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Comparison of Functional Capability, Flexibility, Strength and Quality of Life in Aged Women Engaged in Resistance Exercise, Weight-Bearing Training or Hydro-Gymnastics

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Abstract: Although any type or amount of physical exercise may reverse the cellular processes that lead to the aging, regular physical exercise can attenuate the decline in physical and functional abilities observed in elderly. Currently, the most encouraged activities in gyms and clubs are resistance training, functional training, and hydrogymnastics. The main objective of this study was to compare the effects of the aforementioned exercises regarding muscle strength, flexibility, functional capability and quality of life of elderly women. We divided 36 elderly women in four groups: Sedentary (S); Hydro-gymnastics (H); Functional Training (F); or Resistance Training (RT). The results reveal that the groups engaged in physical exercise showed a significant difference ($p < 0.05$) in relation to S in all evaluations. The results also show that between the different exercises evaluated, resistance training practitioners have greater strength and better functional capability.

Key words: Aged, exercise, physical fitness, quality of life.

1. Introduction

In the last decades, worldwide elderly population has been growing. According to the Brazilian Institute of Statistics and Geography (IBGE), 60 years old and over people correspond to 14.4% of total population. In other words, in agreement with the National Research per Home Sample (PNAD) there are about 29.6 million elderly people. The last demographic projections indicate that in the next 25 years this value can be increased, reaching 30 million elderly people. This increase leads to changes in how the society thinks about aging, once the aging is related to increase of the probability of chronic diseases appearance [1].

The aging process is marked by physiological changes [2, 3] in most systems [4]. In this sense, the most aggravating factor is the sedentary lifestyle, because some researchers have noticed the prevalence of chronic diseases, like hypertension and cardiovascular diseases [5-7], diabetes [8-10], obesity [11], dyslipidemia [12, 13], hepatic steatosis/fatty non-alcoholic diseases [14], cancer [15-17] and others. The sedentary lifestyle can be seen as a risk factor for the aging process, because the cells reduce their rhythm, working slowly [18-20]. Thus, researchers have stimulated the creation of an elderly active life guideline [21].

Regarding performing the daily tasks with independence, the muscle weakness can be one of the

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main factors to become the elderly dependent and susceptible to falls [4]. Therefore, attenuating the strength and flexibility losses is essential to the physical independence and improvement of elderly quality of life [22, 23].

In addition, the physical exercise has a fundamental role in well being and quality of life, assisting the cellular changes-control, independence, improving social and psychological aspects and bringing back or maintaining the autonomy during the aging process [24-27].

Falls are among the main accident and mortality causes in elderly people, and usually are related to strength, flexibility and balance weakness [28-31].

Weight bearing exercises have been gaining practitioners and credibility. This kind of exercise tries to reach the improvement of physical capabilities most requested to perform the daily tasks, like proprioception, balance, agility, motor coordination, flexibility, force and muscular endurance [32, 33].

Some researchers have been observing that in general the physical exercise, even when performed in a moderate intensity, is able to significantly promote the increase in strength [34], cardiorespiratory endurance [33], flexibility [35], and functional capability [32] in elderly people. Unfortunately little is known about which exercise modality brings additional benefits to this population [36]. Thus, the main objective of the present research was to compare the effects of resistance training, hydrogymnastics and weight bearing training on muscular strength, flexibility, functional capability and quality of life of elderly women.

2. Material & Methods

That is a transversal, experimental and quantitative research. The individuals that accepted our invite have received the information about the objectives and evaluating procedures, and been instructed to sign the informed consent. The present research has used the YMCA (Young Men's Christian Association) (Sorocaba, SP, Brazil) classes.

This research followed the guideline for human research, regarding 466/12 resolution of Brazil Health Ministry, being previously authorized by the YMCA, and approved by Ethic Research Commitment of Medical and Health Sciences Faculty of Catholic University of São Paulo (83767418.4.0000.5373).

For this research, 36 elderly women, 60 to 85 years old, were selected, as participants of YMCA exercise classes. The samples were separated regarding their exercise practice: S = Sedentary (n = 9), do not perform any physical exercise; H = Hydrogymnastics (n = 9), just hydrogymnastics practitioners; F = Functional (n = 9), just weight bearing training practitioners; RT = Resistance Training (n = 9), just resistance training practitioners.

In order to characterize the sample and to access the comparative data for the protocols application, all participants were submitted to some evaluations: (1) blood pressure; (2) oximetry; (3) functional capability; (4) muscular flexibility; (5) lower limb strength; (6) quality of life questionnaire.

The blood pressure and percentage of blood oxygen saturation was measured by a Clinical Blood Pressure Automatic Arm Monitor HBP-1100-OMRON® and a finger Oxymeter Contec® respectively.

Body mass and height were measured by scale/stenographer FILIZOLA®.

To measure flexibility of lumbar and hips regions, the seat and reach test was performed [37]. For this a Ballke® box was used. Elderly women did not warm

Table 1 Anthropometric characteristics and sample age (mean and standard deviation).

	Height (cm)	Age (years)	Body mass (kg)
S	153.46 ± 9.35	68.84 ± 4.34	64.67 ± 9.34
H	151.66 ± 10.45	69.77 ± 5.28	65.83 ± 10.42
F	161.88 ± 7.54	72.44 ± 6.40	65.22 ± 11.14
RT	153.33 ± 7.35	69.66 ± 4.71	66.02 ± 8.23

up before the test. They realized it 3 times, and the mean value was used for statistical analysis.

To access the functional capabilities TUG (timed up and go) test, the description in the original research [38], was used. The elderly women were timed after they got up from the chair, walked in a straight line for 3 m, turned around, and got back to seat on the chair.

Seat and get up test, used to lower limb strength, used a 45 cm height chair, and the number of repetitions in 30 s was registered [39].

It is important to highlight that all evaluations were performed in the same time of day, in order to reduce any interference in the results.

Previously before evaluations above, in order to access the exercise intensity performed by physical exercise practitioners groups, CR-10 [40] scale was used during one random session of their daily exercise classes.

Elderly quality of life was accessed by WHOQOL-OLD questionnaire [41], applied individually, being asked to answer considering their last 2weeks.

Participants of physical exercise groups developed 3 weekly sessions, lasting 45 to 60 min each one.

Hydrogymnastics classes had 10 to 15 min for warm up, followed by 25 to 35 min of main stimulus. The 5 to 10 last minutes were reserved to stretch and relaxing exercises.

Functional training consisted of 5 to 10 min of warming up with aerobic cyclic and/or acyclic activities. The main part of the session lasted 30 to 35 min of weight bearing exercises. In this stage, elderly women performed jumps, burpees, squats, stationary running, pushups, crunch abdominal. Stimulus lasted 1 to 1.5 min, separated for 1 min of passive recovery.

Finally, all body resistance training consisted of 7 exercises, where 4 sets of 10 repetitions were performed in each one. Exercise plan included: chest press machine, seated row machine, lateral raise, leg press, seated leg extension, seated leg curl, plantar flexion machine and low back extension machine. Inter-set recovery lasted 1.5 to 2 min, and the total time training was about 50 to 60 min.

Each group had the same training pattern, and consisted of 3 weekly sessions, in an every other day way, lasting 45 to 60 min.

The anthropometric characteristics and sample age are presented in table 1.

3. Statistical Analysis

Results were analyzed by Graph Pad Prism 7.0, taking the average values, standard deviation and ANOVA one way for parametric data, in order to identify statistical differences ($p < 0.05$). When statistical differences were found, Tukey posttest was applied.

4. Results

Statistical differences were not found in subjective exercise intensity of each exercised group (Table 2) and for SBP (Sistolic Blood Pressure), DBP (Diastolic Blood Pressure), oximetry and body temperature (Table 3).

Table 2 Subjective exercise intensity.

	H	F	RT
CR-10 scale	3.3 ± 0.48	3.6 ± 0.69	3.4 ± 0.56
Classification	Moderate/somewhat strong	Moderate/somewhat strong	Moderate/somewhat strong

Table 3 SBP, DBP, body temperature and % oxygen saturation.

	S	H	F	RT
SBP (mmHg)	138 ± 4.1	142.2 ± 7.7	152.5 ± 8.6	134 ± 4
DBP (mmHg)	77 ± 8.5	74 ± 6.8	75.2 ± 12.7	63 ± 3
% Oxygen saturation	96.7 ± 1.1	96.8 ± 1.5	97.4 ± 1.5	98.5 ± 0.5
Body temperature (°C)	35.5 ± 1.0	35.7 ± 0.9	35.5 ± 1.0	35.6 ± 0.8

Data obtained by seat and reach test are presented in Fig. 1. Once again, statistical differences were not found between physical exercise groups (H: 23.2 ± 6.6; F: 26.7 ± 7.3; RT: 26 ± 1.4). Nevertheless, when compared with S (19.1 ± 0.8), statistical difference was reached.

Regarding strength, Fig. 2 shows that exercise practitioners groups showed statistical difference to S. And among exercise practitioners groups, RT performed significant more repetitions (H: 12.8 ± 4.1; F: 11.4 ± 1.3; RT: 18 ± 1.4; S: 10.3 ± 0.8).

In relation to functional capabilities (Fig. 3), exercise practitioners performed the task in significantly ($p < 0.05$) less time than S. Another significant difference can be seen between RT and H (GH: 9.2 ± 1.8; GF: 7.9 ± 2.1; GTR: 7.5 ±0.8; GS: 11.5 ± 0.8).

Finally, concerning quality of life (Fig. 4), it was observed that exercise practitioners had greater score ($p < 0.05$, H: 83.6 ± 7.4; F: 87.3 ± 8.7; RT: 83 ± 1.3; S: 72.1 ± 1.7).

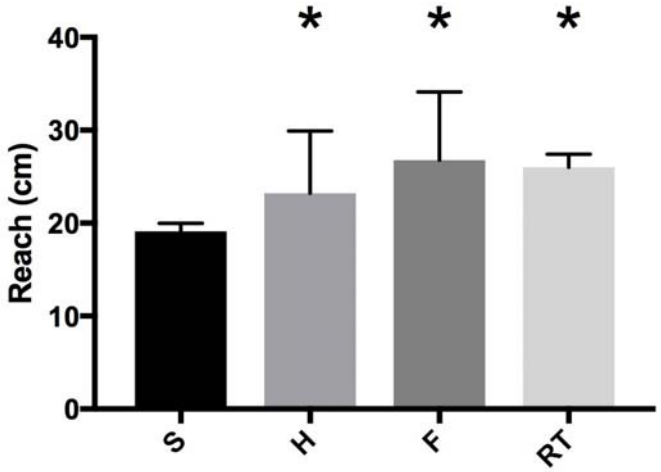

Fig 1 Muscular flexibility of S, H, F, and RT.
* Statistical difference ($p < 0.05$) between exercise practitioners groups and S.

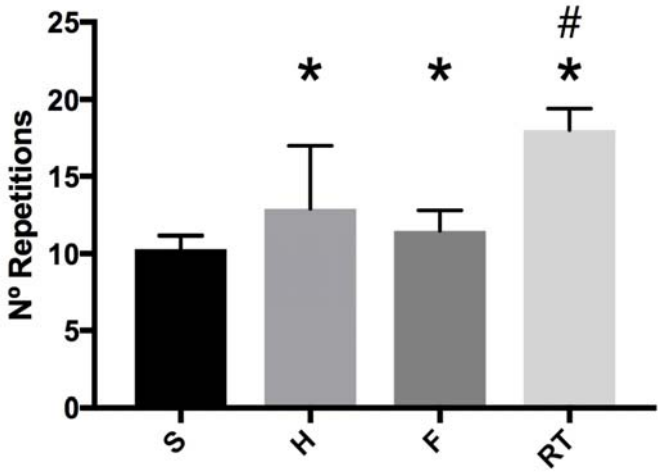

Fig 2 Lower limb strength.
***** Statistical difference ($p < 0.05$) between exercise practitioners groups and S; # Statistical difference ($p < 0.05$) between RT and the others exercise practitioners groups.

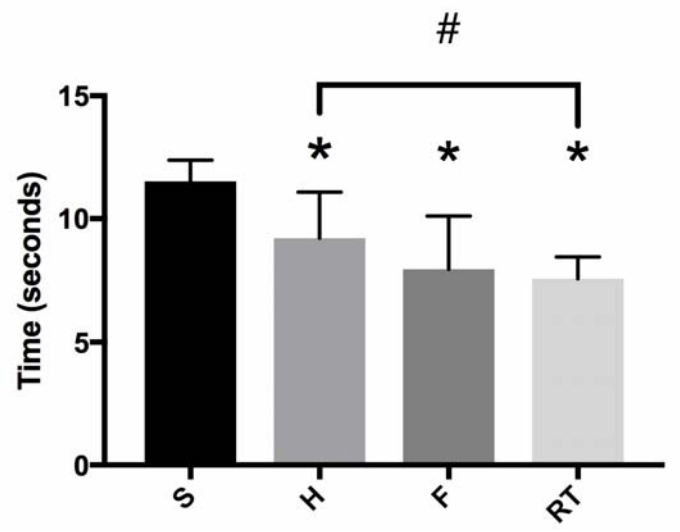

Fig. 3 Functional capabilities (Timed up and Go).
* Statistical difference ($p < 0.05$) between exercise practitioners groups and S.; # Statistical difference ($p < 0.05$) between RT and H.

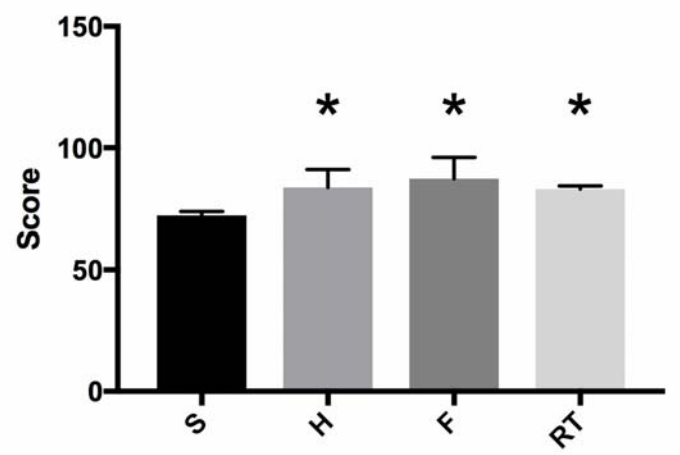

Fig. 4 Quality of life questionnaire.
* Statistical difference ($p < 0.05$) between exercise practitioners groups and S;

5. Discussion

The aim of this study was to compare the effects of hydrogymnastics, functional or resistance training on muscular strength, flexibility, functional capabilities and quality of life in elderly women.

Analysing the exercise intensity of all exercise practitioners groups, we have noticed the both usually performed their exercise sessions in a moderate level. In 2015 a systematic review was made about the low to moderate exercise intensity on physical capabilities and cognitive elderly health, showing that the high intensity is not necessary to reach satisfactory benefits in this population [42]. On the other hand, the high intensity can even prejudice the strength and hypertrophy gains [43].

About muscular flexibility, both exercise practitioners (H, F and RT) showed significant difference when compared with S. Although some studies had verified improvement in muscular flexibility of elderly women exercising [44], the most part of them had flexibility—specific exercises, which did not occur in present study.

Another aspect to be considered is the positive correlation between muscular flexibility and functional capabilities in elderly people [45]. Thus, the three different modalities of exercise accessed in our study can help, at least indirectly, improve the functional

capabilities in elderly people.

Therefore, when functional capabilities were evaluated, we have observed that exercise practitioners groups took significantly less time to do the TUG test than S.

Still with regard to functional capabilities, we were already waiting for a better TUG—execution time for F group [46], once this exercise works to improve functional capabilities and movement efficiency [47]. But, surprisingly there were no significantly differences between F and RT.

Coelho et al. [48] evaluated hydrogymnastics, weight bearing or resistance trained elderly people (> 1 year of experience, two days per week frequency) and noticed that an improvement in their functional capabilities, as in our study. Another similar result, between Coelho's and our study, was the RT group presented higher functional capabilities than H group. But, interestingly the RT also showed a significant difference related to F group. Another research group [49] analysed the resistance training effects over the functional capabilities of 22 elderly women. The intervention had 16 weeks of duration, and found significant improvement in functional capabilities associating that with muscular strength and showing the importance of this capacity to perform daily life activities.

Recent studies have shown that functional training promotes increase in elderly women muscular strength [50], and hydrogymnastics has been efficient to improve muscular endurance [51] and strength [52].

About muscular strength, evaluated by seat and get up test, both exercise practitioners groups performed significantly more repetitions than S ($p < 0.05$). However, when compared between them, RT was significantly better than F and H. This result was expected, because some researchers have classified RT as the main type of exercise to improve elderly-muscle strength [36, 49, 52, 53].

Finally, it was observed that exercise practice (H, F and RT), promoted higher score in quality of life in questionnaire, but not between them. These results are corroborated by Silva et al. [18] and Caporicci and Neto [19].

6. Conclusion

This study set out to compare the effects of the aforementioned exercises regarding muscle strength, flexibility, functional capability and quality of life of elderly women.

In summary, important conclusions drawn from this work include: (1) The regular practice of exercise is important to reduce the deleterious effects of sedentary life over muscular strength, flexibility, functional capabilities and quality of life; (2) The RT practitioners performed more repetitions than other groups; (3) The RT practitioners performed the Timed up and Go Test more quickly than H.

Therefore, for elderly people, starting an oriented and regular physical exercise practice is indispensable, because it will bring safe and efficient possibilities related to sedentary life risk factors control such as to contribute for an active lifestyle improving their quality of life physical and physical/functional capabilities.

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