



# Comparative effectiveness of Pilates and yoga group exercise interventions for chronic mechanical neck pain: quasi-randomised parallel controlled study

K. Dunleavy<sup>a,d,\*</sup>, K. Kava<sup>b</sup>, A. Goldberg<sup>a,e</sup>, M.H. Malek<sup>a</sup>, S.A. Talley<sup>a,e</sup>,  
V. Tutag-Lehr<sup>c</sup>, J. Hildreth<sup>a</sup>

<sup>a</sup> Wayne State University, Physical Therapy Program, Detroit, MI, USA

<sup>b</sup> Oakland Physical Therapy, Novi, MI, USA

<sup>c</sup> Wayne State University, Department of Pharmacy Practice, Detroit, MI, USA

<sup>d</sup> University of Florida, Department of Physical Therapy, Gainesville, FL, USA

<sup>e</sup> University of Michigan-Flint, Physical Therapy Department, Flint, MI, USA

## Abstract

**Objectives** To determine the effectiveness of Pilates and yoga group exercise interventions for individuals with chronic neck pain (CNP).

**Design** Quasi-randomised parallel controlled study.

**Setting** Community, university and private practice settings in four locations.

**Participants** Fifty-six individuals with CNP scoring  $\geq 3/10$  on the numeric pain rating scale for >3 months (controls  $n = 17$ , Pilates  $n = 20$ , yoga  $n = 19$ ).

**Interventions** Exercise participants completed 12 small-group sessions with modifications and progressions supervised by a physiotherapist.

**Main outcome measures** The primary outcome measure was the Neck Disability Index (NDI). Secondary outcomes were pain ratings, range of movement and postural measurements collected at baseline, 6 weeks and 12 weeks. Follow-up was performed 6 weeks after completion of the exercise classes (Week 18).

**Results** NDI decreased significantly in the Pilates {baseline: 11.1 [standard deviation (SD) 4.3] vs Week 12: 6.8 (SD 4.3); mean difference  $-4.3$  (95% confidence interval  $-1.64$  to  $-6.7$ );  $P < 0.001$ } and yoga groups [baseline: 12.8 (SD 7.4) vs Week 12: 8.1 (SD 5.6); mean difference  $-4.7$  (95% confidence interval  $-2.1$  to  $-7.4$ );  $P < 0.00$ ], with no change in the control group. Pain ratings also improved significantly. Moderate-to-large effect sizes (0.7 to 1.8) and low numbers needed to treat were found. There were no differences in outcomes between the exercise groups or associated adverse effects. No improvements in range of movement or posture were found.

**Conclusions** Pilates and yoga group exercise interventions with appropriate modifications and supervision were safe and equally effective for decreasing disability and pain compared with the control group for individuals with mild-to-moderate CNP. Physiotherapists may consider including these approaches in a plan of care.

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**Keywords:** Chronic neck pain; Yoga; Pilates

## Introduction

Chronic mechanical neck pain (CNP) affects 11% to 20% of working adults [1], and adversely influences an individual's ability to participate in activities of daily living. The prevalence and impact of CNP is increasing, with CNP ranked 21st out of 291 conditions for overall disease burden, and

\* Corresponding author. Address: University of Florida, Department of Physical Therapy, College of Public Health and Health Professions, PO Box 100154, Gainesville, FL 32610-0154, USA. Tel.: +1 352 273 6114; fax: +1 352 273 6109.

E-mail address: [kdunleavy@phhp.ufl.edu](mailto:kdunleavy@phhp.ufl.edu) (K. Dunleavy).

fourth for years lived with disability [2]. As with other chronic pain conditions, individuals with CNP often seek alternative or complementary methods for pain relief [3]. Evidence supports the use of cervical, scapulothoracic and upper quarter strengthening and stretching for CNP [4], which are components of both Pilates and yoga exercise methods. These exercise approaches have been used for physiotherapy treatment, postrehabilitation transition and community wellness classes [5,6], and there is a need to determine their effectiveness and safety for patient populations. Prior research of either approach has focused on low back pain [7–12] with limited investigation for CNP [13–15]. Although Pilates and yoga have been found to provide pain relief and improvement of function compared with minimal intervention for individuals with low back pain [7–12], to the authors' knowledge, no studies have compared the effectiveness of Pilates and yoga for individuals with CNP.

Pilates and yoga include a physical and mental focus using breathing control, spinal alignment and flexibility via multiple exercises. Pilates focuses on core stability and spinal alignment [16], whereas yoga combines specific postures, movement sequences, relaxation and meditation [17]. Both approaches are often provided in group formats, with instructors selecting and modifying the exercises and providing feedback on performance. Group exercise has the advantage of providing a cost-effective and efficient format, and may be useful for continued care of individuals with CNP; however, this has not been widely studied.

The Pilates principles provide static and dynamic postural alignment, along with distributed spinal mobility. Neuromuscular re-education concepts are used to develop optimal coordination of three-dimensional breathing, balanced spinal curvatures and scapulothoracic connection [16]. These concepts have evolved using current knowledge of motor learning, pain and muscle function principles. A small pre–post CNP pilot study reported improvements in Neck Disability Index (NDI) and Patient Specific Functional Index scores after 6 weeks of Pilates mat exercises [13].

Yoga aims to integrate mind, body and spirit focus for a positive impact on health. Yoga includes postures, breathing, meditation and mindfulness with general goals of relaxation, strength, endurance, flexibility and balance [18]. Room temperature, intensity and duration/pace of moving between postures vary between yoga styles. Cramer *et al.* [15] reported significant improvements for pain, NDI, quality of life and range of movement for individuals with CNP after 9 weeks of yoga group classes compared with home exercise.

The purpose of this study was to investigate the effectiveness of Pilates and yoga group exercise interventions on outcomes for individuals with CNP. It was hypothesised that 12 weeks of intervention would result in greater improvements in pain, functional ability, range of movement and posture compared with no intervention. Secondarily, it was hypothesised that there would be no differences in outcomes between the Pilates and yoga groups.

## Methods

### Participants

Participants were screened using medical history, and were included if they reported average Numeric Pain Rating Scale (NRS) scores  $\geq 3/10$  for  $>3$  months. Exclusion criteria included: cervical radiculopathy symptoms (numbness, tingling or weakness); cervical stenosis; spinal surgery; whiplash; medical conditions precluding exercise; easily aggravated pain with exercise; or current physical therapy, massage, chiropractic, Pilates or yoga management.

### Procedures

A quasi-randomised parallel controlled design was used. The study was approved by Wayne State University Institutional Review Board. Participants were recruited between 2010 and 2013 from an urban university setting, suburban physiotherapy clinics, fitness and community centres, and email lists. Participants were assigned to one of three groups based on geographic and time convenience: control, Pilates or yoga. When a class was full, participants were assigned to the control group. An a-priori power analysis estimated 90 subjects using the NDI ( $\beta = 0.80$ ). Outcomes were measured prior to the start of classes (baseline), and after completion of six sessions (Week 6) and 12 sessions (Week 12). Follow-up testing of the Pilates and yoga groups was performed 6 weeks after completion of the exercise classes (Week 18). Examiners completed a minimum of 15 hours of training to achieve consistency of testing procedures. Examiners were not blinded to the participant's intervention group due to location.

### Neck Disability Index

The NDI has 10 questions scored on a Likert scale (0 to 5), with higher total scores out of 50 indicating greater levels of perceived difficulty with activities of daily living due to neck pain. The NDI is a commonly used clinical outcome measure with good internal consistency, excellent test–retest reliability [mean retest difference  $-1.5$  (standard deviation (SD) 3)] and good construct validity [19]. The minimal detectable change is 4.7 to 5/50 for CNP [19].

### Pain ratings

Participants completed 11-point NRS instruments (0 to 10) including: (1) average pain over the past week; (2) pain evoked with upper-extremity movement with overhead reaching, lifting and carrying objects, dressing, grooming, meal preparation and housework; and (3) pain with sustained activity (e.g. sleeping, work, driving, sitting and standing). The means for upper-extremity pain and sustained-activity pain were reported. NRS reliability is moderate [intraclass correlation coefficient (ICC) 0.76], and the minimum clinically important difference is 1.3 points [20].

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