



EXERCISE PHYSIOLOGY

The effects of Pilates-based exercise on dynamic balance in healthy adults

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Summary Professionals in theater, athletics, and rehabilitation settings have integrated Pilates-based exercise into their practice. The Pilates method of exercise claims to have several benefits including improving posture and improving balance; however, there are few studies to support these statements. We studied the effects of Pilates-based exercise on dynamic balance in healthy adults. A certified Pilates instructor conducted all exercise sessions. After completing 10 Pilates-based exercise sessions a significant change ($P = .01$) in dynamic balance was found in the functional reach test (FRT) mean scores in the exercise group ($n = 17$). The control group ($n = 17$) demonstrated no significant change ($P = .54$). The results suggest that Pilates-based exercise improved dynamic balance as measured by the FRT in healthy adults.

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Introduction

Pilates is an exercise system developed over a period of approximately 50 years, beginning in the 1920s by Joseph H. Pilates (Anderson and Spector, 2000). Pilates-based exercises can be performed on the floor, termed “mat work” by the Pilates community, or on a variety of machines, termed “apparatus work.” Perhaps the most commonly

used apparatus is the Reformer. The Reformer is a single bed frame that is equipped with a carriage that slides back and forth using springs to regulate tension and resistance. Cables, bars, straps, and pulleys allow a variety of Pilates-based exercises to be done from multiple positions (see Fig. 1). Postural muscles, including the transverse abdominis and internal and external oblique muscles, provide trunk stability, which is crucial to balance (Mullhearn and George, 1999). Pilates-based exercise incorporates the principles of trunk stability, which is also referred to as core stability or core control (Akuthota and Nadler, 2004). According to

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Figure 1 Pilates-based exercises including (A) tall arm series, (B) open leg rocker, and (C) leg press series.

Akuthota and Nadler, “the ‘core’ is described as a box with the abdominals in the front, paraspinals and gluteals in the back, the diaphragm as the roof, and the pelvic floor and hip girdle musculature as the bottom.”

Professionals in rehabilitation settings, theater, and athletics have integrated Pilates-based exercise into their practice. In addition to improving core stability and flexibility, Pilates-based exercise claims to improve balance, which may be helpful for improving athletic performance (Anderson and Spector, 2000; Hutchinson et al., 1998; Segal et al., 2004) Balance is described as being either static or dynamic. Dynamic balance requires moving a stable

postural set over a base of support and can be reliably measured using the functional reach test (FRT) (Duncan et al., 1990).

The FRT requires the subject to stand upright with feet approximately shoulder width apart and arms raised to 90° of shoulder flexion while making a fist.

A baseline measurement of the third metacarpal is taken using a wall-mounted yardstick and the subject is asked to lean as far forward as possible without changing their base of support.

A new measurement of third metacarpal position is taken and the total amount of excursion is recorded. The test is repeated a total of three times and the average excursion, in centimeters, is the FRT score (see Figs. 2A and B).

Hall et al. (1999) determined that Pilates-based exercise improved static balance in an elderly population. The effects of Pilates-based exercise on dynamic balance in healthy adults have not been previously investigated. The purpose of this study was to determine if Pilates-based exercise could improve dynamic balance in healthy adults using the FRT as the outcome variable.

Methods

Forty subjects were randomized into control ($N = 20$) and experimental ($N = 20$) groups with each group being pre-tested to obtain a baseline FRT measurement. The experimental group completed ten Pilates sessions within a 5-week period. Subjects were excluded if they had any medical condition that would impair their balance, had any heart-related conditions that would have prevented them from exercising, had previously participated in a Pilates-based exercise program, or subjects who had begun a new exercise program within the previous 6 months. All subjects voluntarily signed an informed consent form approved by the Loma Linda University Institutional Review Board prior to participation in the study. All Pilates exercise sessions were conducted by a certified Pilates instructor at the Loma Linda University Medical Center Outpatient Physical Therapy Department. No more than five subjects at a time attended an exercise session to assure proper supervision and correct performance of the exercises. All Pilates exercises were performed on a Reformer and included a tall arm series, open leg rocker, leg press series and tall kneel arm series (See Figs. 1A–C). The control group received no Pilates training during the five-week period

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