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ORIGINAL ARTICLE

Geriatrics, Gerontology and Aging

Affective response of postmenopausal women to resistance training on stable and unstable surfaces: a randomized cross-over study

Respostas afetivas de mulheres pós-menopausadas submetidas ao treinamento com pesos em superfície estável e instável: um estudo cross-over randomizado

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Abstract

Objective: To compare the affective response of postmenopausal women who undergo 6 weeks of resistance training on stable and unstable surfaces.

Methods: This randomized counterbalanced cross-over study carried included 14 postmenopausal women (55 [SD, 3] years; height 1.55 [SD, 0.03] m; body mass 78.70 [SD, 12.00] kg; and body mass index 32.80 [SD, 4.90] kg/m^2), who underwent 6 weeks of resistance training on stable and unstable surfaces. The participants were initially allocated to 1 experimental condition (stable or unstable) in a randomized counterbalanced manner. The intervention consisted of 8 exercises in 3 series of 8-10 repetitions, with intervals of 60-90 seconds, for 3 weeks. After the first 3-week protocol, they were switched to the other experimental condition for another 3 weeks. To evaluate affective response, the Hardy and Rejeski Sensation Scale was applied weekly at the end of each exercise and again at the end of the 6 weeks.

Results: Affective response was similar to the general affect observed at the end of the sessions (stable surface: 5.00 [3.00]; unstable surface: 5.00 [1.00]; p = 0.114), except for the bridge exercise (stable surface: 3.00 [2.00]; unstable surface: 4.00 [2.00]; p = 0.048]).

Conclusions: The affective response of these women was not affected by training on unstable surfaces, except for the bridge exercise, in which the unstable surface increased affective response

Keywords: affect; resistance training; postmenopause; postural balance.

Resumo

Objetivo: Comparar as respostas afetivas de mulheres pós-menopausadas submetidas a seis semanas de treinamento com pesos realizado em superfície estável e instável.

Metodologia: Trata-se de um estudo *cross-over*, randomizado e contrabalanceado realizado com 14 mulheres pós-menopausadas (55 ± 3 anos; estatura de 1,55 ± 0,03 m; massa corporal 78,70 ± 12,00 kg; e índice de massa corporal de 32,80 ± 4,90 kg/m^2) submetidas a seis semanas de treinamento com pesos em superfície estável e instável. As participantes foram alocadas, inicialmente, numa das condições experimentais de forma randomizada e contrabalanceada. A intervenção foi composta por oito exercícios em três séries de oito a dez repetições, com intervalos entre 60 e 90 segundos, durante três semanas. Para avaliação das respostas afetivas, foi aplicada a Escala de Sensação de Hardy e Rejeski ao fim da última série de cada exercício e ao final das sessões, durante as seis semanas.

Resultados: As respostas afetivas foram similares para o afeto geral observado ao final das sessões [Superfície estável: 5,00 (3,00); Superfície instável: 5,00 (1,00); p = 0,114], mas não para o exercício de ponte [Superfície estável: 3,00 (2,00); Superfície instável: 4,00 (2,00); p = 0,048)].

Conclusões: Conclui-se que as respostas afetivas de mulheres pós-menopausadas, observadas ao final da sessão, não foram afetas pela instabilidade. Contudo, as sensações de prazer, no exercício de ponte, foram maiores com a inserção da instabilidade.

Palavras-chave: afeto; treinamento com pesos; pós-menopausa; equilíbrio postural.

INTRODUCTION

Regular exercise has been recommended for improving the health level and quality of life of the Brazilian population. For adults, the Ministry of Health recommends 150 minutes of moderate physical activity or 75 minutes of vigorous activity per week to obtain health benefits, such as preventing and/or reducing mortality from chronic diseases and reducing weight, stress, and anxiety and depression symptoms.[1]

However, more than a quarter of the world's adult population (1.4 billion) is insufficiently active. In high-income countries 26% of men and 35% of women are considered insufficiently active, while in low-income countries 12% of men and 24% of women are considered insufficiently active.[2]

Among exercise-related factors, there is a positive relationship between feeling pleasure during physical activity and habitual engagement.[3] Exercise programs could be modified to add a greater feeling of pleasure, thus ensuring adherence and, consequently, improved health indicators. Given that resistance training effectively increases muscle strength[4] and several other parameters linked to health and functional autonomy,[5] the impact of affective response on resistance training has been investigated.

There is evidence that changing the intensity of resistance exercises does not affect the sensation of pleasure, and it can even reduce pleasure when performed until voluntary failure.[6] No differences in perceived effort and pleasure scores could be found between traditional resistance training methods and cluster sets.[7] However, studies on the use of unstable surfaces in resistance training are still scarce.

According to the literature, adding instability to resistance training can promote simultaneous gains in balance and muscle strength that are superior to traditional methods[8,9] and it can reduce the fear of falling.[10] This is because the imbalance produced by unstable surfaces is a greater challenge for the neuromuscular system, requiring adaptation and stabilization during movement.[11,12] The increased neuromuscular demand is due to proprioceptive stimulation through sensory input from mechanoreceptors in muscles, joint capsules, tendons, ligaments and skin.[13]

In view of the above, it is important to determine whether adding instability to resistance training, which can provide additional benefits to traditional resistance training,[8,9,14,15] produces displeasure due to the increased exercise complexity, ie, the need for strength and balance at the same time. The results may be important for interventions to maintain functional capacity, especially in post-menopausal women, who suffer from physiological changes that can influence affective responses to training, such as muscle fatigue, sleep-wake cycle disorders, chronic or persistent pain, and the harmful effects of premature aging.[16] Therefore, the objective of this study was to compare affective response in postmenopausal women who underwent 6 weeks of resistance training on stable and unstable surfaces.

METHODS

This quasi-experimental randomized counterbalanced crossover study of postmenopausal women was approved by the Universidade Federal Rural de Pernambuco Research Ethics Committee (number 35220014.1.0000.5207). All procedures adhered to national legislation and the Declaration of Helsinki.

The sample included postmenopausal women between 50 and 60 years old. The age group restriction was intended to create a minimally homogeneous sample, excluding women with premature menopause and those of advanced age. Menopause was considered a minimum of 12 months without menstruation or the use of hormonal contraceptives.[17] Exclusion criteria consisted of injury during the intervention, regardless of the nature, and inability to continue participating for any declared reason (eg, moving to another city or personal/family problems).

The study was conducted between February and May 2019. Eligible participants underwent an initial assessment consisting of anamnesis, collection of personal data (name, date of birth, date of last menstrual period, date of last hormonal contraceptive use), history of regular exercise (types and length of training in weeks/months/years), anthropometric data (weight, height and body mass index), and history of injuries and chronic diseases. After being informed about the risks and benefits of this research, the volunteers provided written informed consent to participate.

Before data collection, the researchers underwent the training protocol to ensure methodological rigor, in addition to evaluating the feasibility of methodological and operational procedures. The study took place in 2 stages: in the first, which lasted 2 weeks, the participants adapted to exercises in both the stable and unstable protocols. They were then allocated to a single experimental condition. The second stage consisted of 3 weeks of intervention

in the allocated condition. At this stage, affective response data on the stable and unstable exercise protocols were collected (Figure 1).

The training consisted of 8 exercises involving the lower and upper limbs and trunk. In the adaptation stage, there were 2 series of 7 or 8 repetitions for each exercise, with a 60- to 90-second recovery interval, while in the intervention stage this was increased to 3 series of 8 to 10 repetitions, maintaining the same recovery interval. At the end of the third week of the intervention, the experimental conditions were reversed for another 3 weeks. Both experimental conditions strictly followed the same volume, intensity, recovery intervals, and weekly frequency, differing only by adding unstable surfaces to the exercises, which are shown in Box 1. Affective response data were collected using the Hardy and Rejeski Sensation Scale (1989) at the end of each week of the intervention.[18] The scale was applied after the end of the last series of each exercise and 10 minutes after the end of the session. This instrument is an 11-point scale, with responses ranging from +5 to 5 and verbal descriptors for all odd numbers and 0: +5 ("very good"); +3 ("good"); +1 ("reasonably good"); 0 ("neutral"); 1 ("fairly bad"); 3 ("bad"); 5 ("very bad"). Positive numbers represent pleasure (positive affect) and negative numbers represent displeasure (negative affect). Previous studies have recommended this scale to measure affective response during exercise and to verify adherence to training/intervention programs.[19,20]

The data were processed and analyzed using IBM SPSS Statistics 20.0 (IBM, Armonk, NY, USA), Statistica for Windows 5.1 (StatSoft Inc., Minneapolis, MN USA), and GraphPad Prism 5.03 (GraphPad Software, Inc., Boston, MA, USA) Affective response, globally and for each exercise, in the first and last weeks were compared using the Wilcoxon test. For all statistical analyses, $p < 0.05$ was considered significant. The data are presented as median and interquartile range.

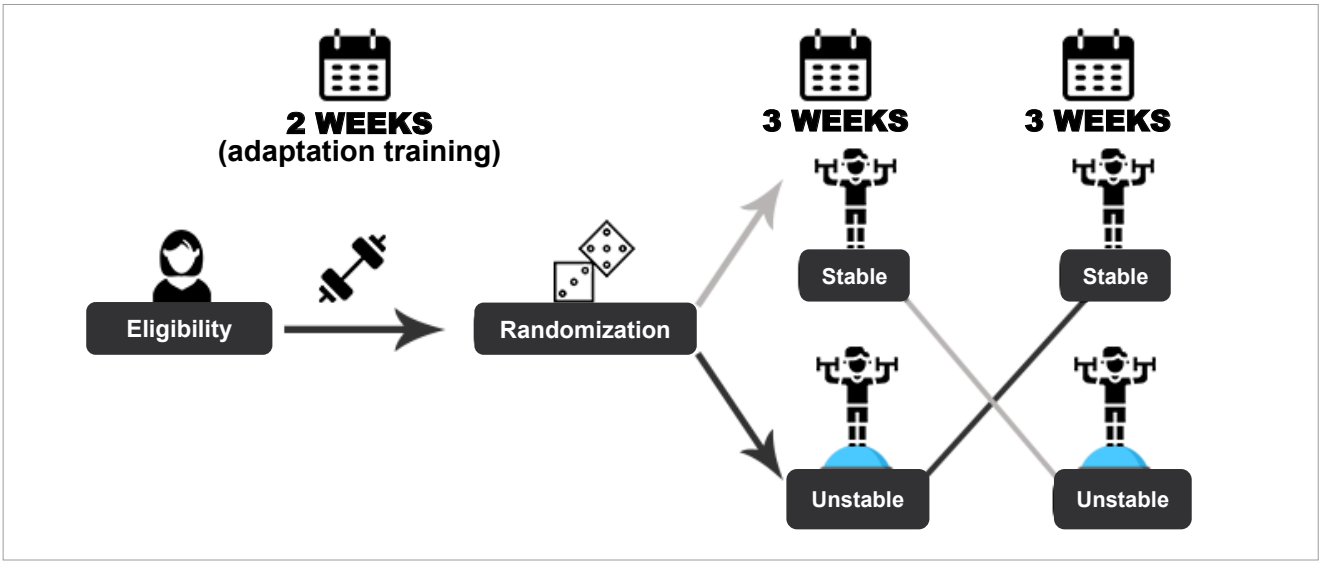

FIGURE 1. Infographic of the experimental design.

BOX 1. Description of exercises involving unstable surfaces, including the device and the supported body region.

Exercise	Device	Support location
Horizontal barbell bench press	Swiss ball	Trunk (supine position)
Barbell squats	Trampoline	Feet (bilateral)
Single-leg barbell row	Swiss ball and proprioception disc	Knee (Swiss ball) and hand (balance disc)
45º leg press	Bosu ball	Feet (bilateral)
Lying triceps extension	Swiss ball	Trunk (supine position)
Simultaneous curls	Swiss ball	Hip (sitting position)
Board	Balance disc	Feet (bilateral)
Bridge	Balance disc	Feet (bilateral)

RESULTS

Of the 30 initial volunteers, 14 completed the study (Figure 2). Some dropouts were due to changes in address, work hours, other uninformed personal reasons, or pre-existing health conditions. The study included 14 postmenopausal women (55.00 [SD, 3.00] years; height 1.55 [SD, 0.03] m; body mass 78.70 [SD, 12.00] kg; and body mass index 32.80 [SD, 4.90] kg/m).

Surface type did not influence affective response at the end of the sessions or between the first and last weeks of the intervention (stable surface: median (interquartile range [IQR] 5.00 [3.00]; unstable surface: median [IQR] 5.00 [1.00]; p = 0.114). Positive affect predominated in both conditions; negative affect was only reported in the stable condition (7.14%). A significant difference in affect was only observed for the bridge exercise (Table 1).

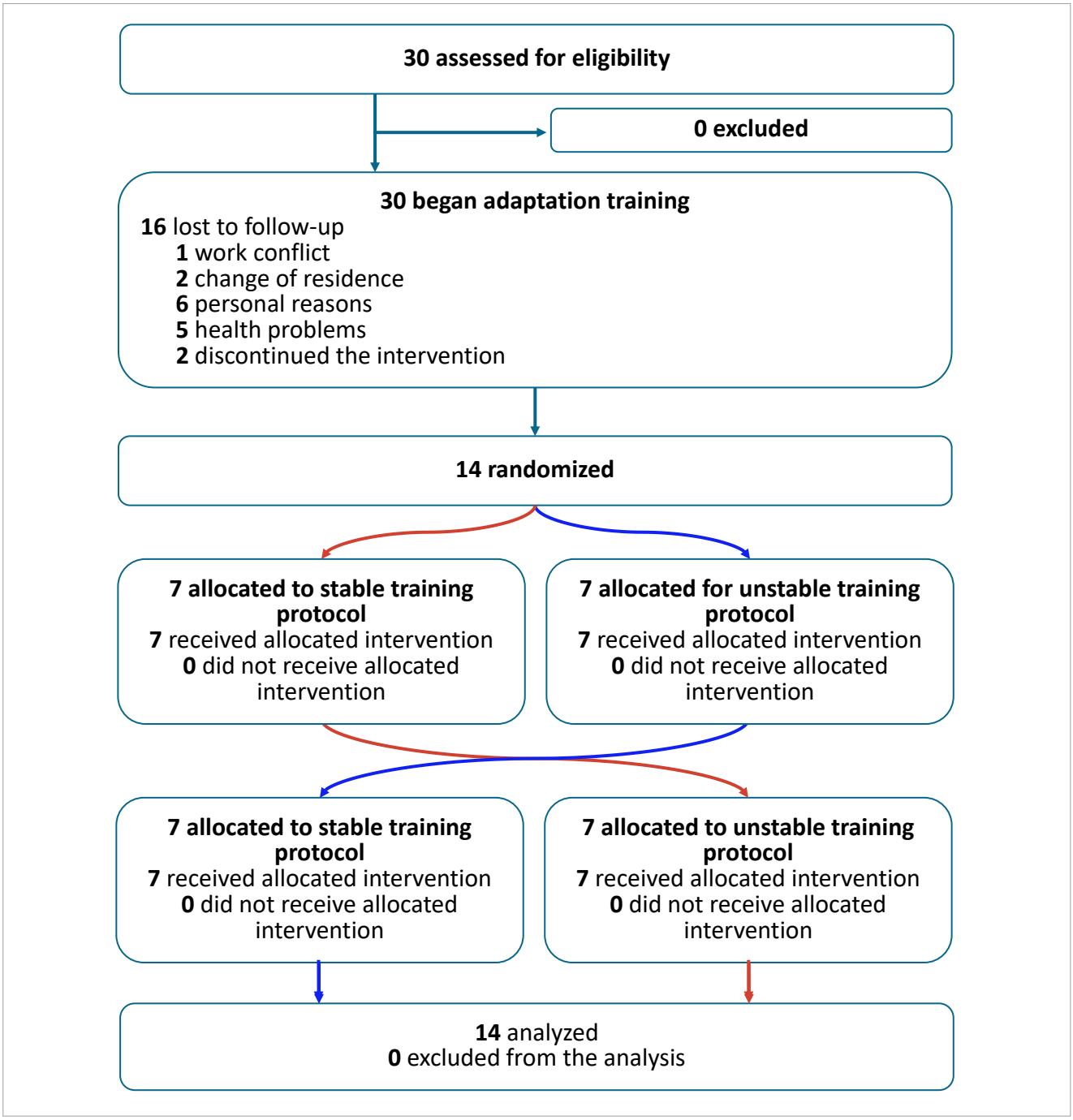

FIGURE 2. Participant flowchart.

DISCUSSION

Adding unstable surfaces to resistance training did not negatively impact the affective response of the participants. In general, affective response at the end of the sessions and in the intra-exercise comparison varied between "pleasant" and "very pleasant". It should be pointed out that the responses were similar in all tested conditions.

One possible explanation for this similarity is that the sessions were supervised by the researchers.[21] Supervision may have increased the participants' perceived safety level during the unstable exercises. Thus, contrary to expectations, the greater neuromuscular demand under these conditions[22] was not considered sufficiently problematic to produce displeasure.

Affect was also similar among the individual exercises in both conditions, except the bridge exercise. For this exercise, participants had to remain in a static position with their torso suspended while raising their hips and supporting their feet on a balance disc. However, even given the complexity of the task, instability increased the perception of pleasure. One explanation for this could be perceived self-efficacy, ie, when people feel more capable, they tend to perform tasks with greater ease and motivation,[23] which reinforces the idea that unstable surface conditions increase affect.

Considering that affective response was similar across conditions, it may be assumed that adherence to resistance training will also be similar with or without unstable surface conditions during training sessions. Thus, unstable surfaces can be incorporated into resistance training without compromising affective response in short-term interventions.

A systematic review[24] of 94 clinical trials (9821 older adults) involving different exercise interventions found balance improvement in only 11 of 22 trials involving resistance training. The authors concluded that resistance training alone may not lead to significant balance gains in older adults.

It is possible that adding unstable surfaces to resistance training can improve balance, considering that resistance training is not very effective for this purpose. For example, benefits in muscle strength, balance, and apprehension about falling have been observed in other studies that compared instability training with resistance training on a stable surface.[8-10] The main difference was that unstable surfaces stimulate proprioception by increasing neuromuscular demand.[13] However, the unpredictable movements involved in training on unstable surfaces can pose a risk to joints.[25]

This study involves some limitations, including:

1. the small number of participants who completed the protocol, which made more robust statistical analysis and, consequently, extrapolation of the results unfeasible;
2. the short study training protocols, which could have been extended for additional weeks;
3. the lack of a washout period between interventions;
4. we did not control for medication use, sleep status, mood, or other variables that could have influenced the results.

However, the strength of this study is that it is the first to investigate affective response to a resistance training intervention involving unstable surfaces.

As a practical application, resistance training involving unstable surfaces does not lead to discomfort in post-menopausal women, which may improve adherence to training regimens and promote benefits, such as greater balance and coordination and a lower risk of injury due to increased proprioception, motor skills, and intra- and intermuscular coordination.[25] In terms of scientific advancement, this study increases the feasibility of research on strength training on unstable surfaces among older adults and its potential psychometric benefits.

TABLE 1. Comparison of affective response in the first and last week of the stable and unstable exercise conditions, considering the final series of each exercise.

Exercise	Stable surface	Unstable surface	p-value
Horizontal barbell bench press (score)	5.00 (1.00)	4.00 (2.00)	0.438
Barbell squats (score)	4.00 (2.00)	4.00 (2.00)	0.492
Single-leg row with barbells (score)	4.00 (2.00)	4.00 (2.00)	0.416
45° leg press (score)	4.00 (2.00)	4.00 (2.00)	0.263
Lying triceps extension (score)	4.00 (3.00)	5.00 (1.00)	0.118
Simultaneous curl (score)	4.00 (3.00)	4.00 (2.00)	0.168
Board (score)	3.00 (4.00)	4.00 (2.00)	0.173
Bridge (score)	3.00 (2.00)	4.00 (2.00)	0.048*

Values expressed as median (interquartile range); data analyzed using the Wilcoxon test; *statistically significant difference.

Finally, future studies can focus on how affective response can positively or negatively influence regular exercise programs.

CONCLUSIONS

Including instability in resistance training did not negatively impact affective response in postmenopausal women at the end of the sessions. Although instability increased perceived pleasure in the bridge exercise, a more robust analysis is needed to clarify the relationship between resistance exercises involving unstable surfaces and perceived pleasure in postmenopausal women.

DECLARATIONS

Conflict of interests

The authors declare no conflicts of interest.

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Author contributions

DCL: conceptualization; data curation; formal analysis; investigation; methodology; project administration; visualization; writing – original draft; writing – review & editing. JDAS: formal analysis; investigation; methodology; visualization; writing – original draft. FDAA: formal analysis; investigation; methodology; visualization; writing – original draft. RRA: conceptualization; methodology; project administration; visualization; writing – review & editing; supervision. BQF: conceptualization; methodology; project administration; visualization; writing – review & editing; supervision. ALTP: conceptualization; methodology; project administration; visualization; writing – original draft; writing – review & editing; supervision.

REFERENCES

1. Brasil. Ministério da Saúde. Secretaria de Atenção Primária à Saúde. Departamento de Promoção da Saúde. Guia de Atividade Física para a População Brasileira [recurso eletrônico]. Ministério da Saúde, Secretaria de Atenção Primária à Saúde, Departamento de Promoção da Saúde. Brasília: Ministério da Saúde, 2021. https://bvsms.saude.gov.br/bvs/publicacoes/guia_atividade_fisica_populacao_brasileira.pdf
2. World Health Organization. Physical activity. 2022. Available from: https://www.who.int/news-room/fact-sheets/detail/physical-activity
3. Ekkekakis P, Hall EE, Petruzzello SJ. Variation and homogeneity in affective responses to physical activity of varying intensities: an alternative perspective on dose–response based on evolutionary considerations. J Sports Sci. 2005;23(5):477-500. https://doi.org/10.1080/02640410400021492
4. Radaelli R, Wilhelm EM, Botton CE, Rech A, Bottaro M, Brown LE, et al. Effects of single vs. multiple-set short-term strength training in elderly women. Age (Omaha). 2014;36(6):9720. https://doi.org/10.1007%2Fs11357-014-9720-6
5. Liu CJ, Latham NK. Progressive resistance strength training for improving physical function in older adults. The Cochrane Database Of Systematic Rev. 2009;3. https://doi.org/10.1002/14651858.cd002759.pub2
6. Vasconcelos GC, Damorim IR, Santos TM, Lima-Junior D, Fortes L. Acute effect of intensity and volume during strength training on sensation of pleasure, rating of perceived exertion, and pain in trained men. Hum Mov. 2023;24(1):104-13. https://doi.org/10.5114/hm.2023.107245
7. Vasconcelos GC, Costa BDV, Damorim IR, Santos TM, Cyrino ES, Lima-Junior D, et al. Do traditional and cluster-set resistance training systems alter the pleasure and effort perception in trained men? J Phys Educ Sports. 2019;19(suppl 3):823-8. https://doi.org/10.7752/jpes.2019.s3118
8. Eckardt N. Lower-extremity resistance training on unstable surfaces improves proxies of muscle strength, power and balance in healthy older adults: a randomised control trial. BMC Geriatr. 2016;16(1):1-15. https://10.1186/s12877-016-0366-3
9. Silva-Batista C, Corcos DM, Roschel H, Kanegusuku H, Gobbi LTB, Piemonte MEP, et al. Resistance Training with Instability for Patients with Parkinson's Disease. Med Sci Sports Exerc. 2016;48(9):1678-87. https://doi.org/10.1249/mss.0000000000000945
10. Silva-Batista C, Corcos DM, Kanegusuku H, Piemonte MEP, Gobbi LTB, Lima-Pardini AC, et al. Balance and fear of falling in subjects with Parkinson's disease is improved after exercises with motor complexity. Gait Posture. 2018;61:90-7. https://doi.org/10.1016/j.gaitpost.2017.12.027
11. Park SY, Yoo WG. Differential activation of parts of the serratus anterior muscle during push-up variations on stable and unstable bases of support. J Electromyogr Kinesiol. 2011;21(5):861-7. https://doi.org/10.1016/j.jelekin.2011.07.001
12. Wahl MJ, Behm DG. Not all instability training devices enhance muscle activation in highly resistance-trained individuals. J Strength Cond Res. 2008;22(4):1360-70. https://doi.org/10.1519/jsc.0b013e318175ca3c
13. Smith TO, King JJ, Hinh CB. The effectiveness of proprioceptive-based exercise for osteoarthritis of the knee: a systematic review and meta-analysis. Rheumatol Int. 2012;32(11):3339-51. https://doi.org/10.1007/s00296-012-2480-7
14. Pirauá ALT, Oliveira VMA, Cavalcante BR, Beltrão NB, Batista GA, Pitangui ACR, et al. Effects of 24 weeks strength training with and without unstable devices on strength, flexibility and quality of life in older women: A secondary analysis from randomized controlled trial. Isokinet Exerc Sci. 2020;29:1-9. https://doi.org/10.3233/IES-204187
15. Pirauá ALT, Cavalcante BR, Oliveira VMA, Beltrão NB, Batista GA, Pitangui ACR, et al. Effect of 24-week strength training on unstable surfaces on mobility, balance, and concern about falling in older adults. Scand J Med Sci Sports. 2019;29(11):1805-12. https://doi.org/10.1111/sms.13510
16. Mishra N, Mishra VN, Devanshi. Exercise beyond menopause: Dos and Don'ts. J Midlife Health. 2011;2(2):51. https://doi.org/10.4103/0976-7800.92524
17. Lumsden MA, Davies M, Sarri G. Diagnosis and management of menopause: the National Institute of Health and Care Excellence (NICE) guideline. JAMA Int Med. 2016;176(8):1205-6. https://doi.org/10.1001/jamainternmed.2016.2761
18. Hardy CJ, Rejeski WJ. Not what, but how one feels: The measurement of affect during exercise. J Sport Exerc Psychol. 1989;11(3):304-17. https://doi.org/10.1123/jsep.11.3.304

19. Rhodes RE, Kates A. Can the affective response to exercise predict future motives and physical activity behavior? A systematic review of published evidence. Ann Behav Med. 2015;49(5):715-31. https://doi.org/10.1007/s12160-015-9704-5

20. Frazão DT, et al. Feeling of pleasure to high-intensity interval exercise is dependent of the number of work bouts and physical activity status. PLoS One. 2016;11(3):e0152752. https://doi.org/10.1371%2Fjournal.pone.0152752

21. Lacroix A, Hortobágyi T, Beurskens R, Granacher U. Effects of supervised vs. unsupervised training programs on balance and muscle strength in older adults: a systematic review and meta-analysis. Sports Med. 2017;47(11):2341-61. https://doi.org/10.1007/s40279-017-0747-6

22. Behm DG, Muehlbauer T, Kibele A, Granache U. Effects of strength training using unstable surfaces on strength, power and balance performance across the lifespan: a systematic review and meta-analysis. Sports Med. 2015;45(12):1645-69. https://doi.org/10.1007/s40279-015-0384-x

23. Souza I, Souza MA. Validação da escala de autoeficácia geral percebida. Rev Univ Rural. 2004;26(1-2):12-7.

24. Howe TE, Rochester L, Neil F, Skelton DA, Ballinger, C. Exercise for improving balance in older people. Cochrane Database Syst Rev. 2011;11. https://doi.org/10.1002/14651858.cd004963.pub3

25. Souto Maior A, Moraes ER, Santos TM, Simão R. Análise da força muscular em indivíduos treinados na plataforma de instabilidade. Rev Bras Ciênc Mov. 2006;14(2):41-8.