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THE EFFECT OF CORE STABILITY EXERCISE ON MYOGENIC LOWER BACK PAIN: A SYSTEMATIC REVIEW

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ABSTRACT

Introduction: Myogenic low back pain is a sign of pain, muscle spasm, and limited functional activities. This disease can be treated with core stability exercise, which is a form of active exercise designed to strengthen muscles and increase stability to support the spine and help prevent lower back pain. However, until now there has been no literature discussing the effect of core stability exercise on myogenic low back pain. Methods: A systematic search was conducted through PubMed, ScienceDirect, and Cochrane Library to identify studies examining the effect of core stability exercise on myogenic lower back pain. Results: There were 6 pre and post test control group studies with a total 143 patients that met inlclusion criteria. All existing studies show that core stability exercise can reduce NRS, ODI, VAS, and QVAS significantly ($p<0.05$) and increase flexibility scores significantly ($p<0.05$). The frequency of intervention was between 8-12 times for 4-8 weeks. Conclusion: Core stability exercise had a significant effect in reducing pain and increasing functional capacity in myogenic low back pain patients.

INTRODUCTION

Low back pain is a condition where there is a muscle disorder in the lower back area which is caused by a person carrying out excessive daily activities, for example such as standing for too long, lifting too heavy a load and sitting too hard. too long (Urits et al., 2019). The international prevalence of Low Back Pain shows that 33% of people in developing countries experience persistent pain. In England, around 17.3 million people have suffered from back pain and of this number, around 1.1 million people have become paralyzed as a result of back pain. 26% of American adults have reported experiencing lower back pain at least 1 day within 3 months (Hlaing et al., 2021). Based on Basic Health Research Results (2018), the prevalence of musculoskeletal diseases in Indonesia that have been diagnosed by health workers is 11.9% and based on diagnosis or symptoms is 24.7%. The number of sufferers of lower back pain in Indonesia is not known for certain, but is estimated to be between 7.6% and 37% (Ministry of Health of the Republic of Indonesia, 2020). As many as 90% of all cases of lower back pain are caused by myogenic factors. Myogenic low back pain is a sign of pain, muscle spasm, and limited functional activities.

Problems arising from Myogenic Low Back Pain can affect a person's functional abilities, such as limitations when lifting, carrying and lowering heavy loads, decreased ability to carry out daily activities, decreased quality of work and loss of working hours in productive and elderly ages (Areeudomwong & Buttagat, 2019). These problems are caused by shortening and weakness and poor trunk muscle coordination, especially in the core muscles, and poor trunk proprioception can lead to a greater risk of instability in the lumbar spine, further spinal injury, and subsequent reduction in physical activity and hip muscle weakness will cause problems such as impaired ROM in the lumbar spine and lower extremities such as the hips and knees (Tazji et al., 2023).

In the case of myogenic lower back pain, the treatment that can be carried out by a physiotherapist is by providing intervention in the form of core stability exercises. Core stability exercise is a form of active exercise designed to strengthen muscles and increase stability to support the spine and help prevent lower back pain. By strengthening the muscles that stabilize the lumbar spine and spine, you can reduce pain and increase functional ability. Core Stability Exercise increases trunk stability, pelvic floor stability, simultaneous contraction of abdominal muscles, multifidus muscles and improves spinal motor performance (Gorji et al., 2022). However, until now there has been no literature discussing the effect of core stability exercise on myogenic low back pain.

Understanding the role of core stability exercise in the treatment of myogenic lower back pain necessitates a systematic review of existing literature. By synthesizing empirical evidence from randomized controlled trials and observational studies, this review aims to elucidate the efficacy, safety, and clinical implications of core stability interventions in individuals with myogenic lower back pain. Through a comprehensive analysis of available evidence, we endeavor to inform clinical practice and guide future research endeavors aimed at optimizing therapeutic outcomes for this prevalent musculoskeletal condition.

METHODS

Eligibility Criteria

We conducted a comprehensive literature search of English-language clinical studies that reported any the effect of core stability exercise on myogenic lower back pain. No restrictions were made about country, age or gender. Articles that did not contain primary data, such as review

articles, were not included in the study. During the full-text screening, only studies that specified the effect of core stability exercise on myogenic lower back pain were selected.

Search Strategy and Information Sources

A comprehensive search strategy was conducted, incorporating the following search terms: "core stability exercise" AND "lower back pain", along with their related MeSH terms, synonyms, and elaboration. The literature review was independently conducted by two authors, who reviewed PubMed (MEDLINE), ScienceDirect (Embase), and Cochrane Library databases (accessed date April 30, 2023, 10:35 a.m.). The search was limited to English-language publications with no limitation on the year of publication. No additional filters were utilized during the search; however, subsequently, the articles were manually selected. Furthermore, apart from conducting electronic searches, we manually examined the reference lists of pertinent articles to uncover supplementary studies.

Data Collection Process

Two authors conducted independent data collection from chosen reports. The selection of articles was based on their title and abstracts to ensure their relevance to the systematic review. No automated tools were utilized during the selection process. The data was extracted into Excel for further analysis. From selected studies, we collected author/year of publication, sample size, mean age, female, comorbidities, study design, myoclonic low back pain criteria, follow up duration, efficaty, safety, and clinical implication. Continuous variables were represented as mean ± standard deviation or range of outcomes. Categorical variables were represented as percentages.

Risk of Bias

Risk of bias assessment was conducted by two authors working independently. Disagreements were resolved by discussion with a senior author. The tool used for assessment was the Newcastle Ottawa Scale (NOS) for observational studies.

Data Analysis

Analysis was carried out on the efficacy, safety, and clinical implication of the core stability exercise on myogenic lower back pain by comparing the results before and after exercise. The

parameters used in this research include the Numeric Rating Scale (NRS), Quebec back pain disability scale, flexibility value, Oswestry Disability Index (ODI), Visual Analog Scale (VAS), and Quadruple Visual Analog Scale (QVAS).

HASIL DAN PEMBAHASAN

Selection of Studies

The process of selecting studies encompassed a grand total of 314 publications that were initially identified. Following the elimination of duplicates (n=4) and the exclusion of papers that were deemed irrelevant to the topic or did not meet the predetermined inclusion criteria (n=289). Initially, two reviewers conducted a thorough examination of the titles and abstracts of the collected studies in order to identify suitable publications. Subsequently, the researchers independently scrutinized the full-text records of the remaining twenty one studies that successfully passed this initial screening phase to determine their eligibility. It is important to note that no automated tools were employed throughout this meticulous process. During the full-text evaluation stage, the two reviewers, who had previously conducted the screening process, thoroughly examined the complete texts of the research. Through discussion and collaboration, the reviewers were able to resolve any discrepancies in their assessments of both the title/abstract and the entire text. As a result, a total of 6 manuscripts were deemed suitable for inclusion in the systematic review (Figure 1).

Quality of Studies

The risk of bias in each included study was assessed and is presented in Table 3. The final evaluation of the studies revealed that they had a mean NOS score above 7, signifying that the follow-up duration was satisfactory and the dropout rates were reasonably low. No detection bias, or problems with the measurement or classification of outcomes, were found in any of the studies. The statistical analysis provided in each study was deemed to have high methodological quality.

Study Description

There were a total of 6 studies included in this review. The six existing studies have a study design in the form of a pre-post test control group discussion. The total sample involved was 143

patients. All patients were adults (>18 years). Of all the studies, only Sampurno et al.'s study included 13 female patients. Meanwhile, regarding comorbidities, only Ali et al.'s study included inactivity and obesity. All studies were conducted in Indonesia with different patient work backgrounds.

Table 1. Characteristic of included studies

Author/Year of Publication	**Study Design**	**Sample Size**	**Mean Age**	**Female**	**Comorbidities**
Amiriawati et al., 2021	Pre-post test control group design	20	45-65 years	NA	NA
Segita., 2021	Pre-post test control group design	9	NA	NA	NA
Ali et al., 2022	Pre-post test control group design	38	33.29 years	NA	Inactivity, obesity
Hasmar et al., 2023	Pre-post test control group design	20	NA	NA	NA
Sampurno et al., 2023	Pre-post test control group design	20	35-50 years	13	NA
Wahyono et al., 2023	Pre-post test control group design	36	40.44 years	NA	NA

Table 2. Studies results

Author/year of publication	**Intervention**	**Myogenic low back pain criteria**	**Frequency of intervention**	**Follow up duration**	**Outcome**
Amiriawati et al., 2021	Core stability exercise	Patients with painful sensations in the lower back when bending	8 times	4 weeks	Significant decrease in NRS value ($p<0.001$)
Segita., 2021	Core stability exercise	NA	NA	NA	Significant increase in flexibility value
Ali et al., 2022	Core stability exercise	Complaints of myogenic low back pain for more than 3 months, with SLR examination results (-), pain in isometric movement of lumbar extension (+), and spasm of para lumbar muscles (+)	12 times	4 weeks	Significant decrease in ODI value ($p<0.05$)
Hasmar et al., 2023	Core stability exercise	NA	NA	4 weeks	Significant decrease in ODI value ($p<0.05$)
Sampurno et al., 2023	Electrotherapy and core stability exercies	Patients with a diagnosis of Myogenic Low Back Pain have	8 times	4 weeks	Significant decrease in VAS value ($p<0.001$) Significant decrease in Quebec

		an NPRS score of 5-7			functional capacity ($p<0.001$)
Wahyono et al., 2023	Core stability exercise	Pain persists for ≥ 3 months	12 times	8 weeks	Significant decrease in QVAS ($p<0.05$)

Table 3. Risk of bias assessment using the Newcastle Ottawa Scale (NOS)

Author/Year of Publication	Selection	Comparatibility	Exposure	Total Score
Amiriawati et al., 2021	***	***	***	9
Segita., 2021	**	***	***	8
Ali et al., 2022	***	***	***	9
Hasmar et al., 2023	**	***	***	8
Sampurno et al., 2023	***	***	***	9
Wahyono et al., 2023	***	***	***	9

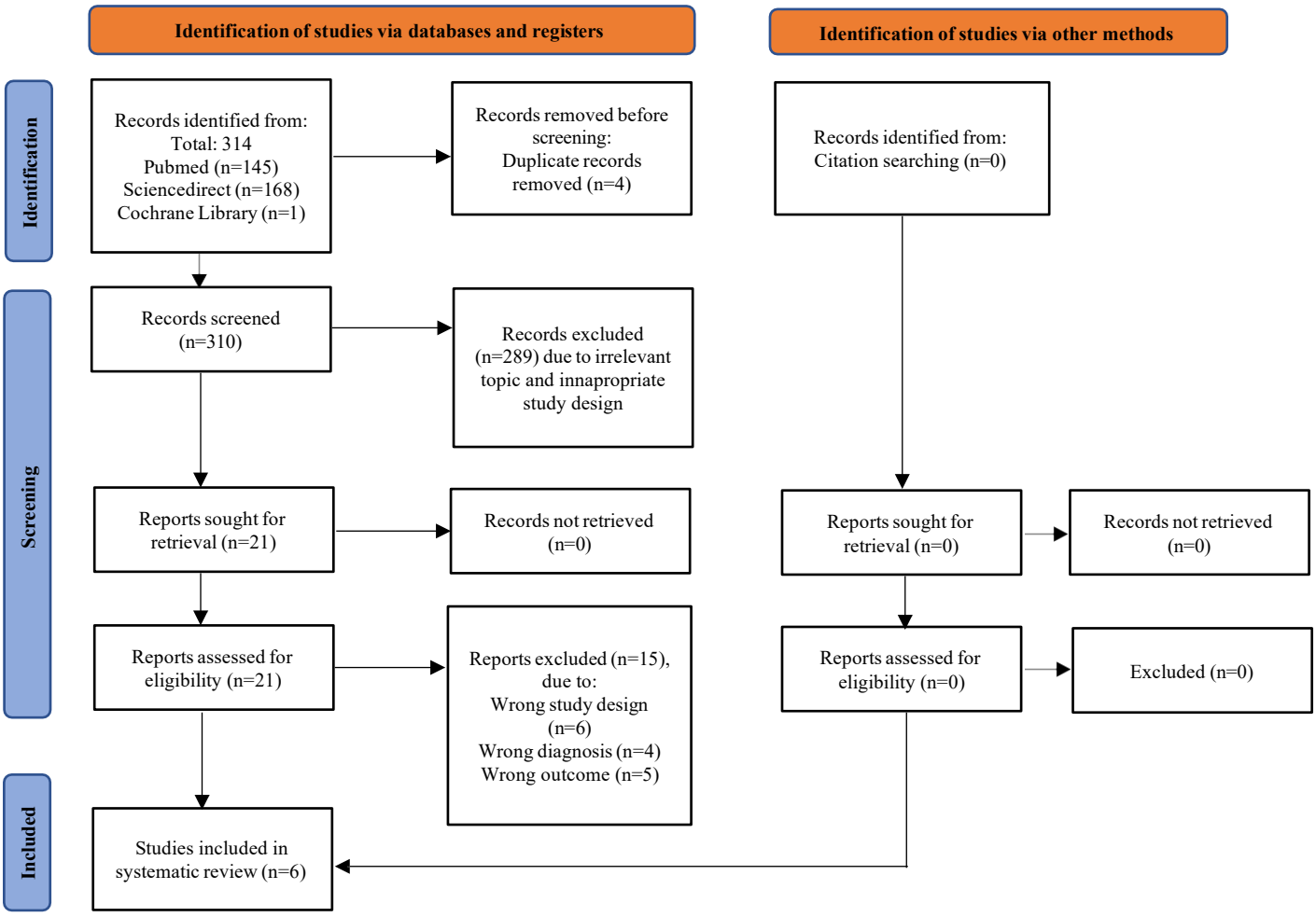

Figure 1. PRISMA flowchart diagram

DISCUSSION

Based on the results of qualitative analysis of six existing studies, it was found that all studies stated that core stability exercise had a significant effect in reducing pain and increasing functional capacity in myogenic low back pain patients.

In Amiriawati et al's study, it showed a median value of 5.50 in the NRS measurement before administering core stability and a median value of 3.00 in the NRS measurement after administering core stability, indicating a Wilcoxon test significance value of <0.001. The conclusion of this study shows that providing core stability exercise techniques is effective in reducing pain (Amiriawati et al., 2021). In Segita et al's study, the results showed that the average flexibility of Low Back Pain Myogenic before intervention was flexion 16.44 cm (abnormal) with

a standard deviation of 0.726 cm, extension 16.78 cm (abnormal) with a standard deviation of 0.833 cm and the average The average influence of Low Back Pain Myogenic flexibility after intervention is flexion with a standard of 23.22 cm (normal) with a standard deviation of 0.441 cm, extension of 22.89cm (normal) with a standard deviation of 0.333 cm (Segita et al., 2021). In Ali et al's study, it was found that there was an increase in functional activity with a mean difference of 13.68% in the treatment group and a mean of 4.74% in the control group (Ali et al., 2022). In Hasmar et al.'s study, core stability therapy had an ODI value of $p=0.038$ ($p<0.05$), meaning that there was a significant effect of core stability therapy on functional improvement in myogenic low back pain muscles. Meanwhile, when compared with William flexion, the value of $p=0.014$ ($p<0.05$) was obtained (Hasmar et al., 2023). In Wahyono et al's study, the results obtained were $p = 0.00$ ($p < 0.05$) for a decrease in QVAS pre and post core stability exercise intervention. Meanwhile, when compared with William flexion, the value of $p = 0.03$ ($p < 0.05$) is obtained, which means that core stability exercise is better (Wahyono et al., 2023). Of the six existing studies, there is one study that uses a combination intervention, namely the study by Sampurno et al. From this study, the results showed that the median NPRS value; (1) pre as much as 6.00; (2) post is 2.00 and (3) P value is 0.00, while the Quebec value; (1) pre as much as 25.50; (2) posts of 7.50 and (3) P value of 0.00. So it can be concluded that the combination of electrotherapy and Core Stability Exercise (CSE) is effective in reducing pain and improving functional capacity in cases of myogenic low back pain (Sampurno et al., 2023).

Core stability is the simultaneous activity of the muscles in the lower trunk to control body weight transfer and steps during walking. The first movement preparation is always based on postural tension, such as co-activation of the abdominal and multifidus in stabilizing the trunk and head during body initiation or facilitating limb movements during activity (Suadnyana et al., 2017). Core stability aims to activate the trunk (core), diaphragm and pelvic floor muscles to maintain the stable position of the spine. All three muscle groups contract simultaneously during this exercise. Core stability is very important for patients with myogenic low back pain because it can activate synchronized movements between the four core muscle groups (diaphragm, pelvic muscles, trunk muscles and abdominal muscles) thereby providing stability to the lower back and increasing functional activity. Increasing control of the lumbopelvic by stimulating coordination

and control of the lumbopelvic muscles so that it can maintain the position of the spine by increasing muscle activity (Yossi, 2017).

Core stability exercises are given to sufferers of myogenic low back pain which is characterized by muscle tension, abdominal weakness and mutifidus. This exercise can activate the core muscles which function as spinal stabilizers so that the global muscles that previously experienced tension relax. Increased functional activity is integrated in the activation of deep and multi-segmental (global) spinal stabilizer muscles. The effect of this exercise is to strengthen the dynamic muscular corset activity. Coordination of muscle contractions provides lumbar stability, reduces pressure on the intervertebral discs and reduces load on the lumbar muscles, thereby reducing tissue damage and lumbar strain. The muscle relaxation that occurs can improve blood circulation, supply food and oxygen to muscle tissue, and reduce pain due to tension in the back muscles (Kisner C, Colby LA, 2017).

Physiologically, myogenic low back pain causes changes in muscle activity surrounding the local pain. The pattern of trunk muscle activation in patients with myogenic low back pain (where pain arises from the muscular structure) of the vertebrae including bones, ligaments, discs, seODI, nerves and meninges is different from that of the healthy population. Changes in muscle activity in patients with myogenic low back pain should be considered a functional adaptation for spinal stabilization. This vertebral stabilization results from passive dysfunction of the spine (non-contractile) or active structures (muscles) of the vertebrae or the effects of nerve fiber impulses. Movements in core stability cause excessive muscle tissue tension and result in reduced lower back pain with passive stabilization movements in the vertebrae. Dynamic control of the vertebrae involves a control spectrum of isometric contractions at one end of the muscle (i.e. large flexor and extensor muscle contractions cause restricted movement and loading of the vertebrae). In other words, strategically this exercise is more dynamic on the other hand (that vertebral stability is achieved through alternating time with the activity of the core muscles and muscle contractions that underlie the initial activity of the deep muscles). So the investigation by Shamsi and his friends stated that core stability training reduces pain and increases the strength of the lower back muscles. (Shamsi et al., 2020).

During physiological isometric contraction of the muscle, seODI proprioceptors and mechanoreceptors send stronger impulses. This can reduce the sensation of pain caused by the

inhibitory effect of the Golgi tendon which reacts to changes in tension in the muscles. If the golgi tendon senses excessive muscle contraction, potentially damaging the associated soft tissue structures, then excitation occurs and results in relaxation or failure of contraction. In core stability movements, stimulation of the Golgi tendon inhibits muscle spindles so that the autonomic nervous system stimulates type III and IV nerve receptors; which in turn reduces ischemia due to increased local blood circulation in the skin and muscles, parasympathetic nerve activity is reduced, relaxation hormones and endorphins are released, metabolic waste is removed and oxygen supply increases. Parasympathetic reduction alters serotonin, cortisol, endorphin, and oxytocin, thereby reducing the perception of pain. A study conducted by Brian and his colleagues showed that in the short term, core stability exercises were more effective than general exercise for reducing pain and improving back-specific functional status in patients with myogenic low back pain (Coulombe et al., 2017).

Core stability exercises aim to stabilize the lower back by increasing lumbopelvic and abdominal control through m activation. transversus abdominis and multifidus. The effectiveness of increasing flexibility values after giving Core Stability Exercise effectively increases body flexibility (Segita, 2021). Good core stability will function to increase the speed of movement to prevent injury. Core stability is an important aspect of posture. Core stability is written in sports medicine literature as 'a product of motor control and muscle capacity in the lumbo-pelvic hip complex', which is said in musculoskeletal terms to include the spine, hips and hip seODI, as well as the proximal lower extremities. In addition to all the associated muscles, core stability requires control of trunk movement, to provide stability throughout the movement and the muscles need to be activated in the movement pattern. (Kibler et al., 2006).

CONCLUSION

In this study it can be concluded that core stability exercise had a significant effect in reducing pain and increasing functional capacity in myogenic low back pain patients. Further research needs to be carried out involving many patients and eliminating confounding factors so that the research results are not biased.

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