

Grip Strength in Young Top-level Table Tennis Players

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Abstract: Introduction. Table tennis is an individual and asymmetric sport in which a great number of shots are performed at high velocity and power involving the dominant body side. The aim of this study was to determine the presence of force production differences between dominant and non-dominant upper limbs in young top-level table tennis players. **Methods.** A total of 63 players (38 males and 25 females), aged between 10 and 13 years participated in this study. All subjects carried out a simple grip strength test using an isometric handgrip dynamometer (Takei 5101; Tokyo, Japan). Once handgrip dynamometer was adjusted to the size of the player's hands, each subject performed three attempts with each hand alternatively trying to reach the peak force in the three first seconds. Two-minutes rest period between attempts was established. Tests were executed maintaining the standard position (from stand position, extending the arm next to the body and maintaining a neutral grip with the palm oriented to the tight) and the best result for each hand was registered. A 2x2 ANOVA was performed in order to examine the interaction between sex group and laterality (dominant and non-dominant hand). **Results.** Males showed higher levels of grip strength than females both with the dominant and non-dominant hand (20.2±3.5 and 18.2±1.4 kgf for dominant and non-dominant hand in female players, respectively vs. 27.1±5.1 and 22.4±4.1 kgf for dominant and non-dominant hand in male players, respectively). Also, male and female players showed higher levels of grip strength when they used the dominant hand, although these differences were more remarkable in the male players.

Keywords: Handgrip dynamometry, Isometric force, Laterality, Young table tennis players.

1. INTRODUCTION

Table tennis is an individual asymmetric sport, in which hits with great speed and power [1]. Technical actions that take place during the game are unilateral at the trunk and upper extremities level. Thus the dominant side of the player goes into action repeatedly and exclusively.

Table tennis is an opposition sport, in which the most basic rule of the game is to hit a ball with a racket using a specific technique with the intention of sending it toward a free space away from the opponent [2].

Table tennis is characterized by consecutive series of fast and powerful hits against a lightweight ball. This has an alternating aerobic-anaerobic requirement, caused by short and intermittent efforts and incomplete recoveries. Moreover, the dominant arm is totally involved. The different positions that the link racket-arm may assume may also develop the technique of this sport.

In recent years a series of regulatory changes in the size and weight of the ball, quick glue ban, etc., have been produced this led to modifications in the

characteristics of the racket.

This is a preliminary study for assessing the strength of upper extremities developed by young players of high level.

2. METHODS

A total of 63 players (38 males and 25 females), aged between 10 and 13 years and ranked between 1st -20th in Spanish national table tennis ranking for youth during the last two years were included in the study (Table 1). All subjects carried out a simple grip strength test using an isometric handgrip dynamometer (Takei 5101; Tokyo, Japan). Once handgrip dynamometer was adjusted to the size of the player's hands, each subject performed three attempts trying to reach the peak force in the three first seconds and alternating each hand. A rest period of two minutes was established between each attempt. Tests were executed maintaining the standard position (from stand position, extending the arm next to the body and maintaining a neutral grip with the palm oriented to the tight) and the best result for each hand was registered. A 2x2 ANOVA was performed in order to assess the interaction between sex group and laterality (dominant and non-dominant hand) ($p < 0.05$).

Table 1. General characteristics of participants.

	n	Age (years)	Competitive experience (years)
Males	38	12.0±1.1	4.8±1.2
Females	25	11.9±0.9	3.7±1.0
Total	63	12.0±1.0	4.2±1.0

3. RESULTS

The values of grip strength test recorded, for males and females, are presented in Table 2 and Figures 1 and 2. In any case, data showed statistical differences between dominant and non-dominant hands, and a clear influence of sex factor on the ability to generate grip strength regardless of laterality. Indeed, male players were able to generate higher levels of grip strength than female players with both dominant and non-dominant hands (Tables 2 and 3). Also, male players showed greater differences between dominant and non-dominant hands than those found in female players (Figure 2).

Table 2. Values of grip strength test (kilograms of force [kgf]) for male and female players (mean ± sd). RH: right-handed. LH: left-handed.

SEX	HAND	n	Non Dominant (mean±sd)	Dominant (mean±sd)
Males	RH	25	22.5±3.9*	27.44±5.2*
	LH	13	22.0±4.4*	26.408±5.1*
	Total	38	22.4±4.1*	27.1±5.1*
Females	RH	16	18.2±1.6	20.0±2.2
	LH	9	18.4±0.9	20.6±1.6
	Total	25	18.2±1.4	20.2±3.5

*p<0.001 between male and female players.

Table 3. 2x2 ANOVA results.

Source	Type III sum of squares	gl*	F	Sig
Sex	89.303	1	23.188	0.001
Error (sex)	30.810	8		

Hand	62.603	1	16.032	0.016
Error (hand)	19.680	8		
Sex*hand	707.996	1	40.798	0.001
Error (sex*hand)	25.859	8		

*only 8 of 25 female players were left-handed

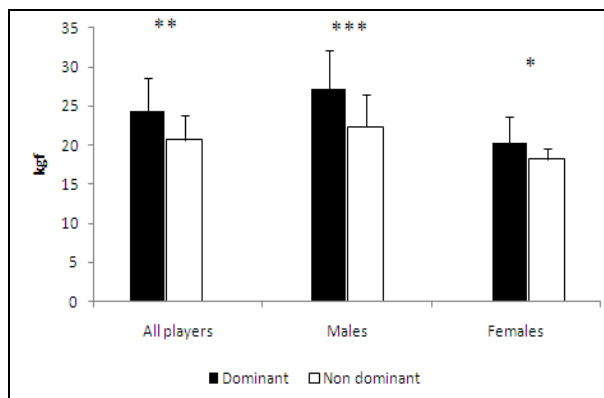


Figure 1. Grip strength (mean ± sd) for complete group, males and females players. *p<0.05, **p<0.01, and ***p<0.001 between dominant and non-dominant hands.



Figure 2. Percentage differences between dominant and non-dominant hands.

4. DISCUSSION

The values obtained in this study are directly related to subsequent and coordinated motor actions that are developed in this sport. This combination of skills must be accurate in space-time and with a high degree of automation. This precision, defined as the ability of positioning the body segments in one place and in a particular moment, is affected by fatigue during the game. This leads a decline in physical performance, including strength, thus low rates of strength could be related to a neuromuscular fatigue and poor technique [3].

In general, in the table tennis, the maximum strength

hand is not the most important requirement even though it has some significance during the game since the strength needed to overcome resistance is smaller than in other racket sports such as badminton [4, 5]. Absolute strength is required in situations where only the arm muscles have to be used [4], such as the forehand topspin shot or backhand loop and in situations where the player is acting or out of the position to make the hit.

In Table 2, males showed higher levels of grip strength than females regarding both dominant and non-dominant hand (20.2 ± 3.5 and 18.2 ± 1.4 kgf for dominant and non-dominant hand in female players, respectively vs. 27.1 ± 5.1 and 22.4 ± 4.1 kgf for dominant and non-dominant hand in male players, respectively). Both male and female players showed higher levels of grip strength when they used the dominant hand.

In this study significant differences between the dominant and non-dominant hand were obtained, both for males and females. As indicated by Hanten et al. (1999) [7], if one knows the maximum strength of one hand, one can estimate the value of other hand with a variation of 13%. The results obtained in our study are very similar to the rate establish by Hanten (1999): percentage differences between dominant and non-dominant hand were between 16.5 and 17.9% for male players, while these differences ranged between 9.2 and 10.9% in female players (Figure 2).

When a comparison between right-handed and left-handed players was performed, no statistical differences were found in both male and female players. (Table 2).

4. CONCLUSIONS

Hand maximum strength is higher in the dominant versus non-dominant hand, both for left-handed and for right-handed young table tennis players.

The maximum grip strength measured in both hands is higher in male than in female players.

By means of assessing the maximum grip strength of the dominant hand, it is possible to predict the maximum grip strength of the non-dominant hand with an estimated error of 9-18%.

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