



Effects of a six-week Pilates intervention on balance and fear of falling in women aged over 65 with chronic low-back pain: A randomized controlled trial



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ABSTRACT

Objective: The purpose of our study was to evaluate the effects of six weeks of Pilates regarding functional balance, fear of falling and pain in community living women older than 65 years old with chronic low-back pain.

Study design: A single blind controlled randomized trial of six weeks of Pilates in addition to physiotherapy treatment ($n=50$) vs. physiotherapy treatment alone ($n=47$) was conducted on 97 community living women (71.14 ± 3.30 years) with chronic low-back pain (CLBP).

Main outcome measures: Main outcome measures were fear of falling (FoF), assessed by the Falls Efficacy Scale-international; functional mobility and balance, measured with the Timed up and Go Test; and pain, evaluated using the numeric rating scale.

Results: Only the Pilates group showed improvement in FoF (ES; $d=.68$) and functional mobility and balance (ES; $d=1.12$) after treatment, and also had better results in pain (ES; $d=1.46$) than the physiotherapy-only group.

Conclusions: Six weeks of Pilates exercises may be effective in fall prevention through the improvement of FoF, functional balance, and pain in Spanish women over 65 years old with CLBP.

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1. Introduction

The aging process is linked to the deterioration of some physical and psychological aspects such as strength and static and dynamic balance, as it down-regulates activity and increases the risk of falling in older populations [1,2]. A previous history of falls, being female, age, and gait alteration have all been associated with an increased fear of falling (FoF) [3]. The prevalence of FoF varies between 21% and 85% and is defined as “low perceived self-efficacy at avoiding falls during essential, nonhazardous activities of daily living” [4]. FoF has been identified as a common problem with potentially serious outcomes in older adults, especially in women [5] and it is considered as an intrinsic and modifiable fall risk factor

[6] which may lead to secondary degeneration of postural control, thus increasing even more the risk of falling [7].

Exercise is widely extended over fall prevention programs in elderly woman because of its positive effects on bone mass loss prevention, balance, muscle strength, flexibility, and general quality of life [8,9]. Pilates is an exercise modality which is associated with injury prevention and the improvement of balance, posture and psychological status life in older individuals [10]. It focuses on the motor control of deep trunk and pelvic floor muscles, as well as on lumbar-pelvic stabilization [11]. These muscular groups, the transversus abdominis and multifidus in particular, are usually inhibited in those with chronic low-back pain (CLBP), and their activation through the practice of Pilates has been linked to CLBP improvement [12,13]. CLBP is a common musculoskeletal disorder in older adults which is associated with functional difficulty [14], and the coordination of postural control may be affected in subjects with CLBP [15].

Although Pilates is widely extended and recommended by many physicians and physiotherapist for older population due to its

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positive effects on CLBP, balance and fall prevention, until recently there have been no studies evaluating the effects of Pilates in this population. The objective of the present study was to analyze the short term effects of Pilates and physical therapy on fall risk factors such as FoF, functional balance, and lumbar pain in community living women population older than 65 with low-back pain. We hypothesized that Pilates practice would result in balance, fear of falling, and pain improvement.

2. Methods

2.1. Participants and study design

The study was a single blind randomized controlled trial (NTC02371837) evaluating the effects of a six-week Pilates intervention on community living woman older than 65 years old with CLBP. All participants signed an informed consent form before the beginning of the study, which was approved by the Human Ethics Committee of the University of Jaén and conducted in accordance with the Declaration of Helsinki, good clinical practices, and applicable laws and regulations.

Community living women aged over 65 years with CLBP seeking physiotherapy treatment for LBP were eligible for recruitment. Inclusion criteria also included LBP for at least three months; absence of radiculopathy or other damages to the spine such as fractures, stenosis, or tumors; not being an habitual Pilates practitioner; and physical autonomy to perform basic daily activities. A total of 107 patients were screened for inclusion in the study and 103 met the inclusion criteria and accepted to be enrolled.

2.2. Experimental protocol

Patients included in the study were randomly allocated, using a computer-generated table of random numbers, to either a physiotherapy or Pilates group (PPTG) or to a physiotherapy-only group (PTG). A single independent investigator, who was blinded to group assignment, performed all assessments. Both groups received the same physiotherapy intervention during six weeks, two times per week, with the addition of Pilates exercise training for the PPTG. PTG treatment consisted in the application of Transcutaneous Electrical Nerve Stimulation (TENS) with a pulse frequency of 100 Hz for 40 min, and 20 min of massage and stretching of the low-back zone. In addition to this treatment, the PPTG also received two sessions per week of Pilates exercises (one hour per session). Patients were excluded if they missed more than three sessions during the six-week intervention. Patients were evaluated at baseline and after six weeks of treatment.

2.3. Outcome measures

The Falls Efficacy Scale-International (FES-I) [16] is a 16-item questionnaire which has demonstrated to be a valid and reliable instrument for measuring fear of falling in an older population, [17] and a useful tool with the power to predict risk of falling [18]. In this study, we have used the Spanish version of the FES-I, which has been validated for a postmenopausal population [19]. The FES-I evaluates a wide range of physical, social, and functional aspects related with concerns about falling. Total scores range from 16 (complete absence of concern) to 64 (extreme concern).

The Timed Up and Go Test (TUG) is a simple, valid, and reliable method to assess functional mobility and balance [20], and it has already been used in elderly women [21]. It is based on everyday activities and requires standing from a chair, walking three meters, turning around, and sitting down again [22]. The time required by the subject to complete this task is recorded. This has been reported

to be a useful tool for identifying community-dwelling adults who are at risk for falls [23].

The NSR is a 10 cm line marked with the numbers 0–10 and divided in equal intervals, and is considered to be a valid and reliable tool to measure pain intensity. A score of 0 indicates no pain, while 10 represents the worst pain imaginable. Patients circle the number that better represents their actual pain status [24].

2.4. Statistical analysis

Statistical analyses were performed using SPSS statistical software, version 17.0 (SPSS, Inc., Chicago, IL, USA). Mean values, standard deviations, number of cases, and the percentage of total for each variable of interest were calculated. Student's *t* test for independent samples and statistical Chi-square test were used to examine the differences between both study groups. A mixed variance analysis was employed in which therapeutic intervention (Pilates + physical therapy vs physical therapy) was the between-group factor and measurement time (pre-treatment – post-treatment) was the within-subject variable. Dependent variables were FoF, time to perform TUG test, and perceived low-back pain intensity. Separated analyses were performed for each dependent variable. A possible interaction between treatment × measurement time was examined. A *p* value below 0.05 was considered statistically significant. Intergroup effect sizes were

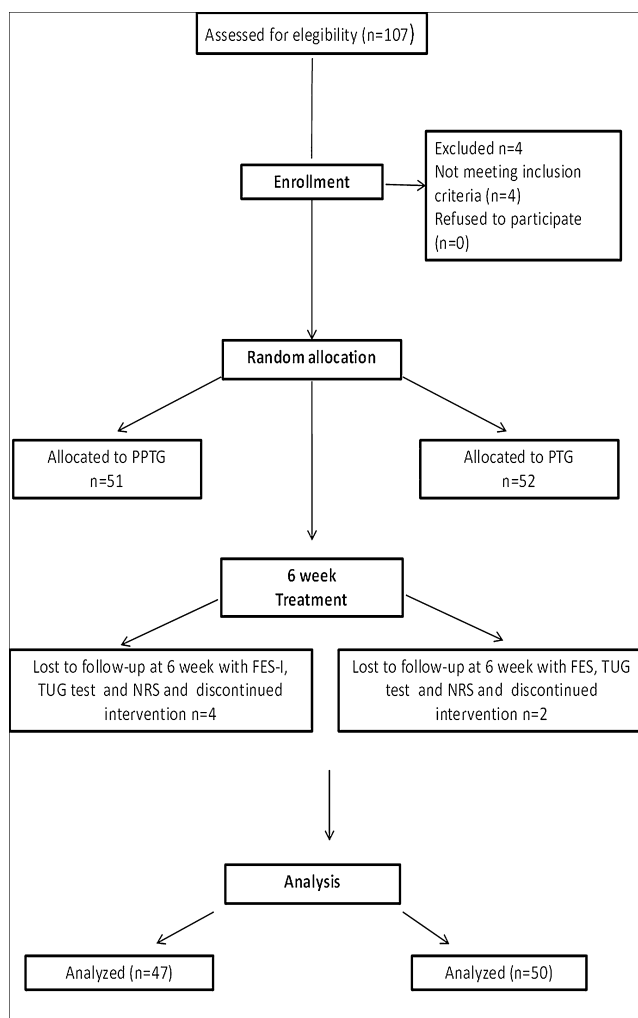


Fig. 1. Flow diagram of study design. PPTG: Pilates and physiotherapy group. PTG: physiotherapy group. TUG: Timed Up and Go test. FES-I: Fall Efficacy Scale International. NRS: Numeric Rating Scale.

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