ANATOLIA SPORT RESEARCH

ISSN: 2757-6485

2023 & 4 (1)

# THE EFFECT OF DYNAMIC AND STATIC STRENGTH EXERCISES WİTH RESISTANCE BAND ON RESPIRATORY FUNCTIONS

"Direnç Bantlı Dinamik ve Statik Güç Egzersizlerinin Solunum Fonksiyonlarına Etkisi"

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**ORGINAL ARTCILE**

**History**
Received: 12 April 2023
Accepted: 10 May 2023
Published: 30 April 2023

**DOI:** http://dx.doi.org/10.29228/anatoliasr.37

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**Acknowledgement**
This study was presented verbally in the 1st International Congress of Battalgazi on Multidisciplinary Studies (7-9 December 2018 / Malatya / TURKEY).
**Funding**
This study received no specific financial support.
**Competing Interests**
The authors declare that they have no conflict of interests.
**Transparency**
The authors confirm that the manuscript is an honest, accurate, and transparent account of the study was reported; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained.
**Ethical**
This study follows all ethical practices during writing.
**Citation**
Agirbas, O., & Karakurt, S. (2023). The Effect of Dynamic and Static Strength Exercises with Resistance Band on Respiratory Functions, Anatolia Sport Research, 4(1): 19-24.



**ÖZET**

**Amaç:** Bu çalışmanın amacı direnç bandı ile yapılan kuvvet egzersizlerinin solunum fonksiyonlarına etkisini incelemektir.
**Materyal ve Metot:** 19 sağlıktı ve gönüllü elit erkek boksorün katıldığı araştırmamızda boksörlere 8 hafta süreyle ve haftada 3 gün olmak üzere elastik bant ile dinamik ve statik kuvvet antrenmanları yaptırıldı, Egzersiz öncesi, ilk egzersiz sonrası ve 8 hafta sonunda son egzersiz sonrası solunum fonksiyonları Poly marka el spirometre cihazıyla ölçüldü. Sporcuların zorlu vital kapasiteleri (FVC), 1. saniyedeki zorlu ekspiratuar volüm (FEV1) ve zirve ekspiratuar akım (PEF) değerleri ölçüldü. Elde edilen veriler SPSS 22 for Windows programında incelendi. Verilerin dağılımları normal olmadığından dolayı Friedman ve Wilcoxon testleri kullanıldı. Sonuçlar .05 anlamlılık düzeyinde yorumlandı.
**Bulgular:** Dinamik kuvvet egzersizleri sonucunda solunum fonksiyon değerlerinde anlamlı bir fark görülmedi. Statik kuvvet egzersizleri sonucunda boksörlerin zorlu vital kapasiteleri anlamlı derecede azalırken kronik dönemde anlamlı arttığı, diğer solunum fonksiyon değerlerinde ise anlamlı bir fark olmadığı görüldü.
**Sonuç:** Araştırmada elastik band ile yapılan dinamik kuvvet egzersizlerinin elit boksörlerde solunum fonksiyonları üzerinde etkisi olmadığı, statik egzersizlerin ise sadece zorlu bital kapasiteleri üzerinde etkili olabildiği sonucuna ulaşıldı. Bunun nedeninin statik çalışmada, solunumdan sorumlu göğüs kaslarının, izometrik çalışmadan daha fazla etkilenmiş olabileceğidir. Araştırma üst düzey antrene olan elit boksörler üzerinde uygulandığından, yapılan çalışmanın etkisinin az olabileceğini düşündürmektedir. Bu nedenle farklı brans sporcuları ile sedanterler üzerinde de araştırılması önerilir.

**Anahtar Kelimeler:** Boks, Elastik Band, Kuvvet Egzersizi, Solunum Fonksiyon

**ABSTRACT**

**Aim:** The aim of this study was to investigate the effect of strength exercises with resistance band on respiratory functions.
**Material and Method:** 19 healthy and volunteer elite male boxers participated in our study where boxers did dynamic and static strength exercises with elastic band 3 days a week for 8 weeks. Respiratory functions were measured by POLY brand spirometer before and after the first exercise and at the end of 8 weeks. Forced vital capacities (FVC), forced expiratory volumes in one second (FEV1), and peak expiratory flow (PEF) values of the athletes were measured. The obtained data were examined using SPSS 22 for Windows. Friedman and Wilcoxon tests were used since the distribution of the data was not normal. Resultswere interpreted at the level of significance of .05.
**Results:** No significant difference was observed in respiratory function values as a result of dynamic strength exercises. As a result of the static strength exercises, it was observed that the forced vital capacity of boxers decreased significantly while it increased significantly in the chronic period and that there was no significant difference in other respiratory function values.
**Conclussions:** In the study, it was concluded that dynamic strength exercises with elastic band had no effect on respiratory functions of elite boxers, whereas static exercises could only affect the forced vital capacities. The reason for this is that the pectoral muscles responsible for breathing may have been affected more in static exercises than isometric exercises. Since the study was performed on elite boxers with a high level of training, the effect of exercises may have been low. Therefore, it is recommended to examine athletes from different branches and their sedentary conditions.

**Keywords:** Boxing, Elastic Band, Respiratory Function

## GİRİŞ

The need for oxygen increases with exercise because muscles need more oxygen (O2) during exercise. Rrespiratory volume increases by the effect of exercise (Demir and Filiz, 2004). Respiration occurs with the air pressure inside and outside the lungs and respiratory muscles that creates this pressure difference. Respiratory muscles are grouped as inspiratory muscles (diaphragm, external intercostal muscles, sternocleidomastoid, scalene muscles, pectoral muscles) and expiratory muscles (internal intercostal and abdominal muscles). At rest, inspiration is performed by the contraction of the diaphragm, external intercostal and scalene muscles. These muscles that function in calm breathing are called primary inspiratory muscles. The contraction of the primary inspiratory muscles expands and increases the volume of the thorax (Hall, 2016).

Lung function tests are used to measure lung volumes and capacities and to determine the expansion capacity of the respiratory tract, respiratory muscles, and lungs (Kayatekin et al., 1993; Yildirim et al., 1996). From a physiological point of view, like other physiological tests, respiratory function tests are extremely important to measure the fitness condition of individuals (Astrand and Rodahl, 1986). Respiratory function values are determined by measuring the volume and capacity of lungs (Atan et al., 2013). Some of them are;

Forced Vital Capacity (FVC) is the volume of air exhaled from lungs with a maximum and forced expiration after a deep and maximum inspiration (Paoletti et al., 1986).

Forced Expiratory Volume in one second (FEV1) is the volume of air exhaled in the first second of forced and rapid exhalation after maximum inhalation (Miller et al., 2005; Tasgin and Donmez, 2009).

Peak Expiratory Flow (PEF) is the maximum amount of air exhaled from the lungs at one time. In other words, it is the flow rate of the maximum amount of air that is reached at the earliest stage of the FVC manoeuvre. It reflects the diameter of the central respiratory tract and the strength of the respiratory muscles in a healthy person and is a good indicator for respiratory tract (trachea and central respiratory tract) (Tasgin and Donmez, 2009; Yıldırım and Demir, 2011).

In order to meet the increasing oxygen demand while exercising, the respiratory system needs to work more efficiently. Strengthening the muscles responsible for respiration will undoubtedly increase the efficiency of this system. Therefore, the research was designed to determine the effectiveness of dynamic and static strength exercises in strengthening respiratory functions in boxing, which requires a high level of endurance.

## MATERYAL VE METOD

This study was carried out with the approval of the Ethics Committee of Erzincan University dated 22-06-2016 and numbered 4/01 and voluntary participation of elite boxers.

### Participants

The study was carried out with a dynamic exercise group of 10 elite boxers of 16.89 ± 3.37 years of age, with the height of 168.22 ± 8.96 cm, body weight of 63.55 ± 14.48 kg and body mass indexes of 22.29 ± 3.42 kg/m2 and a static exercise group of 9 elite boxers of 17.22 ± 3.35 years of age, with the height of 166.89 ± 9.73 cm, body weight of 59.56 ± 12.68 kg and body mass indexes of 21.19 ± 3.36 kg/m2.

### Exercise Tools and Program

- ✓ Thera-Band exercise band (gold colour - with very high level of resistance)
- ✓ Thera-Band exercise band (silver colour - with high level of resistance)

The boxers were grouped according to dynamically and statically similar strength characteristics and they performed strength exercises with Thera-Band 3 days a week for 8 weeks. Direct punch, hook punch, uppercut punch, elbow stretching, elbow extension, lateral lifting, rowing up, reverse flapping, chest press, front lifting, cross lifting, cross back cutting exercises were performed for the upper extremities. Exercises were performed for the same duration in the dynamic and static exercise groups. The muscle contractions performed with the Thera-Band continued steadily in the static exercise group, while the movements were repeated at a certain pace in the dynamic group (Karakurt and Aggon, 2018).

### Measurement of Respiratory Functions

Forced vital capacities (FVC), forced expiratory volume in one second (FEV1), and peak expiratory flow (PEF) values were measured in the standing position by POLY® spirometry device before and after the first exercise and at the end of 8 weeks after the last exercise.

### Statistical Analysis

Descriptive statistics and normality tests were performed with the data obtained. Because the distribution of the data set was not normal, Friedman test for the repeated measurements of the same groups, Wilcoxon test for the determination of significant differences in binary groups, and Mann Whitney U test to compare the resting after acute exercise and after chronic exercise values of different groups were performed. All resultswere evaluated according to .05 significance level.

## RESULTS

***Table 1.*** *Comparison of FVC, FEV1 and PEF values of boxers who did dynamic strength exercises*

| Parameter | Measurement | N | Min | Max | Med | Mean Rank | $X^2$ | p |
|---|---|---|---|---|---|---|---|---|
| FVC (lt) | **Resting (a)** | 10 | 2.74 | 5.69 | 4.66 | 2.22 | 1.750 | .417 |
| | **After the first exercise (b)** | 10 | 2.44 | 5.24 | 4.21 | 1.67 | | |
| | **After 8 weeks of exercise (c)** | 10 | 2,71 | 5,94 | 4,75 | 2.11 | | |
| FEV1 (lt) | **Resting (a)** | 10 | 2.37 | 4.68 | 3.63 | 2.25 | 1.000 | .607 |
| | **After the first exercise (b)** | 10 | 2.25 | 4.48 | 3.72 | 2.00 | | |
| | **After 8 weeks of exercise (c)** | 10 | 2,09 | 4,31 | 3,53 | 1.75 | | |
| PEF (lt) | **Resting (a)** | 10 | 4.78 | 11.51 | 9.04 | 2.13 | .250 | .882 |
| | **After the first exercise (b)** | 10 | 5.83 | 10.92 | 7.67 | 2.00 | | |
| | **After 8 weeks of exercise (c)** | 10 | 3,02 | 10,41 | 6,71 | 1.88 | | |

lt : Liter

When Table 1 is examined, it is seen that there is no significant difference in FVC, FEV1 and PEF values of boxers who did dynamic strength exercises.

***Table 2.*** *Comparison of FVC, FEV1 and PEF values of boxers who did static strength exercises*

| Parameter | Measurement | N | Min | Max | Med | Mean Rank | $X^2$ | p | Different Groups |
|---|---|---|---|---|---|---|---|---|---|
| FVC (lt) | **Resting (a)** | 9 | 4,01 | 4,82 | 4,42 | 2.25 | 7.000 | **.030*** | a-b* b-c* |
| | **After the first exercise (b)** | 9 | 3,57 | 4,46 | 4,15 | 1.25 | | | |
| | **After 8 weeks of exercise (c)** | 9 | 4,02 | 5,20 | 4,76 | 2.50 | | | |
| FEV1 (lt) | **Resting (a)** | 9 | 3,47 | 4,28 | 4,16 | 2.31 | 2.516 | .284 | - |
| | **After the first exercise (b)** | 9 | 3,26 | 4,33 | 4,13 | 1.56 | | | |
| | **After 8 weeks of exercise (c)** | 9 | 3,56 | 4,86 | 4,32 | 2.13 | | | |
| PEF (lt) | **Resting (a)** | 9 | 7,26 | 10,40 | 8,33 | 2,44 | 2.387 | .303 | - |
| | **After the first exercise (b)** | 9 | 6,99 | 9,92 | 8,51 | 1,75 | | | |
| | **After 8 weeks of exercise (c)** | 9 | 5,94 | 20.08 | 7.97 | 1,81 | | | |

*$p \leq .05$ ; lt : Liter

When the Table 2 is examined, it is seen that the FVC values of the boxers who did static strength exercises decreased significantly after the first exercise, but increased significantly after 8 weeks of exercise, and there was no significant difference in FEV1 and PEF values

## DISCUSSION

In this study, where the effect of dynamic and static strength exercises on respiratory functions of boxers were examined, the FVC, FEV1, and PEF values of boxers who did dynamic strength exercises and FEV1 and PEF values of boxers who did static strength exercises did not change significantly after the first exercise, while FVC values of boxers who did static strength exercises was found to have decreased significantly after the first exercise and increased significantly after 8 weeks of exercise (Table 1-2). In the literature, researches that show the development of respiratory functions were carried out on the basis of endurance exercises where the respiratory system was used for a longer period of time, and strength exercises especially for the muscles responsible for respiration were rare. These researches support the results of this research in general. Calik Kutukcu (2014) reported that there was no significant improvement in inspiratory and expiratory muscle strength of patients with chronic obstructive pulmonary disease after 8 weeks of upper extremity muscle strength exercises. Similarly, Lake et al. (1990) reported no significant improvement in respiratory muscle strength at the end of 8 weeks of exercises for the upper extremity.

In many studies, different effects of exercises on respiratory functions were demonstrated according to their forms of application, severity and duration. Ozaltas, Savucu, and Hamzaogullari (2015) reported that there were significant changes in the respiratory parameters of football players, basketball players, volleyball players, and athletes after exercises, but no such difference was observed in tae kwon do sportsmen. Velloso et al. (2013) reported a significant improvement in the upper extremity muscle strength of patients with COPD after upper extremity exercises performed with free weights and in accordance with 8-week proprioceptive neuromuscular facilitation (PNF) techniques. A regular 20-week running exercise resulted in a 16% increase in the strength of respiratory muscles of healthy men and women (McArdle et al. 2000). Endurance exercises increase the strength of the respiratory muscles (Park et al., 2012; Leischik and Dworrak, 2014). Durmic et al. (2017) reported that FVC and FEV1 values of endurance athletes were higher than those exercising for strength and sedentary people. It has been shown that respiratory functions of regular athletes and competing athletes develop more than sedentary people (Eker, Ağaoğlu and Albay, 2003; Akhade and Muniyappanavar, 2014). Yaprak (2004) reported that strength exercises performed for 8 weeks to strengthen the respiratory muscles of the upper body resulted in the development of respiratory parameters such as MVV and FVC. A significant positive correlation was found between muscle strength and FVC in male patients and between muscle strength and FEV1 in female patients after upper extremity strength and endurance exercises in chronic lung patients (Shah et al., 2013). Penchuk and Vovkanych (2016) found that post-exercise FVC and FEV1 values in male orienteering athletes aged 18-25 were higher than pre-exercise values. Kim et al. (2014) reported a significant increase in FVC values of canoe athletes after exercise. Farid et al. (2005) reported that aerobic exercises improved respiratory functions in asthma patients.

## CONCLUSION AND SUGGESTIONS

In this research, it was found that dynamic strength exercises performed with Tera-Band for upper extremity did not affect respiratory functions, and that static strength exercises performed with Tera-Band for upper extremities had an effect on the forced vital capacities of boxers.

When the results obtained are evaluated, it is thought that static exercises with elastic band is more efficient on respiratory functions compared to dynamic exercises and that such applications should be included in training. It is recommended that the subject should also be examined on athletes from different branches.

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