

Importance of hand-grip strength as an indicator for predicting the results of competitions of young judokas

Authors' Contribution:

- A** Study Design
- B** Data Collection
- C** Statistical Analysis
- D** Manuscript Preparation
- E** Funds Collection

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Abstract

Background and Study Aim:

The optimum hand-grip strength during a judo match has become an important element for judo athletes. The aim of this study was to determine whether hand-grip strength is a relevant indicator of predicting the results of competitions of young judokas.

Material/Methods:

One hundred two judokas (71 male and 31 female) aged between 15 and 19 years participants of the Junior Championship of Galicia 2008 (Spain) took part in this study. The handgrip strength was measured by digital dynamometer in both hands. All subjects complete questionnaire with information about their weight class, results in competition, gender and lateral dominance hand.

Results:

Male show statistically significant differences in favor higher weight classes. However, the differences in the female divisions were not statistically significant. Differences in handgrip strength among the different podium placements achieved was statistically different in female ($p=0.001$) but not in male ($p=0.198$)

Conclusions:

The results indicated that grip strength is not an extremely relevant factor to take into account for the specific preparation of a competitor since the only relationship found between both parameters was in the female category.

Key words:

hand dynamometry • Judo • performance • grip • strength

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BACKGROUND

A multitude of scientific evidence exists about the importance of grip strength for some sports [1,2]. Disciplines such as climbing, sailing, motocross, wrestling, and – of course – judo among others, require in some form or another a good grip to provide security in other actions [3,4]. For a grip to be considered good, correct technical execution and a optimum level of strength are necessary in order to be able to maintain the action for the required amount of time [5,6].

The studies for each athletic discipline that pertain to this parameter are varied, but it should be noted that

the analysis of hand-grip strength using hand dynamometers is most frequent within the scope of climbing [1]. Thus we find that the grip strength level demonstrated by athletes dedicated to climbing is 483N [3], a figure very similar (481N) to that reached by tennis players in a study conducted by Fleming and McGregor [7]. In a study by España-Romero et al. [8], a remarkable difference was shown between the grip strength of women and men that practice the sport of climbing, the males achieving 490N yet the females only 294N. In the field of motorcycling, Gobbi et al. [2] found strength values at 528N and a study from Barrionuevo et al. [4] found those dedicated to nautical sports to be especially gifted with a grip strength at 615N. Therefore, it was asked

Hand-grip strength – the ability to exert force while grasping an apparatus with one hand [25].

Non-sport confrontation – defensive fight or destructive struggle, as individual cases hand-to-hand fight [26] – also i.e. *street fighting* [27].

whether or not judokas would have strength levels similar to the other athletes studied.

The revision of the scientific literature published in relation to this discipline showed that the vast majority pertained the realm of athletic performance, especially in the application of strength (referred to also as force) [9–12]; to technique [5,6,12–17] and to both motor and cognitive capacities in terms of success in competition [18], but very few dealt with the effect of the athletes' grip on their technique, their strength, and even the precisely required force. However, it is considered to be an important indicator in competition, due to the need to hold their own against the will of their attacker by means of their grip. [19].

Judo is a martial art that has spawned from the hand of Japan's master Jigoro Kano. He based the art mainly in the philosophical principals of Seiryoku-Zeny and those of others, which can be roughly translated as the maximum efficiency in the used of strength or the use of the smallest possible force in order to obtain the maximum result, hence the literal translation as the "gentle way," JU = gentle, DO = way [20]. From these words one can think of the practice of judo is not necessarily aimed at the possession of high levels of physical strength. However, within the context of the sport, judo is a martial art in which two individuals compete in hand to hand combat, using a grip that incorporates complex technical and tactical actions to leverage the power of the opponent, all of which requires a great deal of both physical and psychological skill in each combat. This definition reflects the importance that grip, as a technical skill, has within the development of this activity, given that it constitutes the first step in the competition. The following research questions can then be raised from our study: To what extent it is grip strength important to success in competitions? What levels of grip strength are judokas able to obtain?

The aim of this study was to determine whether hand-grip strength is a relevant indicator of predicting the results of competitions of young judokas.

MATERIAL AND METHODS

Subjects

One hundred two judokas (71 male and 31 female) aged between 15 and 19 years participants of the Junior Championship of Galicia 2008 (Spain) took part in this study. All subjects were healthy, and none of them was taking any medications at the time of the study. They did not experience any pain or disability in their upper extremities.

All subjects and parents were thoroughly informed of the purposes and content of the study, and written informed

consent was obtained from the parents, subjects and coaches before participation. The research was undertaken in compliance with the Helsinki Declaration. Juniors' competition experience was similar (7 to 8 years). The subjects were divided by gender and into weight categories (Table 1).

Table 1. Number of subjects (n=102) in different weight categories.

Male (n = 71)		Female (n = 31)	
Weight categories	N	Weight categories	N
–55 kg	8	–44 kg	0
–60 kg	6	–48 kg	6
–66 kg	17	–52 kg	2
–73 kg	13	–57 kg	6
–81 kg	16	–63 kg	8
–90 kg	5	–70 kg	4
–100 kg	4	–78 kg	4
+100 kg	2	+78 kg	1

They were selected by following criteria:

- Having federal license to the Galician Federation of Judo and Associated Sports from the period of 2007–2008.
- Being born in 1989, 1990, 1991, or 1992, which are the birth years included in the junior category (under 20 years of age) at the time of the study.
- Participate in the Junior Championship of Galicia held in Ferrol on February 2, 2008.

Procedures

The maximal hand-grip strength of both hands was measured with a hand dynamometer (GRIP-D TTK 5401, Takei Scientific Instruments CO). The subjects were standing comfortably with the shoulder adducted. The dynamometer, which had been previously adjusted to the size of their hand, was held freely without support; it was not touching the subject's trunk. The position of the hand remained constant, with a downward direction. The palm did not flex on the wrist joint. The subjects were required to exert maximal strength on the dynamometer (maximal voluntary contraction) for 5 seconds. All subjects performed 3 trials, and the best performance was used in both hands.

Basic demographic data and information about the athletes' gender, individual's year of birth, competition weight categories, the result obtained in the competition and lateral dominance of the competitor were

collected. Hand dominance was determined by asking the subject which hand was used to hold a pencil and to throw a ball [21]. The measurement of weight was taken in cooperation with the committee of judges (weighing commission). Sport achievements was determined as the dependent variable, where 0 represents not obtaining a medal, 1 corresponds to winning the gold medal, 2 with silver, and 3 with bronze.

Statistical analysis

All values were reported as mean ±SD. Gender, weight categories, handgrip strength, lateral dominance and sport achievements were assessed via a general linear model with repeated-measures analysis of variance (ANOVA) to compare hand-grip strength and gender, sport achievements. Additionally, a Levene test for homogeneity of variances was completed on each dependent variable during the ANOVA, and, in each case, homogeneity of variance was found. When the data were not normally distributed, the Friedman ANOVA followed by the Wilcoxon signed-rank test was used. When a significant F ratio was achieved, post hoc comparisons were completed using a Tukey HSD least significant difference. For all tests, the significance level was set at p<0.05. The analyses were done using SPSS 15.0 (SPSS Inc. Chicago, IL).

RESULTS

As seen in Table 1, of the 102 subjects analyzed, many more participants pertained to the middle weight class than to either the light or the heavy weight classes. In the case of the males, 17% of the individuals, that is to say nearly a quarter of all of the male participants, belonged to the -66 kg category. In the female category, the most relevant data is the low participation at the regional level since there are three weight categories in which less than 4 judokas participate.

Junior category (under 20 y) were judokas born between 1989 and 1992. The age distribution is so that the greatest representation is among the youngest in the category with 33.33%, followed by those born in 1991 – a total of 32 competitors – totally 31.37% of the participation. The remaining was distributed very closely among the veterans of 1989 with 15.69%, and those born in 1990 representing 19.61% of the total.

The percentage of right-handed participants (N=102) in the competition was notably higher than that of left-handed competitors. The 75% of athletes were right-handed, 20% left-handed and just 5% ambidextrous. Dominant hand show more hand-grip strength than non-dominant (439±90.56 Newton (N), 421±90.56 N; p=0.000 respectively) – Figures 1 and 2.

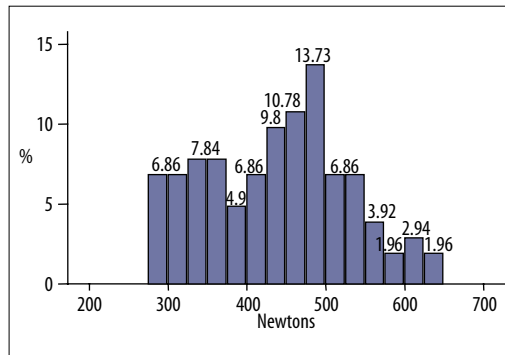


Figure 1. Percentage of grip strength of dominant hand. All subjects (N=102).

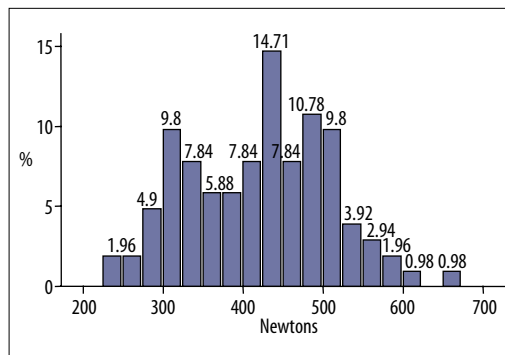


Figure 2. Percentage of grip strength of non-dominant hand. All subjects (N=102).

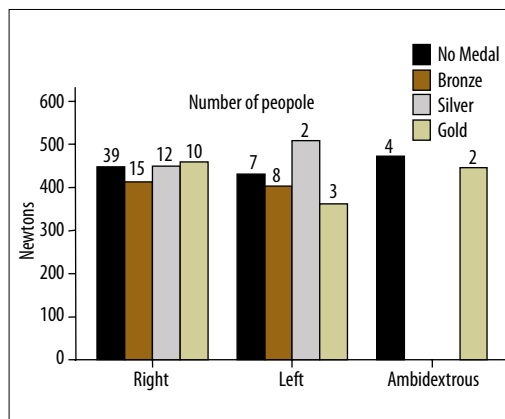


Figure 3. Hand-grip strength (in Newton) by lateral dominance and sport achievements.

Both, males and females, show more handgrip strength in dominant than non-dominant hand (481±69.43 N vs. 464±67.38 N; p=0.000 and 343±52.38 N vs. 323±51.46 N; p=0.000 respectively). In handgrip strength in both hands by gender, male show more handgrip strength than female (472.63±64.94 N and 333.16±50.81 N; p=0.000 respectively).

Figure 3 shows the grip strength according to competition placement achieved and lateral dominance. The latter are prevalent in all of the medal ranking, however

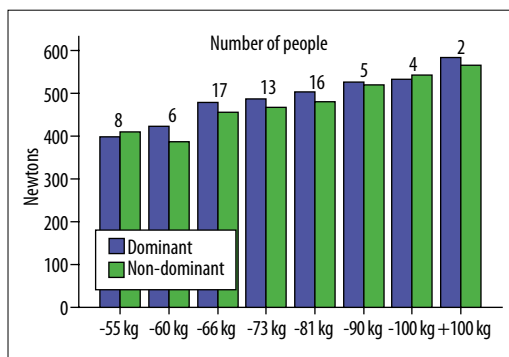


Figure 4. Male handgrip strength (N) by weight categories.

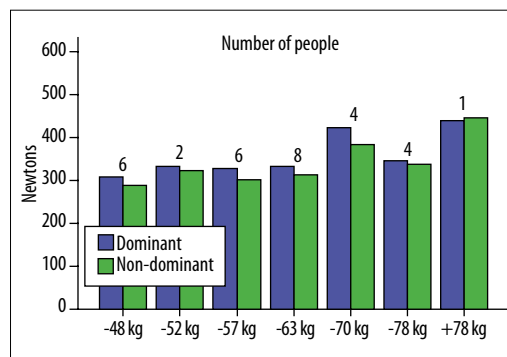


Figure 5. Female handgrip strength (N) by weight categories.

Table 2. Hand-grip strength and sport achievements by gender.

Sport achievements	Gender	N	Min. (N)	Max. (N)	\bar{x} (N)	SD	P
Gold	Female	7	333	460	385.57	50.60	0.031
	Male	8	366.5	594.5	469.06	77.66	
	Total	15	333	594.5	430.1	77.28	
Silver	Female	6	318.5	455	351.67	51.95	0.001
	Male	8	409	644	518.19	80.45	
	Total	14	318.50	644	446.82	108.80	
Bronze	Female	10	261	363	309.35	32.84	0.000
	Male	13	351.5	606	474	61.66	
	Total	23	261	606	402.41	97.36	
No medal	Female	8	273	346	303.19	26.07	0.000
	Male	42	313	581	464.21	58.92	
	Total	50	273	581	438.45	80.98	

(N) – Newton.

Table 3. Hand-grip strength (Newton) and sport achievements in female (N=31).

		Mean	95% CI	P	
Gold	No medal	82.38	25.65	139.12	0.003
	Bronze	76.22	22.19	130.25	0.003
	Silver	33.91	-27.09	94.89	0.439
Silver	No medal	48.48	-10.73	107.68	0.138
	Bronze	42.32	-14.29	98.93	0.197
Bronze	No medal	6.16	-45.84	58.16	0.988

CI – Confidence Interval.

the percentage of left-handed participants who receive bronze stands out from those obtained by other medals.

Figures 4 and 5 shows the level of strength according to gender and weight class. Male show statistically significant differences ($p < 0.05$) in favor higher weight classes (-55 kg, 403.68 ± 42.68 N vs. -81 kg, 491.78 ± 57.72 N; -90 kg, 522.6 ± 45.25 N; -100 kg, 536.5 ± 71.85 N;

+100 kg, 574.25 ± 58.33 N). However, the differences in the female divisions were not statistically significant.

Table 2 shows handgrip strength for each gender division according to the sport achievements.

Differences in hand-grip strength among the different sport results achieved was statistically different in female ($p = 0.001$) but not in male ($p = 0.198$). Concretely,

in female competitors, these differences were found when comparing gold with bronze and not won medal (Table 3).

DISCUSSION

In interpreting the findings related to grip strength of a judoka and its possible influence on performance, the consulted bibliographic documents showed that the average obtained grip strength in both male and female divisions was very similar to those presented by other authors in the scope of judo [9,10] and outside of it [2–4,7,8]. The observed average strength recorded for females is very similar to that presented by Little [24] in a similar study. Regarding the level of strength observed in males, it was confirmed that it is higher than that of women. This data coincides with research articles of the same nature both within the field of judo [9–11,22] and in other athletic disciplines [8,23].

Some research discards the notion that predominance to the left side is not beneficial in itself. This is based namely on the fact that by being a minority left-handed athletes of various athletic disciplines must adapt to playing with or competing against a right-handed opponent. Left-handed athletes therefore often tend to surprise their rivals [24].

Even when the highest percentage of competitors are right-handed – both in competition and in the medal positions – a noteworthy relationship can be made about the left-handed judokas that receive bronze medals from those that obtained other medals in our study. Corroboration with research by Sterkowicz et al. [16], shows that those who have a left side dominance have a significantly improved chance of winning medals.

As for the higher levels of strength recorded in the dominant hand, the data are consistent with that which has been established by Franchini et al. [10], but disagrees with that presented by Carballeira and Iglesias [11].

The results show that participants pertaining to heavier weight classes presented greater levels of strength than did those of the lighter weight classes. It can therefore be stated that significant differences exist for strength according to the weight class in which one competes.

The relationship between grip strength and performance for the male division showed no significant differences. It can thus be stated that such a relationship did not exist. This is unlike in the data obtained in the study of Dri et al. [18], in which the medal placement achieved meant a better performance in all motor tests performed when compared to non-medalists. However, in the results of our study in the female division, these differences did exist between the level of grip strength and the position achieved in the competition. This aspect was confirmed by comparing the strength of the female competitors that obtained gold and silver medals with those that achieved bronze medals or did not win a medal at all. This allowed us to see the relationship between performance and grip strength among females, as was observed in the aforementioned study [18]. Although the differences in motor skills among the female judokas with more and less success were not as pronounced as in the males, it can be concluded that the most successful judokas, in general, have better cognitive skills, coordination, and greater strength than those with less success competitively, an aspect similar to our study. The results lead to repeating the importance of both gripping in competition [19], and the application of strength [9–12,25].

CONCLUSIONS

The results show that there is no basis to consider indicator hand-grip strength as the information, on which basis it is possible to predict the results in the judo competition. However, it has been proved that female concede male at statistically significant levels of grip strength, which may be relevant in cases of non-sport confrontation when the woman is forced to defend an attack of the man (the aggressor).

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