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RESEARCH

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Composição corporal e autonomia funcional de mulheres idosas após um programa de treinamento resistido

Composición corporal y autonomía funcional de mujeres adultas mayores después de un programa de entrenamiento resistido

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ABSTRACT

Objectives: To assess the effects of a resistance training program for older adult women's functional autonomy and body composition. **Method:** A total of 13 volunteer women aged 55±5.1 years participated in this study. Functional autonomy and body composition were assessed. The linear training program lasted for three months with 65, 70 and 75% intensity with 10 maximum repetitions. **Results:** Statistical improvement in fat percentage (Δ% = -6.92%, p=0.04) and the WHR index (Δ% = -3.44%, p<0.001) was confirmed. In addition, statistical improvement in functional autonomy was observed in the tests: POTOS (Δ% = - 36.9%, p<0.001); 10mW (Δ% = - 8.9%, p=0.01); RSP (Δ% = - 16.7%, p=0.002); RCWH (Δ% = - 16.5%, p<0.001); and in the GDLAM index (Δ% = - 14.3%, p<0.001). **Conclusion:** The resistance training showed positive effects on older adult women's functional capacity and body composition. **Descriptors:** Muscle strength, Body composition, Physical activity, Activities of daily living.

RESUMO

Objetivo: Avaliar os efeitos de um programa de treinamento resistido sobre a autonomia funcional e composição corporal de mulheres com idade avançada. **Método:** Um total de 13 mulheres com 55±5,1 anos de idade participaram da pesquisa. Avaliou-se a autonomia funcional e a composição corporal. O treinamento linear durou três meses com intensidade de 65, 70 e 75% com 10 repetições máximas. **Resultados:** Verificou-se melhora estatística para o percentual de gordura (Δ% = -6,92%, p=0,04) e para a RCQ (Δ% = -3,44%, p<0,001). Além disso, observaram-se melhoras estatísticas para a autonomia funcional nos testes: VTC (Δ% = - 36,9%, p<0,001); C10m (Δ% = - 8,9%, p=0,01); LPS (Δ% = - 16,7%, p=0,002); LCLC (Δ% = - 16,5%, p<0,001); e no Índice GDLAM (Δ% = - 14,3%, p<0,001). **Conclusão:** O treinamento resistido mostrou efeitos positivos para a capacidade funcional e composição corporal das mulheres em idade avançada. **Descritores:** Força muscular, Composição corporal, Atividade física, Atividade cotidiana.

RESUMEN

Objetivo: Evaluar los efectos de un programa de entrenamiento resistido sobre la autonomía funcional y la composición corporal de mujeres adultas mayores. **Método:** Un total de 13 mujeres de 55±5,1 años de edad participaron en el estudio. Se evaluó la autonomía funcional y la composición corporal. El entrenamiento linear tuvo una duración de tres meses con intensidad de 65, 70 y 75% de 10 repeticiones máximas. **Resultados:** Hubo mejoría estadística en el porcentaje de grasa (Δ% = -6,92%, p = 0,04) y la RCC (Δ% = -3,44%, p <0,001). Además, se observó mejoría estadística de la autonomía funcional en las pruebas: PSC (Δ% = - 36,9%, p <0,001); C10M (Δ% = - 8,9%, p = 0,01); LPS (Δ% = - 16,7%, p = 0,002); LSCC (Δ% = - 16,5%, p <0,001); y en el índice GDLAM (Δ% = - 14,3%, p <0,001). **Conclusión:** El entrenamiento resistido mostró efectos positivos para la capacidad funcional y la composición corporal de las mujeres adultas mayores. **Descriptores:** Fuerza muscular, Composición corporal, Actividad física, Actividades de la vida diaria.

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INTRODUCTION

The aging process is inherent to every living being, but human beings differ from the other species, because the process is influenced by both the lifestyle and genetic factors, causing physiological, psychological and social changes.[1, 2]

Physical inactivity is a factor related to the lifestyle and can increase the loss of lean body mass. Consequently, muscle strength is lost in a process known as sarcopenia. Although natural to man, it is strongly influenced by the lack of movement, which in many cases results in the increased risk of falls and fractures that will affect older adults' functional independence and quality of life.[3, 4]

Older adults' body composition is another variable that declines with advancing age, since there is an increase in abdominal circumference due to accumulation of fat gained over the course of life.[5] In addition, there is also loss of bone mass that implies the decrease in stature and may cause fractures in the individual.[4] This set of factors makes oriented-physical activity necessary in order to minimize the effects caused by aging.[6]

Among other consequences, these aging-related implications cause loss in functional autonomy. This is associated to the ability of performing activities of daily living (ADL) and its loss can even cause the dependence on third parties for performing these activities, in addition to a sense of worthlessness towards society.[7]

For the Brazilian Ministry of Health, basic healthcare related to older adults' health is a strategic action of the federal government that seeks to promote a lifestyle with functional autonomy, development for maintaining independence and improvement of the quality of life through physical activities.[8] This way, special attention is drawn to physical inactivity, because it is considered a potential factor that aggravates the variables related to human aging. These variables include: functional autonomy; muscle strength; balance; bone density; and quality of life, among others.[4, 7]

Physical exercise can even contribute with healthcare regarding older adults' psychological and social variables. These exercises, when performed in groups, provide proper social conviviality to combat loneliness and depression, which are consequences of the abandonment by the families and are also associated with the cause of other diseases.[2]

Therefore, resistance training as oriented exercise has been widely recommended by scientific literature. It has contributed to the control and prevention of bone mass reduction, increasing muscle strength and improving the quality of life and body balance, thus preventing falls and avoiding fractures. As a result, it increases older adults' functional autonomy and independence.[4, 7, 9]

In this sense, the overall goal of this study was to assess the effects of progressive intensity resistance training on functional autonomy and body composition of older adult women, who attended the training program in the Municipality of Tucuruí, State of Pará, Brazil.

From this perspective, the following hypotheses were traced:

- H_1 – There will be significant statistical effect of progressive intensity resistance training on older adult women's body composition.
- H_0 1- There will be no significant statistical effect ($p<0.05$) of progressive intensity resistance training on older adult women's body composition.
- H_2 – There will be significant statistical effect of progressive intensity resistance training on older adult women's functional autonomy.
- H_0 2 - There will be no significant statistical effect ($p<0.05$) of progressive intensity resistance training on older adult women's functional autonomy.

METHOD

This research has the pre- and post-test design with a single experimental group and a pre-experimental quantitative approach.[10] It was developed at the Laboratory of Resistance Training for Health (LERES) of the State University of Pará (UEPA), XIII Campus, Municipality of Tucuruí.

The subjects of the study were older adult women, who participated in the research and institutional extension project of UEPA named "Health in motion". The project aims to offer free physical activities with professional accompaniment to the older adult population of the municipality. The project has been approved by Public Notice No. 061/10 of UEPA.

The volunteers included in the study were aged 50 years or older, they did not have any chronic skeletal muscle or mental disorder and they had not performed physical exercises for at least six months. Volunteers excluded from the study were those who had uncontrolled arterial hypertension and those that did not have a fitness certificate with recommendations for the practice of physical activities through the prescription provided by each volunteer's physician.

After verification of the inclusion and exclusion criteria, the sample consisted of 13 volunteers who agreed to participate in the study by signing an informed consent form. The study was approved by the Ethics and Research Committee of the Federal University of the State of Rio de Janeiro (UNIRIO) as a multicenter project with UEPA, Tucuruí Campus, No. 0050/2011, CAAE No. 0061.0.313.412-11 following the criteria of willingness to participate, in accordance with the recommendations of the Resolution 196/96 of the Brazilian National Health Council.[11]

The protocol of the Latin American Development Group for Maturity (GDLAM) aims to standardize the assessment of functional autonomy, through a battery of tests related to older adult women's ADL.[7, 12] GDLAM protocol has the following tests to assess functional autonomy:

a. **10-meter walk** (10MW): the individuals must walk the distance of 10 m rapidly in order to have the displacement speed asessed.

b. **Rising from sitting position** (RSP): being in sitting position, with hands free and the chair at 50 cm from the ground, the individuals should get up and sit down five times consecutively in order to have the strength of lower limbs assessed.
c. **Rising from ventral decubitus position** (RVDP): the individuals in ventral decubitus position, with the arms outstretched along the body, must stand up as fast as possible after the 'go' command. This test aims to assess the ability that the individuals have to rise quickly from the ground.
d. **Rising from a chair and walking around the house** (RCWH): from sitting position and with feet off the ground, individuals should get up, walk to their right, rotate around a cone, sit down again, take the feet off the ground and perform the same movement again to the left. This test aims to assess agility and dynamic balance.
e. **Putting on and taking off a shirt** (POTOS): the individuals, with the arms by their sides and holding a shirt in their dominant hand, must put on and take off the shirt as fast as possible, returning to the starting position.[12]

After performing the tests, the GDLAM index was calculated using the following formula:

$$GI: \frac{[(10MW+RSP+RVDP+POTOS)\times 2]+RCWH}{4}$$

For the performance of the tests, the following equipment was used: a tape measure (Sanny®, Brazil); a stopwatch (Casio®, Brazil); a chair 50 cm above the ground; and a 20-mm-thick exercise mat.

For body composition assessment, body mass and height measures were determined in a 150 kg capacity and 100 g intervals anthropometric scale (Welmy® CH110, Brazil), with the individual barefoot, wearing light clothes, standing with the heels together and the head positioned in the horizontal plane. Height was assessed using a vertical anthropometer fixed to the scale. On the basis of these variables, the body mass index (BMI) was calculated through the following formula: [$BMI = Mass (kg) / Height (m)^2$].

To determine fat percentage, the protocol of three skin folds for women was used, providing the calculation of body density. The areas of the measures were as follows: triceps, supra-iliac and thigh, expressed in millimeters (mm).[13] The calculation of body density was carried out using the following equation: sum of the three skin folds, i.e., triciptal, supra-iliac and thigh.

To calculate fat percentage, the following formula was used: [$F\% = (4.95 / \text{body density} - 4.5) \times 100$].

To assess muscle strength, the 10 maximum repetitions test (10MR) was used, in which the procedures adopted for the implementation were the following:

a) Performance of static stretching (10) to prepare the large muscle groups, especially the specific ones for the accomplishment of the desired movement. Two to three series of exercises were performed with light loads for familiarization with the execution of the movements.

b) Each individual had from three to four attempts to perform the test with a 10MR load according to the recommendations of the American College of Sports Medicine

(ACSM).[14] The breaks and the intervals—three to five minutes—between attempts were restoring. It is worth mentioning that the participants were not aware of the number of repetitions of the test, i.e., 10MR. The ACSM has recommended this test, especially for older and untrained adults.[14] The equipment used was from Physicus® (Brazil).

c) The volunteers underwent a linear program of resistance training, understood as intervention procedures for three months, with three monthly cycles, progressive intensity and frequency of three alternated times per week with 60-min class for each session,[4] as shown in Demonstrative Chart 1.

Demonstrative Chart 1. Training periodization

Cycle 1		Cycle 2	Cycle 3
stretching	10MR test	10MR test	10MR test
adaptation	65% intensity	70% intensity	75% intensity
light loads	15-20 repetitions	10-12 repetitions	6-8 repetitions
10-12 repetitions	3 series	3 series	3 series
2-3 series	8-10 exercises	8-10 exercises	8-10 exercises
8-10 exercises	30-40' intervals	40' intervals	60' intervals
stretching	stretching	stretching	stretching
2 weeks	2 weeks	4 weeks	4 weeks
60 min	60 min	60 min	60 min

Legend: 10MR = 10 maximum repetitions

Statistical analysis was performed considering a value p≤0.05 for an error (α) of 5% as index of significance. The IBM® SPSS® 20.0 software was used for data analysis. Initially, a descriptive analysis of the volunteers' variables was conducted. Subsequently, the Shapiro-Wilk test for normality was applied and, according to the normal distribution, Student's *t*-test was used for the variables functional autonomy and body composition.[15] The percentage difference was calculated by the formula: [Δ% = (post-test – pre-test)*100/Pre-test].

RESULTS

Table 1 shows the descriptive results of the pre-test data of the variables obtained through measures of central tendency and dispersion of the group under study.

Table 1. Input data of the study variables

	Resistance training group - n = 13			
Variables	Average	SD	No. Max	No. Min
Age (years)	55	5.21	68	50

Mass (kg)	63.1	11.78	92,6	48.9
Height (cm)	148.1	2.79	152	143
BMI kg/m²	28.8	5.56	42.3	21.6
WHR (cm/cm)	0.87	0.02	0.92	0.82
Fat percentage (%)	32.8	8.09	45.6	18.2
Body density (g/ml)	1.025	0.017	1.057	0.998
RVDP (s)	3.15	0.84	4.95	2.13
10MW (s)	6.48	0.77	7.75	5.26
POTOS (s)	11.70	1.99	14.48	7.88
RSP (s)	7.88	2.01	12.88	6.31
RCWH (s)	44.94	5.05	50.47	33.87
GI (Score)	51.20	7.54	63.03	38.85

SD = standard deviation; BMI = body mass index; WHR = waist-hip ratio; RVDP = rising from ventral decubitus position; 10MW = 10-meter walk; POTOS = putting on and taking off a shirt; RSP = rising from sitting position; RCWH = rising from a chair and walking around the house; GI= GDLAM index.

Table 2 shows the results for body composition variables surveyed after the training program, demonstrating significant statistical improvement for WHR and body fat percentage.

Table 2. Results of the comparison between body composition variables

	Resistance training group - n = 13			
	Test	Post-test		
Variables	Average ± SD	Average ± SD	Δ%	*p-value*
BMI (kg/m²)	28.2±5.56	28.55±5.39	1.24	0.372
WHR (cm/cm)	0.87±0.02	0.84±0.33	- 3.44	**<0.001**
Fat (%)	32.8±8.09	30.53±5.62	- 6.92	**0.047**
Body density (g/ml)	1.0255±0.017	1.0302±0.012	0.45	0.055

SD = standard deviation; BMI = body mass index; WHR = waist-hip ratio. Bold numbers indicate $p<0.05$.

Figure 1 shows the results for functional autonomy, demonstrating significant statistical improvement for the following tests: POTOS (Δ%= -3.44%, $p<0.001$); 10MW (Δ%= -8.9%, $p=0.01$); RSP (Δ%= -16.7%, $p=0.002$); and RCWH (Δ%= -16.5%, $p<0.001$).

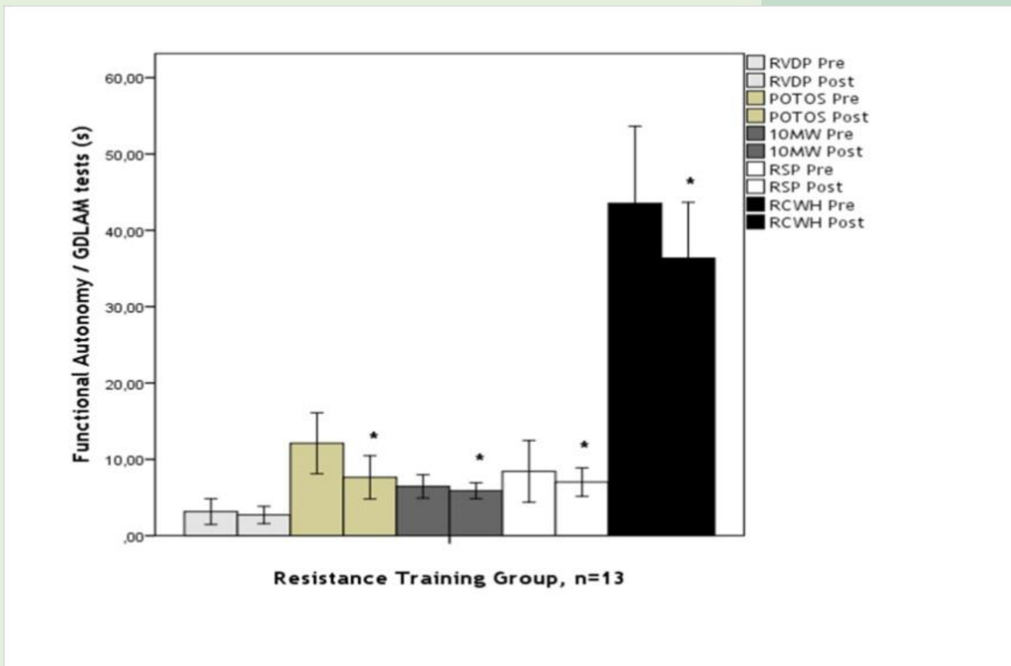

Figure 1. Results for functional autonomy. * = value p<0.05.

Figure 2 shows significant statistical improvement for the GDLAM index: Δ%= -14.3%, p<0.001.

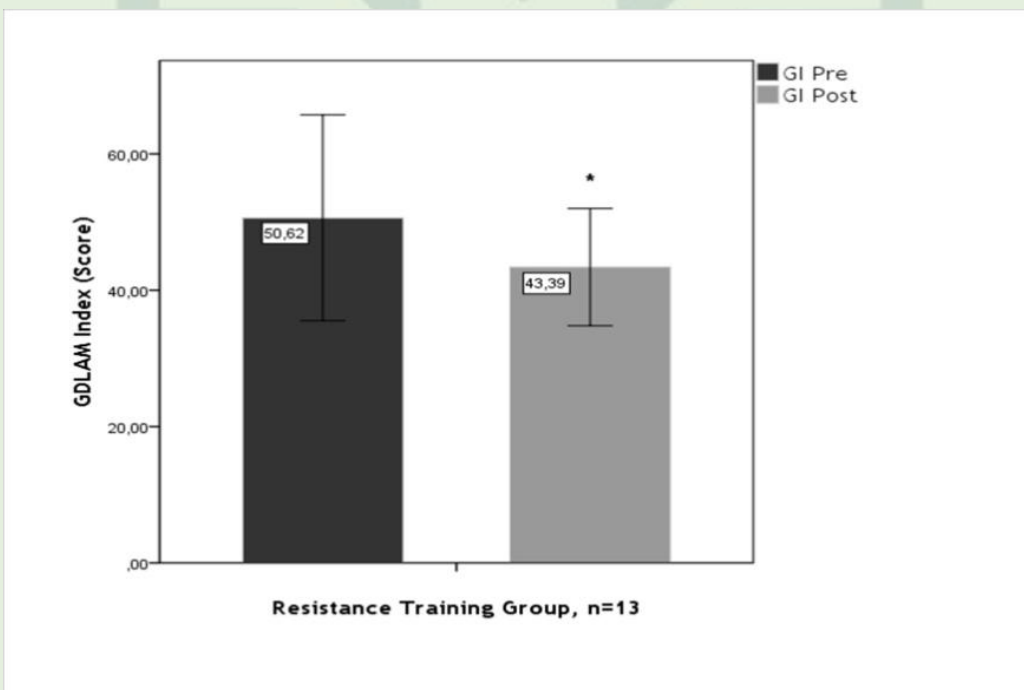

Figure 2. Results for the GDLAM index. * = value p< 0.05.

DISCUSSION

After a three-month period of progressive intensity resistance training, there was statistical improvement in body composition measures and functional autonomy of the participants in the study. These results suggest that, in three months of intervention, the methodology with progressive increase of effort intensity—already referenced in other studies with other variables,[4] however with a longer intervention period—can also be effective for maintenance of older adult women's health.

The need for maintenance of physical activity throughout life is widely recommended by the scientific literature, in particular, during the stage at which aging accentuates the decline of the systems responsible for the functionality of the body, thus increasing the risk of developing diseases with physical and psychological consequences.[2,16]

Body weight gain in older adults is associated with metabolic level decline and lack of physical activity. Therefore, the practice of regular physical exercises is one of the main factors for controlling body mass with a view to maintaining an active and healthy life.[17, 20]

In this study, there was significant improvement ($p \leq 0.05$) in volunteers' body fat percentage and WHR (Table 2). These data reinforce the assumption that controlled physical exercise is effective for maintaining and/or decreasing body fat mass and WHR, which are variables related to the risk of cardio- and cerebrovascular diseases.[16] Similar results are found in the literature on body composition variables in 12-week periods of resistance training, also promoting significant decrease in fat percentage.[21] Another study conducted with older adult women subjected to strength training—also for a 12-week period—showed no significant change in fat percentage, but showed a significant improvement in BMI and total body mass.[22]

Other studies with longer periods demonstrated more chances of obtaining better results, as the training that grouped multiple exercises, including strength training for 29 weeks, with statistically significant results in the variables total body mass, fat mass and BMI.[23]

It is noteworthy that these data are strongly related to reducing the risk of developing diseases associated with dyslipidemias, especially the cardio- and cerebrovascular diseases caused, among other factors, by the accumulation of visceral fat. They are also related to arterial diseases, representing the leading cause of morbimortality worldwide. Maintaining an active lifestyle with regular physical exercises minimizes the occurrence of these diseases.[7, 16, 24]

However, studies also showed contradictory results like one that used strength training for 36 weeks and confirmed no differences ($p<0.05$) in anthropometric data.[25] Similar results were found in another research that also found no significant change in the body composition variables conducting a 24-week resistance training with older adult women.[26]

The divergent results found in the scientific literature for the body composition variables can be related to both the methodology used and the control of variables related to diet. The latter was considered a limitation for this study.

Another variable assessed in this study was functional autonomy. The functional capacity of physically active older adult women is considered statistically better—regarding autonomy tests and the GDLAM index—when compared to sedentary older adult women's functional capacity.[26, 28] The literature states that physical exercise can increase and maintain functional independence levels in physically active older adults, especially for the performance of ADL.[19, 27, 28]

This study also confirmed statistical improvement in functional autonomy according to the tests POTOS, 10MW, RSP, RCWH, and the GDLAM index (Figures 1 and 2). Studies in the scientific literature conducted with older adult women corroborated with the results of this research, as the resistance training for a 16-week period, in which there were improvements ($p<0.05$) for the tests 10MW and RSP of functional autonomy and also in the physical activity program with 12-week duration that found significant improvement in the execution of the tests RSP, RCWH, 10MW, and RVDP, as well as in the GDLAM Index.[9, 29]

These findings demonstrate that oriented-resistance training can bring positive effects to older adult women's functional autonomy, even in a three-month period, favoring the maintenance of an active life, with less risk of being dependent on third parties to perform ADL.

The scientific literature also shows that, with a healthy lifestyle, proper nutrition and the practice of regular physical exercises, it is possible to minimize the effects of the aging process in the human body. This fact is reinforced by the Brazilian Ministry of Health that recommends individuals to perform at least 30 minutes of regular exercises, with moderate or high intensity, most or all days of the week. The goal of this activity is to prevent or control diseases and, consequently, improve the functional status in the different stages of the life cycle, especially for adults and older adults.[30, 32]

The studies cited above show the need to maintain functional autonomy, because the loss of this capacity compromises basic personal care activities, such as brushing teeth, showering, putting on shoes, and dressing up, among others, causing greater dependency to older adults, besides needing care provided by third parties.[2, 33] These studies show to the Brazilian public basic healthcare that physical exercise of resistance training can be part of care programs directed to the older adult population in the public health network.

However, the profile of public policies related to the area of health and social welfare needs reformulations carried out by municipal and state health departments, regarding vacancies for physical education professionals with specialization in the area of health. The goal would be to complement the multiprofessional team working in basic healthcare, such as the Family Health Program,[2] considering that physical activity is part of the strategies of the Brazilian Ministry of Health regarding the healthcare provided to the older adult population.[8]

However, further studies with the methodology and variables used in this study are recommended, especially with respect to body composition, together with nutritional monitoring and with a control group, in order to enable better results to the scientific field.

This research has contributed to improving participants' quality of life. The resistance training made it possible that older adults could improve and/or maintain the physical qualities related to health, through functional autonomy and body composition, thus encouraging greater independence and autonomy to the volunteers under study.

CONCLUSION

The resistance training program showed positive effects on improving older adults' functional capacity. The program affected body composition influencing fat percentage and the WHR, in addition to the tests of functional autonomy and the GI that compose the GDLAM Protocol, with the exception of the RVDP test. These individuals became more independent in their daily activities.

Therefore, the methodology applied in the three-month resistance training program may be recommended, because it was effective for the body composition and functional autonomy variables of the group studied.

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