

Research on the Relation between Hand Preference and Success in Karate and Taekwondo Sports with Regards to Gender

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Abstract

This study is conducted with the aim of determining whether there is a difference between hand preference and success of adult Karate and Taekwondo athletes with regards to their gender. 255 athletes in total (144 male and 111 female) who participated in Turkey inter-university karate and taekwondo championships are included in the research. The “Oldfield Survey (1971)” that was developed to determine the hand preferences and some bio-motor characteristics of the athletes was implemented. In order to evaluate the success status, the correlation difference between the data obtained by following the results of the competition evaluation, hand preference and success was evaluated in the SPSS program. Dominant hand preference, athletic success and medal winning status of the athletes in both branches were compared. According to the findings, female karate and taekwondo athletes’ dominant hand preference and medal winning status have a weak and negative relation ($p < 0.05$). There was no significant relation between dominant hand preference and the branches ($p > 0.05$). There was also no significant relation between dominant hand preference, medal winning status and branches of male karate and taekwondo athletes ($p > 0.05$). In conclusion, a weak relation was found out between dominant hand preference of left-handed female karate and taekwondo athletes in their favor with regards to winning medals. However, no relation was found regarding male athletes.

Keywords

Hand Preference, Karate, Taekwondo, Sports

1. Introduction

Interest towards Karate and Taekwondo is increasing every other day because combat sports like these contribute to both physical performance and personality development. Fighting sports include high-intensity, short-acting and anaerobic alactic type of applications. The success of the athlete in these sports depends on conditioning features as well as coordinative features such as joint mobility, balance, coordination and stimulus response (reaction). For this reason, it is also clear that different scientific studies are needed in the sports branches mentioned. One of the issues that is thought to be untouched in this area is whether there is any relation between hand preference and athletic success in the mentioned sports branches.

1.1. Hand Preference

Hand preference is use of right or left hand dominantly. The hand preference idea is that the preferred hand is used more effectively and skillfully in daily activities. In other words, while the right-handed people use their right hand more successfully than left-handed ones in daily activities, and the left-handed people use their left hand more effectively and efficiently than right-handed ones. The motor fields that control the hands are in the left hemisphere in 95% of the people. This is why people most commonly use their right hands (Leong, 1980).

It has been found that the left-handed people use their right brain and right-handed people use their left brain more dominantly, because of their right and left brain hemispheres. Motor spaces are more dominantly located in the left hemisphere, which allow approximately 95% of the humans to control their hands. For this reason, the majority of people use their right hand (Turan, 2010).

Many people use their right hand to hold knives or forks, throw stones and open box covers. These people are “right-handed”. And some others do these tasks with their left hand, for which they are called “left-handed”. However, some people use their both hands equally. If they do not have any dominant preferences, they are defined as “ambidextrous” or mixed-handed or two-handed.

1.2. Karate

Karate, contrary to the common belief, is not an attack sport but a defense sport. The first movements of the “Kata”, which hold an important place in the karate sport, are blocks and that is a clear proof of this statement (Doğan, 2003). It has an important role in personality development as well as physically improving the body composition of a person. Dojo is a salutation stance extended towards the field of competition (tatamiye), opponent and trainers which is an indicator of previous statement (Türkeri, 2007).

Karate is a martial art aiming the development of character through education. All techniques and behaviors that could harm human beings are prohi-

bited. This is why all attacks should be controlled. Competitors must apply all techniques in accordance with the Karate's technical rules and in a controlled manner (Soykan, 2003).

The most important feature distinguishing karate sport from other sports is the "Do" philosophy. This thinking system which can be found in the vast majority of Far East fighting sports, indicates ripening over time (Doğan, 2003).

1.3. Taekwondo

Taekwondo, besides being a defense art and sport, aims to improve physical fitness, resistance and ability. Its main characteristic is that it contains defensive techniques against the opponent with bare hands and feet. Respect, love, humbleness and patience are among the other attributes of Taekwondo (Chun, 1975). All of Taekwondo's movements are based on a foundation in which the defense spirit is dominant since the days it was developed to defend against enemies. In ancient times, people lived primitively which require physical strength and abilities, this is why their bodies collapsed and their back hunched in short time during their older ages. Sports, especially Taekwondo, help developing physical fitness, resistance and abilities at the same time (Kim, 1995).

2. Method

255 athletes in total which consist of 144 male, 111 female, 120 karate and 135 taekwondo athletes, 223 right-handed and 32 left-handed people, who have participated in interuniversity karate and taekwondo championships of Turkey which is in the activity program of Karate and Taekwondo federations in 2016, contributed to this research. The athletes participated in this study with their own consent and none of them had any health problem.

Geschwind & Behan (1982) (Edinburgh Handedness Inventory) questionnaire was applied to determine the hand preference of the athletes. Questionnaire has been developed by adding some questions in terms of application. In the questionnaire, the activities take part in the horizontal rows and the level the individual makes his/her choice at takes part in the vertical order. This level has been determined in five ways, they are written in the form of: (SSE) always the left, (GSE) usually left, (HIE) both hands, (SSE) always the right hand. These preferences were evaluated according to the Geschwind score. A total of 10 questions were used in the questionnaire and these questions include: which hand is used to 1) write, 2) paint, 3) throw balls or stones, 4) hold scissors, 5) brush the teeth, 6) hold a knife without a fork, 7) hold a fork, 8) hold a shovel handle, 9) strike a match and 10) open a bottle cap.

The choices are "always with the right hand" (+10 points), "usually with the right hand" (+5 points), "with both hands" (0 point), "usually with the left hand" (-5 points), and "always with the left hand" (-10 points).

In the data obtained from the questionnaire, the evaluation was done like this:

+80 to +100 points for dominant right-handed ones, +20 to +75 points for non-dominant right-handed ones, -15 to +15 points for two handed ones, -20 to -75 points for non dominant left-handed ones and -80 to -100 points for dominant left-handed ones.

In order to evaluate the dominant hand preference and athletic success status of the athletes, the results of the competition evaluations were tracked and the percentage distributions of the dominant hand preference and athletic success compared to the genders in the obtained data were shown in the frequency analysis. The distribution ratios of matches won and lost regarding branches and dominant hand preferences of athletes are shown in cross tables with respect to their gender. Whether there is any relationship between the variables was determined by correlation analysis according to the significance level of 0.05. regression analysis difference and 0,05 significance level was evaluated in the SPSS 22 package program to determine the ratio of the affected variable in case of presence of a relationship between the variables. This study was carried out with approval from Muğla Sıtkı Koçman University, Institute of Health Sciences, Ethics Committee.

56.5% of the athletes are male and 43.5% is female. Out of all athletes participated the height of; 10 (3.9%) were 150 - 159 cm, 60 (23.5%) were 160 - 169 cm, 116 (45.5%) were 170 - 179 cm, 64 (25.1%) were 180 - 189 cm, 5 (2%) were 190+ cm (**Table 1**).

Among male athletes from Karate branch the weight of; 9 (12.9%) were 60 kg, 17 (24.3%) were 67 kg, 26 (37.1%) were 75 kg, 11 (15.7%) were 84 kg, 7 (10%) were 84+ kg. Among male athletes from Taekwondo branch the weight of; 17 (23%) were 58 kg, 29 (39.2%) were 68 kg, 12 (16.2%) were 74 kg, 6 (8.1%) were 80 kg, 10 (13.5%) were 87+ kg. (**Table 2**)

Among female athletes from Karate branch the weight of; 12 (24%) were 50 kg, 13 (26%) were 55 kg, 10 (20%) were 61 kg, 8 (16%) were 68 kg, 7 (14%) were 69+ kg. Among female athletes from Taekwondo branch the weight of; 18 (29.5%) were 49 kg, 23 (37.7%) were 57 kg, 9 (14.8%) were 62 kg, 8 (13.1%) were

Table 1. Genders and heights of athletes.

Gender and Height		Frequency	%
Gender	Male	144	56.5
	Female	111	43.5
	Total	255	100.0
Height	150 - 159	10	3.9
	160 - 169	60	23.5
	170 - 179	116	45.5
	180 - 189	64	25.1
	190+	5	2.0
	Total	255	100.0

67 kg, 3 (4.9%) were 73+ kg (**Table 3**).

43 (16.9%) of the female karate athletes were right-handed while 7 (2.7%) were left-handed; and 53 (20.8%) of the female taekwondo athletes were right-handed while 8 (3.1%) were left-handed. 62 (24.3%) of the male karate athletes were right-handed while 8 (3.1%) were left-handed; and 65 (25.5%) of the female taekwondo athletes were right-handed while 9 (3.5%) were left-handed (**Table 4**).

Table 2. Branches and weights of male athletes.

Athletes' Weights	Branches			
	Karate		Taekwondo	
	Frequency	%	Frequency	%
58 kg	-	-	17	23.0
60 kg	9	12.9	-	-
67 kg	17	24.3	-	-
68 kg	-	-	29	39.2
74 kg	-	-	12	16.2
75 kg	26	37.1	-	-
80 kg	-	-	6	8.1
84 kg	11	15.7	-	-
84+ kg	7	10.0	-	-
87+ kg	-	-	10	13.5
Total	70	100	74	100

Table 3. Branches and weights of female athletes.

Athletes' Weights	Branches			
	Karate		Taekwondo	
	Frequency	%	Frequency	%
49 kg	-	-	18	29.5
50 kg	12	24	-	-
55 kg	13	26	-	-
57 kg	-	-	23	67.2
61 kg	10	20	-	-
62 kg	-	-	9	14.8
67 kg	-	-	8	13.1
68 kg	8	16	-	-
69+ kg	7	14	-	-
73+ kg	-	-	3	4.9
Total	50	100	61	100

13 (21.7%) of right-handed male karate athletes won a medal while 47 (78.3%) didn't win; and 8 (19%) of right-handed female karate athletes won a medal while 34 (81%) didn't win. 13 (20.6%) of right-handed male Taekwondo athletes won medal while 50 (79.4%) didn't win. 13 (25%) of right-handed female Taekwondo athletes won medal while 39 (75%) didn't win. 3 (30%) of left-handed male Karate athletes won medal while 7 (70%) didn't win. 7 (87.5%) of right-handed female Taekwondo athletes won medal while 1 (12.5%) didn't win. 2 (18.2%) of left-handed male Taekwondo athletes won medal while 9 (81.8%) didn't win. 2 (22.2%) of left-handed Taekwondo athletes won a medal while 7 (77.8%) didn't win (**Table 5**).

Among right-handed male karate athletes, 27 (45%) didn't win any matches, 16 (26.7%) won 1, 5 (8.3%) 2, 8 (13.3%) 3, 4 (6.7%) won 4 matches. Among right-handed female karate athletes 13 (31%) didn't win any matches, 15 (35.7%)

Table 4. Distribution of branch and gender regarding the dominant hand preference of athletes.

Hand Preference Regarding the Branch and Gender	Athletes	
	Frequency	%
Female Karate Right-Handed	43	16.0
Female Karate Left-Handed	7	2.7
Female Taekwondo Right-Handed	53	20.8
Female Taekwondo Left-Handed	8	3.1
Male Karate Right-Handed	62	24.3
Male Karate Left-Handed	8	3.1
Male Taekwondo Right-Handed	65	25.5
Male Taekwondo Left-Handed	9	3.5
Total	255	100

Table 5. Gender, branch and medal winning status of athletes regarding their dominant hand preference.

Dominant Hand	Branch	Gender	Medal				Total	
			Won		Didn't Win		F	%
			F	%	F	%		
Right-Handed	Karate	Male	13	21.7	47	78.3	60	100
		Female	8	19.0	34	81.0	42	100
	Taekwondo	Male	13	20.6	50	79.4	63	100
		Female	13	25.0	39	75.0	52	100
Left-Handed	Karate	Male	3	30.0	7	70.0	10	100
		Female	7	87.5	1	12.5	8	100
	Taekwondo	Male	2	18.2	9	81.8	11	100
		Female	2	22.2	7	77.8	9	100

1, 6 (14.3%) 2, 5 (11.9%) 3, 3 (7.1%) won 4 matches. Among right-handed male karate athletes 17 (27%) didn't win any matches, 16 (25.4%) 1, 17 (27%) 2, 9 (14.3%) 3 and 4 (6.3%) won 4 matches. Among right-handed female taekwondo athletes 11 (21.2%) didn't win any matches, 12 (23.1%) 1, 16 (30.8%) 2, 8 (15.4%) 3, 5 (9.6%) won 4 matches. Among left-handed male karate athletes there is no athlete who didn't win any matches, 1 (10%) 1, 6 (60%) 2, 2 (20%) 3 and 1 (10%) won 4 matches. Among left-handed female karate athletes there is no athlete who didn't win any matches. There is no 1 match winning athlete. 1 (12.5%) 2, 5 (62.5%) 3 and 2 (25%) won 4 matches. Among left-handed male taekwondo athletes 1 (9.1%) didn't win any matches, 1 (9.1%) 1, 7 (63.6%) 2, 1 (9.1%) 3, 1 (9.1%) won 4 matches. Among left-handed female taekwondo athletes 4 (44%) didn't win any matches, 1 (11.1%) 1, 2 (22.2%) 2, 2 (22.2%) 3 and there is no athletes winning 4 matches (Table 6).

There is a weak and negative relationship between the dominant hands of female athletes and their medal winning status ($p < 0.05$). There is no relationship between the branches of female athletes and their medal winning status ($p > 0.05$) (Table 7).

Female athletes are dominantly right-handed in general as it can be seen in the Table 8.

There is a relation between the dominant hands of female athletes and their medal winning status ($p < 0.05$). As R^2 is 062, it can be said that there is a direct relationship between the medal winning and the dominant hands of female athletes. In other words, it can be said that the dominant hand preference has a 6% effect on medal winning status of female athletes. B (beta) is the value of the partial correlation coefficient, and the criterion for the relation between the dependent variable and the independent variable. The correlation between the dominant hands of female athletes and their medal status is 0.134 (Tables 9-11).

As a result of Pearson correlation analysis; no relationship between the dominant hands of male athletes and medal winning situations was found ($p >$

Table 6. Gender, branch and won matches count of athletes regarding their dominant hand preference.

Dominant Hand	Branch		Matches Won										Total	
			Didn't Win		1 Match		2 Matches		3 Matches		4 Matches		F	%
			F	%	F	%	F	%	F	%	F	%		
Right-Handed	Karate	Male	27	45	16	26.7	5	8.3	8	13.3	4	6.7	60	100
		Female	13	31.0	15	35.7	6	14.3	5	11.9	3	7.1	42	100
	Taekwondo	Male	17	27.0	16	25.4	17	27.0	9	14.3	4	6.3	63	100
		Female	11	21.2	12	23.1	16	30.8	8	15.4	5	9.6	52	100
Left-Handed	Karate	Male	0	0.00	1	10.0	6	60.0	2	20.0	1	10.0	10	100
		Female	0	0.00	0	0.00	1	12.5	5	62.5	2	25.0	8	100
	Taekwondo	Male	1	9.1	1	9.1	7	63.6	1	9.1	1	9.1	11	100
		Female	4	44.4	1	11.1	2	22.2	2	22.2	0	0.00	9	100

Table 7. Correlation analysis regarding the dominant hand preference and medal winning status of female athletes.

Model		Female Athletes' Dominant Hands	Medals of Female Athletes	Branches of Female Athletes
Dominant Hands of Female Athletes	Pearson Correlation	1	-0.248**	0.017
	P		0.009	0.858
	N	111	111	111
Medals of Female Athletes	Pearson Correlation	-0.248**	1	-0.061
	P	0.009		0.527
	N	111	111	111
Branches of Female Athletes	Pearson Correlation	0.017	-0.061	1
	P	0.858	0.527	
	N	111	111	111

** $p < 0.05$.**Table 8.** Definitive statistics of female athletes.

Model	A. Avg.	Std. Deviation	N
Dominant hands of female athletes	1.1532	0.36177	111
Female athletes' medal status	1.7297	0.44611	111
Branches of female athletes	1.4505	0.49980	111

Table 9. Regression analysis regarding female athletes' dominant hand preference and medal status.

Model	R	R ²	Residual R ²	Estimated Std. Error	Durbin-Watson
1	0.248 ^a	0.062	0.053	0.35206	0.215

^aIndependent variable: Medal status of female athletes. ^bDependent variable: Dominant hand preferences of female athletes.**Table 10.** Score averages and standard deviations regarding the dominant hand preference of female athletes.

Model	Sum of Squares	sd	A.Avg ²	F	<i>p</i>	
1	Regression	0.887	1	0.887	7.153	0.009 ^b
	Residual value	13.510	109	0.124		
	Total	14.396	110			

^aIndependent variable: Dominant hand preferences of female athletes; ^bDependent variable: Medal status of female athletes.**Table 11.** Dominant hand preference and medal winning status of female athletes.

Model	Non-standard coefficient		Standard coefficient	T	<i>p</i>
	B	Std. Error	Beta		
Dominant hands of female athletes	1.501	0.134		11.172	0.000
Female athletes' medal status	-0.201	0.075	-0.248	-2.674	0.009

^aIndependent variable: Dominant hand preferences of female athletes.

005). There was also no relationship between the branches of male athletes and their medal winning status ($p > 005$).

As a result of Pearson correlation analysis; no significant relationship between dominant hand preferences and medal winning status of male athletes was found ($p > 005$).

3. Discussion

The scientific researches conducted on the taekwondo branch, in which we have accomplished significant achievements in the name of our country in international sports events recent years and contradictive Olympics branch, karate, in which we have won several medals in Olympics games the popularity of which increases day by day, are estimated to contribute a lot to these fields.

Since the research subject we have conducted regarding the age group have no precedent in literature, the discussion focuses on scientific studies on athletes from different branches and hand preferences. In this research which examines the relationship between dominant hand preferences and athletic achievements (dominant hand, medal winning status and branches) of a total of 255 volunteer participants which consists of 120 Karate and 135 Taekwondo athletes, 144 of them are male and 111 of them are female and 223 of them are right-handed and 32 of them are left-handed; a weak, negative relationship was found between the dominant hands of female karate and taekwondo athletes and medal winning ($p < 0.05$). There was no significant association between dominant hand preference and sport branches ($p > 0.05$). No meaningful relationship between dominant hand preference and medal winning status and branches of Male karate and taekwondo athletes ($p > 0.05$). In general, 95% of people have more dominant motor fields in the left hemisphere that allow them to control their hands. That is why the vast majority of people use their right hand (Leong, 1980; Tan, 1988). However, many researchers have reported that the proportion of dominant left-handed athletes among high-level athletes in baseball, tennis, fencing, cricket fight sports boxing and wrestling is high. It is obvious that the importance of left hand depends on the feature of the sport (Akça et al., 2015).

Lanzoni et al. (2013) found out in a study on the world's top 100 male racket players of branches like tennis, table tennis, squash, badminton that the proportion of left-handed athletes was higher compared to the general world population. Loffing et al. (2014) have found out in a study in which 903 athletes from various branches such as fencing, bowling, boxing have participated that the ratio of male athletes who dominantly use their left hand is (10.05%) while the ratio of left hand using female athletes is (7.88%) and determined that these ratios are higher compared to society. Left-handed athletes constitute 12.4% of total athletes in our study. In this respect, the ratio of left-handed athletes in our research supports the work done on the hand preference of individual sports.

Fisekcioglu (2011) stated that taekwondo athletes using left hand are more advantageous in exercising. In our study, the research result partially supports

the aim of the study because of the significant difference in the female athletes' hand preference and medal winning status. However, no a significant difference in hand preference and medal winning status considering male taekwondo athletes was found. Raymond et al. (1996); Loffing & Hagemann (2012); Grouios (2004) argues that dominant left-handed athletes in sport branches such as table tennis and Eksim influenced their opponent due to their racket and fencing pattern, and that left-wing athletes were much more successful in these sports branches. In Baseball (McLean & Ciurczak, 1982), in Tennis (Azemar et al., 1983), in Eskrim Bisiacchi et al. (1985) found that dominant left-handed athletes were more successful (Hagemann, 2009). In a study of video analysis of 54 left-handed and 54 right-handed male tennis athletes in 3 groups, dominant left-handed athletes succeeded in predicting the strike direction of right-handed athletes. In support of this hypothesis, it is suggested that left-handed athletes are more successful because of their influence on the detection of frequencies. The analysis results of the study of Del Corral & Prieto-Rodriguez (2010) on Grand Slam tennis tournaments between 2005 and 2008 have shown, when the quality differences between the players are checked, it is found that the right-handed players have about 5.9% have a lower likelihood of success compared to left-handed opponents. Loffing et al. (2012) conducted a video analysis of 18 volleyball players, predicting that the dominant left-handed ones were better than the right-handed ones in anticipating the direction of the shots from close and far distances, revealing that the visual perceptions of left-handed athletes were better.

Similarly, Loffing et al. (2012) found out that the left-dominated tennis players were more successful in another study they have conducted on professional and amateur tennis players. This suggests that the impressive successes of former left-handed players such as Jimmy Connors, John McEnroe or Martina Navratilova could become a role model for future dominant professional tennis players in the years to come. Awamleh et al. (2013) found that the visual response time of left handed handball players was better compared to right-handed athletes in a study participated by 12 female handball players, 9 right-handed and 3 left-handed. Porac & Coren (1981) found out that left-handed athletes are in an advantageous situation in a study on hand, eye and foot preferences of boxers. Again, in the same study, basketball, gymnastics and bowling athletes who prefer left eye were found to be more advantageous than those who prefer right eye.

The study we conducted supports the studies in the various sports branches above, indicating that the dominant left-handed female karate and taekwondo athletes have a weak negative relationship between hand preference and medal winning status, thus indicating that the left dominant athletes are more successful.

In another study on boxers by Gürsoy (2009), left-handed boxers lost 19.3 games in $M = 120.6$ matches, while the right handed boxers lost 42.3 matches in $M = 127.8$ games which indicates that left-handed boxers lost fewer games than

right-handed boxers and, thus were more successful. In the studies by Ziyagil et al. (2010) on two different world wrestling championships (Istanbul and Greece) it was reported that dominant left-handed wrestlers won more matches, more degrees and medals. Our study supports both of the above studies and a weak, negative relationship was found between the number of medals won by female athletes. For this reason, dominant left-handed female athletes were found to be more successful than dominant right-handed athletes.

In studies on ice hockey athletes, Puterman et al. (2010) have found out that right-handed ones have a better chance of recovering shots than left-handed ones. Watson & Kimura (1989) concluded that although there is no performance difference between the left hand and the right hand, the left hand received less hits than the right hand. Akça et al. (2015) reported that the right hand was better than the left hand in terms of shot accuracy, depending on hand dominance.

In addition, our study does not support the studies conducted in favor of the right-handers, since there is no significant difference in favor of the right-handers both in male and female karate and taekwondo athletes.

4. Conclusion

A weak, negative relation between dominant hand preference of female karate and taekwondo athletes and medal winning was found ($p < 0.05$). No significant relationship was found between dominant hand preference and branches ($p > 0.05$). No meaningful relationship among dominant hand preferences and medal status and branches of male karate and taekwondo athletes was found ($p > 0.05$).

It has been determined that dominant left-handed female karate and taekwondo athletes are very slightly more successful than the dominant right-handed ones. However, there was no difference between dominant hand preference and medal winning status of male athletes in the karate and taekwondo branches.

Although findings of our study show great parallelism with the findings of many similar previous studies, they also contradict with the findings of some studies.

5. Suggestions

1) For the reason that there is no precedent to our study in the literature on karate branch regarding the hand preference, more studies should be conducted in this regard. In Taekwondo branch, there are a quite limited number of scientific studies, which also require more scientific studies to be done.

2) It can be said that dominant left-handed female athletes are slightly more successful than dominant right-handed athletes in these sports branches, therefore it can be said that such athletes (left-handed) should be encouraged and supported.

3) Although dominant left-handed male athletes are less successful than female athletes, more studies on male athletes should be done.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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