



Original Article

Are rate of perceived exertion and feelings of pleasure/displeasure modified in elderly women undergoing 8 week of strength training of prescribe intensity?

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Abstract. [Purpose] The aim of the present study was to verify the rate of perceived exertion and feelings of pleasure/displeasure in elderly women, who did normally perform physical exercises, following eight weeks of strength training in a constant routine. [Subjects and Methods] Eleven sedentary women were subjected to anthropometric assessment. The maximum load (100%) for each used in this study was determined by performing a test to determined the 1RM for each of them according to the protocol of Fatouros et al. and the Feeling Scale and RPE scale were explained to the women. After these initial procedures, the subjects followed a routine for strength training, performing three sets of repetitions at 70% of the one-repetition maximum for each exercise (bench press, leg extension, pulldown, leg curl) without modifying the exercises and their execution order. The frequency of training was three days per week. ANOVA was used to analyze the behavior of the dependent variable, and the post hoc tests were used to identify significant differences. [Results] Strength increased only in the fifth week. The rate of perceived exertion showed a reduction only in the fifth week in the leg extension, pulldown, leg curl. [Conclusion] The percentage of 70% the one-repetition maximum recommended to increase the strength gains and hypertrophy of skeletal muscle does not provide feelings of displeasure when performing proposed exercise. However, it may be possible to modulate this percentage to obtain more pleasant feelings over two months.

Key words: Resistance training, Elderly, RPE

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INTRODUCTION

In the last decades, the process of population aging has presented exponential growth in many countries, including Brazil^{1, 2)}. Demographic studies conducted by the Brazilian Institute of Geography and Statistics³⁾ estimate that in 2020, elderly individuals will constitute approximately 15% of the Brazilian population. Moreover, present data indicate that the life expectancy for women better than that for men³⁾. The increase in population aging has been attributed mainly to advances in medicine, which have had the largest effect in decreasing mortality. However, advances in medicine haven not been able to control the decrease in functional fitness observed in the elderly, that is, the decrease in strength, muscular resistance, flexibility, agility, and balance that reduce independence in daily tasks, therefore reducing quality of life²⁾.

The scientific literature reports that the practice of strength training (ST) reverses this situation, assuring the improvement and maintenance of functional fitness (aptitude)⁴⁾. However, this positive fact is partly countered by the fact that the elderly do not have this habit^{5, 6)}. One of the possible explanations for the low level of practice is the high intensity initially prescribed in programs of physical exercises, which promote beneficial changes to health; however, this subjectively perceived effort

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produces feelings of displeasure proceeding from the metabolism⁷). This displeasure felt in the training session negatively affects adherence to physical exercise programs. However, this evidences was observed to a large extent in walking and running, and little is known about the behavior of feelings of pleasure/displeasure in ST.

Recently, Elsangedy et al.⁸) obtained, with only one session of ST at 70% of the one-repetition maximum (1RM) in sedentary men, similar unpleasant feelings as those found in vigorous aerobic exercise. Although the results have been corroborated, it cannot yet be affirmed that the intensity was the cause of the displeasure. Therefore, ST possesses greater complexity and variations of movements compared with walking and running that, in turn, can influence feeling in different ways. Moreover, the studies on ST aimed to verify only the acute behavior of feelings of pleasure/displeasure, neglecting the chronic behavior. Although acute unpleasant feelings affect adherence to physical exercise, it cannot be ruled out that individuals may achieve a vigorous intensity with the same routine of training for a longer period and modify these feelings. For these reasons, the objective of the present study was verify the behavior of the rate of perceived exertion (RPE) and feelings of pleasure/displeasure in sedentary elderly women during eight weeks of ST with a fixed routine.

SUBJECTS AND METHODS

Eleven sedentary women aged between 65 and 75 (average age of 69.1 ± 4.7) took part in this study (Table 1). Recruitment was accomplished by means of printed announcements on public notice boards and, flyers distributed in the streets in locations close to the study center. All the participants were classified as apparently healthy on the basis of the Physical Activity Readiness Questionnaire (PAR-Q). The exclusion criteria were a) one or more positive responses in the PAR-Q b) body mass index (BMI) ≤ 27 kg/m² and c) presence of limitations in joint movements and/or respiration that could affect the mechanics of walking and/or strength training. The inclusion criteria were a) negative responses to all the items of the PAR-Q, b) non-smoking, and c) normal BMI value (22 kg/m² \leq 27.0 kg/m²). All the subjects provided informed consent to participate in the study, in accordance with the guidelines in Resolution 196/96 of the National Council of Health, and the study was approved by the Committee of Ethics of the Federal University of Paraná (UFPR registry number CEP/SD, 1087.012.11.03, and CAAE: 0014.0.091.000-11).

Body composition of participants was evaluated (height, body weight, and BMI), and the participants then participated in three sessions to familiarize them with the training routine used for the study. In these sessions, the exercises, the bench press, leg extension, pulldown, and leg curl, were first demonstrated by the study staff with simultaneous verbal instructions. After this the participants performed the action three times, i.e., 3 sets of 10–12 repetitions with a light load in order to allow better accomplishment and agreement of the movements. Also in the period of familiarization, explanations on interpretation of the Feeling Scale ($-5/+5$) and OMNI Resistance Exercise Scale (OMNI-RES; 0–10) were repassed of individual form. The maximum load (100%) was determined by performing a test to determined the 1RM for all the exercises in this study according to the protocol of Fatouros et al⁹). Once this first stage was completed, the experiment began, in which the participants were subjected to 8 weeks of strength training composed of 3 sets of 10 repetitions per 1 minute for rest to 70% of 1RM. The rest between the sessions of experimental tests followed the recommendations suggested by the American College of Sports Medicine¹⁰.

In the experimental session, the exercises were always performed in the same sequence (bench press, leg extension, pulldown, and leg curl), and in the rest between each series, the RPE and feelings of pleasure/displeasure were measured.

For measurement of the RPE, the participants were instructed in memory anchoring with the OMNI -RES according to the procedures proposed by Robertson et al¹²). The procedure was as follow: In the breaks between each series, the scale was presented, and the following question was asked: At this moment during the exercise, how much effort do you feel have exerted throughout the body? Affective valence during the training sessions was assessed with the Feeling Scale, which uses a bipolar sorting from 11 points, varying by +5 to -5, with an anchor of zero (neutral) and all the odd whole numbers corresponding to description of “very good” (+5) to “very bad” (-5). The anchoring procedure used was memory, following the protocol of Hardy and Rejeski¹²).

For testing of the 1RM, we adopted the following criteria with the intention of minimizing the margin of error: a) standardized instructions throughout data collection; b) instruction regarding the technique in execution of the exercise; c) the appraiser will stay intent during all the execution of the movement to avoid erroneous interpretations of props up them obtained, d) verbal encouragement of the participants during execution of the movement, and e) survey of the weights used in the study with a precision scale.

Table 1. Anthropometric characteristics

Variable	M \pm SD
Age (years)	69.1 \pm 4.7
Height (cm)	152.6 \pm 10.2
Body mass (kg)	62.4 \pm 12.6
BMI (kg/m ²)	26.3 \pm 2.9

The volunteers initially performed a warm-up as specified for the equipment with a load chosen for proper execution, which was comfortable for accomplishing 15 repetitions¹¹⁾.

At the end of the warm-up, they were instructed to perform the movement with one weight at time, as direct by the appraiser. In the case that they had enough strength for an additional movement, the load was increased and another attempt was executed after 3 to 5 minutes of rest, following the procedures of Fatouros et al¹⁰⁾. It is worth emphasizing that repetitions were considered valid when they were made with the complete cycle of movement and the appropriate technique. After 48 hours, the reproducibility of loads obtained in the first test was evaluated.

The data were tabulated and stored in a database developed using Microsoft Access 2003. All the data were analyzed using the PASW Statistics (version Windows), with level of significance stipulated as $p < 0.05$ for all the analyses. Descriptive statistics with measures of central trend and variability (mean and standard deviation) were used for characterization of the participants in the study. For verification of the normality of the data set, the Shapiro-Wilk test was used. Finally, analysis of variance (ANOVA) was used to analyze RPE and feelings of pleasure/displeasure and post hoc tests were used to identify the significant differences.

RESULTS

The anthropometric characteristics of the participants are presented as the mean (M) and standard deviation (\pm SD) in Table 1.

After one month (fifth week) of training, strength increased in all exercises, and after this period, only the pulldown exercise showed higher strength when comparing the first and fifth weeks ($p < 0.05$) (Table 2).

RPE decrease at the end of the first month, and it was significantly different only for leg curl at the end of the second month ($p < 0.05$) (Table 3).

The subjects reported feelings of pleasure for all the exercises, and in the leg extension, pulldown, and leg curl, the feelings of pleasure increased (Table 4).

Table 2. Loads of training at 70% of 1RM

Exercises	Week 1	Week 5	Week 8
Bench press	16.3 \pm 6.1	20.8 \pm 7.0 *	22.2 \pm 6.3 *
Leg curl	15.1 \pm 5.9	20.0 \pm 4.8 *	20.7 \pm 4.5*
Pulldown	24.3 \pm 4.5	27.0 \pm 5.2 *	28.6 \pm 5.4 *#
Leg extension	39.4 \pm 9.5	45.5 \pm 10.5 *	46.2 \pm 4.5 *

* Statistically different from the first week ($p < 0.05$)

Statistically different from the fifth week ($p < 0.05$)

Table 3. Perceptual responses during eight weeks of strength training

Exercises	Week 1	Week 5	Week 8
Bench press	3.9 \pm 1.7	3.5 \pm 1.3	3.8 \pm 1.4
Leg curl	4.7 \pm 1.4	3.4 \pm 1.6 *	3.7 \pm 1.8*
Pulldown	3.2 \pm 1.1	3.0 \pm 1.2	3.0 \pm 1.3
Leg extension	3.9 \pm 1.4	3.4 \pm 1.2	3.7 \pm 1.8

*Statistically different from the first week ($p < 0.05$)

Table 4. Responses regarding feelings of pleasure/displeasure feelings during eight weeks of strength training

Exercises	Week 1	Week 5	Week 8
Bench press	3.8 \pm 1.0	4.4 \pm 0.9	4.2 \pm 0.9
Leg curl	3.4 \pm 0.9	4.0 \pm 0.8*	4.0 \pm 0.9*
Pulldown	3.8 \pm 1.1	4.4 \pm 1.0	4.4 \pm 0.8 *
Leg extension	3.7 \pm 0.9	4.2 \pm 1.0 *	3.8 \pm 1.0

*Statistically different from the first week ($p < 0.05$)

DISCUSSION

The aim of the present study was to verify the effect of eight weeks of ST with a fixed routine on the behavior of RPE and feelings of pleasure/displeasure in elderly women performing physical exercises. Strength, as expected, increased within five weeks of training due to neural adjustments. RPE only showed a reduction in value in the fifth week in the leg curl exercise (Table 2). It is known that the elderly use the upper limbs more; however, locomotion levels tend to diminish, and thus the lower limbs are little stimulated. Moreover, the hamstring naturally possesses 40% less strength relative to compared with the quadriceps^{13, 14}). These facts are associated with the accentuated reduction in muscular strength in the process of aging in the elderly, and not performing physical exercise is possibly the cause of this¹⁵). After five weeks of training, the participants had probably obtained greater recruitment of motor units of strength, improving the intra- and intermuscular coordination and in this way diminishing the RPE in the leg curl exercise.

The mean RPE values for all the exercises at 70% of 1RM in present study were different from those reported in literature. According to the American College of Sports Medicine (ACSM), an intensity reaching of 60 to 70% of 1RM which would correspond to vigorous effort, is necessary for strength increases and hypertrophy to occur, and on the OMNI-RES scale (0 to 10 points), this would be equivalent to between 7 and 8 points and classified as “difficult”¹⁰). In the present study, the general mean value was 4 ± 1.5 and classified “a little easy”. Day et al.¹⁶), Gearhart et al.¹⁷), and Lagally et al.¹⁸) also found similar values for the intensity of 70% of 1RM not corresponding to the recommendations of the ACSM. Independent of this previous studies have demonstrated a well established concept, that is, performing a small number of repetition with higher percentages of 1RM as being more difficult than performing repetitions with lower percentages of 1RM¹⁹). However, they have not demonstrated a relation between the RPE and intensity (percentage of 1RM) of ST due to lack of control for different muscular contractions, that is, submaximal repetitions (12 repetitions to 30% of 1RM) versus maximal repetitions (4–5 repetitions to 90% of 1RM).

Maximum and submaximal muscular contraction induces different metabolic and neural responses, directly influencing the perception of effort¹⁹). In this regard, we believe that the results of the RPE may have been underestimated owing to the fact that the participants not having to perform the exercises until concentric failure. This contributed positively to their feelings, which were of pleasure for all the exercises. Ekkekakis et al.⁷) reported that low levels of effort perception provide pleasant feelings, contributing to adherence to physical exercise programs. The evidence found in this investigation corroborates the findings in the literature and demonstrates this inverse relation accurately; that is the lower the perceived effort, the greater the feeling of pleasure observed in the leg curl exercise⁶). However, curiously, even without changes in the RPE, the feelings of pleasure also increased in the pulldown and leg extension exercises over the eight weeks. Thus, it is perceived that the feelings of pleasure/displeasure feelings in ST are not solely modulated by the intensity of the exercise and RPE. From this perspective, we concluded that the physical and functional benefits obtained by increasing muscular strength in a chronic work seem to positively influence feelings independent of whether or not is reduced. Besides, the prescription of strength training with repetitions of 70% of 1RM without concentric failure increased muscle strength and, contrary to what we thought, did not cause feelings of displeasure. In addition, we observed that the feelings of pleasure/displeasure varied over the period of training, suggesting that they are capable of increasing the enjoyment levels of even for a prescribed intensity. The RPE underwent changes during the exercises due to differences in the movements, despite the percentage 1RM being fixed. Therefore, we suggest that further studies aim to verify other variations of strength training exercises and RPE responses along with the feelings of pleasure/displeasure.

REFERENCES

- 1) Camarano AA: O envelhecimento da população brasileira: uma contribuição demográfica. Rio de Janeiro: IPEA, 2002.
- 2) World Health Organization: Defining the problem of overweight and obesity: preventing and managing the global epidemic: report of a WHO consultation. Geneva, Technical Report Series, 2000.
- 3) Instituto Brasileiro de Geografia e Estatística: Síntese de indicadores sociais uma análise das condições de vida da população brasileira. Rio de Janeiro: IBGE, 2011.
- 4) Lee IH, Park SY: Balance improvement by strength training for the elderly. *J Phys Ther Sci*, 2013, 25: 1591–1593. [[Medline](#)] [[CrossRef](#)]
- 5) American College of Sports Medicine Position Stand: American College of Sports Medicine Position Stand. Exercise and physical activity for older adults. *Med Sci Sports Exerc*, 1998, 30: 992–1008. [[Medline](#)] [[CrossRef](#)]
- 6) Cox KL, Burke V, Gorely TJ, et al.: Controlled comparison of retention and adherence in home- vs center-initiated exercise interventions in women ages 40–65 years: The S.W.E.A.T. Study (Sedentary Women Exercise Adherence Trial). *Prev Med*, 2003, 36: 17–29. [[Medline](#)] [[CrossRef](#)]
- 7) Ekkekakis P, Parfitt G, Petruzzello SJ: The pleasure and displeasure people feel when they exercise at different intensi-

- ties: decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Med*, 2011, 41: 641–671. [[Medline](#)] [[CrossRef](#)]
- 8) Isangedy HM, Krause MP, Krinski K, et al.: Is the self-selected resistance exercise intensity by older women consistent with the American College of Sports Medicine guidelines to improve muscular fitness? *J Strength Cond Res*, 2013, 27: 1877–1884. [[Medline](#)] [[CrossRef](#)]
 - 9) Fatouros IG, Kambas A, Katrabasas I, et al.: Resistance training and detraining effects on flexibility performance in the elderly are intensity-dependent. *J Strength Cond Res*, 2006, 20: 634–642. [[Medline](#)]
 - 10) Garber CE, Blissmer B, Deschenes MR, et al. American College of Sports Medicine: American College of Sports Medicine Position Stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc*, 2011, 43: 1334–1359. [[Medline](#)] [[CrossRef](#)]
 - 11) Robertson RJ, Goss FL, Rutkowski J, et al.: Concurrent validation of the OMNI perceived exertion scale for resistance exercise. *Med Sci Sports Exerc*, 2003, 35: 333–341. [[Medline](#)] [[CrossRef](#)]
 - 12) Hardy CJ, Rejeski WJ: Not what, but how one feels: The measurement of affect during exercise. *J Sport Exerc Psychol*, 1989, 11: 204–317.
 - 13) Terreri AS, Greve JM, Amatuzzi MM: Avaliação isocinética no joelho do atleta. *Rev Bras Med Esporte Niteroi*, 2001, 7: 170–174. [[CrossRef](#)]
 - 14) Bittencourt NF: Avaliação muscular isocinética da articulação do joelho em atletas das seleções brasileiras infante e juvenil de voleibol masculino. *Rev Bras Med Esporte Niteroi*, 2005, 11: 331–336. [[CrossRef](#)]
 - 15) Grimby G, Saltin B: The ageing muscle. *Clin Physiol*, 1983, 3: 209–218. [[Medline](#)] [[CrossRef](#)]
 - 16) Day ML, McGuigan MR, Brice G, et al.: Monitoring exercise intensity during resistance training using the session RPE scale. *J Strength Cond Res*, 2004, 18: 353–358. [[Medline](#)]
 - 17) Gearhart RE, Goss FL, Lagally KM, et al.: Standardized scaling procedures for rating perceived exertion during resistance exercise. *J Strength Cond Res*, 2001, 15: 320–325. [[Medline](#)]
 - 18) Lagally KM, Robertson RJ, Gallagher KI, et al.: Ratings of perceived exertion during low- and high-intensity resistance exercise by young adults. *Percept Mot Skills*, 2002, 94: 723–731. [[Medline](#)] [[CrossRef](#)]
 - 19) Hardee JP, Lawrence MM, Utter AC, et al.: Effect of inter-repetition rest on ratings of perceived exertion during multiple sets of the power clean. *Eur J Appl Physiol*, 2012, 112: 3141–3147. [[Medline](#)] [[CrossRef](#)]