

A Study of Effect of the Compound Physical Activity Therapy on Muscular Strength in Obese Women

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Abstract. [Purpose] The aim of this study was to determine how compound physical activity affects muscular strength of middle-aged obese women. [Subjects] The research subjects were 40–50 year-old middle-aged women with excess body fat (30%). [Methods] The subjects were randomly assigned to two group, the experimental group and the control group. The experimental group performed two types of exercise programs for 16 weeks. Aerobic physical activity was performed 5 times per week, and anaerobic physical activity was performed every two days, and the exercise program each day was composed of a warm-up, the main exercise, and cooldown. The type of exercise focused on walking at a quick pace, and the intensity of the exercise focused on long periods of exercise at low intensity with the level of HRmax being 40–60%. The weight training, which was useful for beginners, as a type of kinetic load exercise, was applied with a composition recommended by the ACSM for muscle fitness (intensity of 40–60% of 1 RM and 10–15 repetitions). SPSS version 16.0 was used to analyze the data by ANCOVA and the t-test. [Results] The chest, leg, and abdominal strengths were significantly increased in the experimental group, and this indicates that compound physical activity is effective for improvement of muscular strength. [Conclusion] In conclusion, there were significant differences between groups in terms of muscular strength.

Key words: Therapy, Muscular, Strength

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INTRODUCTION

Resistance weight training was reported to have a positive effect on the reduction of body fat by increasing muscle tissues; maintenance of muscular strength and increase of fat-free mass; and reduction of blood lipid and lipoprotein metabolism, emphasizing the necessity of resistance weight training as an effective method for weight control, controlling the interser rest time during weight training can have a significant have a positive effect on the change of blood lipid concentration and body construction¹⁾. Likewise, weight training increases BMR, improves insulin reaction, increases bone density or prevents its loss, and prevents the loss of muscle mass and muscular strength resulting from aging, which emphasizes the importance of weight training²⁾. In addition, weight training is reported to increase muscle strength and transversal area of muscle not only in men, but also in women who are middle age/old aged. From

this viewpoint, it is recommendable that an exercise program for the safest and most efficient weight loss should be composed of contents that comprehensively combine aerobic exercise with resistance weight training based on the person's level. Even recently conducted precedent studies found that compound training with aerobic exercise and resistance weight training aimed at middle-aged women with obesity had a positive effect on body composition and blood lipids^{3, 4)}. The study reported the importance of dietary therapy as well as exercise therapy and stated that exercise therapy without considering dietary therapy could not reduce body fat⁵⁾.

Recently, there have been more than a few findings regarding the effect of compound exercises

on middle-aged women with obesity who had experienced health risks due to exposure to various adult diseases and illnesses, but the number of studies is still insufficient; further, more specific and diverse experiments and research are necessary with regard to how dietary exercises and resistance weight training can be mixed into an ideal compound physical activity program that is suitable for a

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person's own characteristics. The purpose of this study was to investigate the effect of a compound physical activity program on muscular strength in obese women.

SUBJECTS AND METHODS

The subjects of this study were the obese women. They were selected based on a body fat rate of over 30% obtained using a bioelectric impedance method. The subjects had not participated in physical activity or training for at least 6 months. They were randomly assigned to two groups, the experimental group, $n=20$, and the control, $n=20$ (Table 1). The experimental group performed two types of exercise programs for 16 weeks. Aerobic physical activity was performed 5 times per week, and anaerobic physical activity was performed every two days; the exercise program each day was composed of warm-up, the main exercise, and cooldown. The compound physical activity method used to reach the objective of this study was determined based on exercise prescriptions, such as the intensity, frequency, and duration of exercise suggested by the ACSM (2009) after implementing an exercise load test. The type of exercise focused on walking at a quick pace, and the intensity of the exercise focused long periods of at low intensity rather than short periods of exercise at high intensity with the level of HRmax being 40–60%.

The weight training, as a type of kinetic load exercise, was applied with a composition (intensity of 40–60% of 1RM and 10–15 repetitions) recommended by the ACSM for muscle fitness, and circulatory weight training, which was useful for beginners, was also used and was designed to stimulate the global muscles. In regard to exercise methods, exercise were performed with 15 repetitions and 2–3 sets by each exercise with an intensity of 40–60% of 1RM, and the subjects trained for 40–50 minutes, with a break of 30 seconds between events and 2 minutes between sets. [Maximum muscle strength (1 RM) = $(1.06 \times \text{lifted weight (kg)}) + (0.58 \times \text{repeat count}) - (0.20 \times \text{age}) - 3.41$]

SPSS version 16.0 was used to analyze the data. The *t*-test and analysis of covariance (ANCOVA) were used for statistical analyses. Statistical significance was accepted for values of *p* less than 0.05.

Table 1. Characteristics of the subjects

Group	Age (yrs)	Height (cm)	Weight (kg)	(%fat)
Control	55.5±3.5	154.3±2.3	62.2±2.6	37.9±5.8
Physical activity	54.3±4.4	153.2±2.1	63.2±3.3	38.5±2.9

Table 3. The change in chest muscular strength (units: RM)

Variable	Chest muscular strength	
	Pre	Post
Control	41.3±9.7	39.9±9.5
Physical activity	40.4±11.2	51.1±10.1*

RESULTS

Chest muscular strength of the control group was 41.3 ± 9.7 before the treatment and 39.9 ± 9.52 after the treatment, and chest muscular strength of the treatment group was 40.4 ± 11.15 before the treatment and 51.14 ± 10.1 after the treatment (Table 2). The difference between the two groups was significantly meaningful ($p < 0.05$).

Leg muscular strength of the control group was 83.4 ± 7.3 before the treatment and 86.6 ± 8.421 after the treatment, and leg muscular strength of the treatment group was 81.7 ± 8.47 before the treatment and 101.6 ± 7.51 after the physical activity (Table 3). The difference between two groups was significantly meaningful ($p < 0.05$).

Abdominal muscular strength of the control group was 51.57 ± 7.27 before the treatment and 51.75 ± 7.6 after the treatment, and abdominal muscular strength of the exercise group was 53.27 ± 9.14 before the treatment and 68.16 ± 6.16 after the treatment (Table 4). The difference between the two groups was significantly meaningful ($p < 0.05$).

DISCUSSION

Weight training receives a fervent response, and it is a highly appropriate training method for promoting physical strength in men and women of all ages including children. Weight training is a physical activity that raises contractile or extensible contraction by using fixed or adjustable resistance and utilizes free weight equipment including barbells and dumbbells, or contractile or adjustable resistance machines. Moreover, the effect on muscle strength of weight training has been shown in precedent studies. Weight training reportedly results in statistically meaningful increases in muscle strength and muscle endurance meaningfully in statistics⁶⁾. A statistically significant increase in muscle strength and endurance was also reported in another study⁷⁾.

In the present study, weight training was found to enhance isometric muscle function, which hints that there would be various factors relating to this finding. The improvement of muscle strength can come with the increase of muscle size as a priority. If no physical activity is performed for a long time, muscle area and muscle strength decrease

Table 2. The change in leg muscular strength (units: RM)

Variable	Leg muscular strength	
	Pre	Post
Control	83.4±7.3	86.6±8.4
Physical activity	81.7±8.5	101.6±7.5*

Table 4. The change in abdominal muscular strength (units: RM)

Variable	Abdominal muscular strength	
	Pre	Post
Control	51.6±7.3	51.8±7.6
Physical activity	53.3±9.1	68.2±6.2

rapidly. Hypertrophy of muscular fibers results from the activation of protein synthesis. Analysis of the changes in muscles and muscle endurance revealed that training efficiency is influenced by the difference in exercise intensity with regard to motor unit recruitment⁷⁻⁹.

The motor unit of fast-twitch muscle fibers contains more muscle fibers than the motor units of slow-twitch muscle fibers. Therefore, fast-twitch muscle fibers have an outstanding ability to add more. It was reported that selective recruitment was not determined by the locomotion speed but by the power level required by muscles^{6, 10-13}. Therefore, the program provided in this study exhibits a difference in the selective recruitment aspect of muscle fiber, and this phenomenon had an influence on the change in training effect. This indicates that the change in muscle strength and muscle endurance caused by resistance training is critically influenced by exercise intensity.

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