ORIGINAL ARTICLE

Effect of dynamic and static strength training using Thera-Band® on elite athletes muscular strength

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

Sercan Karakurt[1ABCDE], **Eser Aggon**[1ABCD]

Erzincan University, College of Physical Education and Sports, Erzincan, Turkey

Received: 17 April 2018; **Accepted:** 17 October 2018; **Published online:** 22 November 2018

AoBID: 12069

Abstract

Background and Study Aim: Many training scientists have concentrated on alternative models and materials to find the most efficient way to develop the strength for the last few decades. Thera-Band® is an alternative training tool used to enhance some motoric characteristics (flexibility and strength) by the athletes. The aim of the study is the knowledge about the effects of dynamic and static strength exercises when applied with Thera-Band® on the athlete's strength indicators.

Material and Methods: Twenty boxers, at an elite level, participated the research and were divided into two groups varied as dynamic and static exercise, thus they were exposed to dynamic and static contraction force exercises with Thera-Band® for 8 weeks, 3 days a week. BMI, hand claw strength and back-leg strength tests were performed in the pre-and post-training processes.

Results: A significant increase was encountered in all kinds of strength measurements for the dynamic strength group at the end of the first training ($p<0.05$) after the applications for the eight weeks. Significant increases were seen in the athletes performing static strength training in their left-hand claw, back-leg and leg strength values. In comparing the general performances of the athletes, the results showed that there was not any, significant differences between the two participant groups.

Conclusions: Especially in the sports branches, in which the strength is crucial, it was determined that the strength might increase in dynamic and static applications by determining the training with right resistance levels with the Thera-Band®, which has increasing popularity nowadays. From this point, it can be expressed that Thera-Band® exercises can be used not only for rehabilitation purposes but also to increase the strength of the athletes performing performance sports.

Keywords: BMI • boxers • hand grip • performance

Conflict of interest: Authors have declared that no competing interest exists

Ethical approval: The study project was approved by the Erzincan University Ethics Committee (no 4/01)

Provenance & peer review: Not commissioned; externally peer reviewed

Source of support: Departmental sources

Author's address: Eser Aggon, College of Physical Education and Sports, Erzincan University, Erzincan, Turkey; e-mail: eseraggon@gmail.com

Performance – *noun* the level at which a player or athlete is carrying out their activity, either in relation to others or in relation to personal goals or standards [18].

Strength training – *noun* training that aims to build muscle strength, usually resistance training [18]

Resistance *noun* **1.** the ability of a person not to get a disease **2.** the ability of a bacterium or virus to remain unaffected by a drug **3.** opposition to a force [18].

Resistance band – *noun* a type of extensor [18].

Exercise – *noun* **1.** physical or mental activity, especially the active use of the muscles as a way of keeping fit, correcting a deformity or strengthening a part 2. a particular movement or action designed to use and strengthen the muscles ▪ *verb* **1.** to undertake physical exercise in order to keep fit and healthy 2. to subject the body, or part of it, to repetitive physical exertion or energetic movement in order to strengthen it or improve its condition [18].

Training session – *noun* a period during which an athlete trains, either alone, with a trainer or with their team [18].

INTRODUCTION

The development of muscle strength is a multifaceted and a performance-related fitness component which is underpinned by muscular, neural, and mechanical factors [1]. Since all sports branches demonstrate their specific characteristics, the need for different kinds of strength has led to the classification of strength in different forms. The classification of dynamic and static strength used in the strength classifications also makes it essential to evaluate them according to the types of strength used by the body during the steaks and defence in boxing.

Strength training, which was traditionally applied with heavy metal tools has been replaced by new types of training including different materials, emerged with modern technological developments. Exercise resistance bands are carried out for health problems with a variety of athletic flexibility and warm-up exercises. Thera-Band® (resistance rubber) is one of the best examples of this system.

It was proved that the Thera-Band® rubber increases the mobility and they are functional such as reducing joint pain, to rehabilitating injuries in exercise programs, increasing the functionality of the athlete, improving the athletic performance and treating many chronic diseases. It was found out that the exercises with resistance rubbers improve the balance and posture, are beneficial for cardiovascular health and reduce the blood pressure [2].

Boxing is a sports branch, in which strength and performance must be exhibited at the maximum level as in other fighting sports. Also, as it is evaluated within the scope of the applied techniques, the boxing is a special sport, including the dynamic and static strength principles, and the extremely significant parameters depending on maximum strength are incorporated.

Development and effective use of power from the perspective of the conditional motoric properties is very important, as it is one of the essential combat sports. Contrary to the traditional training, it is extremely important to demonstrate the efficacy of these materials by assuming that the newly developed materials in power exercises will create a more pleasant and alternative working environment with a variety of athletes training. In addition, the view of "*The increase of the ergonomic and disability risk for athletes can be reduced with the use of Thera-Band® exercises*" gets more important nowadays. Thus, the very important issues are to investigate the effects of dynamic and static force applications on the strength values of boxers.

The aim of the study is the knowledge about the effects of dynamic and static strength exercises when applied with Thera-Band® on the athlete's strength indicators.

MATERIAL AND METHODS

Subjects

Totally 20 individuals consisting of 10 elite male boxers (age mean: 17.63 ±3.85 years, height: 171.75 ±10.93 cm, and weight: 67.25 ±15.25 kg) as dynamic training group, 10 elite males boxers (age mean: 18.13 ±3.31 years, height: 172.38 ±5.42 cm, and weight: 69.88 ±19.75 kg) as static training group participated to study.

Study design

An identified controlled design with 2 experimental groups was used in order to determine the effectiveness of a strength training program performed during 8 weeks and applied with 2 different exercise procedures (static and dynamic). After obtaining the pre-test results of the groups, two homogenous groups were identified as static and dynamic groups.

Different colours represent the progressive thickness of bands, which result in increasing levels of resistance. In order to allow the athletes to train with suitable band resistors, pre-test results used.

Training Program with Thera-Band®

Boxers, grouped according to similar dynamic and static strength qualifications, were instructed to perform strength exercises with Thera-Band® for 3 days a week for 8 weeks. Participants were instructed in the dynamic and static test positions. The static and dynamic processes of the same types of exercises were applied to the groups.

For the upper extremities some types of training were applied such as; direct kick, hook kick, uppercut kick, elbow extension, elbow stretch, lateral lift, upward rowing, reverse wing, chest press, front lift, cross lift, cross back cut; for the lower extremities the training types are; leg press, squatting and standing, and attack movements.

In order to load times not to be different, the static group was asked to maintain the static contraction for 15 seconds by measuring the load duration of 15 seconds equal to the duration of 8 repetitions of a dynamic group. 15 movements, 8 repetitions and 3 sets were used for the dynamic group; and 15 movements, 15 seconds and 3 sets for the static group.

Exercise and measurement tools

Thera-Band® exercise bands (gold – with very high-level resistance); Thera-Band® exercise bands (silver – with high-level resistance); Thera-Band® exercise bands (black – with medium resistance); hand grip strength dynamometer; back and leg strength measuring dynamometer; photocell stopwatch.

Back strength measurements

Subjects stood on the foot-plate of the Takei Back, and Leg dynamometer (Takei Scientific Instruments) with the scapulae and buttocks positioned flat against a wall. The back of the foot-plate was 15 cm from the wall. Subjects flexed the legs, sliding down the wall until the leg extension angle equalled 135°. Subjects then reached down with the elbows fully extended. The pull-bar of the dynamometer was placed in the hands, and the chain length was adjusted appropriately. Subjects were instructed to extend the legs with maximal effort, pulling the bar simultaneously without 'jerking'. The highest score from three was recorded.

Leg strength measurements

Subjects stood on the foot-plate of the Takei Back and Leg dynamometer (Takei Scientific Instruments), initially in the same manner as for the measurement of leg strength. The legs were, this time kept straight, and the back was flexed at the hip. Flexion continued until, with fully extended elbows, the tips of the index fingers reached the patellae. The pull-bar of the dynamometer was then placed in the hands, and the chain length was adjusted. A reverse grip was adopted for the measurement of back strength to deter the use of shoulder muscles during the 'pull'. Subjects were also instructed to keep the head up during measurement. The highest score from three pulls was recorded.

Statistical analysis

Descriptive statistics and normality tests were performed on the obtained data. Because the data set distributions were not normal, the Friedman test was used for repeated measures of the same groups, and the Wilcoxon test was performed in duplicate for the detection of significant differences. Mann Whitney U test was used to compare the resting, acute and chronic values of the different groups. All results were evaluated according to the significance level of 0.05

Ethics

The subjects signed an informed consent form before starting the protocol, in accordance with the Research Commission of the Department of Physical Education and Sports at the University of Erzincan (Turkey). All procedures meet the requirements listed in the Declaration of Helsinki and are in accordance with the ethical standards of the Erzincan University Ethics Committee. Approved with date 22.06.2016 and number 4/01 by Erzincan University as a master thesis.

RESULTS

There is no significant difference ($p>0.05$) in body mass indexes of the athletes who do the dynamic and static strength exercises. Significant increases ($p<0.05$) come into appearance as the back strength of athletes, whom do dynamic power exercises are compared with before exercise. A significant increase ($p<0.05$) is noticed compared with before exercise (Table 1).

Is no significant difference ($p>0.05$) between the groups. Body mass indexes, back and leg powers of athletes, who do dynamic and static power exercises, they are similar before and after the exercise (Table 2).

DISCUSSION

At the end of our experiment, when the body mass indexes of the athletes were taken into consideration, the results showed that there is not any significant change in the measurements of pre- and post-training sessions. When the literature was reviewed, some of the previous studies found out similar results about BMI with similar exercises. In the study of Kocaoglu [3], an elastic resistance band exercise was applied for 8 weeks in order to determine the body composition and postural control effects in sedentary ladies and it was found out that the significant effects in BMI during pre- and post-training were similar and there was not any difference depending on

Table 1. BMI, back strength and leg strength values of intergroup during pre- and post-exercises of Static (n = 10) and Dynamic (n = 10) Groups.

Variables	Groups	Period of measurement	Min	Max	Med	X^2	p	Differential groups
Body Mass Index (BMI) kg/m^2	Dynamic	Pre Exercise	17.10	25.20	21.95	.720	.698	-
		Post Exercise	17.2	25.2	22.3			
		Post 8 weeks Exer.	17.2	25.4	22.1			
	Static	Pre Exercise	18.3	40.5	21.1	2.571	.276	-
		Post Exercise	18.3	36.9	20.9			
		Post 8 weeks Exer.	19.10	38.20	21.50			
Back strength (kg)	Dynamic	Pre Exercise	80	155	130	10.414	.005	1-2*(.017) 1-3*(.011)
		Post Exercise	90	190	160			
		Post 8 weeks Exer.	70	200	150			
	Static	Pre Exercise	70	160	112.5	6.000	.050	1-2*(.035)
		Post Exercise	85	180	142.5			
		Post 8 weeks Exer.	60	190	130			
Leg strength (kg)	Dynamic	Pre Exercise	70	170	120	12.074	.002	1-2*(.016) 1-3*(.018)
		Post Exercise	80	170	132.5			
		Post 8 weeks Exer.	85	170	150			
	Static	Pre Exercise	70	140	110	12.069	.002	1-2*(.011) 1-3*(.018)
		Post Exercise	80	170	135			
		Post 8 weeks Exer.	80	182	117.50			

* $p<0.05$

this case. Furthermore, as in the same line with our results (with the same duration, and different types of exercises), the studies of Kurt et al. [4], Cankaya et al. [5] demonstrated that there was not a statistically significant difference about the BMI effect.

The strength of the backside formed by large muscle groups is very important in practising sports skills. In our study, the back strength of the athletes performing dynamic power exercise increased significantly after 8 weeks; on the other hand, there was an increase in static power of athletes at the same time, this increase did not show a statistically significant difference.

In some researches carried out with these tools for developing and continuing strength, some results, similar to our research, are observed in some indicators related to the backside strength. In the study of Ozdil [6], training by 18 elite male boxers (between the ages of 19-25) for 6 weeks, the results showed that the athletes exercising with "rubber" have increased in their "maximal bench" values, but this increase was not statistically meaningful. Colado et al. [7], at the end of the submaximal exercises with 42 female athletes (the mean age: 21.79) for 8 weeks, referred that there is a significant difference in the strength of the athletes training with the resistance rubbers as in the athletes exercising with free weight. Andersen et al. [8], at the end of the studies carried out with the resistance rubber and dumbbell related to 5 different muscle groups, stated that the resistance rubbers increased the strength of muscles similar to the results of the dumbbell. Ghigiarelli et al. [9], after the 7 weeks training process with the resistance rubber and training with free weight on upper extremity muscles, claimed that the training with both the resistance rubber and free weight significantly increased the strength similarly. There is no significant difference in our comparison between the groups (Table 2).

As the literature is investigated, it is observed that there are results are in parallel with the current study in using the Thera-Band® and similar training tools. According to the results of the study carried out by Prieske et al. [10] on 39 elite footballers for 9 weeks, the footballers claimed that there is a significant increase in their

Table 2. BMI, back strength and leg strength comparison of Static (N = 10) and Dynamic (n = 10) Groups.

Variables	Period of measurement	Group	Average of Ranks	Total of Ranks	Z	p
Body Mass Index (BMI) kg/m^2	Pre Exercise	Dynamic	8.25	66.00	–.210	.878
		Static	8.75	70.00		
	Post Exercise	Dynamic	8.50	68.00	.000	1.000
		Static	8.50	68.00		
	Post 8 weeks Exercises	Dynamic	8.69	69.50	–.158	.878
		Static	8.31	66.50		
Back strength (kg)	Pre Exercise	Dynamic	9.38	75.00	–.742	.505
		Static	7.63	61.00		
	Post Exercise	Dynamic	9.44	75.50	–.791	.442
		Static	7.56	60.50		
	Post 8 weeks Exercises	Dynamic	10.19	81.50	–1.424	.161
		Static	6.81	54.50		
Leg strength (kg)	Pre Exercise	Dynamic	9.25	74.00	–.635	.574
		Static	7.75	62.00		
	Post Exercise	Dynamic	8.63	69.00	–.106	.959
		Static	8.38	67.00		
	Post 8 weeks Exercises	Dynamic	9.88	79.00	–1.159	.279
		Static	7.13	57.00		

strength performances as the normal season training. Wallace et al. [11] separated 10 participants (mean age: 21.3) into two groups as those exercising with a flexible band with free-weight and those exercising with solely free-weight and found out that there was more increase in the strength of those, who used the flexible band. Yolcu [12] stated that the increase was observed in the knee extension strengths in the strength development training with Thera-Band®. Treiber et al. [13] referred that using the Thera-Band® and light dumbbell exercises with the university tennis players for 4 weeks, was beneficial in developing the strength.

In our study, while the effects of dynamic and static force exercises on leg strength were similar, it was reported that other investigations on dynamic and static exercises showed different effects. Folland et al. [14] conducted the static and dynamic strength exercises and found out that static strength measurement values were higher than the dynamic strength group at the end of their study. Amusa et al. [15] stated that both of the training increased the strength, but the static strength training enabled significantly more development when compared with the dynamic strength training in their research, examining the effect of dynamic and static strength training on the knee extension muscle strength. O'Shea and O'Shea [16] referred that maximal strength at the end of the static squat was statistically significantly higher than the dynamic training at the end of their study on the effect of static and dynamic squat training on maximal strength values. Jones and Rutherford [17] stated that both the dynamic and the static exercises increased the strength, but the static strength training was more effective in their study, in which they applied the static and dynamic strength training on the participants with different muscle contractions and contraction duration.

The effect levels of the strength training, we applied for our study, on the BMI values are similar to the previous studies in the literature. As it is considered in terms of the strength values, the effect results of static or dynamic exercises differ in terms of the studies comparing strength increase with static and dynamic training. Both the static and the dynamic force exercises increased the strength values of the athletes according to the results of the current study, but no significant differences were observed

between these two practices. The reason of why there is a meaningful might be originated from the total duration of the movement in the static exercises which was similar to the total duration of the movement in the dynamic exercises, and the amount of resistance applied to the body in both exercises was close to each other. To sum up, the results were similar when comparing the effect of the strength of both the dynamic and the static exercises which means that there is an increasing effect of these mentioned types of the exercises for the dynamic and static exercise participant groups.

CONCLUSIONS

In this present study, it was found out that: dynamic and static strength exercises do not cause changes in the BMI values of athletes; dynamic strength exercises increase back and leg strength; static strength exercises increase leg strength; there is not any significant difference in the indicators between the dynamic and static groups during the intergroup comparison.

At the end of the study, it was found out that both dynamic and static strength exercises with Thera-Band® have significant effects on strength values of athletes; moreover, the effects of dynamic and static exercises are similar.

Especially in the sports branches, in which the strength is crucial, it was determined that the strength might increase in dynamic and static applications by determining the training with right resistance levels with the Thera-Band®, which has increasing popularity nowadays. From this point, it can be expressed that Thera-Band® exercises can be used not only for rehabilitation purposes but also to increase the strength of the athletes performing performance sports.

REFERENCES

1. De Ste Croix MBA. Muscle strength. In: Paediatric exercise science and medicine. Armstrong N, Van Mechlen W, editors. Oxford: Oxford University Press; 2008: 199-221
2. http://www.thera-bandacademy.com/tba-portal/sports-performance (accessed 2017 Feb 12)
3. Kocaoglu Y. Effects of elastic resistance training on postural control in sedanter ladies [Master thesis]. Konya: Selcuk University; 2015 [in Turkish]
4. Kurt S, Hazar S, İbiş S et al. Evaluation of the effects of eight-week step-aerobic exercise program on some fitness parameters at middle aged sedentary women. J Hum Sci 2010; 7(1): 665-674 [in Turkish]
5. Cankaya S, Gokmen B, Con M et al. The effect of special balance developer training applications on reaction time and body mass index of eleven-year-old young males. J Sport Perf Res 2014; 5(2): 59-67 [in Turkish]
6. Ozdil G. The Effect of Power Trainings on Maximal Power and Anaerobic Power in Boxers. [Master thesis]. Konya: Selcuk University; 2016 [in Turkish]
7. Colado JC, García-Massó X, Pellicer M et al. Comparison of elastic tubing and isotonic resistance exercises. Int J Sports Med 2010; 31(11): 810-817
8. Andersen LL, Andersen CH, Mortensen OS et al. Muscle activation and perceived loading during rehabilitation exercises: comparison of dumbbells and elastic resistance. Phys Ther 2010; 90(4): 538-549
9. Ghigiarelli JJ, Nagle EF, Gross FL et al. The effects of a 7-week heavy elastic band and weight chain program on upper-body strength and upper-body power in a sample of division 1-AA football players. J Strength Cond Res 2009; 23(3): 756-764
10. Prieske, O, Muehlbauer, T, Borde, Ret al. Neuromuscular and athletic performance following core strength training in elite youth soccer: role of instability. Scan J Med Sci Spor 2016; 26(1): 48-56
11. Wallace BJ, Winchester JB, McGuigan MR. Effects of elastic bands on force and power characteristics during the back squat exercise. J Strength Cond Res 2006; 20(2): 268-272
12. Yolcu SO. The effects of rubber band training versus resistance machines on muscular strength in pre-pubertal children [Master thesis]. Izmir: Ege University; 2010 [in Turkish]
13. Treiber FA, Lott J, Duncan J et al. Effects of Theraband and lightweight dumbbell training on shoulder rotation torque and serve performance in college tennis players. Am J Sport Med 1998; 26(4): 510-515
14. Folland JP, Hawker K, Leach B et al. Strength training: Isometric training at a range of joint angles versus dynamic training. J Sport Sci 2005; 23(8): 817-824
15. Amusa, LO, Obajuluwa, VA. Static versus dynamic training programs for muscular strength using the knee extensors in healthy young men. J Orthop Sport Phys 1986; 8(5): 243-247
16. O'shea KL, O'shea JP. Functional isometric weight training: Its effects on dynamic and static strength. J Strength Cond Res 1989; 3(2): 30-33
17. Jones DA, Rutherford, OM. Human muscle strength training: the effects of three different regimens and the nature of the resultant changes. J Physiology 1987; 391(1): 1-11
18. Dictionary of Sport and Exercise Science. Over 5,000 Terms Clearly Defined. London: A & B Black; 2006

Cite this article as: Karakurt S, Aggon E. Effect of dynamic and static strength training using Thera-Band® on elite athletes muscular strength. Arch Budo 2018; 14: 339-343