ABSTRACT

The purpose of this randomized non-controlled study was to determine the effect of an aerobic or resistance exercise protocol on performance of activities of daily living in elderly women. The sample was constituted of 41 apparently healthy elderly women aged 60 to 85 years ($\pm$ 65.1 ± 7.9 years) randomly assigned in resistance exercise (n: 22) or aerobic groups (n: 19). The resistance exercise protocol consisted of three sets of eight to 12 repetitions at 60% of one repetition maximum test for the leg press 45º. The aerobic exercise protocol consisted in cycling in a cycle ergometer during 40 minutes at 60% of reserve heart rate. Both protocols were performed three times per week during five weeks. Activities of daily living were estimated by velocity to stand from sitting to standing position (VStit), velocity to climb stairs (VCS) and velocity to wear sneakers (VWS). Volunteers of aerobic exercise protocol improved significantly the time to perform WSS (19.1%), while the volunteers of resistance exercise protocol improved the capacity to perform VCS (4.3%) and VSupine (8.9%). These results let us conclude that aerobic as well as resistance exercise protocols induced positive effect on activities of daily living, suggesting that both protocols must be associated for an adequate exercise program to improve the functional capacity of elderly people.

Keywords: activities of daily living, functional capacity, aging, aerobic exercise, muscle strength.

INTRODUCTION

Aging per se plays a deep impact on the functional capacity to perform the activities of daily living which can seriously compromise performance in many daily tasks. The muscular functional characteristics significantly decline as a result from aging, especially associated with comorbidities. Moreover, it has been suggested that the functional capacity to perform many activities of daily living seems to be sensibly dependent on the muscular function.

The scientific evidence has been well-established, demonstrating the benefits of the regular practice of resistance exercises in the apparently healthy population and even in those individuals with non-transmissible chronic or infecto-contagious diseases. The classical studies point benefits such as decrease of body adiposity, increase of muscle strength, increase of the individual myocyte size, decrease of the number of falls, increase of bone mineral density, shorter time of gastrointestinal transit, improvement of the glycolized hemoglobin response, besides increase of functional capacity. Even though, the aerobic exercises still have been more frequently recommended. Therefore, considering the heterogeneity concerning the need of exercise prescription for elderly subjects, this study had the aim to determine the effect of aerobic or resistance exercise in the performance of activities of daily living of elderly female subjects.
Forty-one volunteers (60 to 85 years [x: 65.15 ± 7.88 years]) were submitted to physical and functional capacity evaluation. After that phase, the volunteers were randomly divided in two groups. The resistance exercise group was composed of 22 volunteers (61.67 ± 13.88 years), while the aerobic exercise group of 19 volunteers (65.15 ± 7.88 years). All of them were informed that participation in the study was voluntary and they could drop out at any moment. They were also informed about the possible benefits and health risks, inclusion and exclusion criteria, and adopted procedures. After these orientations, a Free and Clarified Consent Form (TCLE) was obtained from each volunteer according to the guidelines in the resolution # 196/96 of the National Health Board.

**Adaptation period**

Initially, the volunteers were submitted to one week of familiarization and learning. In that period, the volunteers learned the correct exercise performance technique and how to keep velocity in the cycle ergometer according to the percentage of the reserve heart rate (HR reserved) prescribed. Moreover, the following recommendations were adopted for the volunteers of the resistance exercise group: 1) initially limit the range of motion until the volunteer was able to perform the exercise with comfortable complete amplitude and with no risk of injury; 2) period of two minutes of recovery between bouts; and 3) active breathing during the positive phase of the movement. Immediately after this period, the volunteers of the resistance exercise group were submitted to the test of repetition maximum (1RM) which served as parameter for prescription of the exertion intensity.

**Experimental protocol**

The protocols were performed three times a week during five weeks. The resistance exercise protocol consisted in performing three bouts of eight to 12 repetitions at 60% 1RM for the leg press 45º exercise with passive rest of two minutes between bouts. This group performed the exercise in pairs to provide more security in the exercise performance. The volunteers of the aerobic exercise protocol performed exercise in cycle ergometer with intensity corresponding to 60% HR reserved during 40 minutes.

Before and after each session, the volunteers performed stretching exercises. The aerobic group pedaled during five minutes after the end of the lower velocity session, so that the cardiovascular functions returned more rapidly to rest conditions. All sessions were supervised and the volunteers could not engage in any other physical activity program not even join eating diets during the intervention period. The volunteers were also told to preserve the level of daily physical activity, as well as the eating habits during the intervention period.

**Test of one repetition maximum (1RM)**

The 1RM was applied to measure the muscle strength as criterion for prescription of exertion intensity in the leg press 45º exercise. The test procedure was to perform stretching exercises for the specific muscle groups and immediately after it, a bout of eight to 12 repetitions in the leg press 45º exercise with overload between 40% and 60% 1RM. The 1RM was considered as the highest weight quantity possible that the volunteer could lift in a single complete successful performance using the appropriate technique. The appropriate technique was defined as the exercise performance through the demanded muscle groups in the primary motor activity with no help from momentum or alterations in the body position which could aid in performing in the strength development.

The test started by arbitrarily and gradually increasing overload until the volunteer could perform a single repetition with the maximum weight possible. A minimum period of two minutes recovery between trials was respected, and the number of trials to reach the 1RM did not surpass three. In order to avoid the Valsalva maneuver, the volunteers were told to inhale before performing the movement, exhale during its positive phase and inhale again when the weight returned to initial position.

**Activities of daily living (ADL)**

The tests applied for analysis of performance in the ADL were velocity to stand from sitting position (VSitting); velocity to stand from supine position (VSupine); velocity to climb stairs (VCS) and velocity to wear and tie sneakers (VWS). The volunteers should briefly perform in the specific test as fast as possible. The best result out of three trials was considered for analysis, except for the VWS, which was performed in a single trial.

**Statistical analysis**

The Shapiro-Wilk test was applied for analysis of data normality. The Student’s t test for independent samples was applied for intergroup analysis in the pre-program period. While the Student’s t test for dependent samples was used in the intragroup analysis; the significance level adopted was p < 0.05. The percentage delta was also calculated. The Statistical Package for the Social Sciences software (SPSS version 17.0) was applied for the calculations. The data are presented as mean ± standard deviation.

**RESULTS**

Table 1 presents the characteristics of the volunteers according to the groups and time.

It was verified that the volunteers of both groups did not present statistically significant difference in body weight, neither in the functional capacity regardless of the test in the pre-program period, suggesting hence that the illegibility criteria applied resulted in data normally distributed for all variables. The same phenomenon was observed in the post-program period regardless of the intervention strategy.

The volunteers of the resistance exercise protocol significantly reduced in 9% (p < 0.05) the time to perform the VSitting test. The volunteers of the aerobic exercise protocol demonstrated tendency of improvement in performance for VCS in 4%, while the volunteers of the resistance exercise protocol significantly reduced the time for the same performance in 4% (p < 0.05). The magnitude of effect induced by both protocols was higher for VWS. The volunteers of the aerobic exercise protocol significantly improved their capacity in 19%, but the same did not occur for the volunteers of the resistance exercise protocol (12%, p > 0.05) (table 2).
The results demonstrated that the volunteers of the aerobic exercise protocol presented significant improvement in VWS (19%), while the ones of the resistance exercise increased performance in VShut (9%) and VCS (4%). The effect induced in VSupine did not reach statistical significance regardless of the protocol.

The importance of this finding becomes more relevant when two very important intrinsic characteristics are considered: the short time interval of the study duration (five weeks) and the inclusion of only one exercise in the resistance exercise protocol. Moreover, after the intervention period, one of the volunteers who participated in the resistance exercise protocol reported to be able to stand from her bed alone, a task she did not perform without help from another person before engaging in the program.

These results corroborate the current scientific evidence which suggests the use of resistance exercises in the daily routine of exercise programs with elderly subjects and is in agreement with the recommendations of physical activities in the main international institutions.

The volunteers of the resistance exercise protocol demonstrated statistically significant improvement in the tests which depended on the dislocation and transportation of body mass (VShut and VCS). The improvement in performance in these activities is probably associated with the increase of muscular strength which may decrease the relative and absolute exertion and increase tolerance to peripheral and central fatigue during the performance of activities of daily living.

On the other hand, we were not able to devise a hypothesis which supported the improvement in the velocity test to wear and tie sneakers reached by the volunteers of the aerobic exercise protocol (19%, p<0.05). It is probable that, although not having reached statistical significance, the differential performance capacity presented by the pre-program groups represents an important aspect which cannot be discarded. It can be especially supported due to the fact that the clinical impact of this difference has been possibly more important than the statistical power.

The data observed in the present study may be compared to the results of the few investigations available in the literature which directly compare the effects of both exercise programs. Some studies suggest the existence of positive effect in the physical fitness as well as in the bone mass regardless of the exercise protocol (aerobic or resistance training), besides improvement in gait mechanics and decrease in complaint of pain on the knee joint.

More recently, it was verified that aerobic exercise did not induce greater effect in the LDL-C blood concentration in young adult men when compared with the program composed of aerobic exercise and resistance exercise. Both protocols had characteristics similar to the ones in the present study. On the other hand, Raso et al. suggested that muscular strength, more than peak oxygen consumption, seems to have been the main mediator of the effect induced by the resistance training of moderate intensity in the triglycerides concentration of clinically healthy elderly women. However, the same authors demonstrated that the exercise protocol was not efficient in altering the number of co-stimulatory molecules, markers of cellular activation and apoptosis, as well as the lymphocyte function, and that neither the muscular strength, nor the aerobic power represented an important phenotype or functional predictors of the immunological system of elderly women.

However, individuals with many types of cancer submitted to radio or chemotherapy decrease the complaints of fatigue related to this disease, improve functional capacity, emotional wellness, vitality and quality of life either after the home aerobic associated with resistance program or as an effect induced to multiple exercise program of vigorous intensity. Buchner et al. also observed that the aerobic exercise program improved aerobic capacity of elderly subjects while the resistance program increased the capacity of production of isokinetic strength. However, neither of the two programs was efficient in improving the number of co-stimulatory molecules, markers of cellular activation and apoptosis, as well as the lymphocyte function, and that neither the muscular strength, nor the aerobic power represented an important phenotype or functional predictors of the immunological system of elderly women.

The results of this study let us conclude that both the aerobic exercise protocol and the resistance exercises were sufficient to induce significant improvement in performance of the activities of daily living. Although these results are limited to the exercise protocols applied, the classical studies available in the literature demonstrate that engagement in only one exercise (in the case, resistance exercise) is sufficient to induce extremely high increase magnitude in the muscular strength (e.g., from 174% to 227%).

Table 1. Characteristics of the sample before (PRE) and after (POST) the intervention period.

<table>
<thead>
<tr>
<th></th>
<th>Aerobic exercise</th>
<th>Resistance exercise</th>
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<tbody>
<tr>
<td></td>
<td>mean ± standard</td>
<td>Δ%</td>
</tr>
<tr>
<td></td>
<td>deviation</td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>1.56 ± 0.6</td>
<td>–</td>
</tr>
<tr>
<td>Post</td>
<td>1.60 ± 0.8</td>
<td>1</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>63.7 ± 13.8</td>
<td>–2</td>
</tr>
<tr>
<td>Post</td>
<td>62.6 ± 8.0</td>
<td>1</td>
</tr>
</tbody>
</table>

Δ%: percentage alteration induced by the exercise protocol; *p < 0.05.

Table 2. Velocity to stand from a sitting position (VSitting) and supine position (VSupine), velocity to climb stairs (VCS) and velocity top wear sneakers (VWS) before (PRE) and after (POST) the intervention period.

<table>
<thead>
<tr>
<th></th>
<th>Aerobic exercise</th>
<th>Resistance exercise</th>
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<tr>
<td></td>
<td>mean ± standard</td>
<td>Δ%</td>
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<tr>
<td></td>
<td>deviation</td>
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<tr>
<td>VSitting(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>3.4 ± 0.9</td>
<td>–6</td>
</tr>
<tr>
<td>Post</td>
<td>3.2 ± 0.7</td>
<td>–6</td>
</tr>
<tr>
<td>VSupine (s)</td>
<td></td>
<td></td>
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<tr>
<td>Pre</td>
<td>4.5 ± 1.2</td>
<td>–6</td>
</tr>
<tr>
<td>Post</td>
<td>4.2 ± 0.9</td>
<td>–6</td>
</tr>
<tr>
<td>VCS (s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>8.0 ± 1.2</td>
<td>–4</td>
</tr>
<tr>
<td>Post</td>
<td>7.7 ± 0.9</td>
<td>–4</td>
</tr>
<tr>
<td>VWS (s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>32.8 ± 14.5</td>
<td>–19</td>
</tr>
<tr>
<td>Post</td>
<td>26.5 ± 7.9*</td>
<td>–19</td>
</tr>
</tbody>
</table>

Δ%: percentage alteration induced by the exercise protocol; *p < 0.05.
besides significant improvement in the muscular transverse section area and functional capacity to perform the activities of daily living\textsuperscript{1,2}. Additionally, we can mention that the same studies ground the main international institutions on the change of paradigm concerning the prescription of resistance exercises to elderly subjects\textsuperscript{5-7}.

Therefore, in another proportional scale, it is possible to suggest that engagement in exercise protocols similar to the ones applied in this study are initially efficient to elderly subjects who meet the eligibility criteria used here.

On the other hand, it cannot be ignored that the absence of control group, the isolate use of the exercise modalities without a third group associating both protocols (aerobic and resistance exercise), as well as the lack of control of the spontaneous daily physical activities represent important limitations which suggest that further studies should be carried out.

All authors have declared there is not any potential conflict of interests concerning this article.

REFERENCES