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EXERCISE PHYSIOLOGY: UNCONTROLLED CLINICAL TRIAL

The Pilates Method increases respiratory muscle strength and performance as well as abdominal muscle thickness☆

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Summary The aim of this study was to verify the effects of the Pilates Method (PM) training program on the thickness of the abdominal wall muscles, respiratory muscle strength and performance, and lung function. This uncontrolled clinical trial involved 16 sedentary women who were assessed before and after eight weeks of PM training. The thickness of the transversus abdominis (TrA), internal oblique (IO) and external oblique (EO) muscles was assessed. The respiratory muscle strength was assessed by measuring the maximum inspiratory (MIP) and expiratory (MEP) pressure. The lung function and respiratory muscle performance were assessed by spirometry. An increase was found in MIP ($p = 0.001$), MEP ($p = 0.031$), maximum voluntary ventilation ($p = 0.020$) and the TrA ($p < 0.001$), IO ($p = 0.002$) and EO ($p < 0.001$) thickness after the PM program. No alterations in lung function were found. These findings suggest that the PM program promotes abdominal wall muscle hypertrophy and an increase in respiratory muscle strength and performance, preventing weakness in abdominal muscles and dysfunction in ventilatory mechanics, which could favor the appearance of illnesses.

☆ Study developed at Centro Universitário Metodista, IPA, Porto Alegre, RS, Brazil.

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Introduction

The Pilates Method (PM) can be regarded as an exercise technique with a focus on body awareness, where body self perception is improved during its practice, thus connecting the body and mind. PM based exercises have been used for prevention, rehabilitation, physical conditioning (Andrade et al., 2015), and enhancement in mindfulness, associated with wellness (Caldwell et al., 2013).

Initially, the PM took the name Contrology because its creator Joseph Pilates believed that we should have a conscious control of our body movements (Barbosa et al., 2015). The PM is a comprehensive conditioning method that embraces six fundamental and interrelated principles: centering, concentration, control, precision, breathing and movement flow (Muscolino and Cipriani, 2004).

Contrology is the complete coordination of body, mind and spirit. It develops the body uniformly, corrects wrong postures, restores physical activity, invigorates the mind, and elevates the spirit (Muscolino and Cipriani, 2004).

Exercises based on PM principles have been widely used, both with the aid of specific equipment or on the floor on a Pilates Mat (Da Luz et al., 2013). The PM has become popular in rehabilitation and fitness programs. The aims of Pilates training are the improvement of general body strength and flexibility, with an emphasis on the core, good posture and alignment and breathing coordination with movement (Guimarães et al., 2012).

The core is the main focus of the PM and is composed of the abdominal muscles (rectus abdominis, internal and external obliques, transversus abdominis, lumbar paravertebral muscles, quadratus lumborum), hip extensors (gluteus maximus, hamstrings, adductor magnus), hip flexors (iliopsoas, rectus femoris, satorius, tensor fasciae latae), the pelvic floor musculature (perineal muscles) and diaphragm, which are responsible for the static and dynamic stabilization of the body (Muscolino and Cipriani, 2004).

Breathing control is fundamental during the execution of PM exercises, where the practitioner learns how to breathe properly as an essential part of each exercise through forceful exhaling followed by complete inhaling. Thus, adequate breathing aids in controlling movements (Pilates and Miller, 2010), and therefore, the method can be regarded as an indirect strategy for respiratory muscle training. It is known that poor control of breathing can result in compensation and lung volumes and respiratory muscle performance, with several factors involved. This is consistent with the literature, as seen in Hackett et al. (2013), showing a greater lung function in athletes when compared with sedentary individuals. People who perform physical activities regularly present greater respiratory endurance (Martin and Stager, 1981), as well as superior lung volume and inspiratory and expiratory flow rates than the general population (Morrow et al., 1989).

Recent studies have demonstrated that the PM leads to abdominal wall muscle hypertrophy, as assessed by magnetic resonance imaging (Dorado et al., 2012) and ultrasound (Critchley et al., 2011). In light of these findings, the hypothesis that even without the use of a specific training load on respiratory muscles, the PM can favor an increase in respiratory muscle strength and its performance appears plausible. Still, the influence of the PM on the lung function of healthy subjects needs further clarification, as the reports in healthy subjects are scarce and do not clearly state its relation to lung function (Niehues et al., 2015).

To provide a wide evaluation of the performance of the respiratory and abdominal muscles involved in the practice of PM, the aim of this study was to verify the effects of a PM Mat training program on abdominal wall muscles thickness, respiratory muscle strength and performance, and lung function in healthy women.

Methods

Subjects

This study is an uncontrolled clinical trial (register number on REBEC — Brazilian Register of Clinic Trials: RBR-538g6x) involving 16 voluntary women that are sedentary (not engaged in regular physical activity for at least 6 months), non-smoking, and inexperienced in PM, with no reports of lumbar pain, physical limitations, cardiorespiratory or musculoskeletal disease.The volunteers did not present a medical history diagnosed for any of the previously stated conditions, as well as any other which could interfere in the execution of the training program or results of the study.

The recruitment of the volunteers occurred in a non-probabilistic manner by convenience, through printing press adds, online social network promotion, free search for PM and posters placed in fitness gyms in the city of Santa Maria — RS, Brazil.

The research was conducted at the Prana Academia gym in Santa Maria — RS, Brazil. The project was approved by the Research Ethics Committee of the research origin institution under protocol number 271/2012, and all of the subjects were informed of the study procedures and signed the Free and Clarified Consent Term.

Assessments

All of the evaluations occurred before and after the 8 week PM training period, including an ultrasound (US) for measuring abdominal wall muscle thickness, a manovacuometry test for measuring respiratory muscle strength and spirometry for assessing lung function and respiratory muscle performance.

The abdominal wall US exam was conducted at a private company in Santa Maria/RS, where images were collected measuring the thickness of the following abdominal wall muscles: external oblique (EO), internal oblique (IO) and abdominis transversus (TrA), all in a resting position. The equipment used to verify muscle thickness in millimeters (mm) was a model My Lab 50x Vision, Esaote maker in B- Mode (Paris, France) with a linear 10 Hz transducer. The US image collection after training occurred 48 h after the last training session. The exams were performed by the same doctor, licensed in the US, who explained the exam procedures as the volunteer lay in the supine position in a suitable stretcher. The images were obtained with the transducer positioned anterolaterally on the right abdomen, centered between the