The Efficacy of Deep Belly Breathing (Adhama Pranayama) in Chronic Low Back Pain (CLBP): An Analytical Review

[1] Ms. Sandeep Kaur, [2] Dr. Sakshi Nagru

[1] Research Scholar, Department of Physical Education, Guru Kashi University, Talwandi Sabo, Bathinda

[2] Professor, Department of Physical Education, Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India

Email Id: [1] kaursandeep95922@gmail.com, [2] sakshinagru@gmail.com

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Abstract— *Chronic low back pain (CLBP) is the primary cause of disability globally and requires biopsychosocial management instead of molecular or structural explanations and/or pharmacological intervention alone. One example is Adhama Pranayama, which is often taught as low or diaphragmatic breathing; it may also enhance rehabilitation by synchronizing respiration with trunk stabilization and by decreasing arousal due to stress. Objective: This systematic review with meta-analysis aimed to evaluate clinical and mechanistic evidence for breathing exercises in adults with chronic non-specific low back pain. Recent systematic reviews, along with evidence from small randomized trials, suggest that breathing exercises alone or in combination with core stabilization and/or multimodal exercise are associated with short-term benefits in pain, disability, respiratory function, muscle activation and selected psychosocial outcomes. It is also believed that the diaphragm plays a role in anticipatory postural control and intra-abdominal pressure; thus, there may be a mechanism by which breathing retraining can affect lumbar stability. That said, the physiological results showing increased vagally mediated heart-rate variability and potential reduced autonomic arousal with slow breathing should not be misleadingly construed as providing evidence for a particular analgesic pathway in CHRONIC LOW BACK PAIN (CLBP).*

Keywords – Adhama Pranayama, chronic low back pain, diaphragmatic breathing, lumbar stabilization, pain self-management, slow breathing.

I. INTRODUCTION

Chronic low back pain is defined as pain located approximately between the lower rib margin and the gluteal folds that continues/reappears after 12 weeks. In 2020, it was estimated that as many as 619 million people suffered from low back pain [1], and it remains the leading global cause of disability in individuals, which is expected to grow as populations and their age increase [2]. The majority of presentations in primary care are grouped as non-specific because no single pathoanatomical lesion is sufficient on its own to account for the severity, duration, or impact on function of symptoms. This shift has led contemporary management to employ a biopsychosocial model in which factors such as tissue sensitivity, motor behavior, sleep, stress, fear & expectations, physical activity (PA), work, and psychosocial context can modulate pain [3].

This broader model is crucial because chronic pain does not equate to ongoing damage to connective tissue. Individuals with CLBP can show guarded movement, lesser trunk variability, breath-holding or shallow upper-chest breathing or more bracing while executing tasks considered challenging. Although those strategies can be protective in the short-term, they tend to raise exertion levels, fatigue levels, movement fear, and pain-attention. In a case-control study, participants with chronic non-specific low back pain exhibited more altered breathing during lumbopelvic motor-control tests compared to controls [4]. Imaging studies have also demonstrated

differential diaphragm position and postural behavior amongst patients with CLBP [5]. Although these observations do not demonstrate that dysfunctional respiration causes spinal pain, they provide a plausible framework for inquiring into the use of respiratory retraining as an adjunctive rehabilitation component.

Adhama Pranayama refers to a yogic lower-breathing practice that relies on relaxing expansion of the belly and lower rib area upon inhalation, followed by an effortless exhalation which is generally slower. In present-day rehabilitation lingo, it is largely identical to diaphragmatic or belly breathing. This practice is appealing due to the absence of equipment, various positions in which it can be taught, and possibly forming part of a home workout. However, being a popular choice and physiologically plausible does not equal clinical evidence. An analytical review has to separate direct evidence in CLBP from indirect evidence from an autonomic physiology perspective, and speculative claims that have not been tested in this population.

II. REVIEW OBJECTIVES

The objectives of this review are:

- To review the clinical evidence of breathing exercises, especially diaphragmatic breathing, for chronic non-specific low back pain;
- To explain the biomechanical, motor-control, autonomic and psychological mechanisms which appear important in benefit;
- To propose a clinically pragmatic method based on Adhama Pranayama with supplemental rehabilitation;
- Identify methodological weaknesses and priorities for future studies.

Since the studies identified use different terminology and frequently insert breathing during exercise, the review does not justify that every assessed protocol is equivalent to a traditional yogic technique but assesses Adhama Pranayama as a clinically relevant form of diaphragm breathing.

III. ADHAMA PRANAYAMA: CONCEPT & PRACTICE

It is also called the lower type of yogic sectional Breathing (i.e Adhama Pranayama). On inhale, the diaphragm descends, and the abdominal wall/lower lateral ribs are allowed to expand; on exhale, it relaxes and returns without forced contraction. So, the reason you SEE this abdominal movement is related to changes in pressure and volume, NOT because we screw up and tell our belly to bear down with momentum. The shoulders and upper chest should stay fairly quiet, and the jaw, pelvic floor, and superficial abdominal muscles should not be held tight.

Involving some of the aforementioned factors that are most essential for rehabilitation, as it makes it all a little easier to replace being aware, low effort, rhythmic, and programmed into movement. A novice can practice the technique lying in a supported supine position with one hand resting on the upper chest and the other hand at the level of their abdomen. Nasal inspiration lasting roughly three to four seconds may be followed by a relaxed expiration taking two or three times the length of time; e.g., holding your breath is not required and, more importantly, may cause dizziness, anxiety, or excess bracing in sensitive individuals. Once the pattern becomes comfortable, that same strategy should be practiced in sitting, standing, and if necessary, right up to lifting prep or the initial stages of any kind of gentle mobility activity. That maximum inhalation is not the goal; rather, efficient and benign breathing and trunk control can go hand in hand.

IV. REVIEW METHODOLOGY

Because of the variation in interventions (types, dosages, comparisons), we used a narrative analytic approach. We reviewed peer-reviewed clinical trials, systematic reviews, meta-analyses, biomechanical studies, and authoritative clinical guidance. Methods: Web searches were performed,

limiting the data to available articles published before October 2023 using search terms such as chronic low back pain, diaphragmatic breathing, breathing exercise, pranayama, respiratory muscle training, diaphragm muscular stabilization of a major component in the region with written stability diuretic change between abdominal cavity and thoracic experience of quantitative measure or-sensitivity Heart-rate variability (HRV), disability and fear avoidance. Adult studies of chronic non-specific low back pain were prioritized, as were mechanistic studies with direct relevance to postural and autonomic regulation.

Evidence was graded by study design, sample size, the use of breathing alone or with additional treatment, presence of an active control and clinical relevance of outcomes. As this is an analytical, but not a formally registered systematic review, it makes no claim about exhaustive retrieval upon which a PRISMA-based risk-of-bias assessment would be based. All conclusions should be viewed cautiously and updated when bigger trials are published.

V. EVIDENCE SYNTHESIS

A. Pain and Functional Disability

Earlier appraisal of the literature concluded that moderate, Grade B evidence supported including breathing exercises in the care of chronic non-specific low back pain, while emphasizing the small number of eligible studies and the need to integrate patient preference and clinical judgment [8]. An earlier randomized breath-therapy trial also reported clinically relevant improvement, although its intervention was broader than Adhama Pranayama alone [20]. Subsequent trials have strengthened, but not settled, the case. Finta et al. randomized individuals with chronic low back pain to a complex exercise program with or without additional diaphragm training. Pain improved in both groups, while the diaphragm-training group demonstrated changes in diaphragm thickness and selected lumbar stabilizer muscles, including transversus abdominis and multifidus [9]. These findings suggest a training effect on the deep trunk system, but they do not establish that diaphragm training alone was responsible for pain relief.

Masroor et al. compared core stabilization alone with core stabilization plus diaphragmatic breathing in 22 participants over 12 sessions. Both time-related improvement and selected interaction effects were reported for pain, disability, fear-avoidance beliefs, sleep quality, muscle activity, and chest expansion. However, between-group superiority was not uniform across all outcomes [10]. This nuance is clinically important: adding breathing may improve how an exercise program is performed or tolerated, even when it does not produce a large independent effect on every measure.

Recent meta-analytic evidence is encouraging. Jiang et al. Findings included pooled reductions in pain and Oswestry Disability Index scores, with standardized mean differences of nearly −0.84 (pain) and -0.74 (disability) [11]. An additional systematic review reached a similar conclusion in which breathing exercises may provide relief for low back pain but caution against certainty due to methodological quality and inconsistent protocol [12]. Pooled effects can be compelling, but combine interventions that range from diaphragmatic breathing and respiratory muscle training to yoga-based or multimodal programs [18]. The safest conclusion is that breathing exercises can provide short-term improvement in symptoms and function, particularly as an adjunct; however, data from large trials do not yet support efficacy of Adhama Pranayama as a stand-alone intervention.

B. Respiratory Function and Trunk Motor Control

The diaphragm plays a dual role, one pertaining to respiration and the other contributing towards posture. Electrophysiological studies in healthy adults showed anticipatory diaphragm activation prior to quick limb movement, suggesting its involvement in postural stabilization [6]. Co-activation of the diaphragm with associated abdominal muscles maintains intra-abdominal

pressure for prolonged periods during postural tasks [7]. These mechanisms help explain why a variety of systems cannot be fully separate from each other (such as respiration and trunk control).

Patients with CLBP may also show modified co-ordination rather than simple muscle weakness. Roussel et al. detected disrupted respiration during motor disruption tests [4], and Kolar et al. showed alterations in postural function and diaphragm position [5]. In addition, inspiratory muscle training has been related to changes in proprioceptive utilization with reduced low back pain [19]. These studies collectively suggest a model in which breathing retraining is used to decrease unnecessary breath-holding, improve management of intrathoracic pressure, and allow for more flexible activation of the diaphragm, abdominal wall, pelvic floor, and spinal extensors. They don't buy into the simplistic assertion that, with every patient, the diaphragm is "weak," or that abdominal expansion suddenly braces up and stabilizes their spine.

C. Autonomic Regulation, Stress, and Pain Perception

Slow voluntary breathing reliably influences cardiovascular autonomic markers. A systematic review and meta-analysis found that slow breathing increases vagally mediated heart-rate variability during practice and can produce post-practice effects [13]. A broader review described associated changes in respiratory sinus arrhythmia, baroreflex function, central nervous system activity, and psychological state [14]. These findings provide a plausible pathway through which paced breathing may reduce arousal, muscle guarding, and distress during painful movement.

However, heart-rate variability is not a direct pain meter, and increased vagal indices do not prove that pain has been biologically "switched off." In CLBP, autonomic change is more appropriately viewed as one component of a broader self-regulation process. Slower breathing can shift attention from threat to controllable bodily sensation, reduce urgency, and create a predictable rhythm during movement. These effects may reduce pain amplification and improve willingness to move, but direct mediation studies in Adhama Pranayama are lacking.

D. Fear Avoidance, Sleep, and Self-Management

Concerns over pain may encourage activity avoidance, deconditioning, and disability. According to the fear-avoidance model, behavior is regulated not just by pain intensity but also by threat perception and catastrophizing [15]. Breathing practice might act as a graded exposure facilitator: the patient learns to stay relaxed, maintain breathing and do a movement that was previously protected. We see such an interpretation as compatible with evidence connecting pain, motor behavior and physical activity [16]. This also corresponds with the positive changes in selected fear-avoidance and sleep outcomes previously observed when combining diaphragmatic breathing with core exercise [10].

The technique might be as much a self-management value as it is of physiological consequence. Patients are trained in a simple breathing routine that they can use during flare-ups, before exercise, or when stress spikes. This can enhance feelings of control and motivation. Even so, the technique should not be framed as an immediate, necessary pain-elimination technique. The problem with offering such a promise is that it can place another demand for performance, further promoting the notion that you should not move unless symptoms go away.

VI. PROPOSED MECHANISMS OF ACTION

A. Diaphragm, Pressure Regulation, and Spinal Support

When the diaphragm descends with inspiration it causes changes in abdominal pressures as well as interacts with both the abdominal wall and pelvic floor. When tasks are time-on-target, this system can augment trunk stiffness independent of a maximal contraction in superficial muscle. The support that

results is sometimes called an internal brace, but the analogy should be applied with caution. Healthy stabilization is not static: intraabdominal pressure and muscular activity vary with phase of breathing, load, speed, posture, and individual anatomy. Bracing too much or trying hard, in a Valsalva-like manner, may cause fatigue and decrease movement variability. Adhama Pranayama is implicated in that it enables the individual to learn low-load pressure modulation prior to performing higher load activities.

B. Restoration of Respiratory-Motor Coordination

Pain may affect the timing or distribution of muscle activity. Thus, some patients hold their breath when they bend, lift, or move a limb because that strategy increases stiffness in the short term. Without this option for exploring new movement patterns, hyper-responsiveness is ingrained in continuous breathing (though retraining continuous breathing can mitigate this rigid response; see Bulletproofing Breathing). We can infer that you are not strengthening one single muscle; instead, coordination between them may improve. It is this difference that clarifies why breathing exercises are naturally combined with progressive strengthening, walking, mobility, and task-specific practice.

C. Autonomic and Affective Modulation

An extended comfortable expiration and low-frequency breathing can enhance cardiorespiratory oscillation and vagally mediated variability [13]. This may feel subjectively as calmness, less urgency, and better focus. As I discussed in the lower arousal section, lower arousal in a pain context decreases protective co-contraction and makes it easier to expose to movement. Allegations suggesting that slowly breathing directly elevates gamma-aminobutyric acid, inhibits specific inflammatory cytokines or permanently restores the pain system in CLBP are needlessly underexploited and should not be described as settled clinical truths.

D. Attention, Expectation, and Self-Efficacy

Breathing practice is a form of structured interceptive attention. If the teaching is supportive and not catastrophic, then the patient can have bodily sensations without regard to any perceived threat of harm. Repeats likely foster self-efficacy: they transform discomfort into something to be experienced and worked through as the movement persists. Rather, it simply realizes and appreciates that pain is an experience we build for ourselves; one generated by context, focus, feelings, and what we learn about the world.

VII. CLINICAL INTEGRATION & SAFETY

International guidelines for management of chronic primary low back pain recommend person-centered, non-surgical care including education, exercise (structured exercises and active interventions), psychological interventions if indicated, and self-management support [17]. In accordance with this scheme, Adhama Pranayama (control of the respiratory system) applies as an adjunct and not a replacement for active rehabilitation methods. Gradual initiation is one method to prevent this:

- Start at Supine/Supported/Hurdle position. Place one hand on the upper chest and the other over the lower ribs or abdomen. Soft nasal sniff feeling with deep stomach breathing and expansion
- Give a peaceful rhythm by breathing slower yourself (inhaling for three to four seconds, exhaling for four to six seconds) for around five minutes. The timing is a matter of comfort; depth need not be forced.
- You do it once or twice a day and immediately prior to performing the exercise reps that typically elicit guarding. It is only when the patient is able to breathe without bringing his shoulders up, pain or dizziness will it go into sitting and then standing.
- Movement with Breath as Service distributed device level of plan-assisted movement. Inhale

and exhale WITH effort also happens with sit-to-stand, bridging, or lifting practice and is continuous for mobility and endurance work.

- Assess pain severity, disability or dysfunction, and compliance before treatment and at various intervals after completed care. Heart-rate variability can be used for research, but one does not need it to provide usual care quality.

In general, breathing exercises come with relatively low risk of causing direct harm, but they have to be discontinued if simple dizziness, faintness (a feeling of unsteadiness), chest pain, significant shortness of breath, panic, or neurological signs appear. In the case of an introductory CLBP protocol, prolonged retention and aggressive hyperventilation are avoided. Patients with unexplained weight loss, fever, major trauma, progressive weakness or saddle anesthesia (or bladder/bowel disturbance) or some other "red flag" need to be followed by a physician rather than treated alone. At the same time, pregnancy, moderate to severe respiratory or cardiac illness, recent abdominal surgery, and Axis 1 diagnosis of severe anxiety associated with breath-focused practices should also be individualized [5].

VIII. LIMITATIONS & RESEARCH GAPS

The limitations of the literature are many and recurring. One reason for this is that small and underpowered trials give unstable effect estimates. Second, there are heterogeneous methods included in “breathing exercise”: diaphragmatic breathing (DB), resisted inspiration (RI) [3], yoga breathing, paced breathing, breath awareness, and breathing embedded in complex exercise (BCE). Third, co-interventions make attribution difficult. When both groups receive core stabilization, and one group receives breathing, neither group should worsen; the important question is whether there is an incremental benefit, and that has not been entirely consistent [10]. Fourth, masking of participant and therapist is seldom achievable, which strengthens expectation and focus effects. Fifth, durability and prevention of relapse are still uncertain because follow-up is frequently short.

Well-powered multicenter randomized designs, utilizing preregistration and active attention controls as well as clearly described breathing dose with competency checks, adverse-event reporting, and follow-up periods of six to twelve months should be the goal of future studies. Studies should differentiate Adhama Pranayama from other breathing practices and evaluate both independent and adjunctive delivery. Core outcomes should include pain, ODI or Roland-Morris disability, patient-specific function, physical activity, sleep, fear avoidance, and QoL (treatment adherence). Mechanistic analyses can investigate whether changes in diaphragm function, motor coordination, heart-rate variability, or self-efficacy statistically mediate clinical improvement. Such subgroup research is also required as patients defined by hypersensitivity to breath-holding, heightened arousal, respiratory dysfunction or fear of movement may differ in their response from patients whose disability is predominantly determined by other factors.

IX. CONCLUSION

Adhama Pranayama is a feasible and well-reasoned breathing intervention that provides adjunct rehabilitation for chronic non-specific low back pain. The best evidence also indicates breathing belongs to a multimodal program, not that it appears as an isolated cure. Thus, small randomized trials and pooled analyses show potential short-term improvements in pain, disability, respiratory function, deep trunk muscle behavior, fear avoidance and sleep, while mechanistic research establishes the participation of the diaphragm in posture control and pressure regulation. Changes in autonomic markers underlie some of the motor effects during slow breathing, but it is unclear whether these changes directly contribute to analgesia.

Gentle diaphragmatic breathing therefore might contribute to reductions in breath-holding, improvements in self-management, and be accompanied by graded movement using patient education and physical activity according to individual tolerance. The scientific verdict would be cautiously positive: Adhama Pranayama appears to work, costs nothing, and has a low likelihood of adverse effects for many patients, but definitive tests of an independent effect will probably require high-quality long-term studies.

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