23 - EFFECT OF A 12-WEEK SUBMAXIMAL RESISTANCE TRAINING IN THE LOWER LIMB STRENGTH IN ELDERLY FEMALE POPULATION

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Introduction

The quick increasing in the percentage of the elderly Brazilian population is followed by a large number of studies related to the aging process, as an attempt to measure and adjust the social, economical and cultural components, to better identify the failures and fulfill the gaps related to the work and services to this population in different knowledge fields.

One of the main problems related to the aging process are the physiological changes, which can have a negative contribution to the progressive reduction in the functional fitness. Within the body changes, the one that seems to be most related to the lack of autonomy and independence in the elderly is the decreasing in levels of strength, which is more noticeable in the lower limbs and it can reach a decrease of 15 % per decade between the sixtieth and the seventieth decades of life and 30% from that period onward (KIRKENDALL, GARRETT; ACSM, 1998).

Some issues about the physical prescription for the elderly are already determined, like, for instance, the elderly sensitivity to the training (ACSM, 1998), the relation between physical fitness and autonomy (MATSUDO ET AL., 2003) and the need of special training protocols for this special population (TRIBESS and VIRTUOSO JR, 2005).

The resistance training (RT) seem to be the essential part and maybe even priority in the exercise prescription for the elderly, since it can stimulate the maintenance of the muscular strength in upper and lower limbs (MATSUDO, MATSUDO and NETO, 2001).

Additionally, many studies (MARCHAND, 2003; SALVADOR, 2005; ELSANGEDY, KRINSKI, and JABOR, 2006) have emphasized its importance, reporting improvements after a period of time with strength training in the strength levels, motor coordination and physical fitness, muscular hypertrophy, benefits for the self image of the individual and benefits in the osteoporosis therapeutics.

In 1998, after the publication by ACSM of the text “Exercise and physical activity for older adults”, the RT was definitely incorporated to the physical training programs aiming improvements in health and in quality of life in the elderly population. This document establishes criterions for the creation and development of RT programs for older adults, suggesting a total of 8 to 10 exercises that contemplate the main muscular groups with loads that allow from 8 to 12 maximum repetitions (MR) for healthy adults and from 10 to 15 repetitions for fragile older adults. Also, this document from the ACSM, quoting the researches from Aniansson et al. and Larson, reports that when the exercise intensity is low, only small increments in the strength can be reached by older adults.

So, the purpose of this study was to verify the effect of 12 weeks of sub maximum resistance training (submaxRT) in the lower limb strength in female elderly.

Methods and Instruments

This is a pre-experimental 1 case study (CAMPBELL e STANLEY apud VAN DALEN, MEYER, 1974), in which have participated 6 female older adults with 6 month of experience in the practice of resistance exercise (RT), the mean age was 66 (±5,5) years old, mean body mass 67 (±11,3) kg and mean stature 159 (±4) cm; they were executing the RT exercises three (3) times a week in sessions of 50 minutes.

The training protocol was compound from 8 to 10 exercises, which involved the main muscular groups, with loads that allowed 12 non-maximum repetitions (12 nMR). They were always asked to avoid the Valsalva Maneuver.

The exercises were selected from a general list, and were replaced when necessary by exercises with a similar cineliologycal action, according to the individual limitations inherent in this population. The protocol was formed, although not simultaneously by the *Leg Press* 45º exercise, the Leg Extension Bench, Leg curl Bench, Inner-Outter Thigh Bench, Upright rows with hands spread, Close Grip Lat Pulldowns, Straight Arm Lat Pulldowns, Rowing Bench, Preacher curls "scott", Alternate lateral raises with a low, pulley Bench press, *Peck-Deck*, Abdominal exercise with arch, Underhand barbell curls, Triceps *Pulley*.

The selected exercises in this study to evaluate the lower limbs strength were only the Leg Press 45º (LP) and the Leg Extensor Bench (LEB) because they were the only exercises that were not replaced during all the training period and, this way, could better reflect the adaptations caused by the applied protocol.

The instruments used were the *Leg Press* 45º for the free weight and a leg extensor bench with a set of weights (5 kg per weight disc), both from Vitally®. In addition, a digital scale from Britania®, model BE1 with 150 kg of maximum load was used as instrument to measure the body mass. A stadiometry WCS 217cm with platform from Cardiomed® was used to assess the stature.

The first exercise session was executed on March 30th, 2007, when the tests of load per repetition (12 RM) were executed for each selected exercise, like in the protocol proposed by Heyward (2004).

After the tests were executed and during all the period of the training protocol, the elderly were invited to perform 12 repetitions with loads auto selected by them, which allowed strength reservation (possibility to execute from 1 to 5 additional repetitions in case it were needed) for each set, so that the sub maximal characteristic of the protocol would be ensured (12 nMR). They were oriented to the need of increasing the load values from time to time so that they could avoid the accommodation principle and the prejudice in the training quality, with consequent decrease of the associated benefits. So, the criterion used for the load increase was their subjective perception, and the increase that didn't allow the execution of the number of pre determined repetitions (12 nMR), or if they would interfere in the appropriate exercise technique were forbidden.

To quantify the values of the loads being used by the older women, a surve was made on May 14th, 2007. This date was equivalent to half of their training period; it showed mean load values for the LP of 86 (±26) kg, which corresponded to 81,13% of the load at the initial RM test. The mean load for the LEB was 7 (± 2,7) kg, which corresponded to 71,43% of the load at the initial 12 RM test. The project activities have finished on July 13th, 2007, with the execution of the final load per repetition tests (12 RM), totalizing nearly 34 sessions (12 weeks).

Data analyzes was made with the statistical software SPSS 14.0. The descriptive statistic was used with a measure of central tendency and variability and the statistic test used was the T paired test (p=0,05), since the data have presented a normal distribution in the Shapiro-Wilk test.

Results and Discussion

The results in the initial and final tests presented respectively the following mean values of 102,5 (±47,7) kg and 147,5 (±45) kg in the LP and mean values of 10 (±4,1) kg and 4,2 (±4,3) kg for the LEB.

The t paired test showed a significant difference (p=0,000) between the loads in the initial tests and the final one executed with the LP, with a mean increase of 42±8,4 kg, which represents nearly 41% of mean increase. The t paired test also showed a significant difference (p=0,003) mean 4±1,4 kg, when comparing the results in the initial and final tests in the leg extensor bench and that represents a mean difference of nearly 40%.

These results can be seen in table 1. It also shows the minimum and maximum values reached in the initial and final tests in each exercise.

Table 1. Medium, minimum and maximum values in the initial and final tests in the LP e LEB.

Descriptive Data	Initial LP	Final LP	Initial CE	Final CE_
Mean	102,5	147,5	10	14,2
Standard Deviation	47,7	45	4,1	4,3
Minimum	70	110	5	10
Maximum	170	210	15	20

The results found is this study agree with prior studies findings, which demonstrate that it is not necessary too high intensities of RT to have and increase in the levels of strength in older adults (FARIA ET AL., 2003; CARVALHO ET AL., 2004).

Other study, similar to ours from Trancoso and Farinatti (2002), has analyzed the effect of 12 week RT in the strength in elderly women, and found improvements of 60% in the LP e 62% for the Bench press.

Another recent study, with the same period of training time used in our study, from, Kalapotharakos and colleagues (2005) has identified that both protocols of 60% of 1 maximum repetition (1MR) and 80% of 1 MR, are able to provoke improvements in the functional performance in older people after 12 weeks of RT, and the latter seemed to be more effective. In this study, in addition to the lower limbs strength measurement, they also used other variables: walking speed, time to lift from a chair, stairs climbing and flexibility..

Despite the results show the possibility of considerable increases in the strength in older adults with sub maximal resistance training, the RT in the elderly and middle aged people seem to be essential for the maintenance of the adaptation during the detraining period (Fatouros et al., 2006), especially when the RT interruption is longer than eight (8) weeks (RASO, MATSUDO E MATSUDO, 2001).

Conclusions

The results show that there has been a significant increase, of 40% in the lower limbs strength in elderly women using a RT sub maximal protocol. Since the there has been a greater participation of the elderly population in training programs with non maximum loads, this seem to be a good alternative to diminish the physiological and functional changes related to the aging process.

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EFFECT OF A 12-WEEK SUBMAXIMAL RESISTANCE TRAINING IN THE LOWER LIMB STRENGTH IN ELDERLY FEMALE POPULATION

ABSTRACT

One of the main problems related to the aging process is the progressive decrease in functional. The resistance training (RT) seem to be the essential part and maybe even priority in the exercise prescription for the elderly, since it can stimulate the maintenance of the muscular strength. The purpose of this study was to verify the effect of 12 weeks of sub maximum resistance training (submaxRT) in the lower limb strength in female elderly. Participated in the study 6 elderly women with 6 months of experience in resistance exercise practice, who were executing RT 3 times a week, in 50-minute sessions. The exercises used to assess the strength were the *Leg Press* 45º (LP) and the Leg Extensor Bench (LEG). The first load per repetition test (12 MR) was executed on the first session of exercises (12 RM). On the 5th week another test was executed to ensure the sub maximum training. The load values found were 86 (±26) kg for the LP and 7 (± 2,7) kg for the LEB, which respectively corresponded to 81,13% and 71,43% of the load in the initial 12 MR test. The final test was executed after 12 weeks of training. The results for the initial and final tests showed values of 102,5 (±47,7) kg and 147,5 (±45) kg for the LP and 10 (±4,1) kg and 14,2 (±4,3) kg for the LEB respectively. The t paired test showed that there is a significant difference (p=0,000) between the loads of the initial and final load tests in the LP, with a mean load increase of, 42±8,4 kg, which represents approximately 41% increasing and in the LEB (p=0,003), with a mean weight of 4±1,4 kg, which represents a difference of approximately 40%. The results show that there has been a significant increase, of 40% in the lower limbs strength in elderly women using a RT sub maximal protocol.

KEY-WORDS: Strength, Resistance Training, Elderly

EFFET DE 12 SEMAINES D'ENTRAÎNEMENT RÉSISTÉE SUBMASIMO DANS LA FORCE DE MEMBRES INFÉRIEURS DE FEMMES ÂGÉES

RÉSUMÉ

Un des principaux problèmes rapportés au processus de vieillissement est réduction progressive de l'aptitude fonctionnelle. Le entraînement résistée (ER) semble être partie fondamentale, même si prioritaire, dans la prescription d'exercice pour personnes âgées, de manière à stimuler la manutention de la force musculaire. L'objectif de cette étude a été vérifier l'effet de 12 semaines de entraînement résistée submasimo dans la force de membres inférieurs de femmes âgées. Ont fait partie six personnes âgées avec six mois d'expérience dans la pratique d'exercices résistés, qui réalisaient ER trois fois par semaine, dans des sessions de 50 minutes. Les exercices utilisés pour évaluer la force ont été *Leg Press* 45º (LP) et la Chaise Extensora (CE). Dans première session d'exercices a été réalisé premier test de chargement par répétition (12 RM). Par retour de la 5ª semaine d'entraînement a été faite autre test pour garantir que le entraînement soit submasimo. Elles ont été trouvées des valeurs de chargement de 86 (±26) kg pour LP et 7 (± 2.7) kg pour CE, en correspondant, respectivement à 81,13% et 71,43% du chargement de l'essai initial de 12 RM. Le test final a été réalisé après 12 semaines d'entraînement. Les résultats des test initiaux et finaux ont présenté des valeurs respectivement de 102.5 (±47,7) kg et 147.5 (±45) kg pour LP et valeurs de 10 (±4,1) kg et 14.2 (±4,3) kg pour la CE. Le test t montré qui existe différence significative (p=0,000) entre les chargements des test initiaux et finaux dans LP, avec un accroissement, dont en moyenne, 42±8,4 kg, ce il représente approximativement 41% de développe demi et dans la CE (p=0,003) de, en moyenne, 4±1,4 kg, qui représente une différence approximativement de 40%. Les résultats démontrent qu'il a y eu une amélioration significative, de l'ordre de 40%, dans la force de membres inférieurs de femmes âgées, à partir d'un protocole de TR de caractéristique submasima.

MOTS-CLEF: Force, Entraînement Résistée, Personnes Âgées

EFECTO DE 12 SEMANAS DE ENTRENAMIENTO RESISTIDO SUBMÁXIMO EN LA FUERZA DE MIEMBROS INFERIORES DE ANCIANAS

RESUMEN

Uno de los principales problemas relacionados con el proceso del envejecimiento es reducción gradual de la aptitud funcional. El entrenamiento resistido (ER) parece ser parte básica de la prescripción de ejercicio para los ancianos, pues estimula el mantenimiento de la fuerza muscular. El objetivo de este estudio fue verificar el efecto de 12 semanas de entrenamiento resistido submaximo en la fuerza de miembros inferiores de ancianas. Hicieran parte del estudio seises ancianas con seis meses de experiencia práctica. Las mismas realisaron el ER tres veces por semana, en sesiones de 50 minutos. Los ejercicios utilizados para evaluar la fuerza habían sido lo *Leg Press* 45° (LP) y Extensor de Cuadriceps (EC). En la primera sesión de ejercicios fue usado el primer test de carga (12 RM). En la semana 5ª del entrenamiento fue hecho otro test para garantizar que el entrenamiento fuera submáximo. Fueran encontrados valores de carga de 86 (±26) kg para LP y 7 (± 2,7) kg para EC, correspondiendo, respectivamente a 81,13% y 71,43% de carga de el test inicial de 12 RM. El test final fue realizada después de 12 semanas de entrenamiento. Los resultados de los test iniciales y finales habían presentado valores respectivamente de 102,5 (±47,7) kg y 147,5 (±45) kg para LP y valores de 10 (±4,1) kg y 14,2 (±4,3) kg para EC. El test t pareado demostró que existe diferencia significativa (p=0,000) entre las cargas de los test iniciales y finales en lo LP, con un incremento de, en media, 42±8,4 kg, representando 41% de incremento y en lo EC (p=0,003) de, en media, 4±1,4 kg, que representa una diferencia de 40%. Los resultados demuestran que ocurrió una mejora significativa, de la orden de 40%, en la fuerza de miembros inferiores de ancianas, utilizando un protocolo de ER de característica submáxima. PALABRAS-LLAVE: Fuerza, Entrenamiento Resistido, Ancianas

EFEITO DE 12 SEMANAS DE TREINAMENTO RESISTIDO SUBMÁXIMO NA FORÇA DE MEMBROS INFERIORES DE IDOSAS

RESUMO

Um dos principais problemas relacionados ao processo de envelhecimento é redução progressiva da aptidão funcional. O treinamento resistido (TR) parece ser parte fundamental, até mesmo prioritária, na prescrição de exercício para idosos, de forma a estimular a manutenção da força muscular. O objetivo deste estudo foi verificar o efeito de 12 semanas de treinamento resistido submáximo na força de membros inferiores de idosas. Fizeram parte seis idosas com seis meses de experiência na prática de exercícios resistidos, as quais realizavam TR três vezes por semana, em sessões de 50 minutos. Os exercícios utilizados para avaliar a força foram o *Leg Press* 45º (LP) e a Cadeira Extensora (CE). Na primeira sessão de exercícios foi realizado o primeiro teste de carga por repetição (12 RM). Por volta da 5ª semana de treinamento foi feito outro teste para garantir que o treinamento fosse submáximo. Foram encontrados valores de carga de 86 (±26) kg para LP e 7 (± 2,7) kg para CE, correspondendo, respectivamente a 81,13% e 71,43% da carga do teste inicial de 12 RM. O teste final foi realizado após 12 semanas de treinamento. Os resultados dos testes iniciais e finais apresentaram valores respectivamente de 102,5 (±47,7) kg e 147,5 (±45) kg para o LP e valores de 10 (±4,1) kg e 14,2 (±4,3) kg para a CE. O teste t pareado mostrou que existe diferença significativa (p=0,000) entre as cargas dos testes iniciais e finais no LP, com um incremento de, em média, 42±8,4 kg, o que representa aproximadamente 41% de incremento médio e na CE (p=0,003) de, em média, 4±1,4 kg, que representa uma diferença de aproximadamente 40%. Os resultados demonstram que houve uma melhora significativa, da ordem de 40%, na força de membros inferiores de idosas, a partir de um protocolo de TR de característica submáxima.

PALAVRAS-CHAVE: Força, Treinamento Resistido, Idosas.