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Protocol paper

Resistance training programs on bone related variables and functional independence of postmenopausal women in pharmacological treatment: A randomized controlled trial

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ABSTRACT

Introduction: Osteoporosis is a chronic disease that leads to bone fragility and is associated with fracture risks and serious consequences for mobility.
Objective: To verify the effects of two linear programs of resistance training (RT) on bone mineral density (BMD), functional autonomy (FA), muscular strength and quality of life (QoL) of postmenopausal women in pharmacological treatment.
Study design: Randomized controlled trial, code: RBR-6bqsw8.
Methods: 52 volunteers were distributed into three groups, according to randomly parallel form: RT3times-per-week (RT3, $n = 20$); RT2times-per-week (RT2, $n = 16$) and control group (CG, $n = 16$). The following assessment tools were used: bone mineral density (BMD) by dual X-ray absorptiometry, 'Latin America Group for maturity' (GDLAM) protocol for FA, 10RM test for leg exercises and the 'Osteoporosis Assessment Questionnaire' (OPAQ) for QoL. The physical activities were planned for 13 months in cycles with different intensities. A two-way *ANOVA* with *Bonferroni* post-hoc test were used.
Results: The results showed that the RT3/week was significantly more efficient ($p < 0.05$) compared with RT2/week, including: All BMD variables, FA ($\Delta\% = 29.3\%$), leg press at 45° ($\Delta\% = 24.97\%$) and OPAQ ($\Delta\% = 20.23\%$). In addition, both RT3 and RT2 groups were more efficient ($p < 0.05$) compared with CG, including: total BMD ($\Delta\% = 0.09\%$) and ($\Delta\% = 0.06\%$); FA ($\Delta\% = 7.1\%$) and RT2 ($\Delta\% = 3.78\%$); Leg press at 45° ($\Delta\% = 84.1\%$) and ($\Delta\% = 59.1\%$); keen extension ($\Delta\% = 15.28\%$) and ($\Delta\% = 20.37\%$); OPAQ ($\Delta\% = 57.61\%$) and ($\Delta\% = 37.37\%$), respectively.
Conclusion: The study showed that both experimental groups presented favorable results for BMD, strength, FA and QoL. However, the RT3 showed the best results compared to other groups after 13 months of intervention.

1. Introduction

The need for maintenance of physical activity (PA) 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

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psychological consequences (Cabral et al., 2014; Dantas, Figueira, Emygdio, & Vale, 2014).

Osteoporosis is a chronic disease of the skeletal system that leads to bone fragility and is associated with fracture risks and serious consequences for mobility (Kanis et al., 2013). In the elderly, bone fragility, sarcopenia, the risk of falls and the frequency of falls are the decisive factors that considerably affect the quality of life (QoL) (Kanis et al., 2013; Patel, Tweed, & Chinappen, 2005); moreover, these factors also affect the ability of the elderly to participate in daily activities, which consequently affects their functional autonomy (FA) (Cabral et al., 2014; Dantas et al., 2014; Kanis et al., 2013).

The women are more likely owing to the endogenous release of sex hormones and the absorption of the mineral calcium (Ca) (Kanis et al., 2013; Pinheiro, Ciconelli, Jacques et al., 2010). In addition to gender, other risk factors associated with osteoporosis include genetic inheritance, European descent, age, calcium deficiency, excessive consumption of tobacco and alcohol, diseases and medications related to low bone mineral density (BMD) and physical inactivity (Pinheiro, Ciconelli, Jacques et al., 2010). Among women, other risk factors were associated to recurrent falls: age, previous fracture, sedentary lifestyle, poor QoL, diabetes mellitus and current use of benzodiazepine (Kanis et al., 2013; Pinheiro, Ciconelli, Martini et al., 2010).

Pharmacological treatment, with the use of alendronate (bisphosphonate), also efficiently controls the bone loss, acting as an inhibitor of the bone resorption caused by the osteoclastic action (Kanis et al., 2013; Langdahl, 2011).

Considering all of the risk factors, special attention should be given to physical inactivity. The appropriate regular PA is recommended for their beneficial effects on BMD and for the maintenance FA and QoL (Park et al., 2013; Pinheiro, Ciconelli, Jacques et al., 2010).

The relationship between low BMD and PA level was first suggested in the 1940s by the related case of osteoporosis in an immobilized boy (Albright, Burnett, Cope, & Parson, 1941). In contrary, bone mass in athletes who weight train is greater than athletes who do not weight train. This can be explained because the effect of exercise on bone is thought to be due to a net increase in bone formation (Park et al., 2013; Rubin, Judex, & Qin, 2006).

In this study, special attention was given to PA because it has been considered a potential factor to both treatments: pharmacological associated and not associated with PA in this specific problem (Rubin et al., 2006). Given the different types of PAs, resistance training (RT) has been cited as an effective for the treatment of osteoporosis and sarcopenia; due to the increase in muscular strength, FA, QoL and BMD (Cabral et al., 2014; Cusller et al., 2005).

Considering the above, this study aimed to verify the effects of two linear programs of RT on BMD, FA, muscular strength and QoL of postmenopausal women in pharmacological treatment. Our major hypothesis is based on the assumption that resistance training 3 times per week results in more pronounced stimuli than resistance training 2 times per week and should be more effective in maintaining or increasing bone density in postmenopausal women with pharmacological treatment compared to controls with pharmacological treatment without exercise.

2. Material and methods

2.1. Participants

The volunteers residing in Tucuruí (Pará-Brazil) were recruited via local radio and television programs. Registrations of volunteers were performed in campus XIII of State Pará University in the municipality of Tucuruí. The participants performed diagnostic

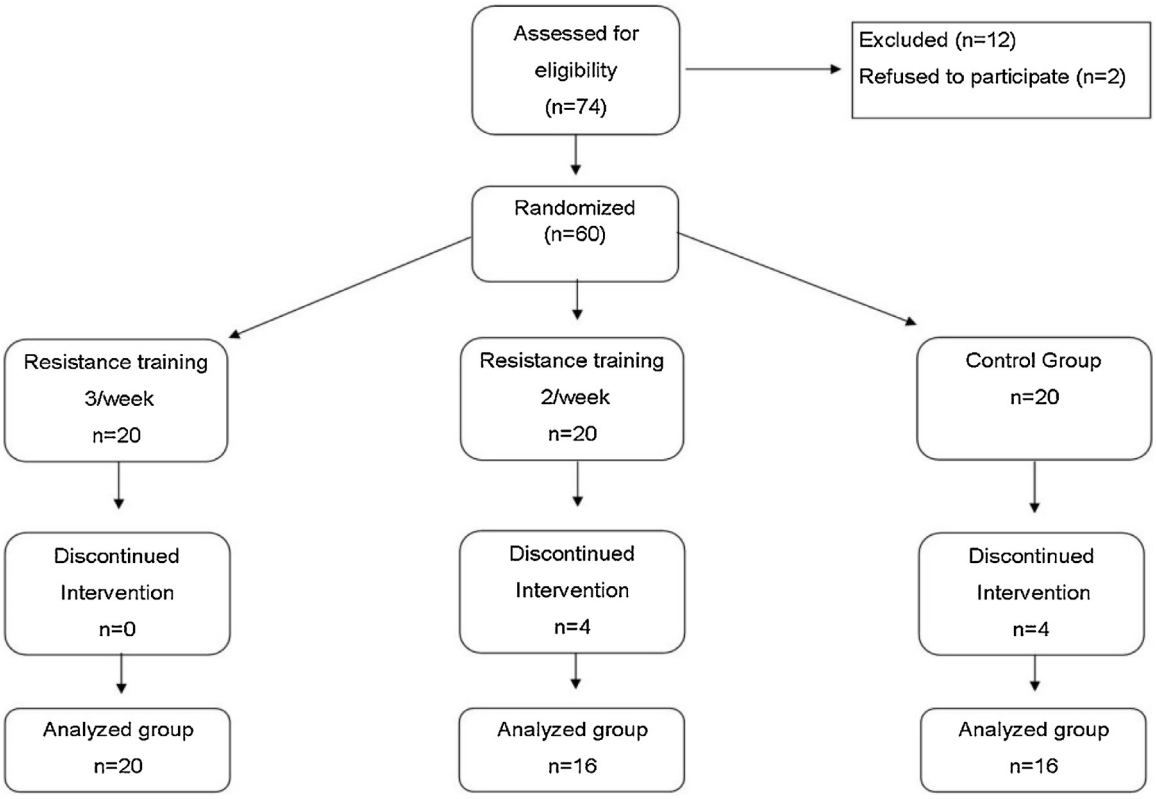

Fig. 1. Diagram of the sample selection process for this study.