

Comparison of Leg, Back and Claw Strength Values of Elite Taekwondo, Athletes and Hawkey Players

Received date: 08.11.2021, Accepted date: 30.11.2021

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Abstract

Objective: The purpose of this research was to compare the leg, back, and claw strength values of elite taekwondo players, athletes, and field hawkey players.

Method: While the universe of the research consists of elite taekwondo players, athletes, and field hawkey players in Turkey, the sample consists of 94 elite athletes, including 16 male and 16 female elite taekwondo players, 16 male and 14 female field hawkey players, and 12 male and 20 female athletes. While the athletes' leg and back strength were measured using a Leg-Back Dynamometer, claw strength was measured using a Hand Dynamometer.

Results: According to the data obtained, a significant difference was determined in the leg strength, back strength and claw strength values of the elite female athletes participating in the research according to their branches ($p < 0.05$). In these determined differences; It was determined that taekwondo players have higher values.

Conclusion: Consequently; leg, back and claw strength values of female elite taekwondo players from elite female athletes and field hawkey players; It can be said that the leg and back strength values of elite male athletes and field hawkey players may be higher than elite male taekwondo players.

Keywords: Strength, Athletics, Taekwondo, Hawkey.

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Introduction

One of the parameters that affect performance in sports is physical characteristics or body composition. Body composition is one of the important indicators for an athlete in terms of the efficiency of his physical and physiological capacity. The physical structure characteristic of the athlete is important for achieving the expected level of performance of his fitness for the sport he has done. However, physical structure is not enough for an athlete to determine performance alone, but combined with other performance indicators such as strength, strength, flexibility, speed, endurance and quickness, it positively affects the athlete's performance^{1,2}.

Whenever we take a look from past and current to studies in the field of sport science athletes leg strength, jumping, flexibility and anaerobic power measured in these studies were evaluated separately or together important performance parameters, such as parameters and that are mentioned they were impressed with each other and also examined the effects on the degree of the physical elements³.

It is well acknowledged that the relevance of five fundamental biomotor abilities, namely strength, speed, endurance, coordination, and flexibility, is quite high across a variety of sports (athletics, taekwondo, basketball, volleyball, swimming, handball, baseball, football, hawkey, field hawkey, etc.)⁴. Remarkably, there is limited evidence to compare these biomotor talents with other athletic populations. For a variety of reasons, trainers and coaches are hesitant to discuss the outcomes of their work with their colleagues and peers^{5,6}.

As a result, it is difficult to assess trainers, trainers, and athletes who analyze athletes' athletic performance. Furthermore, creating scientific evaluations of athletes may differ between sports branches⁷. In order to overcome the problems in the sequence of events that occurred, some trainers, using the normative data obtained from the tests used before them; they change the training they do in their own sportive branches and make them more original⁸.

If facilities allow, normative data are provided for various athletes. Descriptive data are presented within the sporting data for which normative data are not available⁹.

As can be understood that; this data is of particular importance for; athletes, trainers, and researchers in the relevant field. Based on all this information; Purpose this study was to compare the leg strength, back strength and claw strength values of elite taekwondo players, athletes and field hawkey players and to examine the differences between branches.

Materials and Methods

This study compared the leg strength, back strength, and claw strength values of top taekwondo players, athletes, and field hawkey players using the causal comparison research model, one of the quantitative research designs. Elite taekwondo players, athletes and field hawkey players in Turkey constitute the universe of the research; the sample is; Those who want to participate in the research voluntarily, between the ages of 18-36 (years), from all branches and genders; 10 male, 10 female elite taekwondo players, 10 male, 10 female field hawkey players and 10 male and 10 female; comprised of at least 60 elite athletes in total. The research was carried out in the gym of Dicle University/School of Physical Education and Sports and at the same time of each day (15.00-18.00) where measurements were realized.

The data was formed from the personal data collection form created by the researchers and the tests preferred for the measurement of physical and physiological performance within the scope of the research. In the scope of the research; apart from the descriptive variables of elite athletes; height, body weight, body mass index, leg strength, back strength and claw strength were measured. The height and body weight of all elite athletes who will participate in the research were determined with a digital scale with a SECA® 769 height gauge with a precision of 1 millimeter and 100 grams. Body weight measurements, on the other hand, were determined by dividing the athletes in standard sports clothes (shorts, T-shirts) with a minimum level of clothing and bare feet in accordance with the predetermined techniques was calculated as (kg/m²)^{10,11}.

Besides, the determination of leg strength measurements was carried out using Takei brand back and leg (back and lift) dynamometer¹².

The dynamometer used is based on the pressure principle with standard settings. According to the working protocol of the dynamometer; it is based on the principle that the pointer moves by stretching the existing steel wire when an external force is applied. Thanks to the indicator on the dynamometer used in line with this protocol, the force applied by the person is determined in kilograms (kg). Before taking the measurements, a five-minute warm-up protocol was applied to the participants to warm up^{13,14,15}.

Following a five-minute warm-up, participants were instructed to position their feet on the dynamometer table, knees bent. They raised the dynamometer bar that they gripped with their hands vertically using their legs at the maximum level after positioning their feet on the dynamometer table with their knees bent, arms stretched, knees bent between 130-140 degrees, backs straight, and bodies slightly bent forward. The subjects were given a complete rest time and instructed to perform

the test twice after the initial upward pull was a trial. The best value obtained after two trials for each participant was recorded in kg.^{12,13,14,15}

The back strength measurements of the participants were performed using the back and lift dynamometer developed by Takei^{16,17,18}.

In accordance with the test protocol, the participants were asked to place their feet on the dynamometer bench with their knees bent, keep their arms stretched, lean their back straight and slightly forward the body, and then pull the dynamometer bar that they grasped with their hands vertically, using their back muscles as much as possible. The claw strength measurements of the participants were also measured using the Hand Grip brand (Hand dynamometer) developed by Takei. Following a five-minute warm-up period, measures were collected while standing, without bending the arm to be measured and without contacting their body, with the arm at a 45° angle to the body. Following the completion of the protocol for the right and left hands, this test was done twice with a full rest interval in between. The values gathered were recorded in kg as the best value for the right and left hands^{12,13,14,15,16,17,18}.

Statistical Analyses: SPSS 22.0 statistical package program was applied for statistical analysis of the data. After collecting the data, arithmetic mean (X), standard deviation (Sd.), and maximum (Max.) and minimum (Min.) values were determined for the parameters obtained. To test the normality of the received data, it was determined by the Shapiro-Wilk Normality Test. If parametric test assumptions were met, differences between groups were determined using one-way analysis of variance and post hoc LSD test (One-Way-ANOVA-post hoc LSD) in accordance with the design of the study. The LSD (least significant difference) method applies standard t-tests to all possible pairs of group means. The LSD test is a post-hoc statistic that is considered objectionable if the number of groups (k means) for which the difference will be determined is more than 3. Mathematically, it is highly vulnerable to type I error. Because although the type I error level (α) is chosen as 5%, the amount of error per group increases as the number of groups increases. Therefore, LSD multiple comparison statistics should not be used if the number of groups was being compared is large or more than 3. The statistical significance level in the study was accepted as $p < 0.05$ ^{19,20}.

Result

The findings of this study in which the leg, back and claw strength values of elite taekwondo players, athletes and hawkey players were compared are given in Table 1, Table 2 and Table 3.

Table 1. Descriptive Data of Elite Athletes Participating in the Research

Branch	Gender	n	Parameter(Unit)	Minimum	Maximum	$\bar{X} \pm Sd.$
Taekwondo	Male	16	Age(years)	17,0	20,0	18,1±1,2
			Stature(m)	1,65	1,85	1,76±0,1
			Body Weight(kg)	51,0	71,0	60,5±6,4
			BMI(kg/m ²)	17,04	22,41	19,6±1,7
			Leg Strength(kg)	60,00	140,00	113,5±26,5
			Back Strength(kg)	95,00	120,0	108,8±9,9
			Claw Strength(kg)	35,0	50,0	41,9±5,0
	Female	16	Age(years)	17,0	22,0	19,0±1,4
			Stature(m)	165,0	180,0	1,73±0,1
			Body Weight(kg)	55,0	60,0	57,6±1,8
			BMI(kg/m ²)	18,17	20,57	19,4±1,0
			Leg Strength(kg)	65,00	110,0	89,7±19,2
			Back Strength(kg)	75,0	90,0	83,4±6,3
			Claw Strength(kg)	27,0	42,0	38,6±3,8
Hawkey	Male	16	Age(years)	17,0	19,0	17,9±0,1
			Stature(m)	160,0	183,0	1,75±0,1
			Body Weight(kg)	50,0	80,0	65,4±10,6
			BMI(kg/m ²)	17,93	24,97	21,3±2,4
			Leg Strength(kg)	68,0	173,0	133,8±32,6
			Back Strength(kg)	71,0	138,0	117,8±21,6
			Claw Strength(kg)	27,0	57,0	43,8±9,1
	Female	14	Age(years)	17,0	19,0	17,9±1,0
			Stature(m)	146,0	165,0	1,60±0,1
			Body Weight(kg)	45,0	55,0	49,2±4,0
			BMI(kg/m ²)	17,47	22,89	19,4±2,0
			Leg Strength(kg)	73,0	80,0	76,0±2,7
			Back Strength(kg)	62,0	75,0	70,4±4,8
			Claw Strength(kg)	24,0	32,0	27,6±9,1
Athleticism	Male	12	Age(years)	17,0	20,0	17,7±1,2
			Stature(m)	172,0	180,0	1,8±0,1
			Body Weight(kg)	54,0	67,0	58,5±4,3
			BMI(kg/m ²)	17,99	20,68	18,9±1,0
			Leg Strength(kg)	115,0	170,0	141,3±18,1
			Back Strength(kg)	110,0	140,0	126,2±9,9
			Claw Strength(kg)	34,0	43,0	39,0±3,1
	Female	20	Age(years)	17,0	19,0	17,4±0,7
			Stature(m)	162,0	173,0	1,7±0,01
			Body Weight(kg)	43,0	61,0	50,5±5,4
			BMI(kg/m ²)	15,99	20,62	18,1±1,6
			Leg Strength(kg)	42,0	120,0	78,6±21,9
			Back Strength(kg)	52,0	93,0	73,3±15,1
			Claw Strength(kg)	34,0	43,0	32,5-3,0

In Table 1; the age, height, body weight, body mass index (BMI), leg strength, back strength and claw strength values of the elite male and female athletes participating in the research are given in detail according to their branch and gender.

Table 2. Comparison of Leg, Back and Claw Strength Values of Elite Female Athletes Participating in the Study

Parameter	Branch/Branch No	n	$\bar{X} \pm Sd.$	F	Sd.	p	Post Hoc
Leg Strength (kg)	Taekwondo/1	16	89,7±19,2	4,455	2	,041*	1>3(p= ,041)*
	Hawkey/2	16	76,0±2,7				
	Athleticism/3	12	78,6±21,9				
Back Strength (kg)	Taekwondo/1	16	83,4±6,3	6,623	2	,003*	1>2(p= ,001)* 1>3(p= ,006)*
	Hawkey/2	16	70,4±4,8				
	Athleticism/3	12	73,3±15,1				
Claw Strength (kg)	Taekwondo/1	16	38,6±3,8	8,694	2	,001*	1>2(p= ,001)* 1>3(p= ,006)*
	Hawkey/2	16	27,6±9,1				
	Athleticism/3	12	32,5±3,0				

*p<0.05

In Table 2, there was a significant difference determined in the leg strength, back strength and claw strength values of the elite female athletes participating in the research according to their branches (p<0.05). In these determined differences; It was determined that taekwondo players had higher values than athletes in leg strength values, taekwondo players had higher values than both athletes and field hawkey players in back strength values, and taekwondo players had higher values than both athletes and field hawkey players in claw strength values (p<0.05).

Table 3. Comparison of Leg, Back and Claw Strength Values of Elite Male Athletes Participating in the Study

Parameter	Branch/Branch No	n	$\bar{X} \pm Sd.$	F	Sd.	P	Post Hoc
Leg Strength (kg)	Taekwondo/1	16	113,5±26,5	4,143	2	,023*	3>1(p= ,010)* 2>1(p= ,040)*
	Hawkey/2	16	133,8±32,6				
	Athleticism/3	12	141,3±18,1				
Back Strength (kg)	Taekwondo/1	16	108,8±9,9	4,501	2	,017*	3>1(p= ,005)*
	Hawkey/2	16	117,8±21,6				
	Athleticism/3	12	126,2±9,9				
Claw Strength (kg)	Taekwondo/1	16	41,9±5,0	1,846	2	,171	n/a
	Hawkey/2	16	43,8±9,1				
	Athleticism/3	12	39,0±3,1				

*p<0.05

In Table 3 there was a significant difference found in the leg strength and back strength and values of the elite male athletes participating in the research according to their branches ($p < 0.05$). In these detected differences; It was found that athletes and field hawkey players had higher values than taekwondo players in leg strength values, and athletes had higher values than taekwondo players in back strength values ($p < 0.05$). Yet, there was no significant difference found in the claw strength values of the elite male athletes participating in the study according to their branches ($p < 0.05$).

Discussion

Ozkan *et al.* (2014) encapsulated a total of 59 participants, 28 female and 31 male. They found that there was a statistically significant relationship between the height and body weight measurements taken from the participants and their hand claw strength²¹. In a similar study by Şahin *et al.* (2011) it was stated that there was a significant relationship between body weight and hand claw strength²². When the findings of our study were examined, it was determined that the average of the claw strength increased with the average body weight in all of the athletes in the selected branches. At this point, it can be said that there is a positive relationship between the body weights of the athletes and their claw strength.

Şahin *et al.* (2011) stated that there is a significant relationship between the hand-claw strengths obtained from taekwondo players and their ages in their study involving 280 volunteer taekwondo players. There was also a significant relationship between the ages and claw strength of the taekwondo players in our study. In this respect, it is seen that there is a parallelism with our study²³.

Chong *et al.* (1994) stated that there is a significant relationship between the forearm lengths of the subjects and their hand grip strength in their study conducted on a certain group in the People's Republic of China²⁴.

Melekoglu *et al.* (2018) stated that the relationship between hand length and hand grip strength in adolescents is important²⁵.

In our study, the relationship between average height and claw strength values showed changes at the level of branches. Because of this situation, it can be said that there is no relationship between height and claw strength. It is thought that this situation may be caused by living conditions such as socioeconomic status, environmental factors or athlete backgrounds among individuals.

De Ste Croix *et al.* (2000) included the evaluation between age and leg strength in their study. As a result of this evaluation, they found that there was a statistically significant difference between both parameters²⁶.

Barber-Westin *et al.* (2006), it was stated that leg strength increases as age increases²⁶. According to the data we have obtained, there is an inverse relationship between the average age of male athletes and the average leg strength for all branches; It can be said that there is an inverse relationship between female field hawkey players and athletes in the specified branches, and there may be differences between age and leg strength between taekwondo and field hawkey players and athletes depending on the sports branch.

Kaynar *et al.* (2011) reported that hand grip strength is strongly related to the strength in the upper body and neck muscle groups in their study on 22 elite wrestlers²⁷.

Tizar *et al.* (2016), in their research on 45 elite basketball, handball and volleyball players, found a significant difference only in terms of Back Strength when comparing the Basketball-Handball teams in terms of strength right, strength left, vertical jump, long jump, leg strength, back strength²⁸.

Similarly, in our study, we determined differences in some parameters of field hawkey players and taekwondo players who have similar characteristics to the aforementioned branches. In these determined differences; it was found that athletes and field hawkey players had higher values than taekwondo players in leg strength values, and athletes had higher values than taekwondo players in back strength values. However, no significant difference was found in the claw strength values of the elite male athletes participating in the study according to their branches.

Conclusion

In this study, in which the leg, back and claw strength values of elite taekwondo players, athletes and field hawkey players were compared, the mean leg strength (kg) values of male taekwondo players were 113.5 ± 26.5 , and the mean back strength (kg) values were 108.8 ± 9.9 , claw strength (kg) values mean 41.9 ± 5.0 ; Mean leg strength (kg) values of female taekwondo players were 89.7 ± 19.2 , mean back strength (kg) values were 83.4 ± 6.3 , and average claw strength (kg) values were 38.6 ± 3.8 . Mean leg strength (kg) values of male field hawkey players were 133.8 ± 32.6 , mean back strength (kg) values were 117.8 ± 21.6 , and claw strength (kg) values were average 43.8 ± 9.1 ; The mean leg strength (kg) values of female field hawkey players were 76.0 ± 2.7 , the mean back strength (kg) values were 70.4 ± 4.8 , and the average claw strength (kg) values were 27.6 ± 9.1 . The mean leg strength (kg) values of male athletes were 141.3 ± 18.1 , the mean back

strength (kg) values were 126.2 ± 9.9 , the average claw strength (kg) values were 39.0 ± 3.1 ; The mean leg strength (kg) values of female athletes were 78.6 ± 21.9 , the mean back strength (kg) values were 73.3 ± 15.1 and the average claw strength (kg) values were $32.5-3.0$.

There was a significant difference found in the leg strength, back strength and claw strength values of the elite female athletes participating in the study according to their branches. In these determined differences; It was found that taekwondo players have higher values than athletes in leg strength values, taekwondo players have higher values than both athletes and field hawkey players in back strength values, and taekwondo players have higher values than both athletes and field hawkey players in claw strength values. Furthermore, a substantial difference was found in the leg strength, back strength, and values of the elite male athletes participating in the study based on their branch. It was not discovered that athletes and field hawkey players had greater values than taekwondo players in leg strength values, or that athletes had higher values than taekwondo players in back strength values.

However, no significant variation in the claw strength values of the elite male athletes participating in the study according to their branches was found.

As a conclusion, elite female taekwondo players have greater back, leg, and claw strength values than elite female athletes and field hawkey players; elite male athletes have greater back and leg strength values than elite male taekwondo players.

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