, 2017
Published online 30th August, 2017

Keywords:

Football, Leg Strength,
Isokinetic Dynamometer.

ABSTRACT

The purpose of this study is to examine the relationship between the highest value of leg strength and some selected parameters in the soccer players of super amateur league. The experimental group of the research is composed of super amateur level football players who have at least 4 years of sports experience and study at Istanbul Gelişim University, school of Physical Education and Sports (N=90). The sample, which was determined through convenience sampling method, is composed of voluntary participants (n=30). Data form (sport year, position, dominant foot preference) was applied as the data collection tool. Leg force measurements were performed by a specialist physician from the Department of Sports Medicine of the University of Istanbul, Çapa Medical School through a Cybex 350 Isokinetic dynamometer. At 60°/sec angular velocity, both legs of the participants were experimented three times. When the participant was ready, the same act was applied in the form of 4 maximal test repetitions in a row after 6 seconds of resting in between. At 60°/sec angular velocity, the highest strength ratios of front and back muscle groups at the right and left legs were recorded in Newton-Meter (Nm). T test and Anova analysis were applied as the statistical process. As a result, there is no significant difference between the highest strength ratios of right and left leg quadriceps and hamstring muscle groups of the football players at 60 °/sec angular velocity. There is no significant difference when the highest strength ratios of right and left leg quadriceps and hamstring muscle groups of the football players were evaluated in terms of leg preference at 60 °/sec angular velocity. There is no significant difference when the highest strength ratios of right and left legs of the football players were evaluated according to sport age at 60 °/sec angular velocity. A significant difference is found between defenders and goalkeepers regarding the average of the highest strength of the left leg quadriceps muscles at 60 °/sec angular velocity and the highest strength ratio of the left leg hamstring muscles at 60 °/sec angular velocity. As playing football requires a large playing field and the tasks assigned to the players vary, it is needful to evaluate the players in terms of their positions also by taking physical and physiological requirements into consideration. During the application of training methods; the increase in the performances of the players should be provided by regarding their positions in the field.

*Corresponding author: Ömür GÜLFIRAT,

Copyright ©2017, Ömür GÜLFIRAT. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Ömür GÜLFIRAT. 2017. "Comparison of the highest strength value of quadriceps and hamstring leg muscle groups and some selected parameters in football players", *International Journal of Development Research*, 7, (08), 14802-14807.

INTRODUCTION

Strength plays an important role in football and many other branches in sports. Strength, in terms of football, and the muscular strength needed to develop the motor skills for the

perfect display of certain movements are closely related to the strength ratios of the muscles responsible for striking balls, for moments of explosive forces, for sudden changes in direction, and for sudden changes in the struggle against rival and environmental conditions. It can be said that quadriceps and

hamstring muscles are the prominent muscle groups in the football. Football players need to have a developed optimal muscular strength developed due to the fact that football requires durability. It has been reported in the studies investigating muscular activity in football that muscle groups around the knee are highly activated during ball hitting, splashing, running and changing direction (Malliou, 2003). Strength measurements made with an isokinetic dynamometer are the most common measuring devices used today to monitor the strengths and developments of athletes. In many studies, the maximum muscle strength rates of leg anterior-posterior muscle groups of adult individuals and male football players have been determined (Olivier, 2007 and Zakas, 2006). In order to maximize the physical performances of the athletes, it has become an important contribution of the isokinetic dynamometers as they provide athletes to be analyzed in detail and determine the points to be emphasized in their training (Aagard, 1998). Thanks to isokinetic dynamometers, the determination of imbalances in the leg muscle groups of sportsmen in various ages and of the risks of specific football injuries due to the decreasing muscle strength stimuli in the context of aged athletes can be provided. More specific training and rehabilitation programs can be designed in this way (Konstantinos Fousekis, 2010). The purpose of this study is to analyze the relationship between the highest value of leg strength and some selected parameters in super amateur football players.

MATERIAL AND METHODS

The purpose of this study is to examine the relationship between the highest value of leg strength and some selected parameters in the football players of super amateur league. The experimental group of the research is composed of super amateur level football players who have at least 4 years of sports experience and study at Istanbul Gelişim University, school of Physical Education and Sports (N=90). The sample, which was determined through convenience sampling method, is composed of voluntary participants (n=30). Data form (sport year, position, dominant foot preference) was applied as the data collection tool. Football players were given information about all the actions to be done before the test started. Leg strength measurements were performed by a specialist physician from the Department of Sports Medicine of the University of Istanbul, Çapa Medical School through a Cybex 350 Isokinetic dynamometer. Before the experiment, the participants were warmed up in the 2nd level in 60 RPM, and they were warmed up for 8 minutes. After the warm-up, the range of motion was determined and the dynamometer adjustments were specified for each participant. The joint mobility range was set at 90 °, and at 60 °/sec angular velocity, the participants used both their legs to recognize the device and made trials through warm-ups. When the participants declared that they are ready, the same movement was given in the form of 4 maximal test repetition with 6 seconds of rests in between. The highest strength ratios, which were measured with a Cybex 350 isokinetic dynamometer, of anterior and posterior muscle groups in the right and left legs were recorded in SPSS 22 Package program in Newton-Meter (Nm) style at an angular velocity of 60°/sec.

Statistical Analysis

The highest strength ratio data of the right and left leg anterior and posterior muscle groups were entered into the SPSS22.0

package program at 60 °/sec angular velocity obtained from the personal information form (sport year, position, dominant foot preference) and Cybex 350 isokinetic dynamometer, and the analyses have been conducted through the package program. Factor scores of the personal information and measurements related to the candidates were evaluated by determining frequency (f) and percent (%) values. Parametric and nonparametric distribution curves and skewness-kurtosis values of the points are examined in deciding the conditions of parametric and nonparametric distributions. The data show a parametric distribution. T test and Anova analysis were applied as the statistical process.

Table 1. Socio-Demographic Characteristics of the Participants

		Frequency	Percent
Sports Experience	6-10 years	14	46,7
	11-15	16	53,3
	Total	30	100,0
Foot Preference	Right Foot	20	66,7
	Left Foot	10	33,3
	Total	30	100,0
Position	Defensive Player	10	33,3
	Forward Player	14	46,7
	Goalkeeper	6	20,0
	Total	30	100,0

When Table 1 is examined, according to the socio-demographic characteristics of the participants, it is determined that 46,7% has sports experience of 6-10 years, 53,3% has sports experience of 11-15 years, 66,7% has a right foot, 33% has a left foot preference, 33,3% are defensive players, 46,7% is forward players, and 20% is goalkeepers.

FINDINGS

Table 2. Descriptive Analysis of Highest Strength Ratios of Right and Left Leg Quadriceps and Hamstring Muscle Groups at 60°/sec Angular Velocity of Football Players

	N	Min.	Max	$\bar{X} \pm Ss$
Maximal Strength of Right Leg Quadriceps Muscles at 60°/sec Angular Velocity	30	157n/m	255 n/m	208,43± 23,46 n/m
Maximal Strength of Right Leg Hamstring Muscles at 60°/sec Angular Velocity	30	102 n/m	191 n/m	143,23 ± 19,26 n/m
Maximal Strength of Left Leg Quadriceps Muscles at 60°/sec Angular Velocity	30	152 n/m	260 n/m	213,73± 27,05 n/m
Maximal Strength Left Leg Hamstring Muscles at 60°/sec Angular Velocity	30	114 n/m	193 n/m	147,63±19,720 n/m

When Table 2 is examined, the average of the highest strength ratios of the football players' right leg quadriceps muscles at 60°/sec angular velocity is determined as 208,43 ± 23,46 n/m, the average of the highest strength ratios of right hamstring muscles at 60°/sec angular velocity as 143,23 ± 19,26 n/m, the average of the highest strength ratios of the left leg quadriceps muscles at 60°/sec angular velocity as 213,73 ± 27,05 n/m, the average of the highest strength ratios of the right hamstring muscles at 60°/sec angular velocity as 147,63 ± 19,720 n/m. When Table 3 is examined, it is determined that the average of the highest strength ratios of the right leg quadriceps muscles of football players who prefer right leg at 60°/sec angular velocity is 210,20 ± 24,39 n/m, the average of those who prefer left foot as 204,90±22,24 n/m, the average of the highest

Table 3. Descriptive Analysis of Highest Strength Ratio of Football Players' Right and Left Leg Quadriceps and Hamstring Muscle Groups at 60°/sec Angular Velocity in terms of Leg Preference

		N	\bar{X}	Ss	t	p
Maximal Strength of Right Leg Quadriceps Muscles at 60°/sec Angular Velocity	Right	20	210,20 n/m	210,20±24,39 n/m	,577	,569
	Left	10	204,90 n/m	204,90±22,24 n/m		
Maximal Strength of Right Leg Hamstring Muscles at 60°/sec Angular Velocity	Right	20	145,45 n/m	145,45±17,93 n/m	,888	,382
	Left	10	138,80 n/m	138,80±21,99 n/m		
Maximal Strength of Left Leg Quadriceps Muscles at 60°/sec Angular Velocity	Right	20	211,80 n/m	211,80±27,48 n/m	-,547	,589
	Left	10	217,60 n/m	217,60±27,16 n/m		
Maximal Strength Left Leg Hamstring Muscles at 60°/sec Angular Velocity	Right	20	143,80 n/m	143,80±17,55 n/m	-1,541	,135
	Left	10	155,30 n/m	155,30±22,46 n/m		

Table 4. Evaluation of Highest Ratio of Right and Left Legs of Football Players at 60°/sec Angular Velocity According to Sports Experience

	Sports Experience	N	X±Sd	t	p
Maximal Strength of Right Leg Quadriceps Muscles at 60°/sec Angular Velocity	6-10 Years	14	210,93±25,086 n/m	,538	,595
	11-15 Years	16	206,25±22,523 n/m		
Maximal Strength of Right Leg Hamstring Muscles at 60°/sec Angular Velocity	6-10 Years	14	142,50±15,737 n/m	-,192	,849
	11-15 Years	16	143,88±22,402 n/m		
Maximal Strength of Left Leg Quadriceps Muscles at 60°/sec Angular Velocity	6-10 Years	14	215,79±31,145 n/m	,383	,705
	11-15 Years	16	211,94±23,800 n/m		
Maximal Strength Left Leg Hamstring Muscles at 60°/sec Angular Velocity	6-10 Years	14	145,07±18,537 n/m	-,659	710
	11-15 Years	16	149,88±21,036 n/m		

Table 5. Evaluation of Highest Ratio of Right and Left Legs in 60 °/sec Angular Velocity According to Sport Positions

		N	X± Sd	f	p	Tukey HSD
Maximal Strength of Right Leg Quadriceps Muscles at 60°/sec Angular Velocity	Defensive Player ¹	10	215,40±25,238n/m	1,167	,326	-
	Forward Player ²	14	208,36±24,371n/m			
	Goalkeeper ³	6	197,00±15,684n/m			
Maximal Strength of Right Leg Hamstring Muscles at 60°/sec Angular Velocity	Defensive Player ¹	10	153,30±19,721n/m	2,303	,119	-
	Forward Player ²	14	139,21±19,761n/m			
	Goalkeeper ³	6	135,83±11,107n/m			
Maximal Strength of Left Leg Quadriceps Muscles at 60°/sec Angular Velocity	Defensive Player ¹	10	225,90±23,784n/m	3,718	,038	1-3
	Forward Player ²	14	205,71±31,355n/m			
	Goalkeeper ³	6	212,17±13,790n/m			
Maximal Strength Left Leg Hamstring Muscles at 60°/sec Angular Velocity	Defensive Player ¹	10	158,80±23,011n/m	3,888	,033	1-3
	Forward Player ²	14	145,79±16,216n/m			
	Goalkeeper ³	6	133,33±10,690 n/m			

strength ratios of the right leg hamstring muscles of football players who prefer right leg at 60°/sec angular velocity as 145,45 ± 17,93 n/m, the average of those who prefer the left foot as 138,80 ± 21,99 n/m, the average of the highest strength ratios of the left leg quadriceps muscles of football players who prefer right leg at 60°/sec angular velocity as 211,80 ± 27,48 n/m, the average of those who prefer left foot as 217,60 ± 27,16 n/m, the average of the highest strength ratios of the left leg hamstring muscles of football players who prefer right leg at 60°/sec angular velocity as 143,80±17,55 n/m, the average of those who prefer left foot as 155,30±22,46 n/m. When Table 4 is examined, it is determined that the average of the highest strength ratios of the right leg quadriceps muscles of football players with sports experience of 6-10 years at 60°/sec angular velocity is 210,93 ± 25,086 n/m, the average of those with 11-15 years of experience as 206,25 ± 22,523 n/m, the average of the highest strength ratios of the right leg hamstring muscles of the football players with 6-10 years of experience at 60°/sec angular velocity as 142,50 ± 15,737 n/m, the average of those with 11-15 years of experience as 143,88 ± 22,402 n/m, the average of the highest strength ratios of left leg quadriceps muscles of football players with 6-10 years of experience as 215,79 ± 31,145 n/m, the averages of those with 11-15 years of experience as 211,94 ± 23,800 n/m, the average of the highest strength ratios of the left leg hamstring muscles of football players with 6-10 years of experience at 60°/sec angular velocity as 145,07 ± 18,537 n/m and the average of those with 11-15 years of experience as 149,88 ± 21,036 n/m.

When table 5 examined, it is observed that the average of the highest strength ratios of the right leg quadriceps muscles of defensive players at an angular velocity of 60 °/sec are 215,40 ± 25,238 n/m, the same ratios of the forward players are 208,36 ± 24,371 n/m, the same ratios of the goalkeepers are 197,00 ± 15,684 n/m; the average of the highest strength ratios of the right leg hamstring muscles of the defensive players at angular velocity of 60 °/sec is 153,30 ± 19,721 n/m, the same ratios of the forward players are 139,21 ± 19,761 n/m, the same ratios of the goalkeepers are 135,83 ± 11,107 n/m; the average of the highest strength ratios of the left leg quadriceps muscles at angular velocity of 60 °/sec is 225,90 ± 23,784 n/m for defensive players, 205,71 ± 31,355 n/m for the forward players, and 212,17 ± 13,790 n/m for the goalkeepers; the average of the highest strength ratios of the left leg hamstring muscles at angular velocity of 60 °/sec is 158,80 ± 23,011n/m for defensive players, 145,79 ± 16,216 n/m for forward players, and 133,33 ± 10,690 n/m for goalkeepers. Statistically, at 60 °/sec angular velocity, there is a statistically significant difference between defenders and goalkeepers regarding the average of the highest strength of the left leg quadriceps and the highest strength of left leg hamstring muscles (p <0.05).

DISCUSSION

At 60 °/sec angular velocity, it is observed that the average of the highest strength ratios of the football players' right leg

quadriceps muscles is 208.43 ± 23.46 n/m, and the average of the highest strength ratios of the right hamstring muscles is 143.23 ± 19.26 n/m, the average of the highest strength ratios of the left leg quadriceps muscles is 213.73 ± 27.05 n/m, the average of the highest strength ratios of the right hamstring muscles is 147.63 ± 19.720 n/m. As a result of the findings, at $60^\circ/\text{sec}$ angular velocity, it is seen that the highest strength ratios of the left leg quadriceps muscles of the football players are better than the right leg muscle groups. When examining the studies in the literature; Şentürk (Şentürk, 2011), in his work named “A comparison of the isokinetic forces (knee flexion and extensions) in the 17-20 years old basketball and football players”, found that, at $60^\circ/\text{sec}$ angular velocity, the average of the highest strength rate of the football players’ right leg quadriceps muscles is 232.08 ± 41.14 n/m. Küçük (Küçük, 2011) found that, at $60^\circ/\text{sec}$ angular velocity, the highest strength ratio average of the football players’ right leg quadriceps muscles is 121.95 ± 21.81 n/m. In another study, Yılmaz (Yılmaz, 2015), in his work named The Effect of Body Composition and Isokinetic Knee Strength on Agility and Rapidity in Elite Football Players, reported that, at $60^\circ/\text{sec}$ angular velocity, the highest strength ratio average of the right leg quadriceps muscles of the football players is 165.00 ± 24.83 n/m. The findings in our study show differences with similar studies in the literature. Şentürk (Şentürk, 2011), in his work named “A comparison of the isokinetic strengths (knee flexion and extensions) in the 17-20 years old basketball and football players”, found that, at $60^\circ/\text{sec}$ angular velocity, the average of the highest strength rate of the football players’ right leg hamstring muscles is 135.17 ± 20.38 n/m. Küçük (Küçük, 2011), in his study in which he worked on 60 football players, has found that, at $60^\circ/\text{sec}$ angular velocity, the highest strength ratio average of the right leg hamstring muscles of the players is 98.83 ± 19.94 n/m. Yılmaz (2015), in his work named The Effect of Body Composition and Isokinetic Knee Strength on Agility and Rapidity in Elite Football Players, reported that, at $60^\circ/\text{sec}$ angular velocity, the highest strength ratio average of the right leg hamstring muscles of the football players is $105,60 \pm 17,70$ n/m.

Şentürk (2011), in his work named “A comparison of the isokinetic strengths (knee flexion and extensions) in the 17-20 years old basketball and football players”, found that, at $60^\circ/\text{sec}$ angular velocity, the average of the highest strength rate of the football players’ left leg quadriceps muscles is 160.92 ± 50.87 n/m. Küçük (2011), in his study in which he worked on 60 football players, has found that, at $60^\circ/\text{sec}$ angular velocity of, the highest strength ratio average of the left leg quadriceps muscles of the players is $106,37 \pm 17,91$ n/m. Yılmaz (2015), in his work named The Effect of Body Composition and Isokinetic Knee Strength on Agility and Rapidity in Elite Football Players, reported that, at $60^\circ/\text{sec}$ angular velocity, the highest strength ratio average of the left leg quadriceps muscles of the football players is $169,73 \pm 29,57$ n/m. Şentürk (2011), in his work named “A comparison of the isokinetic forces (knee flexion and extensions) in the 17-20 years old basketball and football players”, found that, at $60^\circ/\text{sec}$ angular velocity, the average of the highest strength rate of the football players’ left leg hamstring muscles is 120.58 ± 12.50 n/m. Küçük (2011), in his study in which he worked on 60 football players, has found that, at $60^\circ/\text{sec}$ angular velocity, the highest strength ratio average of the left leg hamstring muscles of the football players is $89,73 \pm 18,67$ n/m. Yılmaz (2015), in his work named The Effect of Body Composition and Isokinetic Knee Force on Agility and Rapidity in Elite Football Players,

reported that, at $60^\circ/\text{sec}$ angular velocity, the highest strength ratio average of the left leg hamstring muscles of the football players is $94,73 \pm 10,65$ n/m. All the data given below is taken at $60^\circ/\text{sec}$ angular velocity: For those who prefer the right foot, the average of the highest strength ratios of the right leg quadriceps muscles is $210,20 \pm 24,39$ n/m, the same average for those who prefer the left leg is $204,90 \pm 22,24$ n/m; the average of the highest strength ratios of the right leg hamstring muscles for those who prefer the right leg is $145,45 \pm 17,93$ n/m, the same average of those who prefer the left leg is $138,80 \pm 21,99$ n/m; the average of the highest strength ratios of the left foot quadriceps muscles for those who prefer the right leg is $211,80 \pm 27,48$ n/m, the same average for those who prefer the left leg is $217,60 \pm 27,16$ n/m; the average of the highest strength ratios of the left leg hamstring muscles for those who prefer the right leg is $143,80 \pm 17,55$ n/m, and the same average for those who prefer the left leg is $155,30 \pm 22,46$ n/m. In the light of the findings, when the highest strength ratios of the leg muscles at $60^\circ/\text{sec}$ angular velocity are evaluated, it is seen that the left leg preference is better than the right leg preference for the football players.

Aktuğ (2013), in his work called “Vertical Jump, Velocity Performance, Isokinetic Hamstring and Quadriceps Muscle Strength Ratio in Football Players”, showed that, at $60^\circ/\text{sec}$ angular velocity, the highest averages of strength in the right leg quadriceps muscle groups in the football players are $204,77 \pm 33,04$ n/m (dominant), and $209,88 \pm 30,88$ n/m (nondominant). Yılmaz (2015), in his work named “The Effect of Body Composition and Isokinetic Knee Force on Agility and Rapidity in Elite Football Players”, found that, at $60^\circ/\text{sec}$ angular velocity, the average of the highest strength ratio of the right leg quadriceps muscles of football players is $168,44 \pm 44,50$ n/m, and $149,71 \pm 23,91$ n/m, for those who prefer the right leg and for those who prefer the left leg, respectively.

Aktuğ (2013), in his work called “Vertical Jump, Velocity Performance, Isokinetic Hamstring and Quadriceps Muscle Strength Ratio in Football Players”, shows that, at $60^\circ/\text{sec}$ angular velocity, the highest averages of strength in the right leg hamstring muscle groups in the football players are $133,36 \pm 19,17$ n/m (dominant), and $130,83 \pm 20,28$ n/m (nondominant). Yılmaz (2013), in his work named “The Effect of Body Composition and Isokinetic Knee Force on Agility and Rapidity in Elite Football Players”, found that, at $60^\circ/\text{sec}$ angular velocity, the average of the highest strength ratio of the right leg hamstring muscles of football players is $100,94 \pm 24,23$ n/m, and $99,50 \pm 22,87$ n/m, for those who prefer the right leg and for those who prefer the left leg, respectively. Yılmaz (2015), in his work named “The Effect of Body Composition and Isokinetic Knee Force on Agility and Rapidity in Elite Football Players”, found that, at $60^\circ/\text{sec}$ angular velocity, the average of the highest strength ratio of the left leg quadriceps muscles of football players is $170,71 \pm 28,06$ n/m, and $149,06 \pm 46,29$ n/m, for those who prefer the right leg and for those who prefer the left leg, respectively. Yılmaz (2015), in his work named “The Effect of Body Composition and Isokinetic Knee Force on Agility and Rapidity in Elite Football Players”, found that, at $60^\circ/\text{sec}$ angular velocity, the average of the highest strength ratio of the left leg hamstring muscles of football players is $91,19 \pm 31,84$ n/m, and $91,19 \pm 31,84$ n/m, for those who prefer the right leg and for those who prefer the left leg, respectively. It is determined that the average of the highest strength ratios of the right leg quadriceps muscles of football players with sports

experience of 6-10 years at 60°/sec angular velocity is 210,93 ± 25,086 n/m, the average of those with 11-15 years of experience as 206,25 ± 22,523 n/m, the average of the highest strength ratios of the right leg hamstring muscles of the football players with 6-10 years of experience at 60°/sec angular velocity as 142,50 ± 15,737 n/m, the average of those with 11-15 years of experience as 143,88 ± 22,402 n/m, the average of the highest strength ratios of left leg quadriceps muscles of football players with 6-10 years of experience as 215,79 ± 31,145 n/m, the averages of those with 11-15 years of experience as 211,94 ± 23,800 n/m, the average of the highest strength ratios of the left leg hamstring muscles of football players with 6-10 years of experience at 60°/sec angular velocity as 145,07 ± 18,537 n/m and the average of those with 11-15 years of experience as 149,88 ± 21,036 n/m. As a result of the study, when the highest strength ratios of the leg muscles at 60°/sec angular velocity are evaluated, football players with 6-10 years of sports experience take place on the top. When examining the studies in the literature; In the study named as Lower Limb Strength in Professional Football Players: Profile, Asymmetry, and Training Age by Konstantinos and et al. (5), the average of the highest strength ratios of the right leg quadriceps muscles of football players with 5-7 years of training at 60°/sec angular velocity is determined as 236 ± 32 n/m, the left leg as 227 ± 34 n/m, the average of the highest strength ratios of the right leg quadriceps muscles of football players with 8-10 years of training at 60°/sec angular velocity as 251 ± 42 n/m, the left leg as 245 ± 36 n/m, the average of the highest strength ratios of the right leg quadriceps muscles of football players with 11 years of training at 60°/sec angular velocity as 240 ± 34 n/m, the left leg as 235 ± 34 n/m, the average of the highest strength ratios of the right leg hamstring muscles of football players with 5-7 years of training at 60°/sec angular velocity as 133 ± 25 n/m, the left leg as 126 ± 24 n/m, the average of the highest strength ratios of the leg hamstring muscles of football players with 8-10 years of training as 141 ± 24 n/m, the left leg as 140 ± 26 n/m, the highest strength ratios of the right leg hamstring muscles of football players with 11 years of training as 140 ± 22 n/m, the left leg as 138 ± 20 n/m.

It is determined that the average of the highest strength rates of the right leg quadriceps muscles at 60°/sec angular velocity and the average of highest for rates of the right leg hamstring muscles at 60°/sec angular velocity belong to defensive players, and the average of the highest strength ratios of the left leg quadriceps at 60°/sec angular velocity and the average of highest strength rates of the left leg hamstring muscles at 60°/sec at the angular velocity belong to defensive players, too. Statistically, there is a significant difference between defensive players and goalkeepers regarding the averages of highest strength of the left leg quadriceps muscles of at 60°/sec angular velocity and of highest strength of the left leg hamstring muscles at 60°/sec angular velocity. When examining studies in the literature; In the study named as Evaluation of the effect of knee isokinetic muscle strength of football players on ball speed in different stroke techniques by Küçük (2011), the average of highest strength ratio of dominant leg quadriceps muscles of the defensive players at 60°/angular velocity is determined as 120,90 ± 20,82 n/m, 119,30 ± 23,38 n/m for the midfield players, 123,05 ± 20,29 n/m for the attack players, the average of highest strength ratio average of hamstring muscles of defensive players as 97,70 ± 19,71 n/m, 99,15 ± 22,51 n/m for midfield players, 98,50 ± 18,23 n/m for forward players; the average of highest strength

ratio of non-dominant quadriceps muscles of defensive players is determined as 103,55 ± 19,08 n/m, 107,40 ± 16,01 n/m for the midfield players, 110,50 ± 22,23 n/m for the forward players, the average of highest strength ratio hamstring muscles of defensive players is determined as 86,15 ± 17,85 n/m, 94,55 ± 19,02 n/m for midfield players and 89,65 ± 19,80 n/m for forward players. In the study named as Comparison of anthropometric measurements and c isokinetic performances of knee joints of professional football players playing in different positions by Meriç et al. (2007), the average of the highest strength ratio of the right leg hamstring muscles of forward players at 60°/sec angular velocity is determined as 180,520 ± 28,0 n/m, 210,3 ± 1414 n/m for defensive players, 184,0 ± 28,1 n/m for midfield players, the highest strength ratio of quadriceps muscles of forward players is determined as 331,8 ± 34,1 n/m, 415,3 ± 14,1 n/m for defensive players and 340,4 ± 29,0 n/m for midfield players.

In the study named as Comparison of anthropometric measurements and isokinetic performances of knee joints of professional soccer players playing in different positions by Meriç et al. (2007); It is determined that there is a significant difference between forward players and midfield players and between forward players and defensive players regarding the averages of highest leg strength at 60°/sec angular velocity ($p < 0.05$). Values of forward players are found lower than both defensive and midfield players. There is a significant difference detected between midfield and defensive players in terms of increase in defensive players regarding their PT/body weight values ($p < 0.05$). Parallel to this study, the fact that high level of leg strength ratios of defensive players participating our study shows that there is a significant difference in football positions in terms of isokinetic performance. Due to the fact that defensive players run less than midfield and forward players and they have to move hastier in order to prevent the attacks of opponent team, it can be said that their explosive power is better off than players in other positions.

Considering the isokinetic studies in the football, there are also studies in which different parameters are evaluated in parallel with this study:

- Cerrah (Futbolda, 2099) Evaluation of muscular activations and ball speed isokinetic force relation in different stroke techniques in football
- Özkan (Sporcularda Bacak Hacmi, 2010) Leg Volume and Mass of Players, Relationship between Hamstring/Quadriceps Ratio and Anaerobic Performance and Isokinetic Leg Strength
- Akın (Profosyonel, 2004) Comparison of physical properties and concentric forces of isokinetic knee muscles of professional and amateur football players
- Commetti (Cometti, 2001) Isokinetic Strength and Anaerobic Power of Elite, Subelite and Amateur French Soccer Players
- Bennell (Kim Bennell, 1998). Intran-rater reliability of a weight-bearing lunge measure of ankle dorsiflexion.

Conclusion

The study results show that there is no significant difference between the highest strength ratios of the right and left leg quadriceps and hamstring muscle groups at 60°/sec angular velocity of football players. It is seen that the highest strength ratios of the football players' left leg quadriceps muscles at

angular velocity of 60°/sec are better than right leg muscle groups. This is thought to be due to the right leg preference of the players participating in the study. As a result of the study, when the highest strength ratios of right and left leg quadriceps and hamstring muscle groups are evaluated in terms of leg preference at 60°/sec angular velocity of football players, there is no significant difference observed. When the highest strength ratios of the leg muscles at the angular velocity of 60°/sec are evaluated, it is seen that the left leg preference is better than the right leg preference. This is thought to be due to the fact that the left leg plays a balance and support role during sportive performance. The study results show that when the highest strength ratios of the right and left legs are evaluated in terms of the sport age at 60°/sec angular velocity of football players, no significant difference is observed. At 60°/sec angular velocity, the highest strength ratio of the leg muscles is found to be better than the left leg preferred football players with sports experience of 6-10 years.

As a result of the study, statistically, there is a significant difference found between the averages of defensive players and goalkeepers regarding maximum strength of the left leg quadriceps muscles at 60°/sec angular velocity and the highest strength at 60°/sec angular velocity of the left leg hamstring muscles. Playing football on a large field and the differences between the tasks assigned to the players require an evaluation according to their positions depending physical and physiological needs. While applying training methods; It is necessary to increase the regional performances of football players with the help of various studies according to their positions in the field.

REFERENCES

- Aagard P, Simonsen EB, Magnusson P, Larsson B, DyrhePoulsen P. 1998. A new concept for isokinetic hamstring/ quadriceps muscle strength ratio. *Am j Sports Med*, 26: 231-237.
- Aktuğ, futbolcularda izokinetik hamstring ve quadriceps kas kuvvet oranı ile dikey sıçrama ve sürat performans selçuk üniversitesi sağlık bilimleri enstitüsü yüksek lisans tezi; 2013 Zait Burak Aktuğ
- Cometti G Isokinetic Strength and Anaerobic Power of Elite, Subelite and Amateur French Soccer Players. *Int J Sports Med* 2001; 22: 45±51
- Farklı mevkilerde oynayan profesyonel futbolcuların diz eklemlerinin antropometrik ölçümlerinin ve izokinetik performanslarının karşılaştırılması, uluslararası insan bilimleri dergisi, Bergün Meriç, Menşure Aydın, Tuncay Çolak, Enis Çolak, Murat Son, Cilt: 4 Sayı: 2 Yıl: 2007, ISSN 1303-5134.
- Futbolda farklı vuruş tekniklerinde kassal aktivasyonların ve top hızı izokinetik kuvvet ilişkisinin değerlendirilmesi Anadolu üniversitesi sağlık bilimleri enstitüsü beden eğitimi ve spor anabilim dalı Yüksek Lisans Tezi Eskişehir, Ocak 2009 Ali Onur Cerrah
- Kim Bennell Intran-rater reliability of a weight-bearing lunge measure of ankle dorsiflexion Australian physiotherapy original article vol 44, no 3 1998
- Konstantinos Fousekis, Elias Tsepis, George Vagenas Lower Limb Strength in Professional Soccer Players: Profile, Asymmetry, and Training Age *Journal of Sports Science and Medicine* (2010) 9, 364-373
- Küçük , Futbolcularda diz bölgesi izokinetik kas kuvvetinin farklı vuruş tekniklerinde top hızına etkisinin incelenmesi. Ondokuz Mayıs Üniversitesi, Sağlık Bilimleri Enstitüsü, Samsun, Yüksek Lisans Tezi; 2011. Hamza Küçük
- Malliou P, Ispiridis I, Beneka A, Taxildaris K, Godolias G. Vertical jump and knee extensors isokinetic performance in professional soccer players related to the phase of the training period. *Isok Exerc Sci*, 2003;11:165–69.
- Olivier N, Rogez J, Masquelier B. Benefit of isokinetic evaluations of knee before and after anterior cruciate ligament reconstruction in soccer players. *Ann Readapt Med Phys*. 2007;50(7):564-9.
- Profosyonel ve amatör futbol oyuncularının fiziksel özellikler ve izokinetik diz kaslarının konsantrik kuvvetlerinin karşılaştırılması klinik araştırma / clinical research Vol. 15, No. 3, (161-167), 2004
- Şentürk, 17-20 yaş basketbolcu ve futbolcuların izokinetik kuvvetlerinin(diz fleksiyon ve ekstansiyonlarının) karşılaştırılması. Balıkesir üniversitesi sosyal bilimler enstitüsü, yüksek lisans tezi; 2011 Uğur Şentürk
- Sporcularda Bacak Hacmi, Kütlesi, Hamstring/Quadriceps Oranı ile Anaerobik Performans ve İzokinetik Bacak Kuvveti Arasındaki İlişki Spor Bilimleri Dergisi Hacettepe *J. of Sport Sciences* 2010, 21 (3), 90–102
- Yılmaz, Elit Futbolcularda Vücut Kompozisyonu Ve İzokinetik Diz Kuvvetinin Çabukluk Ve Çeviklik Üzerine Etkisi ondokuz mayıs üniversitesi sağlık bilimleri enstitüsü beden eğitimi ve spor anabilim dalı yüksek lisans tezi; 2015 Ali Kerim Yılmaz
- Zakas A. Bilateral isokinetic peak torque of quadriceps and hamstring muscles in professional soccer players with dominance on one or both two sides. *J Sports Med Phys Fitness*. 2006;46(1):28-35
