# The Effect of 2 Different Exercise Programs on Pain Intensity and Muscle Dimensions in Patients With Chronic Low Back Pain: A Randomized Controlled Trial

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## Abstract

**Objectives:** The purpose of this study was to compare the effect of 2 exercise programs combined with electrotherapy on pain intensity and lumbar stabilizer muscles dimensions in patients with nonspecific chronic low back pain.

**Methods:** A randomized controlled clinical trial was performed with 41 patients with chronic LBP. Participants were randomly allocated into 2 groups: an experimental group (n = 20) received stabilization exercises plus electrotherapy, and a control group (n = 21) received routine exercises plus electrotherapy. Pain intensity, using a visual analog scale, and muscle dimensions of both right and left transverse abdominis and lumbar multifidus muscles, using rehabilitative ultrasonography, were assessed before and immediately after 4 weeks of intervention.

**Results:** Significant improvement was identified after interventions on pain intensity and muscle size measurements in both groups ($P < .01$ in all instances). The only exception was the right-side lumbar multifidus cross-sectional area of the control group, which was not statistically significant ($P = .081$). No significant differences were found between the 2 exercise groups on pain intensity and muscle dimensions ($P > .05$ in all instances).

**Conclusions:** The results of this study suggest that a combination of electrotherapy with either routine or stabilization exercise programs may improve pain intensity and muscle dimensions in patients with nonspecific chronic low back pain. (J Manipulative Physiol Ther 2018;41:102-110)

**Key Indexing Terms:** *Low Back Pain; Stabilization; Exercise; Ultrasonography; Pain Intensity; Muscle; Thickness*

## Introduction

Nonspecific chronic low back pain (LBP) is among the most common musculoskeletal disorders, affecting 58% to 84% of people at least once in their lives.[1-5] It may result in pain, disability, and work absence. The annual prevalence of LBP was reported as 50% of working age adults.[3-5] The direct and indirect costs of LBP are as high as cardiovascular diseases, diabetes, depression, and headache.[4] In the United States, LBP was identified as the second most common reason for visiting a physician. Cost for treatment is estimated to be about $50 billion annually.[6] Although only a small percentage of patients with LBP develop chronic pain, this minority seems to be responsible for the huge direct and indirect costs of LBP.[6] Despite extensive investigations on the diagnosis of LBP, the exact pathology is still not clear. Among different causes of low back disorders, facet joint dysfunction, disc disorders, ligament or nerve problems, muscle weakness, and imbalance have been listed (defined as nonspecific LBP).[1] Other causes include tumors, congenital abnormalities, fractures, spinal injuries, and inflammatory and rheumatic diseases as well as sciatica (defined as specific LBP). Pain itself may lead to motor control dysfunction, which in turn can increase the pain intensity in a vicious cycle.[7,8]

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Various treatment programs, such as rest, medications, exercise therapy, traction, osteopathic treatment, manipulation, massage, and electrotherapy (eg, diathermy, laser, musculocutaneous and nerve electrical stimulation, and interferential currents) have been suggested for patients with LBP.[9-11] Among exercise programs,[12,13] a stabilization exercise program has received more attention within the past 2 decades. This program is commonly used for its short- and long-term advantages, including pain reduction and facilitation of the neuromuscular control at lumbar spine.[14,15]

Therapeutic exercise is considered as a treatment that encourages patients to engage their muscles. It is recommended as a complementary treatment after the acute phase of LBP. van Tulder et al[16] reported a significant effect of exercise therapy on chronic LBP. Exercises, which are routinely used in physiotherapy clinics, are mainly designed to activate paraspinal and abdominal muscles. Recently, exercises that are related to the engagement of stabilizer muscles[17] such as transverse abdominis (TrA), lumbar multifidus (MF), and internal oblique (IO) have received more attention. Unlike erector spinae and rectus abdominis (which seem to be involved in movement production), these muscles provide segmental stabilization by maintaining a neutral intervertebral position during exercises and functional activities.[18]

Co-contraction of deep muscles such as TrA, lumbar MF, and IO as well as pelvic floor muscles produce a force that may contribute to the stability of the spine through thoracolumbar fascia and interabdominal pressure mechanisms.[19] Accordingly, these muscles play a supportive role for the spine. For example, lumbar MF muscle resists the force coming from outside by engagement during the full range of spine movement and also during movements of upper and lower extremities. Because these muscles are always active during all activities of daily living and exercises, they do not need much power, although good endurance and coordination are required to keep the back in normal position through their constant activities.[19,20] Some techniques, such as magnetic resonance imaging,[21,22] electromyography (EMG),[23,24] and ultrasonography (US)[25-28] are available to detect changes in muscle activities and morphologies. US seems to be superior in terms of safety, accessibility, and cost.

However, because there is no general consensus on the effect of stabilization exercise programs in patients with LBP, the purpose of the present study was to evaluate the effect of 2 types of exercise programs on pain intensity and dimensions of TrA and lumbar MF muscles using US.

It was hypothesized that there would be a significant difference between a stabilization exercise program combined with routine physiotherapy and a routine exercise program combined with routine physiotherapy on pain intensity and dimensions of TrA and lumbar MF muscles using US. The purpose of this study was to compare the effect of 2 exercise programs combined with electrotherapy on pain intensity and lumbar stabilizer muscle dimensions in patients with nonspecific chronic LBP.

## Materials and Methods

### Study Design

A randomized controlled trial was designed to compare the effect of stabilization versus routine exercises on pain intensity and muscle dimensions in patients with nonspecific chronic LPB. Forty-one patients with nonspecific chronic LBP, who were referred by an orthopedic surgeon, were recruited in an outpatient orthopedic clinic. Sample size was estimated[1] on the basis of the power of the study $1 - \beta = 80\%$[2]; to detect the effect size of $d = 0.5$; and[3] to produce a significance level of $\alpha < 0.05$[4]; with a 95% confidence interval, that required 21 participants for each group. The participants were included if they were between 18 and 55 years old, had good general health (using the Farsi version of the 12-item General Health Questionnaire),[29] and were suffering from a nonspecific chronic LBP (with no clear pathologic cause) that had lasted for at least 12 weeks. The exclusion criteria were any history of pain, numbness, or urinary incontinence, indicating cauda equina syndrome along with LBP, and a history of spinal surgery. Patients with severe medical conditions (eg, osteoporosis, infections, neoplasm, and inflammatory diseases), structural abnormalities (eg, scoliosis), compression fracture, and pregnancy were also excluded. This study was approved by Medical Ethics Board at the University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. Participants provided their consent according to the ethical guidelines and principles of the international Declaration of Helsinki for research. The study was conducted from December 2012 to February 2014.

Patients were randomly assigned (using a block-style randomization scheme) into either an experimental group (n = 20) receiving electrotherapy and stabilization exercises or a control group (n = 21) receiving electrotherapy and routine exercises (Fig 1). A physical therapist was responsible for delivering treatments to both groups. Pain intensity was subjectively reported by participants, and muscle dimensions were measured by an experienced radiologist who was blinded to patients' allocation.

### Outcome Measures

Before implementing the intervention, participants were invited to receive oral and written information about the aims and purposes of the study. The patients then completed a questionnaire including questions on demographic data such as gender, weight, height, body mass index, history of back pain, and general health condition and pain intensity was assessed on a visual analog scale.[30] This was followed by measuring muscle dimensions (right and left TrA and MF muscles) by a radiologist using US (Ultrasonic-ES 500, Canada) with 2

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