EXAMINATION OF ISOKINETIC STRENGTH RATES OF KNEE JOINT (H/Q) IN FOOTBALL PLAYERS

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ABSTRACT

The purpose of this study is to examine the isokinetic strength rates of knee joint (H/Q) in football players.

30 males (15 football players, 15 controls) were included in the research who were studying in Yaşar Doğu Sports Sciencies faculty of Ondokuz Mayıs University. The position, age and dominant leg information of the subjects were determined by filling in personal information forms given to the subjects. Body mass index measurements were recorded with a Gaia 359 plus body analyzer and H/Q force rates were measured and recorded with a Humac Norm Cybex Brand computer controlled isokinetic dynamometer at angles of $60^{o}sn^{-1}$, $180^{o}sn^{-1}$ and $240^{o}sn^{-1}$. For the statistical analysis of the data used SPSS 22.0 software was used. Independent t-test was applied for the analysis of football player-control group and dominant leg results. In addition, one-way variance analysis and LSD test were used for repeated measures to compare football players according to their positions. Statistical results were evaluated at 95% confidence interval and $p < 0.05$ significance level.

When we look at the descriptive information between the two groups in our study; there was a significant difference between age, body weight and sport ages, but no significant difference was observed in other parameters. When the H/Q power ratios at angular velocities of $60^{o}sn^{-1}$, $180^{o}sn^{-1}$ and $240^{o}sn^{-1}$ were examined, no significant difference was found between the dominant-nondominant force ratios and footballer positions between the two groups.

As a result, when H/Q power ratios of footballer and control group are examined; There was no significant difference between the two groups when dominant-nondominant strength ratios and soccer player positions were compared.

Keywords: Football player, H/Q ratio, Isokinetic knee strenght

Academic Discipline And Sub-Disciplines

Sport

SUBJECT CLASSIFICATION

Sport Science

TYPE (METHOD/APPROACH)

Sport Performance

INTRODUCTION

Increasing the performances of the athletes and reducing their injuries are made possible by appropriate training programs and accurate assessment of their muscle strength (Miller,2006). Although football is a sport based on high aerobic and anaerobic strength and durability, optimal muscle strength must also be developed at the same time. Particularly, lower extremity muscle strength is of great importance in specific movements in a football game, and muscle groups around the knee are reported to exhibit high activation during throwing, jumping, running and changing direction. Muscle balance and strength between dominant/nondominant and agonist/antagonist can be determined objectively by isokinetic dynamometers (Canüzmez at all, 2006; Malliou at all, 2003).

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In football, quadriceps (Q) and hamstring (H) muscle groups are of primary importance. Many studies have shown us the relationship between weak hamstring muscle strength and acute hamstring injuries in male football players (Karsan at all,1999). Being able to make the right decisions about muscle strength and joint balance on the knee region depends on the research conducted to determine H/Q (hamstring/quadriceps) force ratios. The H/Q ratio is calculated by the ratio of the maximum knee flexor (hamstring) and the maximum knee extender (quadriceps) peak torques to each other at the same angular velocity and concentric contraction. This rate is dependent on speed and position and reflects the tendency to injury and is also known as a suitable tool showing trends in injuries. Due to the importance of lower extremity flexor and extensor muscle force balance, H/Q ratio can also be used for rehabilitation in the case of injuries of the knee (Tortop and Ocak, 2010; Alangari and Al-Hazzaa, 2004; Resene at all, 2001).

As stated in the literature, the importance of isokinetic knee strength is clearly indicated in terms of football players. In this study, it was aimed to investigate the H/Q ratios of the football players in different positions playing football at professional and amateur level and accordingly the tendencies of injury and power balances.

MATERIAL AND METHOD

In the research,15 male football players who play in professional or amateur leagues with a mean age of 22,80 ± 2,14 years and 15 males having no association with football with a mean age of 20,13 ± 1,64 years but have sports history of at least 2-3 years in different sports however at that time who did not do active sports were included as control group. All of the subjects were selected from the students studying at Ondokuz Mayıs University Yaşar Doğu Sports Sciences Faculty and it was noted that the subjects who participated in the study did not have past knee injury.

Before the measurements, all subjects were informed verbally about the purpose of the study and, before the measurements, each subject was asked whether he had any previous knee injury or surgical intervention. The position, age and dominant foot information of the subjects participating in the study were determined by filling in personal information forms given to the subjects. Descriptive information was recorded using an Gaia 359 plus body analyzer with anatomical stading, with sporting clothes, and without shoes, and length in cm, body weight in kg were recorded. The angular velocities were determined as 60osn-1, 180osn-1 and 240osn-1 at the determined H/Q ratios and the tests were performed with Humac Norm Cybex Brand computer controlled isokinetic dynamometer. Before the test, the subjects were informed verbally and visually about the whole of the test and they were asked to apply maximum force at all angular speeds. For each given test at the given angles, loud alerts were made during the test to take into account the repeated numbers given by the atheletes according to the constant protocol of the dynamometer and the intervals between the rest and to obtain maximum results. At all angular velocities, the highest elevator and flexor muscle strength values were determined, and H/Q ratios were recorded based on these results.

In the statistical analysis of the data, SPSS software (SPSS for Windows, version 22.0, 2008, SPSS Inc., Chicago, Illinois, USA) was used. Data were presented as arithmetic mean, standard deviation, minimum and maximum values. For normality testing Kolmogorov-Smirnov/Shapiro-Wilk tests; for homogeneity testing Levene test was applied. The skewness and flatness values for the data sets without normal distribution were checked and it was assumed that the data sets within the range of ±2 showed normal distribution. Independent t-test was applied for the analysis of football player-control group and dominant leg results. One-way variance analysis and LSD tests were used for repeated

measures to compare football players according to their positions. Statistical results were evaluated at 95% confidence interval and p <0.05 significance level.

FINDINGS

In this section, the mean values and statistical results of the data obtained in the study were reported. When the descriptive data of the subjects participating in the study were examined, the mean age was 20,50 ± 1,98 years, height was 179,33 ± 6,91 cm, body weight was 73,73 ± 12,72 kg, bosy mass index was 22,80 ± 2,66 kg/m2, and the sport age was 6.80 ± 4.07 years (Table 1).

Table 1. Identifying information of subjects

Variable	N	Min.	Max.	Mean	S.D.
Age (year)	30	18,00	25,00	20,50	1,98
Length (cm)	30	166,00	194,00	179,33	6,91
Body weight (kg)	30	54,00	113,00	73,73	12,72
Body mass index (kg/m^2)	30	19,16	31,63	22,80	2,66
Sports Age (year)	30	2,00	13,00	6,80	4,07

Table 2. Comparison of descriptive information and H/Q ratios of football and control groups

Variable	Group	N	Mean	S.D.	p
Age (year)	Football Player	15	22,80	2,14	0,001*
	Control	15	20,133	1,64	
Length (cm)	Football Player	15	177,00	4,90	0,524
	Control	15	175,73	5,81	
Body weight (kg)	Football Player	15	75,95	6,91	0,031*
	Control	15	70,17	7,05	
Body mass index (kg/m^2)	Football Player	15	24,22	1,61	0,081
	Control	15	22,77	2,61	
Sports Age (year)	Football Player	15	10,67	1,50	0,000*
	Control	15	2,933	0,26	

60 H/Q Right (%)	Football Player	15	66,13	15,33	**0,791**
	Control	15	64,80	11,79	
60 H/Q Left (%)	Football Player	15	59,20	7,78	**0,168**
	Control	15	54,53	10,11	
180 H/Q Right (%)	Football Player	15	68,27	13,22	**0,536**
	Control	15	64,87	16,33	
180 H/Q Left (%)	Football Player	15	63,47	9,81	**0,247**
	Control	15	58,33	13,65	
240 H/Q Right (%)	Football Player	15	64,53	14,22	**0,700**
	Control	15	62,27	17,54	
240 H/Q Left (%)	Football Player	15	59,80	7,84	**0,782**
	Control	15	58,73	12,57	

The descriptive information of football players and control groups and the average values of H/Q ratios at different angular speeds are presented in Table 2. There was a significant difference in age, body weight and sports age ($p < 0,05$) and no significant difference in other parameters ($p > 0.05$).

Table 3. Examination of H/Q ratios according to dominant leg

Variable	Dominant Leg	N	Mean	S.D.	p
60 H/Q Right (%)	Right	16	65,38	14,86	**0,969**
	Left	14	65,57	12,21	
60 H/Q Left (%)	Right	16	59,69	8,93	**0,071**
	Left	14	53,64	8,64	
180 H/Q Right (%)	Right	16	65,63	15,51	**0,715**
	Left	14	67,64	14,22	
180 H/Q Left	Right	16	61,50	10,05	**0,775**

(%)	Left	14	60,21	14,22	
240 H/Q Right (%)	Right	16	59,75	15,72	**0,179**
	Left	14	67,57	15,24	
240 H/Q Left (%)	Right	16	62,13	8,42	**0,105**
	Left	14	56,00	11,56	

The results of examining the H/Q ratios of football players and control groups according to the dominant leg are given in Table 3. No significant results were obtained when the H/Q ratios were compared according to the dominant leg (p>0.05).

Table 4. Examination of the differences between H/Q ratios according to the players' positions

Variable	Group	Mean	S.D.	p
60 H/Q Right (%)	Defence	56,80	20,36	**0,202**
	Midfield	66,80	13,83	
	Forward	76,00	2,83	
60 H/Q Left (%)	Defence	60,40	7,30	**0,720**
	Midfield	58,60	9,45	
	Forward	56,00	6,58	
180 H/Q Right (%)	Defence	65,80	19,83	**0,688**
	Midfield	64,40	10,24	
	Forward	72,00	2,16	
180 H/Q Left (%)	Defence	66,40	6,50	**0,695**
	Midfield	61,80	15,67	
	Forward	60,75	5,44	
240 H/Q Right (%)	Defence	54,20	16,01	**0,157**
	Midfield	65,40	7,54	
	Forward	70,00	9,56	
240 H/Q Left (%)	Defence	59,00	4,42	**0,827**
	Midfield	57,80	12,38	
	Forward	61,25	4,92	

In Table 4, no significant difference was observed when the H/Q ratios were compared according to the positions played by the football players (p>0.05).

DISCUSSION AND CONCLUSION

Although H/Q force ratio has a great importance in correct assessment of the athletes' muscular strength, the creation of appropriate training programs and boosting performance, researches have shown that dynamic stabilization and muscle balance on the knee joint provided to make the right decisions. The agonist/antagonist peak torque ratio is used as a determining factor in avoidance of injuries as well as in muscular balance. It is reported in studies that the imbalance between the two muscle groups, especially the weakness of the hamstring muscle leads to injuries (Miller,2006; Çolakoğlu,1993; Yamamato,1997; Koutedakis, 1997).

The H/Q power ratio is affected by angular speed rather than age, gender, dominant and nondominant characteristics. As the speed increases, the H/Q force ratio decreases. It has been reported that at 30 deg/s and 60 deg/s speed, the rates were 50-60% at 120 deg/s and 180deg/s speed, they were between 60-70% at speeds above 180 deg/s thay were between 70-80% (Perrin, 1993).In our study, at 60 deg/s angular speed, the ratio of H/Q was 66,13 ± 15,33% in the right foot, 59,20 ± 7,78 in the left foot in football players and 64,80 ± 11,79 in the right foot, 54% 53 ± 10,11 in the left foot in control group. When we examined the H/Q force ratios at 60 deg/s angular speed, we found that the right foot H/Q ratio had a higher percentage than the left foot ratio in both groups, and it can be said that right leg is more convenient for injuries in both groups. When the literature is examined, we can see that H/Q force ratios at 60 deg/s are similar to the left foot force ratios in our study, but lower than the right leg in Özberk et al.(2009)'s study conducted on 1st, 2nd and 3rd league football players, also Meriç et al.(2007) conducted a study on football players in which the measurements that were made at the same angular speed were found to be similar to the left foot strength ratios of our study but lower than the right foot ratios. When the other studies are examined, it is found that H/Q ratios in professional football coincide with the left foot measurement ratios in our study, but they are lower than the right foot, and similar to our study in amateur football players (Eniseler at all, 2012; Çoşkun at all, 2009; Özkan and Kin-işler, 2010;Kayatekin,1994; Croisier at all, 2008). In addition, when H/Q force ratio at 60 deg/s is observed on football players, in this case, it can be considered that the H/Q force ratio decreases as the league quality increases in football, the training age is higher and the training planning is more professional. The right and left foot strength ratios in our study may explain the imbalance of the athletes' efforts to strengthen their dominant legs, as well as the inadequate training program on the teams they play.

In our study, at 180 deg/s speed, the H/Q force ratios were 68.27 ± 13.22% in the right foot in football players group, 64.87 ± 16.33% in the control group and in the left foot 63.47 ± 9.81% and % 58,33 ± 13,65 were recorded respectively. When the researches were examined, Tortop et al. (2010) conducted a study of 30 athletes and found that the dominant foot measurements were similar to our study but the nondominant foot force ratios were higher than the results of our study. Akın et al. (2004) found that at 180 deg/s, in the measurements they applied to amateur and proffesional football players, the amateur football players have high H/Q ratios. Tourny et al. (2002) did not find statistical significance in terms of H/Q ratio between footbal players and sedanter group in a similar way regarding our study.

When the H/Q ratios were examined at 240 deg/s angular speed, the right and left foot strength ratios of the football players were 64,53 ± 14,52% and 59,80 ± 7,89%,

respectively, the right and left foot strength ratios of control group were recorded as 62,27 ± 17,54 and 58,73 ± 12,57%. When the national and international literature is examined, it is seen that the study performed by Aktuğ (2013) shows that the H/Q ratios at 240 deg/s on the footballers was higher than those of out study and Taşmektepligil (2016), in his study conducted on 33 football players had results which were similar to our study. Özçakar et al. (2003) conducted a study on elite football players and found that the right and left foot strength ratios were high in the right foot and low in the left foot as in our study. Again, the study of Şentürk (2011) on football players shows that H/Q ratios at 240 deg/s angular speed gave higher rates than those in our study regarding right foot however shows similar results regarding the left foot.

When we examined the H/Q ratios at 60,180 and 240 deg/s angular speeds according to the positions of the football players in our study, it was found that the 60 deg/s force ratios were lower in defense players compared to forward and midfield players in the right foot, however they were similar in the left foot, at 60,180 and 240 deg/s force ratis are higher in forward players in the right foot than the other players but they are similar in the left foot. When the other studies are examined, the results of the H/Q ratios are similar to those of our studies (Meriç at all, 2007; Eniseler at all, 20012).

From the results, it can be observed that H/Q ratios are affected by angular speeds rather than other parameters, as mentioned in Perrin (1993), but different results are obtained when looking at the positions. Moreover, when we classify the football players as professional or amateur, they also have different ratios at the same angular speeds and it is thought that the training age, the quality of the league they are in, the training programs applied and the training being professionally planned and programmed.

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