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EFFECT OF EIGHT WEEKS OF COMBINED TRAINING PROGRAM (AEROBIC AND RESISTANCE) ON MUSCLE STRENGTH IN ELDERLY PATIENTS WITH PARKINSON

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ABSTRACT

The aim of this study was to evaluate the effect of combined training program (aerobic and resistance) on muscle strength in patients with Parkinson. Thirty patients with Parkinson were participated in this study. The patients were divided randomly into two experimental (n = 15)(mean ± SD; age 60.6±6.01year, weight, 73.8±12.1kg and height, 170.2±8.3cm) and control groups (n = 15)(mean ± SD; age 61.9±5.2years, weight, 74.3±12.6kgs and height, 171.2±7.8cm). The experimental group performed combined training program for 8 weeks, 3 sessions a week, whereas the control group did not experience any regular physical activity. Before and after the training period, muscle strength of the quadriceps, hamstrings, leg press, bench press and butterfly strength were measured with a 1- RM and the results were analyzed using t-dependent and independent difference tests. Significant differences were observed in muscle strength of the quadriceps, hamstrings, leg press, bench press and butterfly in the experimental group between before and after training (P <0.05), but there was no significant difference in the control group (P> 0.05). A significant differences were observed between experimental and control groups (P <0.05). It can be concluded that resistance and aerobic exercises does positive effect on muscle strength, therefore it can be recommended for these patients.

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Introduction

Parkinson's disease is the most common neurodegenerative disorder of the nervous system after Alzheimer's disease [1] and around 100 to 200 people per 100,000 people worldwide are diagnosed with the disease [2]. Parkinson's disease (PD) is a chronic and progressive disorder that is thought to be caused by death of dopaminergic neurons in the substantia nigra of the basal ganglia [3]. By reducing the levels of dopamine and the subsequent disruption of the balance of dopamine and

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acetylcholine which are both important as neurotransmitters, other centers controlling body movements work irregularly and cause irregular movement disorders in these patients [4]. Patients with Parkinson's disease have low levels of functional capability compared to healthy elderly [5]. Postural instability is the most obvious symptoms of Parkinson's disease and one of the causes of fallings in Parkinson's disease [6]. Shaking, which does not usually cause disability, is the most common and visible symptoms of Parkinson's disease [7]. However, the slowness of movements is the most debilitating symptoms of this disease [8] and often occurs as a result of weakness, fatigue and lack of coordination [3]. Postural instability is the most obvious symptoms of Parkinson's disease and has also been a precarious state of the greatest causes of falls in Parkinson's disease. The main causes of this instability are the lack of coordination between the rotation of the hip and thoracic spine due to muscle stiffness, reduced mobility in order to slip and rotate the trunk, especially during the sitting and standing, reaching out to grab objects and gait as well as reduced muscle strength in ankle and knee [9].

Depression, sleep disorders, swallowing difficulties, behavioral problems, anxiety, fatigue are other symptoms of the disease [10]. It is well proven that with increasing age, level of physical activity and consequently the performance level are reduced to a low level [11-12]. After complications from Parkinson's disease treatment, this reduced level of physical activity in disease occurs faster than their peers, which, in turn, shows decreased levels of strength and function compared to them [13]. This is due to the damage to the basal ganglia and as a result, impaired cortical motor centers of the brain leads to less activity of motor neurons and muscular weakness and strength loss [13-14]. According to the multidimensional nature of Parkinson's disease, multilateral approaches in the treatment of disease control are not unexpected [15]. Accordingly, the research findings have shown that in addition to drug modalities, the use of exercise and movement therapy as a complementary therapy had a positive effect in the control of disease symptoms and improved daily functioning [16]. Indeed, through a positive impact on levels of dopamine, exercise and physical activity can improve functioning of the muscular and nervous systems, anatomical adaptations, breaking the negative cycle of the disease, inactivity and aging and improve the performance of patients with Parkinson's disease [17-18-19]. However, exercise can improve strength, balance, gait speed, improved physical functioning and health-related quality of life as well as reducing depression in Parkinson's patients. Also in the early stages of the disease, exercise can also further delay the progression of the disease [20] and the onset of symptoms [18]. Scandalis et al., (2001) showed in their study that like other people in the same age range, patients with Parkinson's disease can increase their muscle strength and consequently improve stride length, fast-paced and postural position using resistance training [21].

Additionally, Diable et al., (2006) have shown in their research that observed increase in muscle size influencing by resistance training, may be important in improving muscular strength and irritability [1]. According to those mentioned above and problems such as muscle weakness, loss of postural control and decreased flexibility which lead to secondary disorders since the beginning of the disease in Parkinson's patients, the importance of exercise in the treatment of this disease is more pronounced. Thus, the aim of this study was to evaluate the effect of eight weeks of combined training program (aerobic and resistance) on postural control and muscle strength in elderly men with Parkinson's patients.

Method

A total of 30 patients with Parkinson's disease were selected purposefully and participated in this study. Lack of chronic heart disease or cognitive impairments by specialist physician was the selection criteria of the subjects. The patients were with stage 1-3 disease based on the Hoehn and Yahr measures and then were divided evenly into into experimentals (mean ± SD; age 60.6±6.01year, weight, 73.8±12.1kg and height, 170.2±8.3cm) and controls (mean ± SD; age 61.9±5.2years, weight, 74.3±12.6kgs and height, 171.2±7.8cm). In addition to conventional medical treatment for 8 weeks, 3 sessions and complying with all the scientific principles governing the practice, the experimental group performed a training program designed under the supervision of experienced and professional coach, while the control group had no effective physical activity in this period except for drug therapy. Before the start of the study, patients in the experimental and control groups signed their written consent form and voluntarily participated in this study.

Measuring tools

Hoehn and Yahr Scale

Hoehn and Yahr scale is a reasonable indication for Parkinson's classification. This is a five-point scale from 1 to 5. Patients were grouped in the following order: mild disease (HY: 1-2), median (HY: 3) and severe disease (HY: 4-5). However, in this study, patients were in the mild to moderate levels [22].

Muscle strength (one maximum repetition)

Muscle strength was obtained using (DYNAFORCE South Korea) by one repetition maximum testing in muscles of quadriceps, hamstrings, leg press, bench press and butterfly.

Resistance training program

Each session included a warm-up (by extension movements for 5 minutes), the main program and cooling (by gait and extension movements for 5 minutes). The original program included resistance training for 8 weeks, 3 sessions per week. Subjects performed each movement in 2-4 sets of 9-12 repetitions. Maximum rest was 2 minutes between movements. The program was designed for first two weeks by 60 percent with four sets of maximum repetitions, which, in the end, it was increased to 80 percent (at the end of 2 weeks, 4 sets of maximum repetitions of each patient in every movement were measured). The program was set to 4 maximum repetitions). Movements were performed with DYNAFORCE device by South Korea. Movements were thus based on upper and lower-limb movements. Movements included bench press, rowing seat, front legs, back legs, shoulder press, leg press, triceps, biceps and sit-ups.

Aerobic training program

The aerobic exercise program was included 8 weeks and 3 sessions per week of walking on a treadmill. In the first week, each subject started trial with gait speed for a period of 4-minutes and had a 4-minutes rest between each cycle. Every week, a 4-minutes period was added to the time. Gait speed was determined depending on each person's physical strength and speed was the same during the whole period. All subjects were also should held the treadmill handle during the walking. At the beginning of each session, warm-up was performed after the beginning of aerobic exercise and then resistance by the experimental group. Data were analyzed using SPSS software version 18 using statistical T-dependent, independent t-test difference statistical methods.

Results

Strength of the quadriceps

Quadriceps strength in the experimental group improved significantly ($t = 4.6$, $P < 0.05$), whereas no significant difference was observed in the control group ($t = 1.65$, $p > 0.05$). In general, differences between the two groups were significant, $t = 4.77$, $P < 0.05$)) (Figure 1).

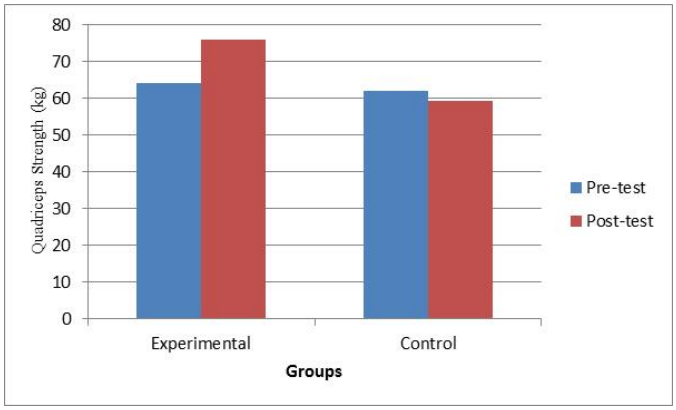

Figure 1. Quadriceps Strength (kg)

Hamstring strength

Hamstring muscle in the experimental group improved significantly (t = 10.02, P <0.05), whereas no significant difference was observed in the control group (t = 1.58, p> 0.05). In general, differences between the two groups were significant (t = 6.59, P <0.05) (Figure 2).

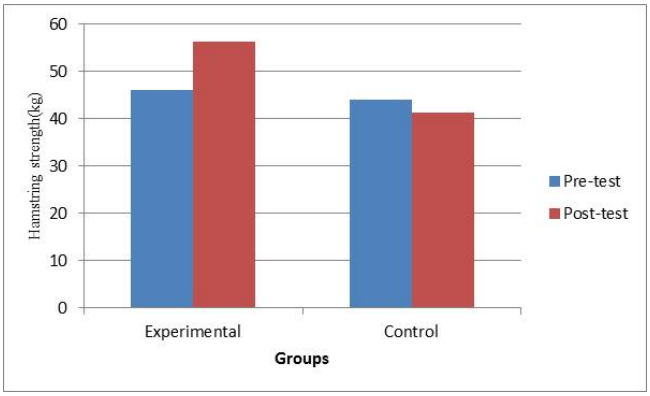

Figure 2. Hamstring strength (kg)

Leg press strength

In the experimental group, leg press strength improved significantly (t = 4.5, P <0.05), whereas no significant difference was observed in the control group (t = 2.46, p> 0.05). In general, differences between the two groups were significant t = 5.15, P <0.05)) (Figure 3).

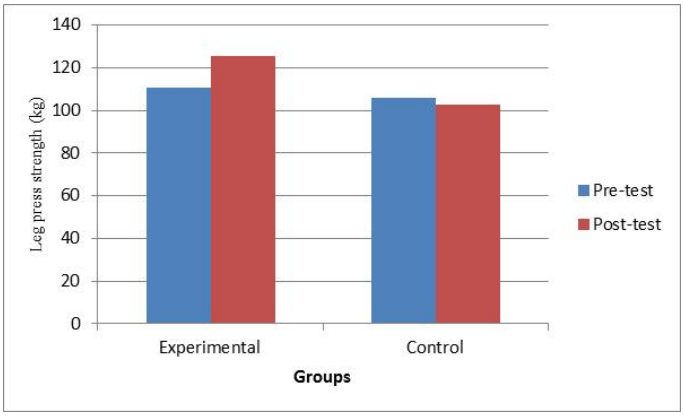

Figure 3. Leg press strength (kg)

Chest press strength

Chest press in the experimental group was significantly improved (t = 5.6, P <0.05), whereas no significant difference was observed in the control group (t = 1, p> 0.05). In general, differences between the two groups were significant (t = 3.98, P <0.05) (Figure 4).

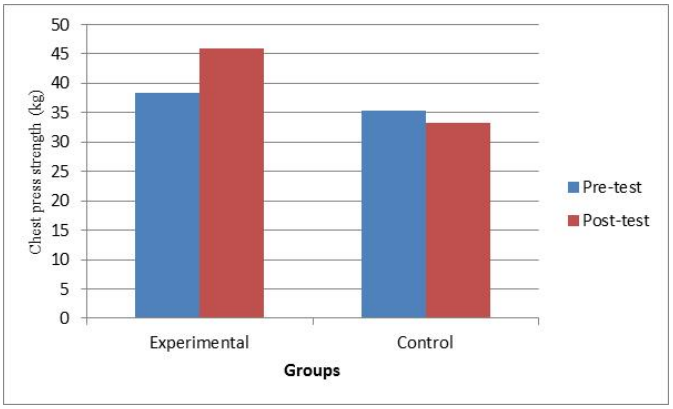

Figure 4. Chest press strength (kg)

Butterflies strength

The butterflies strength in the experimental group improved significantly (t = 5.7, P <0.05), whereas no significant difference was observed in the control group (t = 1.74, p> 0.05). In general, differences between the two groups were significant (t = 5.01, P <0.05) (Figure 5).

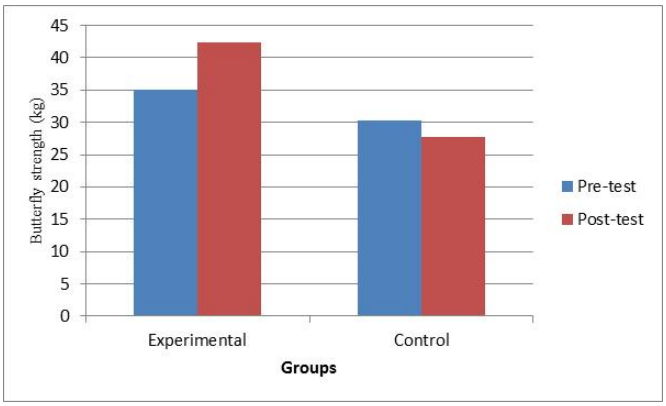

Figure 5. Butterfly strength (kg)

Discussion and conclusions

The aim of this study was to investigate the effect of eight weeks of combined training program (aerobic and resistance) on muscle strength in elderly men with Parkinson's patients. The findings of this study showed that after eight weeks of training, there was a significant increase in muscle strength of quadriceps, hamstring muscles, leg press, chest press and strength in the butterfly in the experimental group. In research by Herch et al (2003), a significant increase was observed at a rate of 52 percent compared with training exercise in quadriceps, hamstrings and gastrocnemius after 4 weeks of resistance training in Parkinson's patients [19]. Toole et al., (2000) also reported a significant increase in the lowered muscle strength of Parkinson's patients for ten weeks of combined training [22]. Diable et al., (2006) evaluated the effect of 12 weeks of intense resistance training program using quadriceps muscle eccentric exercises on Parkinson's patients and reported a statistically significant change in muscle mass, force and quadriceps muscle motor function [1]. Carvalho A et al., (2015), in a research compared strength training, aerobic exercise and additional treatment trainings as supporting training on Parkinson's patients. In fact, the effects of program, strength training, aerobic exercise, physiotherapy on the motor symptoms, functional capacity, and brain waves were compared in patients with Parkinson's disease and at the end of training, the results indicated an improvement in motor symptoms of Parkinson's patients in all groups [23]. Fisher et al., (2012) reported a 10% increase in lower-limb muscle strength in older subjects with Parkinson's disease following home exercises [24]. However, Pedersen et al., (1990) who used the rubber bands, could not achieve significant improvement in muscle strength in Parkinson's disease [25].

Contrary to this research, Palmer et al., did not report significant changes in muscular strength [26]. Probable cause for lack of effect on muscle strength in the research mentioned can be attributed to the inadequate training program and low intensity of training programs. These results indicate the importance and impact of resistance training program in Parkinson's patients. However, research is not available to measure the impact of combined aerobic and resistance training on muscle strength in Parkinson's patients. In fact, people with Parkinson's disease have low levels of physical activity compared with the same age groups, leading to low level of muscular strength , muscular weakness; especially in lowered limb so that it is introduced as one of the primary symptoms of Parkinson's disease [11]. This is due to damage to the basal ganglia, led to decreased impacts on cortical motor centers and eventually causes loss of motor neurons activity and ultimately muscle weakness [22]. In this study, increased muscle strength can be attributed to improved neural activity and also change the intrinsic properties of muscle contraction. Research has shown that Parkinson's patients have less ability to produce maximum torque at the movements of

knee extension, knee flexion and dorsiflexion of the ankle [19]. In addition, decreased production and release of isometric forces have also been recorded in patients [27], which all confirmed the decline in the ability to produce muscle contractions that can be resolved using resistance training it. All these findings elaborate the need for increased emphasis on physical abilities of patients, particularly emphasis on muscle strength. Exercise program used in this study could be the basis for achieving this importance. It can be concluded that resistance and aerobic exercises improved muscle strength in Parkinson patients, so it can be recommended for these patients.

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