

## Hand Grip Strength in Prepubescent Tennis Players

(Preliminary study)

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The aim of the present study is to investigate a grip strength in young male tennis players aged 9-11 years. A total of 39 children (15 tennis players and 24 pupils) took part in the study. All participants were assessed for height, weight and BMI. The grip strength was measured by hand dynamometer in kilograms-force at both (dominant and non-dominant) upper limbs. Statistical analysis was made by SPSS 16.00 for Windows. The measuring showed that sportsmen have higher values on right upper limb hand grip strength than the control group (11.8 kg and 8.00 kg). There are similar results on the left upper limb: 7.79 kg (athletes) and 6.92 kg (non-athletes). A considerably higher difference of hand grip strength between the right and left hand was discovered in athletes (3.67kg.), compared to the control group (0.87 kg). The correlation is significantly higher between the left hand grip strength and body mass index ( $p < 0.01$ ), weight and hand grip strength on the left hand ( $p < 0.05$ ), and height and right hand grip strength ( $p < 0.05$ ) in athlete group. Only in non-athlete group there is a high level of correlation between right and left hand grip strength ( $p < 0.01$ ).

*Key words:* tennis players, prepubescent children, grip strength, BMI

### Introduction

Hand grip strength (HGS) is often used as an indicator of physical strength and of individual hand and forearm muscle performance [4, 6]. It is important for any sport in which the hands are used for catching, throwing or lifting. Tennis is a sport that required mainly the use of hand, because excellent upper extremity power and hand grip strength are necessary to be successful. Without adequate grip and forearm strength, tennis players may run the risk of developing lateral epicondylitis [8].

The handgrip strength measurement is also widely used to assess the asymmetry between the dominant and non-dominant hand in the tennis players [5]. Hand grip strength is affected by a different factors including age, gender and body size. Some investigations report that there is a strong correlation between the hand grip strength and basic anthropological features like height, weight and etc. [3, 4].

The aim of the present study is to investigate the hand grip strength in young male tennis players aged 9-11 years.

## Materials and Methods

A total of 39 children (15 tennis players and 24 pupils) aged 9-11 years took part in the study. All children were in good health in the day of assessment and declared that they were not presented any injury in the upper limbs for at least two months. The parents of the participants were informed about aim and methodology of the study and they were signed a consent (regarding Helsinki declaration). Individuals completed questionnaire regarding hours of training per week and training years. Basic anthropometric features: height (HT, cm), weight (WT, kg) were measured by Martin-Saller's classical methods. A hand grip test (European Test of Physical Fitness - EUROFIT) was performed to defined static arm strength [2]. The right hand grip strength (RHGS, kg) and left hand grip strength (LHGS, kg) were measured using a standard calibrated handgrip dynamometer at standing position with the shoulder adducted and neutrally rotated and elbow in full extension. The subjects were asked to put maximum force on the dynamometer thrice from both sides of the hands. The best scores were recorded in kilograms. Body Mass Index (BMI, kg/m<sup>2</sup>) was calculated by the formula: Body Mass Index = Weight/Height<sup>2</sup>, for each child.

Statistical analysis was made by software package SPSS 16.00 for Windows. Statistically significant differences were evaluated by T-test of Student at  $P \leq 0.05$ . Correlation analysis was used for the assessment of relationship between anthropometric variables.

## Results

The mean age for tennis players is  $10.20 \pm 0.86$  and  $9.88 \pm 0.85$  for control group. A training experience (TE) for athletes are distributed in three categories: TE (years); TE (days/weekly); TE (hours/daily) (**Table 1**). The handedness of the individuals is defined by questionnaire regarding, and showed that 80% of investigated tennis players are right handed and 20 % are left-handed. Result is similar in the control group: 87% are right handed and 13 % - left-handed.

The anthropometric characteristics (height, weight and BMI) in tennis players and control group are presented in **Table 2**. There are significant differences in height ( $p < 0.01$ ) between both investigated groups, but there are no significance in values of weight and BMI.

**Table 1.** Age and training experiences of participants

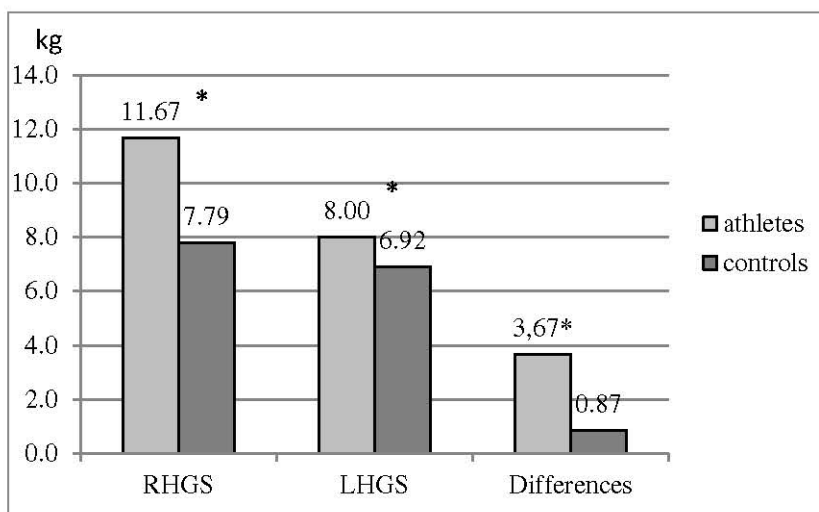
Variables	Tennis players (n = 15)		Control group (n = 24)	
	mean	SD	mean	SD
Age (years)	10.20	0.86	9.88	0.85
TE (years)	3.88	1.46	–	–
TE (days/weekly)	4.08	1.44	–	–
TE (hours/daily)	1.66	0.44	–	–

TE – Training experience

**Table 2.** Anthropometric characteristic of tennis players and control group

Variables	Tennis players (n = 15)		Control group (n = 24)		Differences
	mean	SD	mean	SD	T-test
HT	146.80	6.78	127.00	6.22	9.12*
WT	38.78	7.66	38.88	8.74	0.001
BMI	17.93	2.40	18.52	3.21	-1.43

\* Statistically significant differences at  $p \leq 0.01$ ;  
HT – height; WT – weight; BMI – body mass index.



\* Statistical significant differences at  $p \leq 0.05$ ;  
RHGS – right hand grip strength; LHGS – left hand grip strength;  
Differences – between RHGS and LHGS in both groups

**Fig. 1.** Comparison between right and left hand grip strength in tennis players and control group

Our results indicate that tennis players have significantly greater values of hand grip strength of both hands compared to control group. The measuring show that sportsmen have higher values hand grip strength than the control group (11.8 kg and 8.00 kg) on the right upper limb. We get similar results for the left upper limb: 7.79 kg (athletes) and 6.92 kg (non- athletes). A considerably higher difference of hand grip strength between the right and left hand was discovered in athletes (3.67 kg), compared to the control group where the difference is only 0.87 kg (**Fig. 1**)

The correlation coefficients between hand grip strength on the left and right upper limb and some anthropometric features (height; weight; BMI) are presented in **Table 3** and **Table 4**. The correlations are significantly higher between the LHGS and BMI ( $p < 0.01$ ); LHGS and WT ( $p < 0.05$ ), and between RHGS and HT ( $p < 0.05$ ) in athlete group. In non-athlete group there is a high level of correlation only between RHGS and LHGS ( $p < 0.01$ ).

**Table 3.** Correlation of hand grip strength and some selected anthropometric variables in tennis players

Variables	HT	WT	BMI	RHGS	LHGS
HT	1	0.752**	0.360	0.560*	0.152
WT		1	0.881**	0.462	0.593*
BMI			1	0.241	0.734**
RHGS				1	0.399
LHGS					1

\* Significant at 0.05 level; \*\* Significant at 0.01 level; HT = Height; WT = Weight; BMI = Body mass index; RHGS = Right hand grip strength; LHGS = Left hand grip strength

**Table 4.** Correlation of hand grip strength and some selected anthropometric variables in control group

Variables	HT	WT	BMI	RHGS	LHGS
HT	1	0.705**	0.413*	0.325	0.369
WT		1	0.934**	0.365	0.269
BMI			1	0.313	0.159
RHGS				1	0.653**
LHGS					1

\* Significant at 0.05 level; \*\* Significant at 0.01 level;  
HT = Height; WT = Weight; BMI = Body mass index; RHGS = Right hand grip strength; LHGS = Left hand grip strength

## Discussion

The comparative evaluation of hand grip strength and basic anthropometric features in tennis players and non-athletic prepubescent individuals is presented.

The analysis of basic anthropometric features (HT, WT, BMI) in Bulgarian prepubescent tennis players showed that mean value for body height; body weight; and BMI are: 146.8 cm; 38.78 kg and 17.93 kg/m<sup>2</sup>, respectively. The mean values of body height and body weight in Spanish tennis players on the same age was similar: HT - 147.7 cm; WT - 40.36 kg, according to Berdejo-del-Fresno1 et al. [1] and HT - 146.7 cm; WT - 37.4 according to Sanchis-Moysi et al. [7]. The authors concluded that tennis at prepubertal age is associated with marked hypertrophy of the dominant arm, leading to a marked level of asymmetry (+13%), much greater than observed in non-active controls (+3%) [7].

Gigova [10] studied a physical performance and an anthropometric profile of Bulgarian tennis players (9-13 years old) and reported an average body mass of 41.44 kg and height of 152.44 cm, showing superior values compared to the present study.

Strength must be required in muscles and joints for good performance and also like a protection (ligaments, tendons, joints and etc.) of injuries. An optimal stroke execution is needed from solid contact between the racket and the ball, and it depends by grip strength [8].

Our results indicate that tennis players have significantly greater values of hand grip strength of both hand compared to control group. A statistically significant difference was reported between RHGS and LHGS in tennis players' group: 3.67 kg. In non-athletes' group it was only 0.87 kg. The results obtained from Lucki and Nikolay [5] also suggested that tennis players had significant asymmetry in grip strength. The au-

thors establish that tennis players increased muscle mass and strength of the dominant limb. In similar study [9] an isometric strength of the flexors of the upper limbs with sportsmen (tennis and javelin throwing) and general population were tested. The results showed that in the case of the dominant upper limb sportsmen on average reached higher values of isometric handgrip strength than men belonging to general population. These deviation in the hand grip strength between the dominant and non-dominant upper limb could have negative influence of the athletes' health.

## Conclusion

The differences in height between the groups reach statistically significant difference.

Prepubescent tennis players have significantly greater values of hand grip strength of both hands compared to control groups.

In the athletes' group LHGS correlated positively with BMI and weight and there is also significant correlation between height and RHGS. In non-athletes' group the correlation is significant only between grip strength of both hands.

The findings of the present study might be useful in future investigation on player selection, talent identification in tennis and training program development.

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