"The Effect of Aerobic Exercise on Bone Formation and Resorption Markers And The Quality of Life Tests in Postmenopausal Osteopenic Patients"

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Declaration of conflicting interests

Kübra Nur Deniz and Meliha Kasapoğlu Aksoy declared no conflicts of interest with respect to the authorship and/or publication of this article.

Human Ethics and Consent to Participate declarations:

Ethical approval for the study was obtained from University of Health Sciences Bursa Yüksek Ihtisas Training and Research Hospital the local ethics committee (number 2011-KAEK-252022/10-02) at 19 Oct 2022, and with the Helsinki declaration and comparable ethical standarts.

Each patient included in the study was informed about the purpose of the study, the method of application, duration, possible problems and side effects, and signed a consent form.

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MATERIALS AND METHODS

This prospective, randomized, controlled, single-blind clinical study was planned at the Physical Medicine and Rehabilitation (PMR) Clinic of Bursa Yüksek Ihtisas Training and Research Hospital. Ethical approval for the study was obtained from the local ethics committee (number 2011-KAEK-252022/10-02). The study included volunteer participants who were postmenopausal women from Türkiye aged 45-65 years, who presented to the PMR clinic as outpatients between November 2022 and November 2023. Participants were selected based on bone mineral density (BMD) T-scores between -1 and -2.5, measured by dual-energy X-ray absorptiometry (DXA), and were evaluated according to the exclusion criteria to ensure eligibility for inclusion in the study. Patients with conditions other than osteoporosis that could affect the concentrations of bone formation and resorption markers, such as vertebral compression fracture, a history of traumatic or nontraumatic fractures in the past year, thyroid hormone disorders, parathyroid hormone disorders, liver function disorders, kidney function disorders, chronic heart failure, a history of malignancy, a history of rheumatological diseases, corticosteroid use, immunosuppressive drug use, anticonvulsant and heparin use, and those who could not complete sessions due to mechanical pain exacerbated during aerobic exercise on a treadmill (such as knee and hip osteoarthritis, back pain, etc.) were excluded from the study. Participants were determined to be in menopause by their gynecology and obstetrics doctors. FSH and estrogen levels, which can be used in the diagnosis of menopause, were not evaluated. Participants were not taking antiresorptive or anabolic agent treatments used in the pharmacological treatment of osteoporosis or HRT, which can be used during menopause.

Fifty patients who met these criteria were included in the study. Each patient was informed about the purpose of the study, the application method, duration, potential problems, and side effects, and they signed a consent form. The patients included in the study were numbered and divided into two groups by simple randomization using the closed envelope method: aerobic exercise group (n=25) and control group (n=25). Three patients in the exercise group and two patients in the control group did not participate in the follow-up examination conducted in the 12th week, so the study included 45 patients (exercise, n=22; control, n=23) (Figure 1).

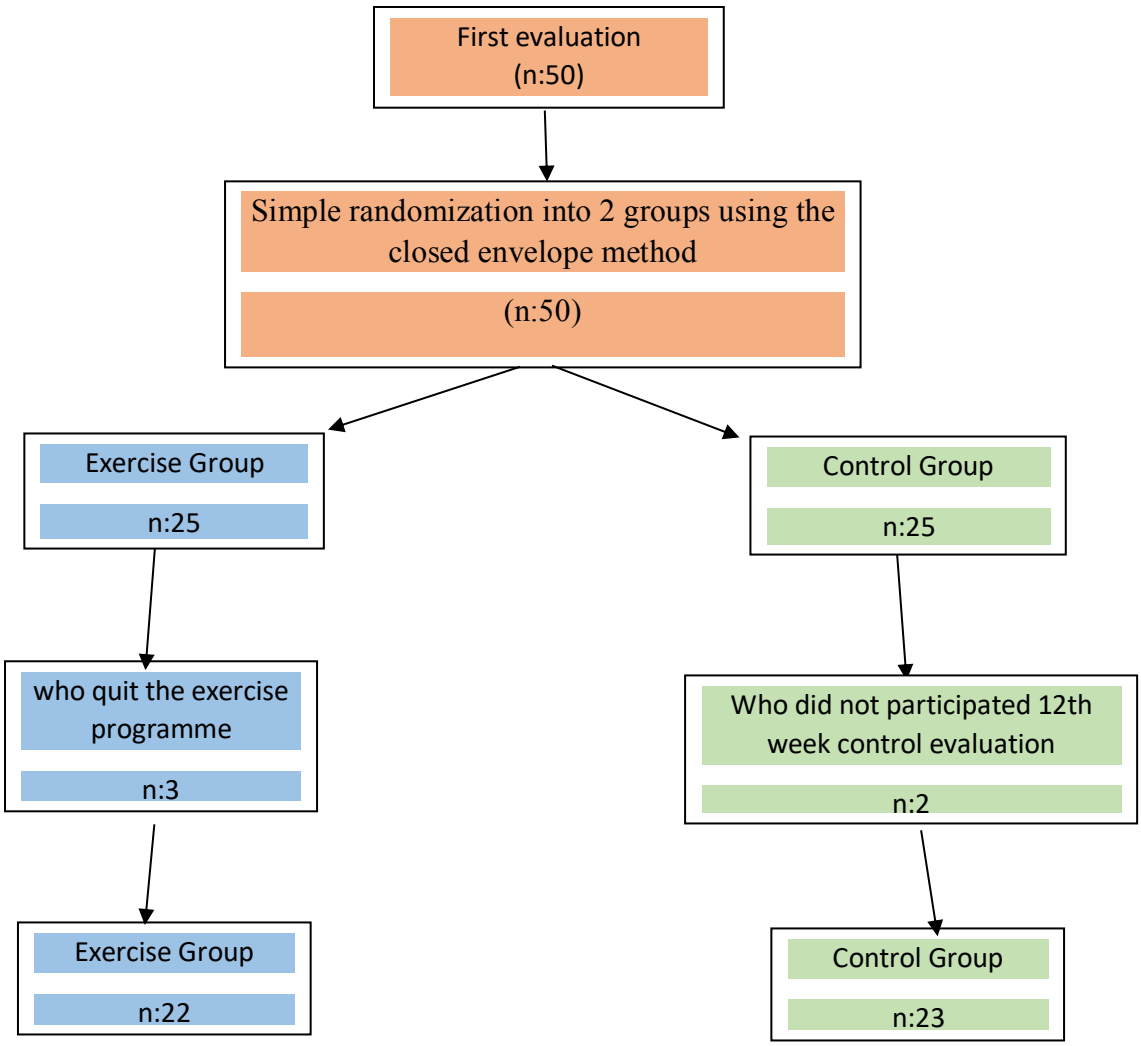

Figure 1

Treatment Protocol

All patients were prescribed 2000 IU of vitamin D (cholecalciferol) and 1200 mg of calcium carbonate daily for 12 weeks. The aerobic exercise program and assessments were conducted at the Exercise Room of Hospital. The exercise group participated in a supervised aerobic exercise program involving treadmill walking (model: Grand Power: 2.5 HP, DP2011017654) for 4 weeks, 3 days a week, for 30 minutes a day, at an intensity of 40-60% of the maximal heart rate. Additionally, they were shown an exercise program at the initial assessment that included balance, posture, and endurance exercises using body weight and weights to be performed 3 days a week, with 3 sets of 10 repetitions. The exercise program consisted of a 10-minute warm-up, 30 minutes of aerobic exercise, and a 10-minute cool-down. All participants completed the exercise program under supervision. Blood pressure, pulse, and oxygen saturation were measured with a pulse oximeter before and after each exercise session. The control group was not included in any exercise program. Patients in the exercise group continued outdoor walking, balance, posture, and resistance exercises for up to 12 weeks of follow-up between November 2022 and May 2023 and were followed up by phone once a week.

Statistical analysis

SPSS version 25 statistical software was used for data analysis. Descriptive findings for categorical variables are expressed as percentages, and continuous variables are presented as the mean ± standard error and median, minimum, and maximum values. For binary analyses, the chi-square test was used for categorical variables, while the Mann–Whitney U test and the Wilcoxon signed-rank test were employed for continuous variables since they did not meet the normal distribution prerequisites.