The Journal of Physical Therapy Science

Review Article

Effects of McKenzie and stabilization exercises in reducing pain intensity and functional disability in individuals with nonspecific chronic low back pain: a systematic review

ANAS MOHAMMED ALHAKAMI1,2), SALLY DAVIS3), MOHAMMED QASHEESH4), ABU SHAPHE4)*, AKSH CHAHAL4)

1) Oxford Brookes University, UK
2) King Faisal Medical City for Southern Region, Saudi Arabia
3) Faculty of Health & Life Sciences, Oxford Brookes University, UK
4) Jazan University, Saudi Arabia

Abstract. [Purpose] The purpose of this review is to compare the effect of McKenzie and stabilization exercises in reducing pain and disability in individuals with chronic nonspecific low back pain. [Methods] A systematic literature review of randomized controlled trials (RCTs) were performed using 6 databases. The quality of reviewed articles were assessed by the risk of bias using the Cochrane collaboration’s tool. [Results] A total of 829 articles were found from the databases, of which 10 were finally selected to be included in this review. The overall risk of bias assessment indicated that the risk of bias was low in one study and high in the other nine studies. One study reported reduced pain and two studies reported reduced functional disability in the McKenzie exercise group compared to other exercises. Two studies reported reduced pain and three studies reported reduced functional disability in the stabilization exercise group compared to other exercises. In two studies, the stabilization exercise group was as effective as McKenzie exercise group in reducing pain and functional disability in patients with chronic nonspecific low back pain. [Conclusion] Only two studies compared stabilization and McKenzie exercises in the management of chronic nonspecific low back pain. Therefore, insufficient evidence is available to draw any conclusive comparison on the effects of McKenzie and stabilization exercises in chronic nonspecific low back pain. However, both McKenzie and stabilization exercises was better than conventional exercise programs in reducing functional disability in patients with chronic nonspecific low back pain.

Key words: Low back pain, McKenzie exercises, Stabilization exercises

(This article was submitted Jan. 20, 2019, and was accepted Apr. 22, 2019)

INTRODUCTION

Low Back Pain (LBP) is considered as one of the commonest problems, in which pain felt in the lumbosacral spinal and paraspinal regions which encompass the buttocks and upper thigh1). LBP is one of most common medical problems that lead to absence from work, the disability arising from this pain resulting in significant economic impact2). In addition, LBP can lead to activity restrictions such as carrying objects, sitting or standing for a long time, twisting and squatting, which can result in participation limitation (work, recreation activities, family and community) and functional disability3). A previous systematic review4) reported the point prevalence of LBP is estimated at 21–33% and 22–65% for one-year prevalence. It has been reported that lifetime prevalence of low back pain globally is as high as 84%)5). Homaid et al.6) reported that global
prevalence of LBP is 45% in Saudi Arabia, and the prevalence of LBP is estimated to be 18%. Heyman and Dekel\(^7\) stated that back pain problems occur more in adults and detailed that the frequency of low back pain amongst females is more than males and increases with age across both genders.

Previous study defined chronic low back pain (CLBP) as a “back pain problem that has persisted for at least three months and has resulted in pain on at least half the days in the past 6 months”\(^8\). Only few cases of CLBP have specific causes of pain and they are defined as symptoms caused by a known pathophysiologic mechanism, for instance infection, herniated nuclei pulposus, rheumatoid arthritis, osteoporosis, tumor or fracture\(^9\)\(^–\)\(^11\). However, patients in the other group with no specific pathophysiologic mechanism are commonly known as “nonspecific LBP”\(^12\). Many clinical guidelines reported that patients can control and deal with chronic LBP by patient instruction and help with self-care\(^3\)\(^–\)\(^10\). Moreover, there was strong emphasis on encouraging patients to be active partners in the treatment of their health situation, for instance, during instruction and exercise programmes\(^17\). However, treatment that focuses on exercise and education instead of medication is amongst the best of treatments\(^18\). Furthermore, active rehabilitation programmes can help in enhancing body function, decreasing pain, reducing disability, improving walking and self-efficacy\(^19\)\(^–\)\(^20\). Although there are many methods to treat or manage chronic low back pain (CLBP), the current study bases its focus on two methods.

The first is McKenzie exercises, devised by Robin McKenzie\(^21\), also known as diagnostic and mechanical therapy\(^22\). This is a common method used among physiotherapists as a treatment method for handling back pain\(^23\). Additionally, Kuppusamy et al.\(^3\) reported that the McKenzie exercises are considered to be frequently used by physiotherapists in the treatment of LBP. Improvement in symptoms is successively measured in terms of ‘centralization’, a phenomenon that has been commonly used\(^24\). It combines recurrent end range actions by examination; the classification of direction for exercise is contingent upon the patient’s response to those recurring actions. Posture correction ensuring the maintaining of the correction is a vital characteristic of the McKenzie exercise\(^3\).

The second method is stabilization exercises because the decrease in spinal stability it is one of the major causes of recurrent LBP\(^25\). As a result, there is more emphasis on training the localized stabilizer muscles; transverse abdominis (TrA) and multifidus muscles (MF)\(^26\). Moreover, people with CLBP are more likely to have inadequate control in TrA muscles and atrophy has been found in the MF muscle\(^27\). The main goals of the stabilization exercises are deep motor control of deep trunk muscles (TrA and MF) restoration and increase in thickness of these stabilizer muscles that result in improved spine stability\(^27\). A study was carried out by O’Sullivan et al.\(^28\) on patients with CLBP and showed that the pain intensity in patients in receipt of TrA and MF muscle training for 10 weeks decreased and that functional disability, in turn, improved.

The current systematic review aimed to assess the efficacy of the McKenzie exercises in comparison with the stabilization exercises in individuals with chronic nonspecific low back pain by systematically and critically assessing the research evidence.

**METHODS**

Six databases were used to attain high quality resources, guarantee the dependability and check the rationality of studies and references found. Moreover, the use of these databases is crucial as they contain health and social care and medical journals. These databases include Web of Science, PubMed/ MEDLINE, Cochrane Library online, National Rehabilitation Information Centre (NARIC), ProQuest Medical Library, and PEDro during the period from its inception to current date. Search terms and Boolean operators that are utilized by the author are “chronic” AND “nonspecific” AND “low back pain” OR “lumbar spine” AND “stabilization” OR/AND “McKenzie” AND “exercise” OR “method” OR “training” OR “therapy” and have resulted in pain on at least half the days in the past 6 months”\(^8\). A total of 829 articles were identified in the title search after excluding the duplicates (n=407) (Fig. 1). A total of 10 articles were included in this qualitative review. Table 2 details the study characteristics. All 10 studies are RCTs; additionally, all of these trials target people that have chronic nonspecific low back pain. All of them are comparison trials that compared McKenzie exercise with other kinds of exercises, compare stabilization with other kinds of treatments and compare McKenzie exercise with stabilization. For instance, there are five studies which compared McKenzie exercise\(^3\)\(^–\)\(^10\), while two studies compared McKenzie exercise with stabilization exercise\(^13\)\(^–\)\(^15\). Furthermore, three studies compared stabilization exercise to other types of exercises. For instance, dynamic strengthening exercises for lumbar region, stretching and general exercise\(^17\)\(^–\)\(^19\).

According to all research that was selected in this review, the outcome measures are the same (Pain intensity and Func-
However, the outcome measure tools are different; for example, for pain there are four types of tools (Visual Analogue Scale (VAS), Numeric Rating Scale (NRS), Mannich Low Back Pain Rating Scale and McGill Pain Questionnaire (MPQ) and four kinds for disability (Roland Morris Disability Questionnaire (RMDQ), Oswestry Disability Questionnaire (ODQ), Functional Rating Index (FRI) and Functional status Questionnaire (FSQ).

All the 10 included trials in this review have clear concentrated questions; in addition, clear objectives are reported in these trials. Moreover, all the outcome measures utilized in these selected studies are valid and reliable and all of them were ethically agreed. According to the variance, statistical power, consequence of size and pre-test significance, suitable sample size is assumed to be considered. In the current study, five out of the 10 studies selected in this review have small sample size according to each study’s author.

Table 3 details the risk of bias assessment of the included studies. Figure 2 presented risk of bias graph of review authors’ judgments about each risk of bias item presented as percentages across all included studies. The overall risk of bias assessment indicated that the risk of bias was low in 1 study, and high in other 9 studies. Bias in the study can be affected by unsuitable masking and inappropriate participants. Blinding of participants can provide a chance to provide performance bias, particularly in relation to subjective results. Patients masking in a study can aid to avoid the placebo effect; failure to complete this can result in leaning the findings in favor of the treatment.

In all 10 included studies, none of the study fulfills the criteria of complete blinding. However, eight studies have assessor blinding and two of them have no blinding. If there is poor randomization and inadequate concealed allocation of the contributors in study, bias will be introduced. Furthermore, the inclusion and exclusion criteria are ex-
| Study design     | Participants | Interventions                                                                 | Outcome | Findings                                                                                           |
|------------------|--------------|--------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------------------------------|
| Assessor blinded RCT | N=271        | Study characteristics: Aged between 18–56 years, chronic nonspecific low back pain | Group 1 (n=134): McKenzie therapy. Exercises repeated five times per day, 10 to 15 repetitions; participants got seven sessions treatment as maximum. Session lasted to 10 hours. Group 2 (n=137): Electro-physical agents (EPAs) treatment for four weeks. | VAS ODQ FTF ROM | Although the findings between two groups stated that there is significant improvement between both groups, improvement in McKenzie group was more than EPAs group in all the parameters. |
| Assessor blinded RCT | N=148        | Inclusion criteria: Aged between 18 and 80 years, nonspecific chronic low back pain | Group 1 (n=74): McKenzie method. Patients were provided with information regarding spinal care and asked to do specific exercises according to movement preference direction movement. Group 2 (n=74): Treatment in this group depends on exercise programme in order to enhance mobility, strength and flexibility. | NRS RMDQ ROM WHOQOL-BREF | There is no significant difference between groups in pain intensity. However, there is important improvement in disability in McKenzie but not in pain. |
| Assessor blinded RCT | N=24         | Inclusion criteria: Nonspecific chronic LBP | Group 1 (n=12): Lumber stabilization exercises. Comprised of 16 exercises, intended to reinforce the deep lumbar stabilizing muscles. Group 2 (n=12): Conventional lumber dynamic strengthening exercise. comprised of 14 exercises, which triggered the extensor (erector spinae) and flexor (rectus abdominis) muscle groups. | VAS ODQ | Pain reduced considerably after treatment; although, the variations were not notably altered between the groups. Disability enhanced notably in the stabilization exercise group only. |
| Assessor blinded RCT | N=30         | Inclusion criteria: Patients aged between 18–50 and chronic low back pain with or without leg pain. | Group 1 (n=15): Stabilization exercises. Patients asked to do stabilization exercises in six steps: Group 2 (n=15): McKenzie Exercise. Individuals were requested to carry out six exercises: four extension-type exercises and two flexion-type exercises. | VAS FRI | After interventions, the pain score reduced in the two groups. The disability score reduced, but only in the stabilization group. |
| Assessor blinded RCT | N=30         | Inclusion criteria: Chronic LBP | Group 1 (n=15): Segmental stabilisation exercise (SS). Concentrated on the TrA and LM muscles. Group 2 (n=15): Muscular stretching exercises (ST). Focused on erector spinae (ES), hamstring (HS), and triceps surae (TS) muscles stretching and connective tissues posterior to column were conducted. | VAS MPQ ODQ | As compared with baseline, the two treatments were essential in relieving pain and bettering disability. Those in the SS group had expressively higher gains for all variables. |
| Study design | Participants | Interventions | Outcome | Findings |
|--------------|--------------|--------------|---------|----------|
| RCT | N=134 | Inclusion criteria: Aged between 18–65 years, employed people with non-specific low back pain. | Group 1 (n=45): Orthopedic manual therapy. Patients received three techniques of treatment such as spinal manipulation, specific mobilization, and muscle stretching. Group 2 (n=52): McKenzie method. Treatment includes an educational module supported with book (year book on back) and an active therapy section, which delivered instructions in exercises repeated several times a day. Group 3 (n=37): Advice only. Patients received 45–60 min counselling from a physiotherapist concerning the good prognosis for LBP. | VAS RMDQ | At the 3-month follow-up, substantial improvements were observed in all groups. However, no significant differences were noted between the groups. At the 6-month follow-up, greater improvement was observed in the McKenzie group compared to the advice only group. At 1-year follow-up, the McKenzie group were noted to have had a better disability index than the advice only group. |
| RCT | N=30 | Inclusion criteria: Chronic low back pain. | Group 1 (n=15): McKenzie Exercises. Participants allocated to this group acquired treatment founded on their history and reaction to the recurrent movement examination after the completion of the McKenzie exam. Group 2 (n=15): Stabilization Exercises. These concentrated on reinforcing the lumbar multifidus and transversus abdominis muscles through performance of a lower abdominal contraction. | Short-Form MPQ FSQ | The stabilization group portrayed a statistically noteworthy enhancement in pain results. The McKenzie group did better in the current pain index of the SF-MPQ only (p<0.05). Between-group comparisons of alterations in the dependent variable scores showed no statistical alterations between the groups. |
| Assessor blinded RCT | N=55 | Inclusion criteria: Recurrent LBP, Nonspecific LBP | Group 1 (n=29) Stabilisation and general exercises group Group 2 (n=26) General exercises only. | MPQ RMDQ PSEQ TSK PLCS | There are differences between groups. All of them were improved in pain and disability. |
| Assessor blinded RCT | N=230 | Inclusion criteria: Low back pain with or without leg pain, aged between 18–60 years, chronic low back pain. | Group 1 (n=132): McKenzie treatment. Consisted of an initial physical assessment, followed by self-mobilizing repetitive activities or sustained positions performed in specific directions, the application of manual overpressure, and/or mobilization by the physiotherapist. Group 2 (n=128): The strengthening training. Involved 5–10 minutes on a fixed bike followed by 10 minutes of warm up exercises of low intensity for the lumbopelvic muscles. | MLBPRS | The effectiveness of the McKenzie treatment equaled that of intensive strengthening training in reducing incapacity and intensity of pain. However, the McKenzie treatment has some potential, compared to strength training in the treatment of chronic low back pain. |
| Assessor blinded RCT | N=30 | Inclusion criteria: Aged between 20–65-year chronic low back pain. | Group 1 (n=15): McKenzie Exercise. After examination, patients were allocated according to one of four symptom classifications. Group 2 (n=15): Mat Based Pilates Exercise. These exercises were performed in six to 10 repetitions with progressive difficulty if needed and stretches were held for 30 seconds. | NRS RMDQ ROM | No significant difference observed between groups and there is improvement in both groups in terms of pain, disability and trunk flexion and trunk extension. |

VAS: Visual analogue scale; ODQ: Oswestry Disability Questionnaire (OSW); FT: Fingertip-to-Floor Disability; ROM: Range of Motion; NRS: Numerical rating scale; RMDQ: Roland-Morris Disability Questionnaire; WHOQOL-BREF: World Health Organization Quality of Life-BREF; FRI: Functional Rating Index; MPQ: McGill pain Questionnaire; FSQ: Functional Status Questionnaire; SLR: Straight Leg Raising; PSEQ: Pain Self-Efficacy Questionnaire; TSK: Tampa Scale of Kinesiophobia; PLCS: Pain Locus of Control Scale; TA: Transverse abdominis; MF: Multifidus; MLBPRS: Manniche’s Low Back Pain Rating Scale.
plained in all the selected studies in this review. Although six studies had concealed allocation27, 29–32, 36), there are four studies that did not mention any such information3, 33, 34, 36).

One study32) reported reduced pain and two studies31, 32) reported reduced functional disability in the McKenzie exercise group compared to other exercises. In the three studies3, 29, 30), the McKenzie exercise group was as effective as other groups in reducing pain and functional disability in patients with chronic nonspecific low back pain. Two studies27, 35) reported reduced pain and three studies27, 35, 36) reported reduced functional disability in the stabilization exercise group compared to other exercises. In two studies33, 34), the stabilization exercise group was as effective as McKenzie exercise group in reducing pain and functional disability in patients with chronic nonspecific low back pain.

DISCUSSION

In this study, the researcher set out to investigate whether McKenzie exercises are more effective than stabilization exercises in terms of reducing pain and functional disability among individuals with chronic nonspecific low back pain. The researcher reviewed ten different studies that examined the effectiveness of either McKenzie or stabilization exercises, sometimes comparing these training regimens against other types of therapies. In such a study, Murtezani et al.32) found significant improvement in pain and disability scores in both treatment groups with a greater increase in the McKenzie group. On the other hand, a few studies comparing McKenzie exercises and other types of therapies did not reveal any statistically significant differences in outcomes between groups3, 30). For example, studies by Kuppusamy et al.31 and Paatelma et al.30 did not find any significant differences between McKenzie and other exercise-based therapies. In other cases, for instance, Garcia et al.33, McKenzie was more efficient in reducing disability scores than pain intensity. These results agree with others in the literature that showed no significant differences between McKenzie exercises and other such therapies. For example, Ghosh et al.40 did not find any difference in outcomes between groups performing McKenzie exercises and Swiss ball exercises for three months. However, McKenzie exercises seemed to have higher efficiency overall. In studies comparing stabilization exercises and other types of therapies based on physical activities, stabilization exercises emerged more effective than muscular strengthening, general exercises and intensive strengthening. The literature available also supports these findings. For example, Chitra41) found that stabilization exercises reduced pain and disability scores compared to extension activities only.

The above results indicated that both McKenzie and stabilization exercises are effective in reducing pain and functional disability scores among individuals suffering from chronic non-specific low back pain. However, a direct comparison of

| Citations                  | Adequate sequence generation? | Allocation concealment? | Blinding? | Incomplete outcome data addressed? | Free of selective reporting? | Conclusions               |
|---------------------------|-------------------------------|-------------------------|-----------|-----------------------------------|----------------------------|---------------------------|
| Muretzani et al. (2015)20 | Yes                           | Yes                     | No        | Unclear                           | Unclear                    | High risk of bias         |
| Garcia et al. (2013)31    | Yes                           | Yes                     | No        | Unclear                           | Unclear                    | High risk of bias         |
| Franca et al. (2012)27    | No                            | No                      | No        | Yes                               | Unclear                    | High risk of bias         |
| Paatelma et al. (2008)30  | Yes                           | No                      | No        | Yes                               | Unclear                    | High risk of bias         |
| Koumantakis et al. (2005)25| Yes                           | Yes                     | No        | Yes                               | Unclear                    | High risk of bias         |
| Peterson et al. (2002)29  | Yes                           | Yes                     | Yes       | Yes                               | Unclear                    | Low risk of bias          |
| Moon et al. (2013)36      | No                            | No                      | No        | Yes                               | Unclear                    | High risk of bias         |
| Kuppusamy et al. (2013)35 | Yes                           | No                      | No        | Yes                               | Unclear                    | High risk of bias         |
| Hosseinifar et al. (2013)34| No                            | No                      | No        | Yes                               | Unclear                    | High risk of bias         |
| Miller et al. (2005)33    | No                            | No                      | No        | Yes                               | Unclear                    | High risk of bias         |
McKenzie and stabilization exercises yielded mixed results. Hosseinifar et al.\textsuperscript{34} investigated the effect of stabilization and McKenzie exercises on pain, disability and muscles. Pain decreased in both groups, while the disability score declined in the stabilization group only, concluding that McKenzie exercises were better in reducing pain, but not disability scores, as compared to stabilization.

Additionally, there were greater scores achieved in the stabilization group compared to the McKenzie group. On the other hand, Miller et al.\textsuperscript{33} compared McKenzie and stabilization programmes and concluded that there was no statistical difference between groups in terms of pain and functional disability scores. However, both groups reported reduced pain and functional disability. Although there can be various explanations for the mixed results in the two studies, it is clear that both stabilization and McKenzie exercises have almost similar efficiencies in pain and functional disability reduction and that the two are better than general exercises, advice-only and other therapies that do not directly target the back muscles. These findings agree with other studies available in the literature. An RCT by Halliday et al.\textsuperscript{23} compared McKenzie exercises and motor control exercises on trunk muscles in individuals with chronic low back pain. The researchers observed no significant differences between groups for pain or function, although perceived sense of recovery was greater in the group undertaking McKenzie exercises. A systematic review by Smith et al.\textsuperscript{42} gave slightly different findings in favor of stabilization exercises in the long-term treatment of LBP and associated functional disability. However, the researchers found no significant between-group differences and concluded that stabilization exercises might not offer additional benefits over alternative forms of physical activities.

The current study had some potential limitations. One of the limitations of the current review is the use of studies with diverse follow-up periods and comparisons. Different research studies included in the review had their own particular length of the follow-up period. This could have affected the results of this review, because the respective findings could be different depending on when they were taken. For example, a 3-month follow-up and a 1 year follow-up may yield differing results depending on the commitment of the participants and the efficacy of the treatment. Additionally, different comparisons were used in the individual studies, which make it difficult to compare McKenzie and stabilization exercises. Most of the included studies in this review compared McKenzie and other therapies or stabilization exercises and other therapies. Only two studies directly compared McKenzie and stabilization exercises.\textsuperscript{33, 34} Also, it is imperative to note that, in most of the studies, the researchers did not blind the therapists and participants and, therefore, there was some element of bias. Moreover, the interventions were applied for different durations. In some studies, the participants were subjected to the intervention for a few weeks, while others for months. These differences could have led to a difference in results and difficulties in comparing the two interventions at an equal level. Finally, use of variety of instrument for assessing pain and disability in the included studies make it difficult for the pooling of data for any quantitative analysis.

In conclusions, only two studies compared stabilization exercise with McKenzie exercises in the management of chronic nonspecific low back pain. Therefore, insufficient evidence is available to draw any conclusive comparison on the effects of McKenzie and stabilization exercises in chronic nonspecific low back pain. However, both McKenzie and stabilization exercises was better than conventional exercise programs in reducing functional disability in patients with chronic nonspecific low back pain.

**Funding and Conflict of interest**

None reported.

**REFERENCES**

1) Dissanayaka TD: Level of awareness of body use in young people. IJSRP, 2014, 4: 2250–3153.
2) Adams MA: Biomechanics of back pain. Acupunct Med, 2004, 22: 178–188. [Medline] [CrossRef]
3) Kuppusamy S, Narayanasamy R, Christopher J: Effectiveness of McKenzie exercises and mat based pilates exercises in subjects with chronic non-specific low back pain: a comparative study. Int J Prev Treat, 2013, 2: 47–54.
4) Hoy D, Bain C, Williams G, et al.: A systematic review of the global prevalence of low back pain. Arthritis Rheum, 2012, 64: 2028–2037. [Medline] [CrossRef]
5) Balagati F, Mannion AF, Pellisé F, et al.: Non-specific low back pain. Lancet, 2012, 379: 482–491. [Medline] [CrossRef]
6) Bin Homaid M, Abdelmoety D, Alshareef W, et al.: Prevalence and risk factors of low back pain among operation room staff at a Tertiary Care Center, Makkah, Saudi Arabia: a cross-sectional study. Ann Occup Environ Med, 2016, 28: 1. [Medline] [CrossRef]
7) Heyman E, Dekel H: Ergonomics for children: an educational program for elementary school. Work, 2009, 32: 261–265. [Medline]
8) Deyo RA, Dworkin SF, Amtrimann D, et al.: Report of the NIH Task Force on research standards for chronic low back pain. Spine J, 2014, 14: 1375–1391. [Medline] [CrossRef]
