

## EFFECT OF A 20 DAY TRAINING PROGRAM ON GRIP STRENGTH IN ELITE WEIGHTLIFTERS

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**Abstract:** Hand grip strength is the sum of the strength of the flexors against the palm, while the extensor muscles help in a secondary way and their contribution plays a minor role in generating grip strength. The relationship between hand grip strength levels and socio-demographic indicators and those characterizing lifestyle is a widely discussed topic in the literature. Handgrip strength is used as an indicator of general muscle strength and health status in adults. It has also been accepted as a potential link to athletic performance in a variety of sports.

The aim of the present study was to determine the effect of a 20-day intensive training regimen on hand grip strength and maximal effort sustain time in elite weightlifters.

A group of 23 national weightlifters (females, n=11; males, n=12) voluntarily completed a test to determine hand grip strength and time to sustain maximal effort. The tests were carried out twice - before the start and after the end of an intensive training regime lasting 20 days. All participants were right-handed dominant. To determine hand grip strength and time to maintain maximum effort dynamometer was used, system BIOPAC, (USA). The time to sustain maximal isometric effort was also determined with three consecutive measurements for the left and right arms, with a minimum interval of ten minutes. The duration of time of maximum isometric effort was taken as the period until the grip strength decreased by 5% compared to the maximum. The results of the measurements were processed with Paired samples *t*-test, statistical program SPSS v. 13. A statistically significant difference was accepted at  $P < 0.05$ . Data are presented as  $X \pm SD$ .

A 20-day intensive training regimen resulted in a significant increase in grip strength in both hands in man (right hand from  $35.539 \pm 3.17$  to  $39.116 \pm 2.48$  kg,  $P < 0.05$ ; left hand from  $32.089 \pm 2.25$  to  $38.564 \pm 4.26$  kg,  $P < 0.05$ ). The time to sustain maximal strength in men was also prolonged in both hands (right hand from  $8.417 \pm 2.11$  to  $10.692 \pm 2.35$  s,  $P < 0.05$ ; left hand from  $9.583 \pm 2.71$  to  $13.533 \pm 3.94$  s,  $P < 0.05$ ).

In women, we reported different results. Only the maximal strength of the left, non-dominant hand was statistically increased in the female weightlifter group. The time to maintain maximal strength showed a tendency to lengthen without reaching a statistical difference. The maximum grip strength of the right, dominant hand was increased, but not significantly.

The applied 20-day intensive training program was sufficient to increase grip strength and maximal effort sustain time in male weightlifters. For female weightlifters, the results were lower.

**Keywords:** weightlifters, grip strength, dynamometry.

## 1. INTRODUCTION

The grip strength of the hand is the sum of the contraction force of the flexors against the palm, while the extensor muscles have a complementary role and their contribution is considerably less to generate the grip force (Mathiowetz et al., 1985; de Lima et al., 2017).

The relationship between hand grip strength levels and socio-demographic indicators and those characterizing lifestyle is a widely discussed topic in the literature (Araujo et al., 2010; Hansen et al., 2013; Hossain et al., 2012; Saito et al., 2012; Schlüssel et al., 2008; Rodrigues de Lima et al., 2017). Handgrip strength is used as an indicator of general muscle strength and health status in adults. It has also been accepted as a potential link to athletic performance in a variety of sports (Huebner et al., 2022; Otterson and DeBeliso, 2020).

In combat sports, grip strength has a strong prognostic value, especially for professional boxers (Guidetti et al., 2002). According to some studies, this is also true in elite wrestlers (Nikooie et al., 2017). Similar observations have also been made in professional baseball players, with correlations between grip strength and home runs, total bases, and slugging percentage (Hoffman et al., 2009). Hand grip strength can be a good indicator of experience in a given sport, and it also allows for differentiating elite athletes from their sub-elite counterparts, as studies have confirmed that elite athletes have greater grip strength (Cronin et al., 2017; Suazo and DeBeliso, 2021).

There are also studies in the available literature on the relationship between athletic performance and grip strength in elite weightlifters (Suazo and DeBeliso, 2021; Huebner et al., 2022; Masale and Sawant, 2011).

## 2. AIM

The aim of the present study was to determine the effect of a 20-day intensive training regimen on hand grip strength and maximal effort sustain time in elite weightlifters.

## 3. MATERIALS AND METHODS

A group of 23 national weightlifters (females, n=11; males, n=12) voluntarily completed a test to determine grip strength and time to sustain maximal effort. The tests were carried out twice - before the start and after the end of an intensive training regime lasting 20 days. All participants were right-handed. Before each test, the weightlifters were instructed in detail about the research technique, underwent a medical examination and signed an informed consent.

An electronic hand isometric dynamometer TSD121C from the BIOPAC system (USA) was used to determine the hand grip strength and time to maintain maximum effort. In the study, the person grasps the handle of the TSD121C and squeezes it with maximum force, during which the system registers a dynamometric curve that provides information about the amplitude and time parameters of the muscle contraction (Boyadjiev, 2023). To determine hand grip strength, three consecutive measurements were performed on the left and right hand with an interval between individual trials of at least three minutes. The highest value reached was determined for grip strength.

The time to sustain maximal isometric effort was also determined with three consecutive measurements for the left and right arms, with a minimum interval of ten minutes. The duration of time of maximum isometric effort was taken as the period until the grip strength decreased by 5% compared to the maximum.

The results of the measurements were processed with Paired samples t-test, statistical program SPSS v. 13. A statistically significant difference was accepted at  $P < 0.05$ . Data are presented as  $X \pm SD$ .

## 4. RESULTS AND DISCUSSION

A 20-day intensive training regimen resulted in a significant increase in grip strength as well as a prolongation of the time to sustain maximal strength in men for both left and right hands (Table 1).

*Table 1. Maximal grip strength and maximal effort sustain time in men. X±SD.*

Male, n=12	before		after		P
	Mean	SD	Mean	SD	
grip strength right hand (kg)	35.539	3.17	39.116	2.48	<b>0.002</b>
grip strength left hand (kg)	32.089	2.25	38.564	4.26	<b>0.010</b>
effort sustain time right hand (sec)	8.417	2.11	10.692	2.35	<b>0.002</b>
effort sustain time left hand (sec)	9.583	2.71	13.533	4.94	<b>0.020</b>

In women, we reported different results. Only the maximal strength of the left, non-dominant hand was statistically increased in the female group (Table 2). The time to maintain maximal strength showed a tendency to lengthen without reaching a statistical difference. The maximum grip strength of the right, dominant hand was increased, but not significantly (Table 2).

*Table 2. Maximal grip strength and maximal effort sustain time in women. X±SD*

Female, n=11	before		after		P
	Mean	SD	Mean	SD	
grip strength right hand (kg)	23.797	2.34	26.726	1.21	0.077
grip strength left hand (kg)	21.223	1.46	25.403	1.50	<b>0.001</b>
effort sustain time right hand (sec)	9.126	2.14	10.273	2.79	0.058
effort sustain time left hand (sec)	8.690	1.69	10.782	3.90	0.056

A study of 31 female weightlifters confirms the association between grip strength and athletic performance. The authors reported a positive correlation between grip strength and back squat, bench press, deadlift and lifter's total of female athletes (Suazo and DeBeliso, 2021).

An Indian study of hand strength and some functional and morphological parameters reported that grip strength of both hands was greater in national-level athletes compared to state-level weightlifters in both men and women (Masale and Sawant, 2011).

A study of 164 weightlifters and athletes in other sports found that hand grip strength was lower in weightlifters compared to athletes in other sports that require gripping or force application. Data from the same study indicated that the age-related decline in handgrip strength was less steep than the decline in weightlifting performance (Huebner et al., 2023).

## 5. CONCLUSION

The applied 20-day intensive training program was sufficient to increase grip strength and maximal effort sustain time in male weightlifters. In female weightlifters, it did not cause a distinct effect.

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