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### RESEARCH ARTICLE

# The Effect of 8 Weeks Squat Exercises Program on Body-Composition in Young Males

Emre SERİN<sup>1\*</sup> and M. Akif ZİYAGİL<sup>1</sup>

<sup>1</sup>Mersin University, Faculty of Sports Sciences, Mersin, Turkey

\*Corresponding author: emreserin1@gmail.com

### Abstract

Not only aerobic exercises, but also resistance exercises program with maximum effort for large muscle groups such as squat has also been reported to be effective on muscle and body fat mass. Thus, this study aims to investigate the effect of squat exercises program on body composition. The data of this study were collected from 18 young adult males in July 2019 after 8 weeks of training. Workouts were held in 3 days in a week with the 48 hours resting interval. Each session consists of 4 sets of 6 repetitions squat exercises with the loads of 85% maximum strength. Independent t-test analysis was used in binary comparisons because of normal data distribution. The results of this study were not statistically significant with the increase in body weight, body mass index, total muscle weight, total body fluid weight and lean body mass and the decrease in total fat weight variable as a result of the 2-month squat strength training program. Only a significant decrease in body fat percentage by 7.15% was observed after two months squat training. In conclusion, it was proposed that the squat exercises as a resistance training program can be used effectively in decreasing body fat ratio and increasing muscle mass due to increased post-exercise oxygen consumption in aerobic metabolism supplying energy from fats mostly.

### Keywords

Squat exercise, Resistance Training, Body Fat Percentage, Body Muscle Mass.

## INTRODUCTION

The importance of resistance exercises to strengthen muscle and bone is well known and it is suggested that resistance training might have an impact on weight status in youth. Generally, resistance training with medium and high loads is an effective method for improving body composition and muscular strength from childhood to adolescence (Behringer et al., 2010; Malina, 2006) and it is necessary to work with appropriate techniques and methods in order to get rid of muscle injuries in adolescents (Behringer et al., 2010; Malina, 2006). A meta-analysis suggested that an isolated resistance training intervention may have an effect on weight status in youth. Overall, more quality research should be undertaken to investigate the impact of resistance training in youth as it could

have a role to play in the treatment and prevention of obesity (Collins, Fawcner, Booth and Duncan, 2018).

In a study related the effects of squat exercise on body composition and muscular strength, results demonstrated that body mass based squat exercises training for two months is a applicable and effective method for improving body composition and muscular strength of the knee and hip extensors, and jump performance in male adolescents (Takai, Fukunaga, Fujita, Mori, Yoshimoto, Yamamoto & Kanehisa, 2013).

Eccentric contraction as a form of contraction is manifested by skeletal muscles during many daily physical activities such as running, climbing stairs or walking. Eccentric contractions, unlike concentric contractions, are caused by the lengthening of sarcomers, and

thus, the actin filaments in the sarcomer separate. Although there is less energy consumption in eccentric contractions compared to isometric and concentric contractions, the level of force produced is quite high. During the contraction process, muscle damage occurs due to the stresses in the muscle fibers (Newham, Mills, Quigley, & Edwards, 1983).

Not only aerobic exercises, but also resistance exercises programs with maximum effort for large muscle groups such as squat have also been reported to be effective on muscle and body fat mass. Serin (2018) stated that fat loss can be effectively supplied by squat exercise including 4 and 6 seconds eccentric contraction for flexing knees and hips, one second isometric contraction for keeping skuating position and two seconds concentric contraction for extension of knees and hips. In the study conducted by İşlegen (2013), it was emphasized that classical stretching exercises have acute effects in the prevention of sports injuries, and stretching exercises in which eccentric contractions are used to prevent chronic sports injuries.

Apart from aerobic exercises, strength training is used not only for muscle strength, but also for improving body composition and motor fitness in young people. We investigate how positive improvements in body composition using body mass change when working with loads close to the maximum strength of young adults. Thus, the aim of this study is to investigate whether 8-week squat training has an effect on body compositions in young men.

## MATERIALS AND METHODS

### *Participants*

A total of 18 healthy athletes participated in this study, with an average age of  $20.72 \pm 1.93$  years, average dye of  $175.11 \pm 6.02$  cm, average body weight of  $70.58 \pm 10.80$  kg. All potential risks have been disclosed before participating in the work, and voluntary consent forms will be signed.

### *Experimental Design*

The data of this study were collected from 18 young adult males in July 2019 after 8 weeks of training. Workouts were held in 3 days in a week with the 48 hours resting intervals. Each session consists of 4 sets of 6 repetitions squat

exercises with the loads of 85% maximum strength interspersed 3 minutes rest interval between exercises. All measurements were taken before and after squat exercise training program with no control group.

### *Data Collection Tools*

#### *Measurements of anthropometry and body composition*

##### **Body height and body weight:**

Body weight was measured in a weighing scale of 0.1 kg with the participants wearing bare feet shorts and a T-shirt, and body height was measured using a metal stick in this scale with a height measuring instrument of 0.1 cm. Body mass index (BMI) was calculated using the formula: weight (kg) divided by height (m) squared (Zorba & Ziyagil, 1995).

#### **Measurement of Body Composition**

Bioelectrical impedance (Tanita Body Composition Analyzer BC418) method was used to determine the body composition of the participants. In body composition analysis, all participants' body weight, body fat percentage, lean body mass (LBM), total body water (TBW) and body mass index (BMI) were determined in accordance with the protocol (Heyward & Stolarczyk, 1996; Kravitz & Heyward, 1997).

#### *Measurements of squat exercise*

Traditional strength training was performed with squat exercises. In the period of first month, squat exercise includes 4 seconds eccentric contraction for flexing knees and hips, one second isometric contraction for keeping skuating position and two seconds concentric contraction for extension of knees and hips. In the period of second month, squat exercise includes 6 seconds eccentric contraction for flexions of knees and hips, one second isometric contraction for keeping skuating position and two seconds concentric contraction for extension of knees and hips (Serin, 2018).

#### *Statistical Analysis*

All statistical analyzes were performed with SPSS version 20.0. Due to the normal distribution of the data, independent t-test analyzes were used in binary comparisons.

## RESULTS

Comparison of the physical characteristics of young adults between pre and post tests was presented in Table 1 while Comparison of

physical characteristics between pretest and posttest in young males in Table 2.

**Table 1: Comparison of the physical characteristics of young adults between pre and post tests.**

| Variables        | Tests     | N  | Mean   | ±SD   | Difference | % Difference | t-Value | Sig  |
|------------------|-----------|----|--------|-------|------------|--------------|---------|------|
| Age (years)      | Pre-test  | 18 | 20,72  | 1,93  | 0          | 0            | 0       | 0    |
|                  | Post-test | 18 | 20,72  | 1,93  |            |              |         |      |
| Body Height (cm) | Pre-test  | 18 | 175,11 | 6,02  | 0          | 0            | 0       | 0    |
|                  | Post-test | 18 | 175,11 | 6,02  |            |              |         |      |
| Body weight (kg) | Pre-test  | 18 | 70,58  | 10,80 | -0,1       | -0,14        | -,191   | ,851 |
|                  | Post-test | 18 | 70,68  | 10,76 |            |              |         |      |

**Table 2: Comparison of physical characteristics between pretest and posttest in young males.**

| Variables                | Tests     | N  | Mean  | SD   | Difference | % Difference | t-Value | Sig   |
|--------------------------|-----------|----|-------|------|------------|--------------|---------|-------|
| BMI (kg/m <sup>2</sup> ) | Pre-test  | 18 | 22,94 | 2,84 | -0,04      | -0,17        | -,263   | ,796  |
|                          | Post-test | 18 | 22,98 | 2,92 |            |              |         |       |
| Total Fat (kg)           | Pre-test  | 18 | 8,89  | 4,48 | 0,57       | <b>6,41</b>  | 1,876-  | ,078  |
|                          | Post-test | 18 | 8,32  | 4,84 |            |              |         |       |
| Total Muscle (kg)        | Pre-test  | 18 | 58,88 | 6,84 | -0,57      | -0,97        | 1,190   | ,251  |
|                          | Post-test | 18 | 59,45 | 6,99 |            |              |         |       |
| Total Body Fluid (kg)    | Pre-test  | 18 | 45,53 | 5,46 | -0,12      | -0,26        | -,569   | ,577  |
|                          | Post-test | 18 | 45,65 | 5,26 |            |              |         |       |
| Lean Body Mass (kg)      | Pre-test  | 18 | 62,04 | 7,46 | -0,32      | -0,52        | -1,095  | ,289  |
|                          | Post-test | 18 | 62,36 | 7,20 |            |              |         |       |
| Body fat Percentage (%)  | Pre-test  | 18 | 12,03 | 5,08 | 0,86       | <b>7,15</b>  | 2,185   | ,043* |
|                          | Post-test | 18 | 11,17 | 5,45 |            |              |         |       |

\*P<0.05

## DISCUSSION AND CONCLUSION

Squat exercise is an effective tool in the development of low body muscular endurance, strength and power. It is a compound movement that includes many joint actions and associated muscular system. People performing squatting exercises should make the necessary corrections and be protected from preventable injuries, being aware of the common incorrect positions occurring in the feet, ankles, knees, hips and

spine. Squat movement with or without weight is one of the most controversial exercises in physical fitness or conditioning, especially in the development of muscular endurance, strength and power of the legs. However, detailed motion analysis is needed to discuss its effectiveness. Presently, there is a lot of evidence explaining that its use is effective to improve muscular stamina, strength and power (Clark, Lambert &

Hunter, 2012; Folland & Williams, 2007; Marques et al., 2015; Soriano, Jiménez-Reyes, Rhea and Marín, 2015). There are many variations such as squatting with body weight, barbell bar squatting, barbell chest or neck squatting, dumbbell squatting, sumo squatting, split squatting. From this point, resistance training might have also an impact on weight status in youth. So, we aimed to investigate the effect of not only aerobic exercises but also full strength squat strength exercises on large muscle groups such as muscle and body fat mass. In our study, a significant decrease of 7.15% in body fat was observed only as a result of squat training. In another similar study, These findings decreased the body fat percentage by 4.2% compared to the control group by 4.2% of the 8-week exercise program consisting of 45 exercises with 100 repetitions per day for the experiment group consisting of 36 participants and the control group consisting of 22 participants, the lean body mass was 2.7% and the muscle thickness was 3.2%. This result seems to be consistent with the study of Takai et al. (2013). In a study examining the effect of aerobic exercises on body composition, it was observed that it had a positive effect on body composition (Serin, 2020). It has been reported in the literature that training models, in which eccentric contraction is used predominantly, are an effective method to improve sprint agility, especially in pliometric studies.

In the study conducted by Markovic et al. (2007), it was emphasized that training programs, such as the pliometric training model, where eccentric contraction is at the forefront, are an effective method of improving athletic performance. In the study conducted by Meylan and Malatesta (2009), it was aimed to examine the effects of the pliometric training model, where eccentric contraction is predominantly performed on young players, on some performance parameters. In this research, it was determined that the pliometric training program implemented during the season significantly improved sprint and agility performance as well as explosive force and vertical jump performance (Meylan and Malatesta (2009). In another study conducted by Vaczi et al. (2013), it was aimed to examine the effects of short-term high-intensity pliometric studies on motor performance parameters, and it was found that

there was a statistically significant improvement in the agility performance of footballers in parallel with the training program applied at the end of the research. In similar studies in the literature, it was found that there was no significant difference in the agility performance of eccentric contraction training. On the basis of this, it can be thought that muscular and physiological adaptation lies in the training programs applied. Similar studies in the literature have also been reported to improve sprint and agility performance as a result of adaptation to different training models (Cochrane et al., 2004; Odabaş-Özgür et al., 2016; Chelly et al., 2010; Arazi and others, 2012).

In another study conducted by Kurt (2011), it was aimed to investigate the effects of eccentric contraction exercises (pliometric exercises) applied to football players on the motor performance parameters, and a statistically significant increase in speed, agility and anaerobic power performances was observed at the end of the 8-week training program. Several studies have consistently reported a greater excess postexercise oxygen consumption (EPOC) response for higher-intensity and intermittent exercise. It was also indicated that resistance exercise can produce a greater EPOC response. EPOC were highest for the heavy resistance exercise compared to aerobic cycling, circuit weight-training exercise. In general, EPOC represents the oxygen used in the regeneration of ATP used during training, the synthesis of muscle glycogen from lactate, the increase of oxygen levels in venous blood, skeletal muscle blood and myoglobin, protein repair for muscle tissue damaged tissue during exercise and lowering body temperature during exercise (Elliot, Goldberg, & Kuehl, 1992; Phelain, Reinke, Harris & Melby, 1997; Scott, 1998). Fat burning and decreasing body fat for the participants of our study can be partly explained in this way. Another reason for the significant increase in the muscle mass of the athletes included in this study can be shown that the training program implemented improves the muscular strength level, and the muscle mass increases in parallel with the development of the force.

In conclusion, it is proposed that the resistance training program including squat

exercises program can be used effectively in decreasing body fat ratio and increasing muscle mass due to increased post-exercise oxygen

consumption in aerobic metabolism supplying energy from fats mostly.

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