Research Article

Four-Week Outcomes Of Daily-Routine–Integrated Pelvic Floor Muscle Training With Diaphragmatic Breathing In Nonspecific Chronic Low Back Pain

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Abstract

Background: Although recruiting specific pelvic muscles and diaphragmatic breathing may help in rehabilitation of low back pain, these strategies have not been integrated into daily routines, and therefore, have not been directly tested. Objective: To evaluate and interpret the pelvic-floor evidence reported in the literature concerning pain and disability for a period of 4 weeks. Methods: A targeted publication review was conducted to identify 2020 to 2025 evidenced articles, and then separate the 4-week studies from systematic reviews. Results: In a 44-subject 4-week study, QUADRUPLE Visual Analogue Scale (QVAS) pain scores from 6.40 to 4.45; the difference between groups was nonsignificant (p= 0.379). Using the Oswestry Disability Index-Korean version (ODI-K), the pain levels also indicated significant improvement in the lower range from 17.32 to 9.45, versus 16.09 to 10.95 (p= 0.025). Another 22-person, 4-week diaphragmatic breathing study reported significant changes over time, but little between-group effects. Published systematic reviews and meta-analyses favored breathing and pelvic-floor interventions. Conclusion: Respiratory-related interventions may improve disability levels in a short time period; however, the 4-week pelvic-floor breathing intervention has not been studied.

Keywords: Chronic nonspecific low back pain; pelvic floor muscle training; diaphragmatic breathing; four weeks; disability; secondary data

1. Introduction

In 2020, an estimated 619 million cases of low back pain were reported, with an estimated 843 million cases expected by the year 2050 (GBD 2021 Low Back Pain Collaborators, 2023). The International Classification of Diseases (ICD-10 and ICD-11) describes chronic nonspecific low back pain (CNSLBP) as pain that has persisted for more than 12 weeks and has no identifiable pathology. Limitations caused by CNSLBP may affect an individual's ability to work and engage in social, family, and leisure activities, as well as their general quality of life (Roger et al., 2010).The current best evidence physiotherapy guidelines recommend active exercise and the appropriate activation of the localized muscles of the trunk, rather than advising patients to avoid activities and rest (George et al., 2021).

Techniques to improve lumbopelvic pressure and control may include diaphragmatic breathing and pelvic floor muscle training. Evidence suggests altered abdominal muscle function and recruitment in individuals with chronic low back pain (Rasouli et al., 2020; Arab et al., 2021). Therefore, diaphragmatic breathing and pelvic floor muscle training may provide an adjunct benefit for chronic low back pain.

While the effectiveness of routine integrated-diaphragmatic breathing and pelvic-floor muscle training for chronic low back pain has not been established, the integration of PFMT within routine activities has been found to be less of a burden compared to traditional clinical PFMT (Russ et al., 2020). This study investigates the feasibility and the direct effect of practice of this technique on pain, disability and muscle function. Indirect effects on other associated outcomes are described.

2. Literature Review

Bernard et al. (2021) conducted a systematic review to study the addition of PFMT to exercise for people with nonspecific low back pain and found limited and heterogenous randomized evidence. Lim et al. (2024) conducted a systematic review and meta-analysis and included 19 studies. Overall, the pooled analyses showed a large effect in pain

(SMD = −0.73, 95% CI = −1.10 to −0.36) and large mean effect in disability (MD = −5.21, 95% CI = −7.15 to −3.26), both rated as low certainty evidence. Studies were done in clinical populations including pregnant women and other clinical populations and therefore limited generalization to the healthy population with CNSLBP.

More evidence in the general population is available. Four-week studies in the respiratory system provide additional evidence. Oh et al. (2020) and Masroor et al. (2023) completed studies using core stabilization with respiratory training and diaphragm training. Otadi et al. (2021) included a different comparator using TENS. A systematic review (Jiang et al., 2024) evaluating 13 respiratory training trials reported a mean difference of 0.84 for pain and 0.74 for disability and reported durations of less than four weeks. Other longer duration interventions (>8 weeks) exist and show little to no retention of benefits after training ceased (Rabieezadeh et al., 2024). A study in telerehabilitation (Tawfek & Çil, 2025) found that the addition of supervision of a specific format for 12 weeks of rehabilitation improved pain and function. The study showed that a four-week combination of rehabilitation exercises and instructions is feasible.

3. Materials And Methods

Type of Design: structured secondary-data synthesis; not an original randomized trial.Identification of targeted literature and bibliographic verification: used PubMed/PubMed Central and full-text accessible journals; the Cochrane Library, PEDro, Google Scholar, and the Wikipedia library, informed the search, but an extensive search or a PRISMA complete screening was not performed. The search window was 2020-2025. The search combined the following: chronic low back pain, pelvic floor, diaphragmatic breathing, respiratory training, stabilization and interventions of 4 weeks. Unsupported record counts and/or meta-analytic re-estimations were not made.

Primary-outcome evidence comprised of randomized control trials of adult patients, which evaluated pain, disability and function of the trunk after approximately 4 weeks of an intervention of interest which encompasses elements of respiration and/or stabilization. Relevant reviews of 2020-2025 were used as contextual secondary evidence; their constituent studies often preceded 2020 and/or their pooled estimates were not 4-weeks only data. Evidence from studies of healthy subjects and evidence of studies of different diagnoses from direct efficacy were not evaluated. Long protocols were cited for context only.

The following were extracted from the primary studies where it was available: sample size, treatment schedules, baselines, follow-ups, means, p values, SMDs, confidence intervals and other statistics. QVAS was not replaced by NPRS and ODI-K. Derived change was determined by subtracting baseline by follow-up means; percentage reduction was determined by dividing baseline by follow-up and multiplying by 100. Published review estimates were displayed without modification or recomputing confidence intervals or overlapping trials. Where means and variances could not be determined, it was reported as not extracted. Fabrication of new data, e.g. from patient level observations, week-2 scores, and other tests was not performed.

4. Data Analysis And Statistical Findings

Table 1. Source characteristics and applicability to the four-week question

Study	n / duration	Intervention vs comparison	Applicability
Oh et al., 2020	44; 4 weeks	Resistance breathing + stabilization vs stabilization	Four-week QVAS and ODI-K
Otadi et al., 2021	24; 4 weeks	Diaphragm training + TENS vs TENS	Four-week pain and function
Masroor et al., 2023	22; 4 weeks	Diaphragmatic breathing + core exercises vs core exercises	Four-week NPRS and ODI
Lim et al., 2024	19 trials; mixed	PFMT + physiotherapy: review	Contextual pooled results
Jiang et al., 2024	13 trials; mixed	Breathing interventions: review	Contextual pooled results

TENS = transcutaneous electrical nerve stimulation. Review sample counts are numbers of trials, not participants in a new study.

Table 2. Verified four-week means from Oh et al. (2020), n = 22 per arm

Outcome / group	Baseline	Week 4	Derived Δ	Reduction
QVAS / resistance	6.44	4.58	-1.86	28.9%
QVAS / control	6.40	4.45	-1.95	30.5%
ODI-K / resistance	17.32	9.45	-7.87	45.4%
ODI-K / control	16.09	10.95	-5.14	31.9%

QVAS is reported in points on a 0–10 scale; ODI-K values are raw scores (maximum 45). Δ is calculated from displayed means. Published QVAS "post-pre" entries do not reconcile with the displayed means and are intentionally not repeated.

Within the Oh et al. trial, pain improved in both groups, but respiratory resistance did not improve QVAS more than stabilization alone (time × group p = .379). ODI-K showed a statistically significant interaction (p = .025), and the reported change-score contrast was p = .032. From displayed ODI-K means, the corresponding reductions were 45.4% and 31.9%; these are descriptive percentages rather than new tests. Neither arm directly practiced a prescribed independent PFMT program (Oh et al., 2020).

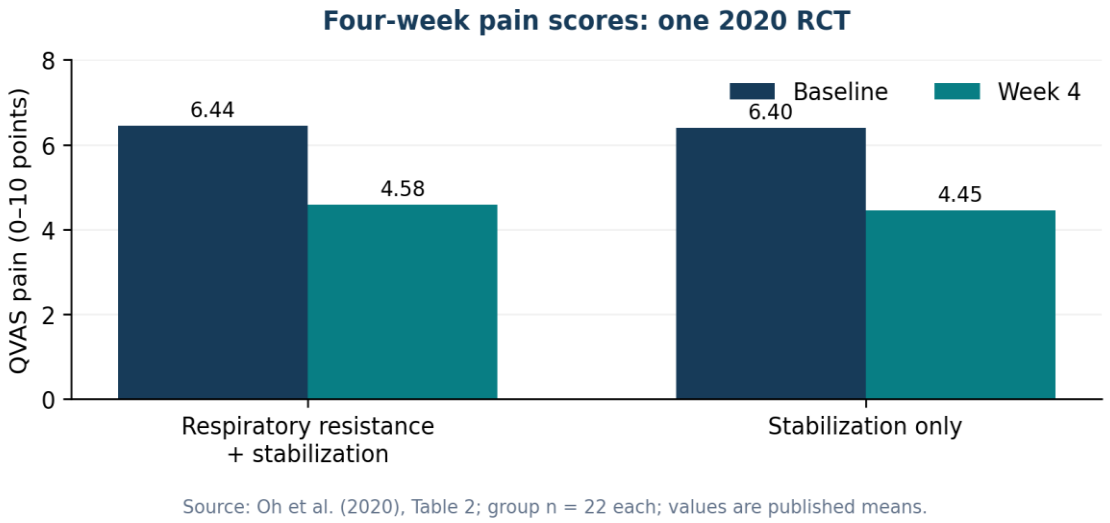

Figure 1. Published baseline and week-four QVAS means; this is not an NPRS measurement.

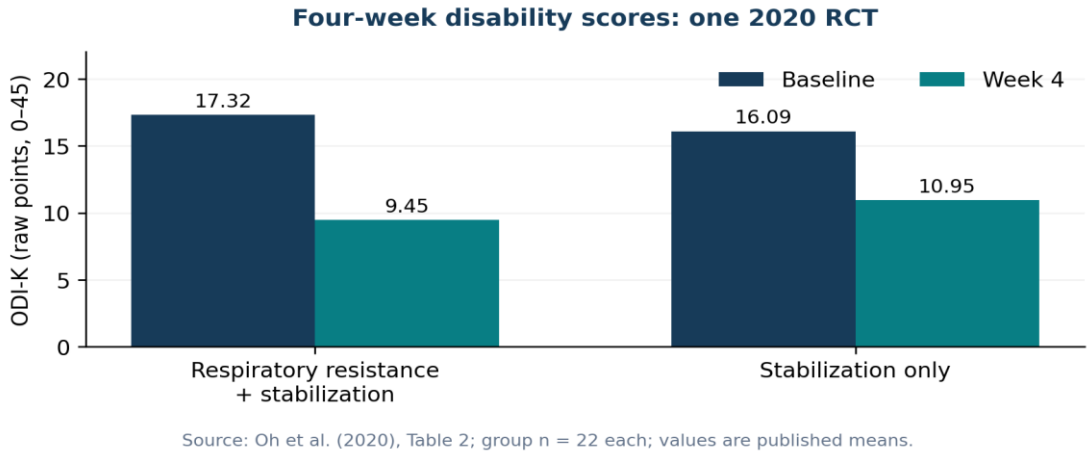

Figure 2. Published ODI-K means; raw scores are retained rather than assumed to equal generic ODI percentages.

Table 3. Reported inferential findings and contextual summary effects

Source / outcome	Reported result	Inference / limitation
Oh 2020 / QVAS	Interaction p = .379	No extra analgesic effect
Oh 2020 / ODI-K	Interaction p = .025	Favors added breathing resistance
Otadi 2021 / NRS	Interaction p < .001	Athletes; TENS co-intervention
Masroor 2023 / NPRS, ODI	Time effect p = .01; most interactions NS	Core exercise in both groups
Jiang 2024 / pain	SMD −0.84 [−1.24, −0.45]	Mixed-duration meta-analysis
Jiang 2024 / disability	SMD −0.74 [−0.95, −0.54]	Mixed-duration meta-analysis
Lim 2024 / pain	SMD −0.73 [−1.10, −0.36]	Low-certainty PFMT evidence

NS = not significant. Confidence intervals are 95%. Rows combine trial tests and previously published meta-analyses; they are not statistically interchangeable.

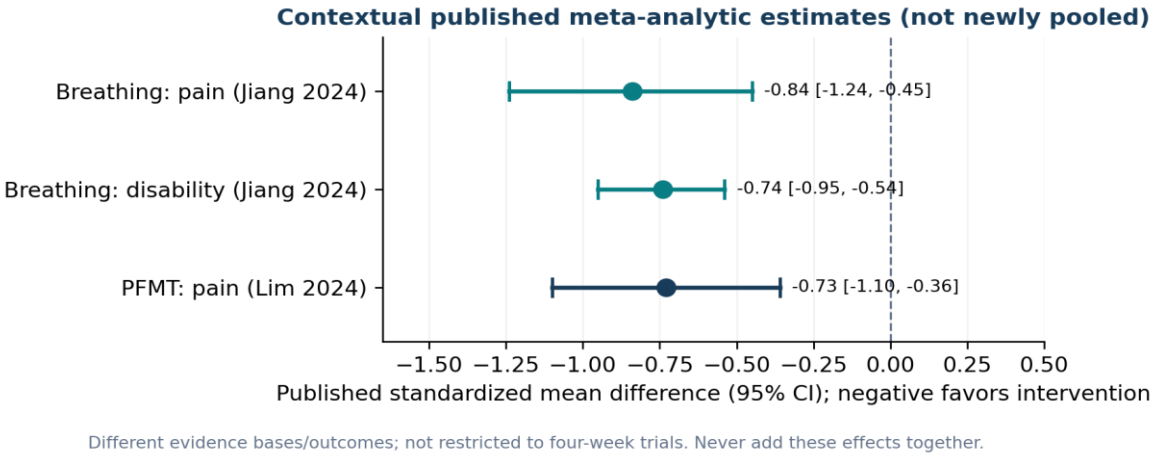

Figure 3. Forest-style display of independently published SMDs; the chart does not imply a new meta-analysis.

5. Results

Three relevant short-term randomized trials for respiratory interventions (Oh et al., 2020; Otadi et al., 2021; Masroor et al., 2023) were used for this review. While the total sample size of these studies was 90, the differences in the study populations, comparators and outcomes did not allow for a defensible pooled analysis. The Oh study was the only study that had the arm-level QVAS and ODI-K at baseline and after four weeks. As such, the results presented in this review are based on Oh et al. (2020) and are represented in Figures 1-2. It is important to note that these figures do not present an estimated trajectory.

Masroor et al. (2023) reported positive changes for multiple outcomes including pain and sleep, as a result of 12 (4 weeks of daily) diaphragm-based respiratory muscle training sessions. Significant change in right transverse-abdominis muscle (TrA) and chest wall expansion was not reported. Otadi et al. (2021) found a greater and earlier pain response to diaphragm training and TENS among amateur athletes, but the difference in the functional test was not significant (p = .09). A separate, low-certainty, mixed-population PFMT meta-analysis (2023) also suggested a pain-reducing effect; however, the four-week effect of diaphragmatic breathing coupled with PFMT in the daily routine cannot be defined by this analysis. No study directly assessed this intervention in the researched form.

6. Discussion

Findings help distinguish improvement over time from effect attributed to the addition of a respiratory component. Oh et al. (2020) noted more disability reduction but no additional QVAS reduction. Otadi et al. (2021), however, noted a stronger effect on

pain in four weeks with diaphragm training along with TENS. Masroor et al. (2023) also noted changes in pain and ODI, along with other respiratory and muscle changes, with TENS and diaphragm training. Variable direction and magnitude in effect size may be due to different baseline pathologies, adherence, co-interventions, instruments, and equipments used.

From a mechanistic viewpoint, it has been shown that balanced inhalation and exhalation may impact intra-abdominal pressure and the behavior of the diaphragm, abdominal, and pelvic floor muscles (Rasouli et al., 2020; Arab et al., 2021). Based on the observations, a hypothesis on the role of motor control may be plausible rather than a causal association for pain reduction. The review by Lim et al. (2024) is also positive, but the evidence was of low certainty and included populations like low back pain due to pregnancy.

Brief sessions integrated into the activities of daily living (e.g. sitting, standing, transitioning) could improve the practicality of respiratory rehabilitation. However, no studies have extracted and evaluated this type of program delivery or assessed adherence to it. The 2025 telerehabilitation study suggests that program supervision may be an important component, although the results of the 2025 study are based on 12 weeks, not 4 weeks (Tawfek & Çil, 2025). Other limitations include directed (not exhaustive) searching, small 4-week samples, possible review-study overlap, differing content of interventions, absence of standard deviations, and synthesis of results across studies. Change values in the source paper are inconsistent, and means are independently displayed. Using independently displayed values avoids a discrepancy.

4-week studies provide preliminary evidence that respiratory training integrated into rehabilitation has benefits on disability, pain, and muscle activation and balance outcomes. However, results are comparator-dependent and most of the evidence in favor of PFMT is from low to moderate quality reviews and syntheses. As such, there is no convincing evidence from 4-week studies for the integrated PFMT and diaphragmatic breathing program in daily activities. Evidence for this program should be examined in adequately powered randomized controlled trials to compare it against core stability exercises, report outcomes at baseline and week 4 (NPRS and ODI), and assess adverse events during the study and follow-up periods.

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