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Research Article

Effectiveness of Stabilization Exercises Versus Strengthening Exercises in Chronic Low Back Pain: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Abstract

Background: In current guidelines, studies demonstrated that in order to decrease pain and improve function for patients with chronic low back pain (CLBP), the exercise therapy seems to be efficient. Stabilization exercise and strengthening exercise are becoming increasingly popular for the treatment of patients with CLBP. Then, our study was aimed to compare the most effective technique between stabilization exercises and strengthening exercise in patients with CLBP.

Objective: To review and compare the effects of stabilization exercise and strengthening exercise for patients with CLBP.

Methods: Published articles from inception to October 2020 were identified using electronic database searches (PubMed, Cochrane Library, Scopus, and ScienceDirect database). In our meta-analysis, we were two reviewers who really did the selection and extraction of data from the randomized controlled trials (RCTs) in order to compare the stabilization exercise versus strengthening exercise for seeing which technique that should be the better treatment of patients with CLBP.

Results: Six trials including 267 participants were involved in this review and meta-analysis. The pooling revealed that stabilization exercise was better than strengthening exercise for reducing pain at post-treatment (SMD =-1.33; 95% CI, - 2.45 to - 0.21; P = 0.02) and disability (SMD =-1.28; 95% CI, - 2.53 to - 1.74; P = 0.05). At 3 months follow-up, the overall analysis revealed that stabilization exercise was better than strengthening exercise for increasing functional capacity (SMD = -8.42; 95% CI, -9.93 to -6.91; P < 0.00001). However, in reducing pain at 3 months follow-up, our study found that there was no significant differences between stabilization exercise and strengthening exercise (SMD = -1.34; 95% CI, -2.98 to 0.29; P = 0.11).

Conclusion: Compared to strengthening exercise, stabilization exercise seems to be more effective than strengthening exercise in the improvement of the pain and disability for the patients with CLBP.

Keywords: *Chronic Low Back Pain; Stabilization Exercise; Strengthening Exercise; Systematic Review; Meta-Analysis*

Abbreviations

LBP: Low Back Pain; CLBP: Chronic Low Back Pain; RCTs: Randomized Controlled Trials; MeSH: Medical Subject Headings; PEDro: Physiotherapy Evidence Database; SMDs: Standardized Mean Differences; CIs: Confidence Intervals; ES: Effect Size; MD: Mean Difference

Introduction

In the World, Low Back Pain (LBP) is found as a frequent symptom which affects people of different category of age in general, particularly in active population [1,2]. In most of the time, low back pain is the consequence of a long time that a person lived with disability; and this problem is generally seen in majority low and middle income countries, because of their big numbers of population, informal employment and bad health systems [2]. We can explain the non-specific low back pain as low back pain that is not attributable to a known pathology which is some how specific. Then, it can be spelled as acute, subacute or chronic. Chronic low back pain (CLBP) lasts longer than 3 months or occurs episodically over a period of 6 months [3]. In developing countries such as southwest of Nigeria, China and Thailand, the 1-year prevalence of LBP among farmers was respectively 72%, 64% and 56% [4]. In fact, lumbar flexion, isometric flexion, extension, intensive dynamic back exercise, isometric flexion and passive extension are different methods which were used to treat patients as there are some how variable causes. Even if we have those different methods, many of them have not proved satisfactory results, although it is accepted that some of them are better than none [5]. We have to know that the dynamic spinal and trunk stability are maintained by the neuromuscular control, endurance and strength which are then improved by the stabilization exercises. The effect of stabilization exercise has been demonstrated in patients with recurrent LBP, pelvic pain and sciatica. Strengthening exercises has shown good effects in strengthening the spinal column and are used to support structures [3,6]. Until now, we acknowledge that there is no systematic review or meta-analysis that has been published yet while it was comparing the effectiveness of strengthening exercise and stabilization exercise for patients with chronic low back pain. Furthermore, it is important to make sure that the determination of the most effective exercise for CLBP is based on the best scientific evidence for not loosing staff time, resources and for fighting against unnecessary stress for patients with CLBP and their families. Then, our study was aimed to compare the most effective technique between stabilization exercises and strengthening exercise in patients with CLBP.

Methods

Study protocol

This study referenced to the preferred reporting items for systematic reviews and meta-analysis reporting [7]. This study was not submitted to the ethics committee because we analyzed all the data anonymously**.**

Data sources and searches

Four electronic databases were used to find articles published in English or French from their inception until October 2020. These electronic databases are PubMed, Cochrane Library, Scopus and ScienceDirect. The search strategy of these articles combined keywords related to stabilization and/or strengthening exercises for CLBP. Depending on the case of our research, we adapted to each database, combining the keywords and the terms Medical Subject Headings (MeSH). These keywords were: chronic low back pain, stabilization exercise, strengthening exercise, systematic review and meta-analysis. We used low back pain, sciatica, chronic pain, exercise, and lumbosacral region as the medical subject heading.

Study selection

Studies and participants

We included randomized controlled trials (RCTs) comparing stabilization exercise to strengthening exercise in CLBP. Our included studies were based on adults patient (age ≥ 18 years) who have been diagnosed with CLBP along with more than 3 months. In our study,

subjects with specific back pain such as disorder of bones, tumor, arthritis, osteoporosis or degenerative changes, fracture, etc. were taken as patients with specific CLBP and were automatically exluded in the study as well as subjects involved on neurological signs such as myelopathy and radiculopathy. We also excluded subjects who were previously had spinal surgery, spinal infections, and severe psychiatric disorders.

Interventions

The trials considered in this study used stabilization exercise as treatment group and strengthening exercise as control group for CLBP. The dynamic stability of the spine and the trunk are ensured by the stabilization exercises which aim to improve the neuromuscular control, the strength and the endurance of the muscles which are essential to the maintenance of this stability [8,9].

Stabilization exercises included exercises that were used to strengthen the deep stabilizing muscles of the trunk. These muscles are particularly the transverse abdominal, lumbar paravertebral and internal oblique muscles. Stabilization exercises also help to control the pelvic muscles [8,10,11]. In this review and meta-analysis, strengthening exercise consists of exercises that have been used to improve muscle strength in the trunk flexors and trunk extensors [10]. The strengthening exercises helps to strengthen the surrounding muscle while the Stabilization exercise is helping to coactivate the transversus abdominis and multifidus muscles than strengthening exercises [12].

Outcome measures

To assess pain, the articles used visual analogue scales and other pain assessment tools. For disability assessment, the articles used the Oswestry Disability Index, the Roland and Morris Disability Questionnaire, and other disability measurement tools. It should be noted that the data extraction took into account the results obtained at baseline before the intervention, after the intervention and at all the follow-up points reported.

Data collection and analysis

Data extraction and quality assessment

Two authors (I J and N I) independently screened and reviewed the titles, abstracts and full texts of all records for relevance. The extracting and analysis of data used Review Manager software (version 5.3) [13]. The risk of bias for all articles was evaluated according to the Cochrane Collaboration recommendations [18].

We used the Physiotherapy Evidence Database (PEDro) scale in order to evaluate the quality of included studies [14,15]. Pedro scale is an 11-item scale designed for rating of the methodological quality of randomized trials. We found that items can contribute one point to the total PEDro score except item 1 because 1 = satisfied, 0 = not satisfied while maximum = 10 points. We should add that item 1 is related to the external validity or generalizability of the sample.

Data synthesis and analysis

We used a random-effects model with Review Manager software in order to analyse Statistic issues (version 5.3) [13]. In our study, we calculated 95% standardized mean differences (SMD) with confidence intervals (CI). In each study, it was found that SMD accurately reflects the size of the intervention effect (ES) relative to the observed variability. Since an MDS of 0 shows that treatment and control have similar effects, we can assume that improvement is associated with higher scores on the outcome measure knowing that MDS > 0 or < 0 tell us the degree to which the treatment is more or less effective, respectively, than the control. The ES were also calculated on the basis

of the means, the standard deviations, the size of the intervention groups as well as those of the control. We used Cohen's method to be able to interpret the ES calculated with the SMDs and these were classified as small (0.20), medium (0.50) and large (0.80)

Results

Search results

The process of identifying eligible studies was outlined in figure 1. Three hundred eighty five records were initially identified through four electronic databases (MEDLINE/PubMed, Cochrane Library, Scopus, and ScienceDirect) for articles published in English or French from inception to October 2020. Briefly, we used low back pain, sciatica, chronic pain, exercise, and lumbosacral region as the medical subject heading.

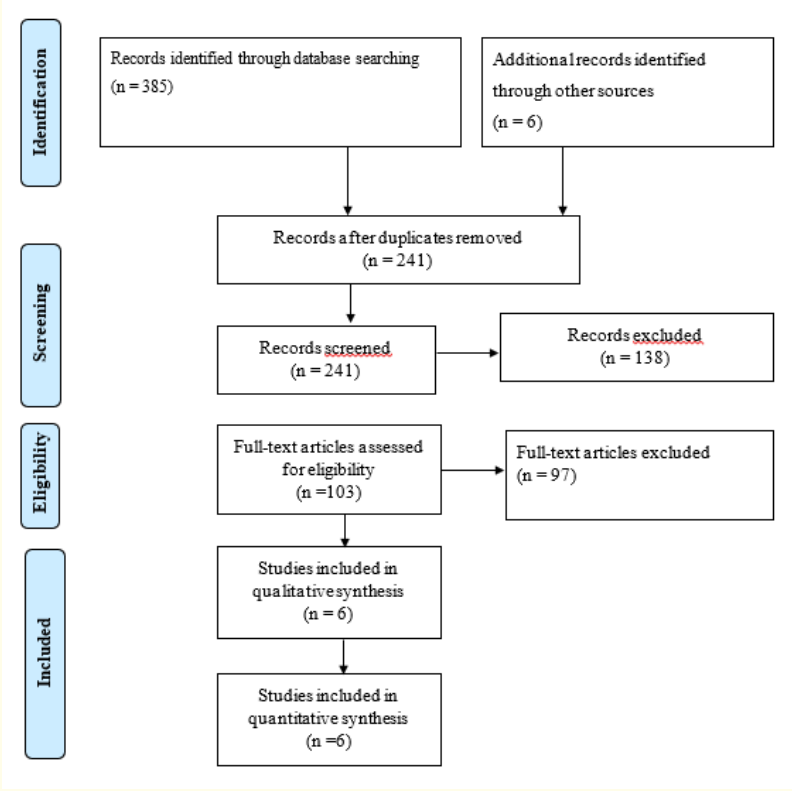

Figure 1: *Flow chart of the study selection procedure.*

The keywords used were chronic low back pain, stabilization exercise, strengthening exercise, systematic review and meta-analysis. Duplicates found in multiple database searches were removed.

We included in our study 103 eligible articles based on their title and abstract. After reviewing these 103 potential articles, only 6 articles [5,6,10,12,16,17] fulfilled the inclusion criteria. As our study were aimed to find articles whose trials included patients diagnosed

with CLBP, there was 97 articles which were removed because they did not meet this requirement as their trials showed diagnoses different to CLBP. In other hand, they did not aimed to compare strengthening exercise and stabilization exercise and we did not find their original data from the authors.

Risk of bias of included Studies

The risk of bias for all articles was evaluated according to the Cochrane Collaboration recommendations [18]. We really blinded participants and outcome evaluations, outcome of data which are incomplete, allocation concealment selective reporting, other bias and random sequence generation for their evaluation. We were two reviewers (I J, N I) while we were evaluating the methodological manner of all articles used in this study. An expert was asked (N JC) in order to fight against any disagreements.

For the quality evaluation of our used studies, 3 studies (50%) were found as moderate to high quality (while Pedro score ≥ 6). It is also good to know that every article was described as randomized, but it should also mentioned that the randomization method was not clear for 2 studies [6,16]. We want to make clear that one of the used articles was only attempted to blind the participants to the known treatment, and outcome evaluators were blinded in 3 trials. The quality evaluation of those used studies is described in this table 1.

Study	A	B	C	D	E	F	G	H	I	J	Final score
Bhadauria 2017	1	0	1	0	0	1	0	0	1	1	5/10
França 2010	1	0	1	0	0	1	0	0	1	1	5/10
Gatti 2011	1	1	1	0	0	0	1	1	1	1	7/10
Moon 2013	1	1	1	0	0	1	0	0	1	1	6/10
Puntumetakul 2020	1	0	1	0	0	1	1	1	1	1	7/10
Sipaviciene 2020	1	0	0	0	0	0	0	0	1	1	3/10

Table 1: *Quality assessment of included studies.*
A= Random allocation; B= Concealed allocation; C= Similar at baseline; D= Subjects blinded; E= Therapists blinded; F= Assessors blinded; G= < 15% dropouts; H= intention-to-treat analysis; I= Between-group comparisons; J= Point measures and variability data.

Stabilization exercise versus strengthening exercise on pain intensity

Six trials involving 267 participants assessed pain intensity (Figure 2). The overall analysis showed that stabilization exercise was better than strengthening exercise for short-term (SMD =-1.33; 95% CI, -2.45 to -0.21; P = 0.02). However, no significant differences were observed between stabilization exercise and strengthening exercise in reducing pain at 3 months follow up (Figure 3) (SMD = -1.34; 95% CI, -2.98 to 0.29; P = 0.11).

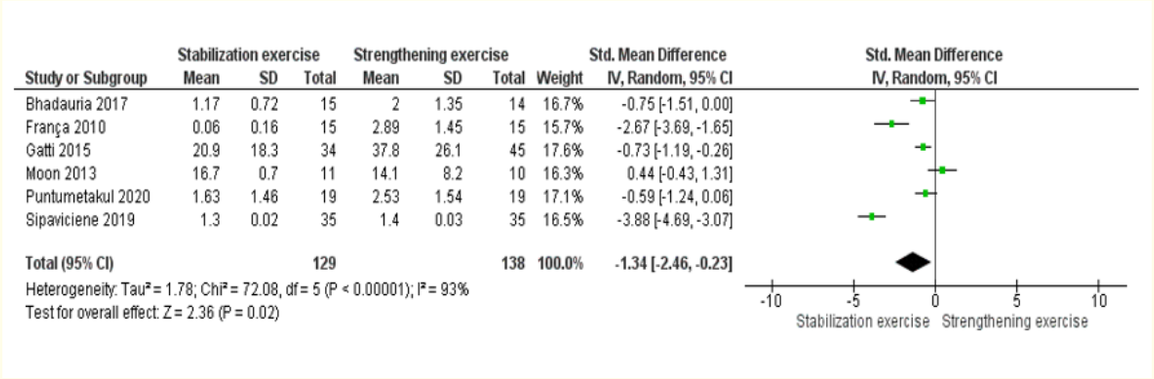

Figure 2: *Meta-analyses of stabilization exercise versus strengthening exercise effect on pain.*

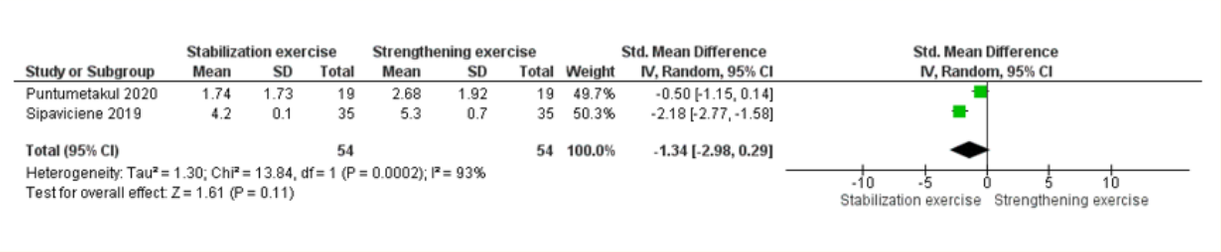

Figure 3: *Meta-analyses of stabilization exercise versus strengthening exercise effect on pain, mean difference (MD) at long-term follow-up.*

Stabilization exercise versus strengthening exercise on disability

Five studies involving 230 participants assessed disability. One study used the Roland Morris Disability Questionnaire, and four study used the Oswestry Disability Index. The Comparison of strengthening exercise and stabilization exercise showed that stabilization exercise has a significant amelioration in functional status in the short term (Figure 4) (SMD=-1.28; 95% CI, -2.53 to -1.74; P = 0.05). At 3 months follow-up, the overall analysis revealed that stabilization exercise was better than strengthening exercise for increasing functional capacity (Figure 5) (SMD= -8.42; 95% CI, -9.93 to -6.91; P < 0.00001).

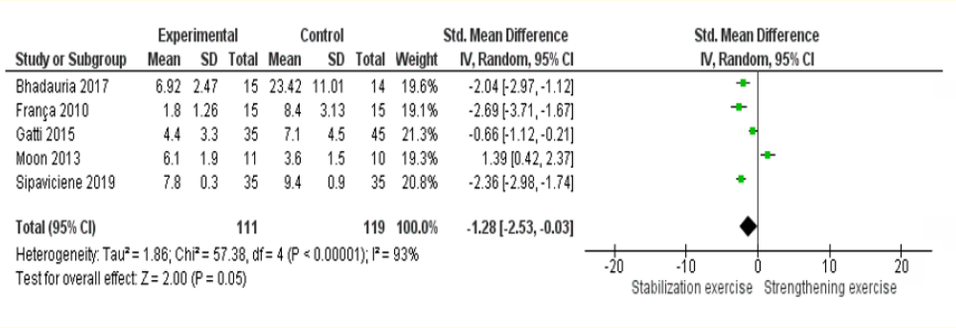

Figure 4: *Meta-analyses of stabilization exercise versus strengthening exercise effect on disability.*

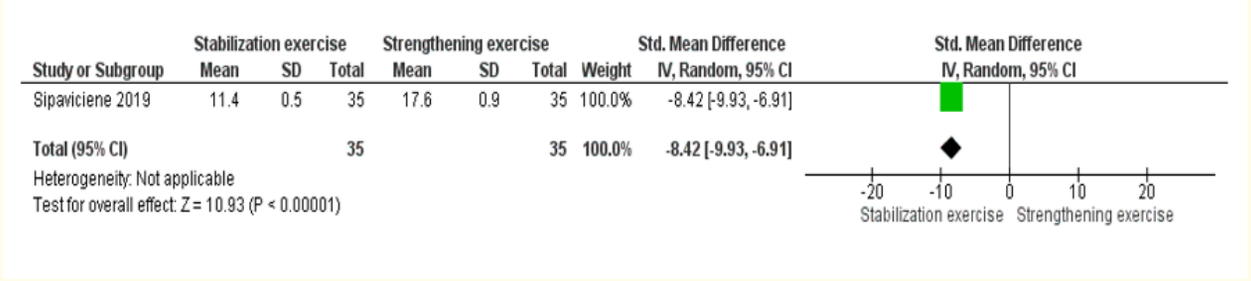

Figure 5: *Meta-analyses of stabilization exercise versus strengthening exercise effect on disability, mean difference (MD) at long-term follow-up.*

Discussion

This systematic review and meta-analysis aimed to show the comparison between the effectiveness of stabilization exercise and strengthening exercise in the treatment of CLBP. Six RCTs were included. The overall analysis showed that stabilization exercise seems to be the most effective in reducing pain and impoving functional status of patients with CLBP. Our findings were inline with previous studies [8,12,11,19-22] which found that stabilization exercises were more effective than conventional exercise in reducing pain and improving functional status. Stabilization exercise was found to be the more effective than strengthening exercise. This finding should be explained by these possible reasons:

Firstly, the dynamic stability of the spine and the trunk are ensured by the stabilization exercises which aim to improve the neuromuscular control, the strength and the endurance of the muscles which are essential to the maintenance of this stability [8,9]. The strengthening exercises helps to strengthen the surrounding muscle while the Stabilization exercise is helping to coactivate the transversus abdominis and multifidus muscles than strengthening exercises [12].

Secondly, stabilization exercises are well executed consecutively one after the other without any repetitions and we really mention that there was no rest period given to patients in order to maintain the posture. This strategy of exercise is very helpful for sustaining the cocontraction of the muscle while executing the exercise [23].

Third, in performing stabilization exercises, a method of tactile facilitation is involved along with verbal stimulation by the therapist given to the patient to explain the muscles surrounding the trunk which act as feedback [23]. The lumbar paravertebrals are a primary intersegmental stabilizer of the spine. Due to its location near the center of rotation of the vertebrae, these lumbar paravertebrals have a short reaction time. Hyperlordosis is a sign of a poor coxofemoral extension movement pattern. Decreased activation of the lumbar paravertebrals, particularly type 2 muscle fiber atrophy, has been found in CLBP and studies have shown that restoration of function can be achieved with stabilization training [23-25].

Limitations

We should note that there are so many limitations in this meta-analysis. Firstly, the number of included studies was too small to determine the safety of stabilization exercise. Furthermore, we should say that the small number of patients who were examined in articles involved in our created some small disparities between the true effectiveness of strengthening exercise and stabilization exercise. Secondly, we found some difficulties of languages methods while the search strategy was only seen to full-length publications written in english and french languages. Then, it would be better if those relevant publications should be found in other multiple languages such as Japanese, Chinese, and Korean. Thirdly, as we tried to contact authors, some studies were excluded because we missed their own authors and then it was very difficult to obtain their full data. Finally, we missed the results for long term follow up of some studies.

Implications for Research

We suggest that there should be methodologically sound and sufficiently powerful articles to refute or confirm the effects of stabilization exercise on pain reduction and functional improvements in patients with CLBP. The types of stabilization exercises in the articles should include trunk proprioception, muscle strength, and trunk muscle endurance to provide insight into the potential mechanisms involved in the process of cooperative action. The majority of articles involved in this study did not evaluate the effects of long-term stabilization exercise. We need more studies to show the long-term effects of these exercises. Finally, the theories by which stabilization exercise relieves pain in patients with CLBP should be explored further. The articles used in this study did not use the same exercises, which could lead to different results. A systematic review and meta-analysis of different stabilization exercises for CLBP should be conducted to determine the optimal treatment approach.

Conclusion

The comparison of stabilization exercises to strengthening exercises shows that the stabilization exercises seems to be more effective in reducing pain and improving specific back function in patients with CLBP in the short term. However, it is found that there is no significant difference observed between stabilization exercise and strengthening exercise in long-term pain reduction. However, these conclusions are based on low quality data and more scientific articles are needed in order to confirm these results.

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