Health, Sports & Rehabilitation Medicine
Vol. 24, no. 1, January-March 2023, 22–26

REVIEWS

A systematic review protocol for chronic low back pain subjects with respiratory muscle involvement

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Abstract

Background. Numerous studies have found that various core muscles are involved in subjects with chronic low back pain. The evidence for profiles of respiratory muscle involvement in normal low backache subjects has not been reviewed explicitly for low back pain.

Aims. The study's primary objective was to scientifically analyze, condense, and to evaluate the evidence for the involvement of respiratory muscles in subjects suffering from chronic low back pain.

Methods. This evaluation procedure will trail the guidelines of PRISMA and MOOSE. The assessors will use a custom-built tool to extract data from the studies, regardless of the methodology used. A modified Downs and Black index will be used to assess the superiority of the methods used in the selected studies.

Results. This index evaluates the characteristics of the subjects, the timing of the outcomes, and the characteristics of the interventions, and quantitative, formal analysis, so-called meta-analysis, is performed if necessary. The study's effect, including the evidence, will be determined using the GRADE a framework for a systematic approach. Earlier research has found that core muscles are involved, and the interventions are tailored to include deficiencies and intrusions that target specific muscle groups.

Conclusion. As an additional component that can be targeted by clinical practitioners in their day-to-day practice and added to rehab programmes, this systematic review protocol will summarise the list of evidence available for the rehabilitation of low back ache and highlight the involvement of respiratory muscles in lowback ache subjects.

Keywords: chronic low back pain, diaphragmatic breathing exercises, respiratory muscles.

Introduction

It is estimated that chronic low back pain (CLBP) contributes to a large amount of the societal illness burden and the number of years spent in disability (Vos et al., 2016; Vos et al., 2015). For more than three months, it is defined as lower back pain that occurs between the lower posterior rib edge and the horizontal gluteal fold (Deyo et al., 2015). A quarter of the world's population is afflicted by CLBP, and it recurs in 24-80% of persons within a year. CLBP is the primary cause of early retirement due to illness, and it is related to substantial economic losses and lowers the quality of life. Nonspecific low back pain has been linked to a variety of physical and behavioural factors, including obesity, depression, and poor living habits (Hoy et al., 2010; Maher et al., 2017).

According to the growing body of research on LBP, respiratory function plays a significant role and is linked to the condition (Mohan et al., 2018); Boyle et al., 2010). The diaphragm is a dome-shaped muscle that descends during inhalation and contributes to spinal rigidity through intraabdominal pressure, mechanical action, and diaphragm crura attachments (Boyle et al., 2010). As a result, LBP is believed to be caused in part by quantifiable variability in diaphragm postural function (Kolar et al., 2012).

Data from an Australian longitudinal study on women's health suggests that breathing difficulties have a significant relationship with back pain when linked to physical inactivity and obesity (Smith et al., 2006). Since people with low back pain have shown an increased interest in studying breathing regulation, it has been assumed that those with lower back pain use more lung capacity than healthy participants (Hagins & Lamberg, 2011; Lamberg & Hagins, 2012).

It is difficult to make the link between LBP and a person's respiratory system. So as a result, it is necessary

Received: 2022, November 8 ; *Accepted for publication:* 2022, November 20
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https://doi.org/10.26659/pm3.2023.24.1.22

to find a suitable association between respiratory parts that are known to cause LBP. Studies comparing people with and without non-specific low back pain should pay close attention to the degree to which these interactions change from person to person. Because of this, new information about the respiratory characteristics of LBP patients will be gleaned from the findings of this study, opening up new possibilities for rehabilitation. In order to diagnose and treat NS-LBP, you'll need a reliable method for determining how well your brain functions (Beeckmans et al., 2016).

During normal tidal breathing, the diaphragm, the body's primary respiratory muscle, is responsible for about 80% of the total breathing effort. Other tissues in the human body serve multiple functions in a similar manner. Similarly, regulating intra-abdominal pressure aids the digestive process. Sphincter function, as well as heart and lymphatic function, are all enhanced by the sphincter mechanism.

For example, diaphragm stability and control of the trunk in monotonous actions are closely linked to its respiratory function. It is possible to keep the spine in a neutral posture with trunk bracing. Synergist and antagonist muscles are actively synchronized to precisely control extreme joint movements. The vertebral column is also stabilized by cumulative intra-abdominal pressure (IAP). Despite the fact that the diaphragm is unable to move the trunk independently, its contraction helps to stabilize the spine by increasing pressure in the abdomen. In chorus, the diaphragm performs a similar function (ventilation and posture) (Kocjan et al., 2017; Kocjan et al., 2018; Hodges & Gandevia, 2000).

A growing body of evidence suggests that spinal disorders associated with low back pain are caused by insufficient function and poor coordination of postural or stabilising muscles; however, the involvement of respiratory muscles is lacking, and recruitment patterns and breathing patterns of respiratory muscles in spinal disorders are altered, and the strategies utilized by the CNS to control the core stability is altered in painful conditions (Khadijeh et al., 2021; Mohan et al., 2020; Hyun et al., 2020).

At this time, our primary search in the global registry didn't bring up anything about individuals with chronic low back pain having respiratory involvement that was current or long-lasting. Chronic low back pain has been linked to core muscle involvement in previous studies. Despite this, there is insufficient evidence of such involvement in subjects with low back pain.

Objective

The main emphasis of the review procedure is to critically appraise and review the comprehensive involvement of respiratory muscles in subjects with chronic low backache.

Review question(s)

1. Is there any involvement of respiratory muscles in subjects with chronic low backache?
2. To which extent is there an involvement of respiratory muscles over core muscles?
3. Can respiratory interventions be used as an additional tool in rehabilitating chronic low backache?

Methods

Design and registration

Authentication of this practice was performed using the PRISMA-Protocol checklist (2015), which will be followed by the MOOSE guidelines as needed (Moher et al., 2015; Stroup et al., 2000). The National Institutes of Health Research have accepted a conditional protocol (International prospective register of systematic reviews -PROSPERO- CRD42022319337).

Inclusion criteria

Subjects: This review considered the studies with the age group of 30-60 years, analyzed clinically or through evidence of radiological findings with low backache.

The settings will encompass Chronic Low backache, Nonspecific low backache; there is no restraint for the length of low back pain (acute, subacute, or chronic).

Conditions such as SI Joint dysfunction, Lumbarization, Sacralization, and spinal fractures will not be included.

Exposure of interest:

This appraisal includes the revisions on primary and secondary muscles of respiration where the respiratory characteristics have been compromised due to low backache, Studies reporting Respiratory muscle changes, change in breathing patterns and any alteration in the mechanics of the ribcage associated with low backache are also be included.

Outcomes / Effects

Primary outcomes: this protocol will review the studies about Chest diameter, Breathing patterns, Thoracic mobility, and Inspiratory capacity. Motor outcomes will include muscle activity using Real-time Ultrasound, movement excursion and thickness, and postural changes of the lumbar spine. Studies will be considered if anything related to an abnormality in breathing capacity due to back pain, any compromise in Motor control tests, and sensory changes related to tactile acuity and two-point discrimination, ultrasound measurements of the diaphragmatic muscle (Excursion & thickness), and changes in proximal and distal compartments of the thoracic and lumbar spine.

Categories of studies

The protocol will include both the available and unpublished literature to reduce bias and will be done in two stages: first, reviewing the title and abstracts, and the second stage contains the full-text screening. It includes all the studies ranging from level 1 to level 4 evidence; Studies should include respiratory characteristics and diaphragmatic movements in individuals with low backache. Most of the studies are taken in which partakers are gauged at single point in stage, which provides for (Observational Research, analytical studies & Ecological studies, and the study designs conducted over a particular period of time)

Exclusion criteria

Reviews, Editorials, letters, short communications, Expert opinions, and case studies are excluded if the sample size is small and the sampling method or an apt comparison in the group.

Search strategy

The resources will be selected for the coverage and reputation, including database-specific search terms by Key concepts, free-text terms, controlled vocabulary terms,

phrase searching, proximity operators, Boolean Operators, and search limits.

Searches are conducted using the following databases: PubMed; CINAHL; Embase; Medline; Web of Science; Scopus & Google Scholar; and Hand searching for selected journal titles for those with high impact factors in the concerned field.

Study selection

The records are identified through the database, the titles and abstracts are selected and reviewed, and full texts are scrutinized for selection following the search; the filtered articles are imported to a web-based data management application Rayyan a key for efficient reviews (Ouzzani et al., 2016). Multiple file searches are used to remove the duplicates, and then combined for final addition. The false negatives and false positives are resolved through discussion and agreement with a third reviewer. The protocol will follow PRISMA guidelines to synthesize and summarize the outcomes of the articles (Moher et al., 2009).

Assessment of methodological quality

Methodological issues in the studies can be measured by the judgment of the reviewers who share at least 80% agreement with the quality of methodology. The value of randomized and non-randomized studies is reviewed by using the Downs and Black index (Downs & Black, 1998; Arumugam et al., 2012).

For the existing review, 17 scale components will be used. Gender, age, and Errors for recording component number 5 will be centralization, peripheralization, and physical activity levels. Each study will be assigned to a scoring system ranging from high quality, moderate quality, and low quality, which highlights measurement errors, validity, internal consistency, and responsiveness of the study included (McLean et al., 2017). Data extraction and synthesis will be carried out regardless of methodological quality; reviewers will contact the third critic if there are discrepancies in methodological quality.

Data extraction

The available data and records from various databases will be extracted according to the review protocol (framework, research question, study characteristics). The entire data will be pulled at once and give unique methodology attention. The eligible studies will be extracted using data extraction forms based on these components: Type of study, Participants, Intervention, Outcomes, Organizational aspects, study intervention basics, Trial characteristics, patient flow, data (continuous & dichotomous data), the similarity of groups & transparency, and completeness.

Data synthesis

Synthesis of data can be intimidating due to the available large volume of data, and formulating a synthesis of records from multiple qualitative studies if the data is more mixed, then a narrative synthesis of review can be adopted as a review tool like RevMan is employed, statistical synthesis includes numerical and graphical presentations of the data by looking for strength and reliability of the evidence that is available and evaluate the data if there are any conflicts. To estimate the overall and combined effect, meta-analysis is preferred. A weighted mean will be estimated instead of a simple mean based on the effect sizes, with some studies receiving a higher weight and others receiving a lower weight (Tufanaru et al., 2015).

In the summarized articles of the protocol, variability of the studies is identified by heterogeneity both clinically, methodologically, and statistically [36]. The reviewers will focus on data entry mistakes, random effect, and change in effect measures to address the heterogeneity. Each outcome drawn if meta-analysis does not favor will compute the mean differences between the groups with a 95% confidence interval.

The conclusion drawn will be tabulated with figures and tables as required. The treatment effect varies across the extracted studies; Subgroup analyses are performed where there is quantitative subgroup effect, unexplained heterogeneity, and covariate distribution. (Patient characteristics like age, gender, Chronic low backache (acute, subacute chronic), type of inferences, and classes of events. The results of the selected studies, which are positive and negative, will have implications for the review protocol. Funnel plots are used to examine the effect size and the precision to reduce the bias (Sterne et al., 2011). The certainty of the findings in the articles/studies ranging from very low, low, moderate, and high is evaluated using the GRADE approach which estimates the effect size for each outcome (Papola et al., 2018).

Discussion

Chronic low back ache constitutes a significant cause of disability, which might result in substantial limitation of low back function Movements are an essential part of the patients' rehabilitation. Existing rehabilitation routines for low back disorders include aerobic exercise, strength or stabilization exercise, and augmenting muscle performance of the lower back, analyses have summarized the role of movements in the low back (Paolucci et al., 2018).

There are currently interventions in musculoskeletal rehabilitation that are in line with the illness model where a physical/mechanical injury is solely responsible for a disorder; however, neurophysiological changes occur in altered regions of the peripheral and central nervous system, including the sensorimotor cortical areas, along with long-lasting musculoskeletal impairments (Pelletier et al., 2015).

The relation between the low backache and other respiratory disorders has a link in which during the stabilization tasks, there is an altered breathing pattern which shows that the diaphragm muscle is indirectly supporting the postural function, which may be a disadvantage for respiration (Roussel et al., 2009).

It is vital to develop novel rehabilitation programs for the low back to provide and promote well-being for individuals with low backache. Despite many guidelines with the similar recommendations for managing low backache have targeted core stabilization exercises, Manual therapies, pain neuroscience education, and biomedical models; however, these strategies have worked for a brief period for which there has been a recurrence of the gap between the evidence, and the clinical practice has been widespread.

Recent research suggests that high intra-abdominal pressure and increased pelvic floor and chest wall muscle

activation go hand in hand with weakening the pelvic floor, underscoring the significance of respiratory involvement (O'Sullivan & Beales, 2007; Roditi & Robinson, 2011). This analysis procedure will recapitulate the substantiation for the respiratory muscle involvement in low backache subjects, underline the importance of using breathing exercises with the traditional practices in the clinical settings, and gives an additional edge to the rehab practitioners while treating low back pain.

Conclusions

1. As an additional component that can be targeted by clinical practitioners in their day-to-day practice and added to rehab programmes, this systematic review protocol will summarize the list of evidences available for the rehabilitation of low back ache and highlight the involvement of respiratory muscles in lowback ache subjects.

2. Use of a respiratory muscles in the rehabilitation of chronic low back pain subjects will be of utmost importance because it will not only target the core muscles of the low back, but also involve respiratory muscles, which will be a huge change in the rehabilitation of low back ache subjects and further to it this review will highlight the importance of breathing mechanics and its role in the rehabilitation of low back ache.

Authors contributions

Nagaraj S – Designing the review and formulating the research question Prospero registration, the first critic - study selection and exclusion of duplications, data extraction and risk of bias assessment for the selected studies. Enrolling the original protocol.

As a second reviewer to ensure agreement and provide guidance for qualitative and quantitative synthesis, *Dr. Dhanesh Kumar K.U.* oversees the review process, document, and final draught intellectual content with a focus on critical evaluation.

Professor Pravin Aaron – An overview of the review's overall strategy, as well as a critical assessment of its rational content in the review protocol, manuscript, and final draught, are all included in the review's overall supervision.

Conflict of interests

None

Acknowledgments

Disclosure statement: no potential conflict of interest was reported by the authors.

Funding: no internal or external funding was received for the Protocol.

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