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Effect of 12 week neuromuscular weighted rope jump training on lower extremity reaction time

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Abstract

The purposes of this study were to determine the influence of a jumping training protocol, using the weighted rope, on lower extremity visual and auditory reaction time performance in adolescent taekwondo (TKD) athletes. Twenty-two elite taekwondo athletes were randomly divided into two groups: the weigthed rope-trained (WRT) group (n = 11) and the control group (n = 11). Subjects in WRT group had jumping training 3 times a week for 12 weeks in addition to the routine taekwondo training program. The control group had no any training protocol in addition to the routine taekwondo training program. The visual and auditory reaction time performances of the subjects, both dominant and non-dominant legs were assessed with the Optojump System. The results of Paired Simple T test showed that the WRT decreased both the visual and the audiotory reaction time of non-dominant leg from pre to post-training ($p=0.00$, $p=0.01$ respectively). Although the pre-training audiotory and visual reaction times of dominant were similar between the groups ($p>0.05$), the post-training visual reaction time of dominant leg was significantly lower in the WRT group compared to control group ($p=0.01$). This study demonstrates that the weighted rope training program is effective in decreasing the reaction time in dominant and non-dominant leg. It is suggested that the WRT can be applied as an effective exercise program for enhancing visual and auditory reaction time performance.

Keywords: Jumping, weighted rope training, taekwondo, reaction time

INTRODUCTION

Taekwondo is one of the most systematic Korean martial arts and fighting sports that has an international fame. Taekwondo, which has been shown among Olympic sports since 2000, is a common sport among young people and children in the world (8, 5).

The number of studies that focus on the physical and physiological levels required for Taekwondo's high-performance matches is quite high (4, 15, 7) . The presence of fast, high-intensity strokes as well as less severe movements in TKD, requires improvement of aerobic physical fitness, in addition to anaerobic physical fitness. Factors related to physical fitness such as agility, quickness, durability, flexibility, reaction are very important in TKD, where more than 90% of the points are based on the kicking strength and endurance of the lower extremity (16). During a TKD event, the average number of heartbeats may correspond to 85% of the maximum number of heartbeats (3, 11). This is very important in order to optimize the short burst of maximum power bursts of the anaerobic metabolic pathway during the TKD event (1, 12). For this reason, it is very important to plan TKD training to train top-level athletes from young age (2, 15).

Rope jumping requires the coordination of various muscle groups in order to be able to maintain rhythmic movements which are an integral part of exercise. Rope exercises are performed for the development of lower extremity strength, endurance, coordination and dynamic balance (13). In addition to Rope training, weighted rope training now also gains importance in terms of improving athletic performance. weighted rope exercise aims the development of the upper extremity in addition to improving lower extremity strength, coordination, reaction and anaerobic power performance (14).

The limitations of studies on weighted rope in TKD, where anaerobic performance and reaction are

so important, draw attention. For this reason, this study aimed to investigate the effect of 12 week weighted rope training on anaerobic performance and reaction time of adolescent taekwondo players.

Table 1. 12- Wk Weighted rope jumping training program for WRJ group

	Training No	Training / Rest Duration (s)	Number of sets		Training No	Training / Rest Duration (s)	Number of sets		Training No	Training / Rest Duration (s)	Number of sets		Training No	Training / Rest Duration (s)	Number of sets
1. wk	1	30/30	1	2. wk	4	40/40	1	3. wk	7	50/50	1	4. wk	10	60/60	1
	2	30/30	1		5	40/40	1		8	50/50	1		11	60/60	1
	3	30/30	1		6	40/40	1		9	50/50	1		12	60/60	1
5. wk	13	30/30	2	6. wk	16	40/40	2	7. wk	19	50/50	2	8. wk	22	60/60	2
	14	30/30	2		17	40/40	2		20	50/50	2		23	60/60	2
	15	30/30	2		18	40/40	2		21	50/50	2		24	60/60	2
9. wk	25	30/30	3	10. wk	28	40/40	3	11.wk	31	50/50	3	12. wk	34	60/60	3
	26	30/30	3		29	40/40	3		32	50/50	3		35	60/60	3
	27	30/30	3		30	40/40	3		33	50/50	3		36	60/60	3

MATERIAL AND METHOD

Study was realized with the voluntary participation of total 22 professional adolescent taekwondo players had played experienced-taekwondo for at least 4 and whose ages vary between 15 and 17. Athletes were randomly separated into two groups being weighted rope training (WRT) (n=11) and control (n=11) groups. After preparatory WRT for 1 week, training program including weighted rope jumping training (Table 1-2) by repetition method for 3 days in a week and for 12 weeks was implemented by the WRT group together with the technical training. The control group followed only technical taekwondo training program for the same duration. Weighted rope with trade mark Powerope (V3067) that has 260 cm length and 600 gr rope weight, and 695 gr total weight was used for the WRT group in the study. At first athletes are informed about the implementation of the test orally, and then demonstrations are made practically. All subjects and their parents had read and signed an institutionally approved informed consent form before the evaluations. The study was approved by the Ethics Committee of University, and each subject provided a written informed consent before participation.

Exclusion criteria were: 1) having had lower extremity pain in movement rated at least 3/10 on an 11 point numeric rating scale; 2) having a systemic pathology including inflammatory joint disaese; 3) having had active intervention related to lower extremity pathology in last 3 month; 4) having taken anti-inflamatory medication in the past two weeks.

Table 2. Weighted rope jump skils for WRJ group

1	Basic bounce step with both feet	6	Alternate foot step
2	Bell jump with both feet	7	Boxer shuffle
3	Skier's jump	8	Side straddle
4	Skipping with right foot	9	Scissors
5	Skipping with left foot	10	Bonus jump with both feet

Measurements were taken by the researcher under the same environmental conditions in the laboratory medium. Firstly, all subjects were instructed in detail about the experiment procedure and location of measurement devices. The research operated the Optojump system (Microgate, Bolzano, Italy) to assess leg reaction time. Visual and audiotory reaction time was measured in pre and post-weigthed rope training conditions. The subject started in a position with knees bent at 90°, hands on the waist. The foot who executed the test was inside the testing area, and the other outside the perimeter. The subject must raise the foot (bending the knee), as quick as he can, when receiving a visual or audiotory stimulus. Optojump systemrecorded the reaction time.

SPSS 16 package program *(Statistical package for social sciences)* was used for statistical analysis of the data. After looking at the normality distribution with the Shapiro-Wilk test,Differences between the pre- and post-tests within the groups were analyzed using the "Paired sample T test" and between the groups by "Independent sample T test" at p <0.05 significance level.

RESULTS

Table 1. Changes in the dominant leg reaction times of the subjects.

Variables	Groups	Pre	Post	t	p
Visual Reaction (ms)	Weighted Rope	0.591 ± 0.04	0.507 ± 0.04*	5.339	0.01
	Control	0.615 ± 0.05	0.605 ± 0.04	0.350	0.98
Audiotory Reaction (ms)	Weighted Rope	0.472 ± 0.05	0.454 ± 0.05	1.316	0.23
	Control	0.409 ± 0.08	0.397 ± 0.09	0.864	0.41

*: within group difference is significant p<0.05

The results of this study showed that the WRT decreased both the visual and the audiotory reaction time of non-dominant leg from pre to post-training (p=0.00, p=0.01 respectively). While the post-training audiotory reaction time of non-dominant leg was not different statistically between the WRT and control group (p=0.14) (Figure 1), the post-training visual reaction time of the non-dominant was significantly lower in the WRT group compared to the control group (p=0.00).

Table 2. Changes in the non-dominant leg reaction times of the subjects.

Variables	Groups	Pre	Post	t	p
Visual Reaction	Weighted Rope	0.581 ± 0.03	0.489 ± 0.04*	5.339	0.00
	Control	0.597 ± 0.06	0.602 ± 0.05	-0.311	0.76
Audiotory Reaction	Weighted Rope	0.463 ± 0.04	0.432 ± 0.02*	3.031	0.01
	Control	0.384 ± 0.09	0.382 ± 0.07	0.132	0.89

*: within group difference is significant p<0.05

There were no significant differences between the pre-training audiotory and visual reaction time of both groups in dominant and non-dominant leg (p>0.05) (Figure 1-2). Although the pre-training audiotory and visual reaction times of dominant were similar between the groups (p>0.05), the post-training visual reaction time of dominant leg was significantly lower in the WRT group compared to control group (p=0.01).

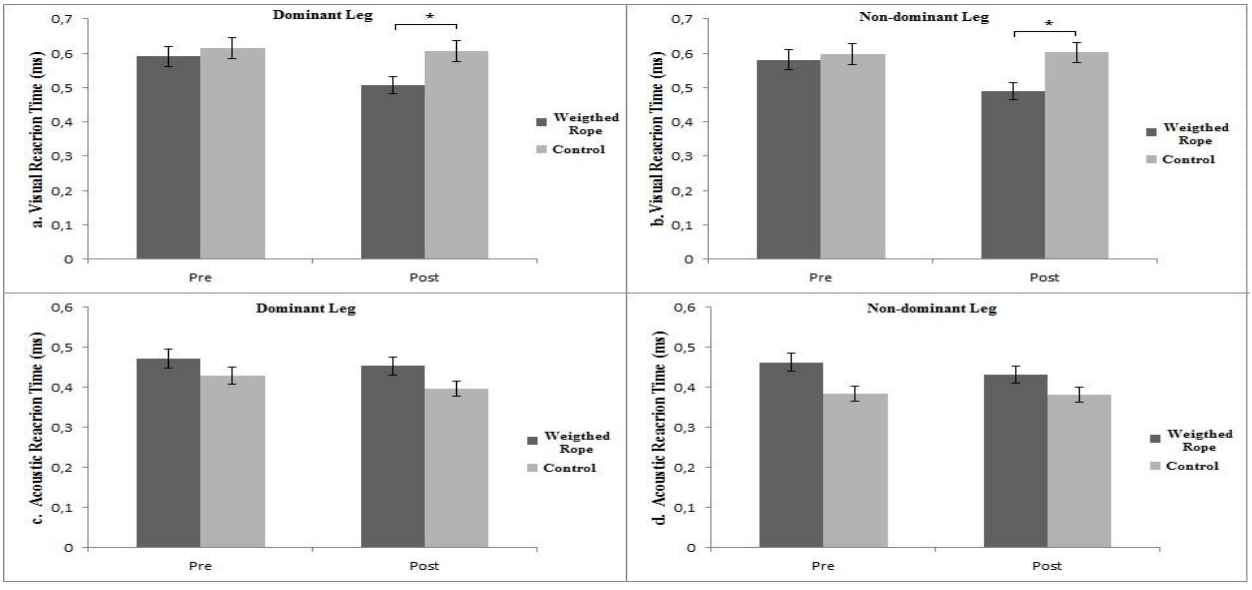

Figure 1. Comparisons between groups from pre-training to post training.

DİSCUSSİON

Jump rope is one of the most important training tools in martial arts such as boxing, tennis, wrestling and taekwondo. When we look at the literature, jumping exercises seem to play an important role in the development of the cardiovascular system and in maintaining muscle strength and maintaining continuity (6, 10). Although weighted rope jumping training is nowadays a popular jumping practice, it is not a thoroughly explored training method in terms of performance. The effects of weighted rope training have been investigated in a limited number of studies (10, 13, 14). In a similar study to our work, Orhan (14) reported that basketball players' weighted rope training improved both dominant and non-dominant reaction times in the upper extremity. The result of this study is similar to our research.

This study focuses on the effect of 12-week weighted rope training on the lower extremity reaction time of taekwondo players. The data show that the 12 week weighted rope training clearly reduces the reaction time. While in the non-dominant foot of the control group, there was no change in visual and auditory reaction time compared to the pre-training period, both the visual and auditory reaction times were reduced in the non-dominant foot of the WRT group after 12 weeks of training. Despite the fact that there is no significant difference in intergroup comparisons of post-training reaction time of non-dominant foot, the decrease in the WRT group as compared with the control group is remarkable regarding arithmetic mean.

When the changes in dominant foot reaction time were examined, no statistically significant change was observed in the visual and auditory reaction time of the control group compared to pre training. In the WRT group, there is no statistical change in the pre-training auditory reaction time, while the visual reaction improves. Lindorf et al., (9) performed a 6-week neuromuscular training consisting of 26 physically active jumping exercises with similar content to our training schedule. It has been reported that as a result of neuromuscular training, lower extremity reaction times of the subjects became better.

Limitations of studies on weighted rope training and role training indicate the necessity of this research. This study reveals what effects weighted rope exercises have on the lower extremities in the neuromuscular sense. Given the results of the study, it was seen that weighted rope training reduced the lower extremity reaction time positively. we recommend this program to the coaches in areas where the reaction time of the lower extremity is very important such as Taekwondo. In the future, researchers who will be working on this issue are encouraged to investigate what will be achieved in the upper extremity as well as in the lower extremity.

REFERENCES

1. Baynaz K, Acar K, Çinibulak E, Atasoy T, Mor A, Pehlivan B, Arslanoğlu E. The effect of high intensity interval training on flexibility and anaerobic power. *Journal of Human Sciences*, 2017; 14(4): 4088-4096.
2. Behm DG, Chaouachi A. A review of the acute effects of static and dynamic stretching on performance. *Eur J Appl Physiol*, 2011; 111: 2633-2651.
3. Bridge CA, da Silva Santos JF, Chaabene H, Pieter W, Franchini E. Physical and physiological profiles of taekwondo athletes. *Sports Medicine*, 2014; 44(6): 713-733.
4. Falco C, Alvarez O, Castillo I, Estevan I, Martos J, Mugarra F, Iradi A. Influence of the distance in a roundhouse kick's execution time and impact force in Taekwondo. *J Biomech*, 2009; 42: 242-248.
5. Fong SS, Fu SN, Gabriel YFN. Taekwondo training speeds up the development of balance and sensory functions in young adolescents. *J Sci Med Sport*, 2012; 15: 64-8.
6. Fox EL, Bowers RW, Foss LM. *Beden Eğitimi ve Sporun Fizyolojik Temelleri.* Bağırgan Yayınevi, 1988: 62-82.
7. Gleim GW, McHugh MP. Flexibility and its effects on sports injury and performance. *Sports Med*, 1997; 24: 289-299.
8. Haddad M, Ouergui I, Hammami N, Chamari K. *Performance Optimization in Taekwondo: From Laboratory to Field*, Omics Group, 2015: 85-93.
9. Linford CW, Hopkins JT, Schulthies SS, Freland B, Draper DO, Hunter I. Effects of neuromuscular training on the reaction time and electromechanical delay of the peroneus longus muscle. *Archives of physical medicine and rehabilitation*, 2006; 87(3): 395-401.
10. Masterson GL, Brown SP. Effects of Weighted Rope Jump Training on Power Performance Tests in Collegians. *The Journal of Strength & Conditioning Research*, 1993; 7(2): 108-114.
11. Matsushigue KA, Hartmann K, Franchini E. Taekwondo: Physiological responses and match analysis. *The Journal of Strength & Conditioning Research*, 2009; 23(4): 1112-1117.
12. Mor A, Ipekoglu G, Arslanoglu C, Acar K, Arslanoglu E. The Effects of Electrostimulation and Core Exercises on Recovery After High-Intensity Exercise. *International Journal of Applied Exercise Physiology*, 2017; 6(4): 46-53.

13. Ozer D, Duzgun I, Baltaci G, Karacan S, Colakoglu F. The effects of rope or weighted rope jump training on strength, coordination and proprioception in adolescent female volleyball players. *Journal of sports medicine and physical fitness*, 2011; 51(2): 211.
14. Orhan S. Effect of weighted rope jumping training performed by repetition method on the heart rate, anaerobic power, agility and reaction time of basketball players. *Advances in Environmental Biology*, 2013; 7: 945-952.
15. Thompson WR and Vinueza C. Physiologic profile of tae kwon do black belts. Sports Medicine, *Training and Rehabilitation*, 1991; 3: 49-53.
16. Yoon SD, Sung DH, Park GD. The effect of active core exercise on fitness and foot pressure in Taekwondo club students. *Journal of physical therapy science*, 2015; 27(2): 509-511.