INTI JOURNAL | Vol.2023:40
eISSN:2600-7320

Efficacy of Core Muscle Stabilization in Chronic Nonspecific Low Back Pain Patients – A Systematic Review

Mohammed Luqman Sulaiman*, K. Kotteeswaran, Saravan Kumar

Saveetha College of Physiotherapy, SIMATS, Thandalam, Chennai, India

*Email: muhammedluqman25@gmail.com

Abstract

Background: Low back pain referred as pain localized between the 12th rib and the inferior gluteal folds with included leg pain sometimes not, most cases are nonspecific but in about 10% of cases a specific cause is identified. The major causes of low back pain are weakness of superficial trunk muscles, abdominal muscles and motor control or delayed activation of deep muscles (multifidus and transversus abdominis). Hence Core Stabilization exercise provides greater support to the spine, control of lumbar deep muscles and pelvis, and integration of activity of superficial and deep trunk muscles.
Aim: The aim of the study is to determine the efficacy of core muscle stabilization exercise in chronic nonspecific low back pain patients.
Search Method: Studies were collected from databases Google scholar, PubMed, Cochrane library, Research gate, CINAHL Medicine.
Methodology: Inclusion criteria was Randomized or quasi-randomized controlled trial studies and Experimental study design. Sample size was 245 articles, 188 articles were collected from Google scholar, 28 articles from PubMed, and 29 articles from Cochrane library. Methodology of the Study was designed as Systematic review.
Results: Out of 245 published studies, we selected 14 articles which describing about efficacy of core muscle stabilization exercise in chronic nonspecific low back pain, among which 8 articles discussed about the effectiveness of core stabilization exercise, 2 articles about lumbar stabilization, 2 articles about Pilates based exercise, 2 articles about segmental stabilization in reducing chronic nonspecific low back pain.
Conclusion: By reviewing the study, we conclude that core muscle stabilization exercise is effective in reducing the chronic nonspecific low back pain (CNSLBP).

Keywords

Nonspecific low back pain, Core stability, Lumbopelvic stability, Neuromuscular control, Oswestry.

Introduction

Pain from the twelfth rib to the lower gluteal folds, with including leg pain sometimes not, is defined as low back pain. Many cases are vague, but about 10% of them have a definite cause (Krismer and Van Tulder, 2007). Over 50% of the global population suffer from LBP at least once in their lifetime. Back discomfort is a common clinical finding in musculoskeletal disorders (Rozenberg, 2008). The causes of low back pain are complex, with some unknown. Weakness of superficial trunk muscles, abdominal muscles (Lee and Lee, 2014), and motor control of deep muscles (multifidus and transversus abdominis) are the most common causes of low back pain (Rozenberg, 2008). NSLBP is described as pain that is not caused by a specific pathology (for example, fracture, infection, structural deformity, osteoporosis, inflammatory

Submission: 27 May 2023; **Acceptance:** 17 August 2023

disorder, tumour, cauda equina syndrome or radicular syndrome). Sometimes Visceral pain is misdiagnosed as somatic pain, but the difference is visceral pain cannot be pinpoint as like somatic pain. It is due to the least number of pains detecting nerves present in visceral organs than in muscles, bones and joints. Using the Bradford-Hill causation criteria, eight systematic reviews concluded that occupational sitting, awkward postures, standing and walking, pushing or pulling, bending and twisting, manual handling or assisting patients, lifting, or carrying were unlikely to be independently causative of low back pain in the workers population studied (Balagué, *et al.*, 2012). In most clinical practice guidelines, exercise therapy is recommended as a successful approach to reduce pain and improve functional status in individuals with chronic LBP (Swetha *et al.*, 2023; Keller, *et al.*, 2007).

Exercise therapy may be administered to individuals or in groups under the supervision of a therapist, or it may consist of home exercises performed with or without the use of machinery, on land or in water. There are also several sorts of exercises, such as aerobic/anaerobic, flexion/extension, stretching/strengthening, stability and mobility, balance/coordination activities. Furthermore, in the latter category, workouts may target on individual muscles (e.g., multifidus or transversus abdominis) or a collection of muscles (e.g., abdomen, trunk and back), and frequency, intensity, and duration may vary (Van Middelkoop *et al*., 2010). Exercise programmes that focus on strength of muscles, endurance, and retraining are appropriate. Physical reconditioning, on the other hand, may not be the limiting factor in recovery for many people seeking therapy for chronic low back problems; it is now recognised that muscular insufficiency in chronic LBP is more than just a problem of muscle power or endurance. Instead, the issue could be related to altered neuromuscular control systems that impact trunk muscle stability and efficiency in movement (Anand *et al.*, 2014). The primary focus of core strengthening is on muscular stabilisation of the abdominal, paraspinal, and gluteal muscles in order to give improved stability and control during athletic activity. Jeng et al. observed that strengthening the lower back, legs, and abdomen to increase muscle stabilisation can reduce the occurrence of LBP (Nadler *et al.*, 2002). Lumbopelvic stabilisation training is widely given for individuals accompany persistent low backache, where impaired stability of the core is one of the causes of the pain mechanism. The therapeutic uses of LPST is infamous to improve the contraction of muscles such as the TrA and lumbar portion of multifidus (LM), and in addition, LPST enhances an a feed-forward process during movements of the peripheral limbs, ensuring control and stability of the lumbopelvic region (Paungmali *et al.*, 2017).

Richardson et al. divided core stability training into three stages based on the "segmental stabilisation exercises model." Based on the motor relearning theory, the stages of these exercises are as follows: local segmental control, open and close chain segmental control, and progression towards function (Kumar *et al.*, 2015). Previous research has emphasised the advantages of CSE lowering pain along with impairment in people with instable spine. The hypothesis was that trunk recruitment of muscles changed in patients with instable spine to adjust to intrinsic spinal instability caused by injury or laxity of osteoligamentous structures. Trunk muscles are classified into two types: deep and superficial. The deep trunk muscles are the LM, TrA and Internal oblique while the superficial trunk muscles are the erector spinae and rectus abdominis. It is thought that the deep muscles of trunk role is to stiffen lumbar segment of spine via its connection to the lumbodorsal fascia, when combined and rise in internal abdominal pressure, resulting in stability of the spine in individuals with clinical spinal instability (Puntumetakul *et al.*, 2013). The core muscles provide all of the human body's power and mobility, in addition to maintaining balance each time we move, and their movements and stability of the trunk can be maximised by repeatedly conducting activities of strengthening and stretching the core muscles (Tayshete *et al.*, 2020). The Oswestry Disability Index (ODI) was one of the most used outcome indicators for people suffering from low back

pain (LBP). The ODI is completing a questionnaire on their own with six statements in ten domains scored from 0 to 5. Scores are related to the degree of disability, which ranges from minimum to bedbound (Vianin, 2008).

Methodology

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) criteria were employed. We included Comparative study, Experimental study and low risk Randomized Controlled Trials in this review. The databases used for searching articles were Google scholar, PubMed, Cochrane library, Research gate. The sample size of 245 was obtained by using keywords Nonspecific low back pain, Core stability, Lumbopelvic stability, Neuromuscular control, Oswestry. Based on the inclusion and exclusion criteria further articles were scrutinized and finally 14 appropriate articles were obtained for this systematic review (Figure 1).The inclusion criteria include: Articles published from 2010 to 2020, All types of Experimental and Randomized controlled trial, population with CNSLBP, Studies which met with the standard outcome measures, Both the gender. The exclusion criteria include: Articles which are not in English language, Articles with pharmacological interventions, Articles which are mentioned about the spinal fracture, any disc involvement, spondylolisthesis, Spinal stenosis, TB spine, radicular pain, any recent injuries, etc, Articles with acute and subacute low backache (Ramalingam *et al.*, 2023). The PRISMA flowchart of the selection process is shown in Figure 1.

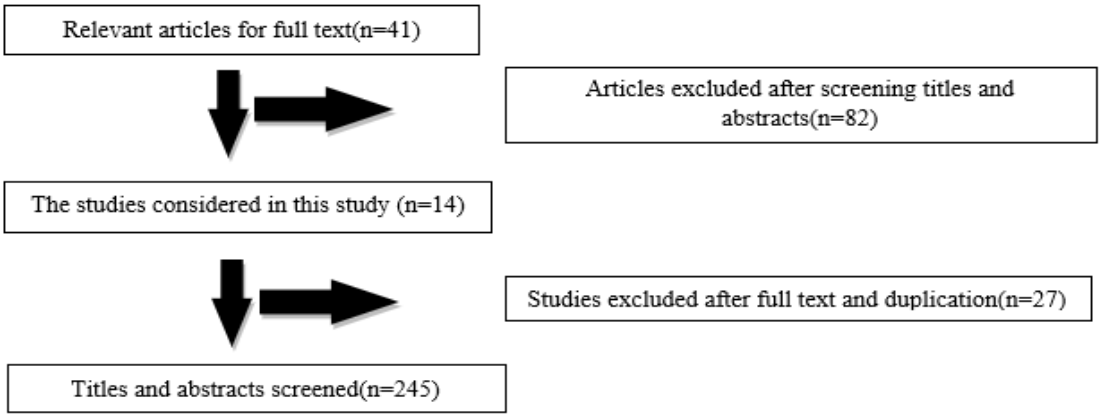

Figure 1. Study Flowchart

Results and Discussion

In this systematic review, out of 14 articles reviewed, 8 articles discussed about the effectiveness of the core stabilization exercise and 2 articles discussed about the effectiveness of pilates exercise and 2 articles discussed about the efficacy of lumbar stabilization exercise and 2 articles discussed about the efficacy of the segmental stabilization exercise (Table 1). As a result of this review, we may infer that core stabilisation activities alleviate pain and impairment in people with CNSLBP. It also proves that any stability exercise is more helpful in reducing low back ache than any other exercises. Still further more articles are required to prove the efficacy of core muscle stabilization exercise in reducing low back pain. We have included 14 articles for the review out of 245 articles screened.

Table 1. Review of Literature

Author	Study Design	Participants And Intervention	Outcome Measures	Result
Inani and Selkar (2013)	Randomized Controlled trial	30 Patients are divided, Group 1 (n=15) Core stabilization exercises Group 2 (n=15) conventional exercise	Oswestry disability index, Visual analogue scale	In people suffering from nonspecific low back pain, core stabilisation activities are more effective at lowering pain and increasing functional status.
You *et al.* (2014)	Randomized controlled, experimente r blinded study	40 patients were divided into two groups: the experimental group, which received ankle dorsiflexion along with abdominal wall drawing, and the control group, which received only abdominal wall drawing.	Oswestry disability index, Roland Morris Disability Questionnaire, Visual analogue scale, Pain disability index, Pain rating scale, Active straight leg raise	This study determined that ankle dorsiflexion paired with draw in abdominal wall exercise is more beneficial than draw in abdominal wall exercise only in lowering pain, disability, and improving core strength in chronic low back pain.
Ahmed *et al.* (2017)	Quasi-experimental study	44 patients were randomly assigned to one of two groups: Group 1 (n=22) lumbar stabilisation exercises, and Group 2 (n=22) Core muscle stabilisation exercise plus lumbar stretching for Group 2 (n=22)	Oswestry disability index, Numerical pain rating scale	The combination of core muscle stabilisation and lumbar stretching is more efficient than lumbar muscle stabilisation alone.
Majeed *et al.* (2019)	Prospective Study	73 individuals with chronic low back pain were treated with the Trivandrum Community-centered Core Stabilisation procedure.	Oswestry disability index, Keele Start Back questionnaire	It concludes that 6 weeks of TRICCS protocol shows a satisfactory outcome in CLBP.
Waseem *et al.* (2019)	Single-blinded Randomized Controlled trial	Out of 120 patients Group A (n=60) core stability activity Group B (n=60) routine physical activity	Oswestry disability index	Greater reduction in disability seen in CNSLBP patients who were treated with CSE.
Zhang *et al.* (2015)	Randomized Controlled trial	92 participants were divided into Experimental group treated with Chinese massage with core stability exercises Control group treated with Chinese massage only	Oswestry disability index, Visual analogue scale	Concluded that core stability exercise in addition with Chinese massage have a greater therapeutic effect in nonspecific low back pain.
Kim and Yim (2020)	Randomized Controlled trial	66 patients were splitted into three groups Stretch group (n=24) performed stretching of hip muscle Strengthen group (n=22) performed hip muscles strengthening	ODI, Visual analogue scale, Passive straight leg raising test, Toe touch test, Modified Thomas test, Ober test, Roland Morris disability questionnaire, one	According to the findings of this study, core stabilisation exercise in addition to hip muscle strengthening proved more helpful in lowering pain and enhancing physical function and activities in people with NSLBP.

		Sham group (n=20) undergone mild palpation of the skin	leg standing test, SF - 36	
França *et al.* (2012)	Randomized Controlled trial	30 participants randomly assigned in two groups Segmental Stabilization group (n=15) exercises focused on transverse abdominis and multifidus muscles Stretching group (n=15) exercises targeted on stretching of erector spinae, hamstrings, and triceps surae	Oswestry disability index, VAS, Mc Gill pain questionnaire, Pressure Biofeedback Unit	This study shows that activation of TrA muscle was higher in segmental stabilization than stretching exercise in chronic low back pain.
Bhadauri and Gurudut (2017)	Randomized Controlled trial	44 subjects randomly allocated into three groups Group 1 (n=15) Lumbar Stabilization exercise Group 2 (n=14) Dynamic Strengthening exercise Group 3 (n=15) Pilates	Oswestry disability index, Visual analog scale, modified Schober test, Pressure biofeedback	It concluded that comparative to dynamic strengthening and pilates, lumbar stabilization was more effective in reducing chronic nonspecific low back pain.
Suh *et al.* (2019)	Randomized Controlled trial	48 participants were randomized into four groups Group 1 (n=13) Flexibility exercise group Group 2 (n=13) Walking exercise group Group 3 (n=10) Stabilization exercise group Group 4 (n=12) Stabilization with Walking exercise group	Oswestry disability index, Visual analog scale	This study concluded that Lumbar stabilization with walking exercise is not only effective in reducing pain but also preventing chronicity by improving muscle endurance.
Ahmed *et al.* (2014)	Quasi experimental study	40 patients selected into two groups Group A (n=20) specific Lumbar mobilisation techniques with Core Stability exercises Group B (n=20) Core Stabilization exercise alone	Oswestry disability index, Visual analog scale	It was concluded that specialised mobilisation techniques combined with core stabilisation exercise improve pain and function more than specific joint mobilisation approaches for individuals with mechanical low back pain**.**
França *et al.* (2010)	Comparative study	30 individuals randomly into two groups Group 1 (n=15) Segmental Stabilization Group 2 (n=15) Superficial strengthening	Oswestry disability index, Visual analog scale, McGill pain questionnaire, Pressure Biofeedback Unit	It concluded that pain and disability is reduced in both the intervention but TrA muscle activation capacity is more in Segmental stabilization.
Valenza *et al.* (2017)	Randomized Controlled trial	54 individuals were randomly splitted into Experimental group (n=27) Pilates exercise program Control group (n=27) receives information in leaflet	Oswestry disability index, Visual Analogue scale, Roland-Morris Disability Questionnaire, modified Shober test, Finger-to-	The result shows improvement in pain, disability, flexibility, and balance in patients with chronic nonspecific low back pain who were treated with 8 weeks of pilates based exercise program.

			floor test, Single limb stance test	
Anand *et.al.* (2014)	Randomized Controlled trial	30 subjects were randomly allocated into two groups Group A (n=15) Modified Pilates based exercise along with Flexibility Exercises Group B (n=15) Therapeutic exercises with Flexibility Exercises	Oswestry disability index, Visual analogue scale	It was established that modified pilates-based workouts not only reduce pain and disability but also improve specific back function, overall health, individual care, social interactions, and flexibility in those suffering from chronic nonspecific low back pain.

Inani and Selkar (2013) Core stabilisation exercises were come to be known more beneficial in lowering pain and increasing functioning in patients suffering from nonspecific low back pain. You *et al.* in 2014 was determined that the dorsiflexion of the ankle with drawing in abdominal wall exercise is more effective than drawing in abdominal wall exercise in reducing pain, disability, and improving core stability. Ahmed *et al.* in 2017 In chronic nonspecific low back pain, core muscle stabilisation exercise plus lumbar stretching was found to be more efficient than lumbar muscle stabilisation exercise. Majeed *et al.* in 2019 was found that 6 weeks of TRICCS protocol resulted in a good outcome in CLBP. Waseem *et al.* in 2019 revealed that core stability training combined with Chinese massage has a stronger therapeutic impact in nonspecific low back pain. Kim and Yim in 2020 Core stabilisation training, in conjunction with hip muscle strengthening, was found to be more effective in lowering pain and enhancing physical function and activity in NSLBP. França *et al.* in 2012 revealed that TrA muscle activation was stronger in Segmental Stabilisation than in stretching sessions in chronic low back pain. Bhadauria and Gurudut in 2017 was stated that lumbar stability was more helpful than pilates and dynamic strengthening in alleviating chronic nonspecific low back pain. Suh *et al.* in 2019 Lumbar Stabilisation with Walking Exercise was found to be not only efficient in relieving pain but also in preventing chronicity by enhancing muscle endurance. Ahmed *et al.* in 2014 concluded that selective mobilisation techniques combined with core stabilisation exercise enhance pain and function in people with mechanical low back pain better than specific joint mobilisation approaches. França *et al.* in 2010 suggests that Segmental Stabilisation increases TrA muscle activation capacity, improves pain and disability. Valenza *et al.* in 2017 has concluded that an 8-week pilates-based exercise programme improved pain, disability, flexibility, and balance in adults with persistent nonspecific low back pain. Anand *et al.* in 2014 concluded that Modified Pilates-based workouts not only reduce pain and disability but also improve specific lumbar function, general well-being, personal care, social life, and flexibility among CNSLBP.

Conclusion

The Core Stabilisation exercises show significant gains of disability and pain in CNSLBP individuals, which aids in their daily routine and lowers sick absence rates.

Acknowledgements

This research work is presented during Stride'23 International Physiotherapy conference on April 6th and 7th and the abstract is published as conference proceedings in International Journal of Physiotherapy and Occupational therapy (IJPOT).

References

Ahmed, A., Waqas, M. S., Ijaz, M. J., Adeel, M., Haider, R., & Ahmed, M. I. (2017). Effectiveness of core muscle stabilization exercises with and without lumbar stretching in non-specific low back pain. *Annals of King Edward Medical University, 23*(3).

Ahmed, R., Shakil-ur-Rehman, S., & Sibtain, F. (2014). Comparison between specific lumbar mobilization and core-stability exercises with core-stability exercises alone in mechanical low back pain. *Pakistan Journal of Medical Sciences Quarterly, 30*(1), 157.

Anand, U. A., ariet Caroline, P. M., Arun, B., & Gomathi, G. L. (2014). A study to analyse the efficacy of modified Pilates-based exercises and therapeutic exercises in individuals with chronic nonspecific low back pain: A randomized controlled trial. *International Journal of Physiotherapy Research, 2*(3), 525–529.

Balagué, F., Mannion, A. F., Pellisé, F., & Cedraschi, C. (2012). Non-specific low back pain. *The Lancet, 379*(9814), 482–491.

Bhadauria, E. A., & Gurudut, P. (2017). Comparative effectiveness of lumbar stabilization, dynamic strengthening, and Pilates on chronic low back pain: Randomized clinical trial. *Journal of Exercise Rehabilitation, 13*(4), 477.

França, F. R., Burke, T. N., Caffaro, R. R., Ramos, L. A., & Marques, A. P. (2012). Effects of muscular stretching and segmental stabilization on functional disability and pain in patients with chronic low back pain: A randomized, controlled trial. *Journal of Manipulative and Physiological Therapeutics, 35*(4), 279–285.

França, F. R., Burke, T. N., Hanada, E. S., & Marques, A. P. (2010). Segmental stabilization and muscular strengthening in chronic low back pain—a comparative study. *Clinics, 65*(10), 1013–1017.

Inani, S. B., & Selkar, S. P. (2013). Effect of core stabilization exercises versus conventional exercises on pain and functional status in patients with non-specific low back pain: A randomized clinical trial. *Journal of Back and Musculoskeletal Rehabilitation, 26*(1), 37–43.

Keller, A., Hayden, J., Bombardier, C., & Van Tulder, M. (2007). Effect sizes of non-surgical treatments of non-specific low-back pain. *European Spine Journal, 16*, 1776–1788.

Kim, B., & Yim, J. (2020). Core stability and hip exercises improve physical function and activity in patients with non-specific low back pain: A randomized controlled trial. *The Tohoku Journal of Experimental Medicine, 251*(3), 193–206.

Krismer, M., & Van Tulder, M. (2007). Low back pain (non-specific). *Best Practice & Research Clinical Rheumatology, 21*(1), 77–91.

Kumar, T., Kumar, S., Nezamuddin, M., & Sharma, V. P. (2015). Efficacy of core muscle strengthening exercise in chronic low back pain patients. *Journal of Back and Musculoskeletal Rehabilitation, 28*(4), 699–707.

Lee, C. W., Hwangbo, K., & Lee, I. S. (2014). The effects of combination patterns of proprioceptive neuromuscular facilitation and ball exercise on pain and muscle activity of chronic low back pain patients. *Journal of Physical Therapy Science, 26*(1), 93–96.

Majeed, A. S., TS, A., Sugunan, A., & MS, A. (2019). The effectiveness of a simplified core stabilization program (TRICCS—Trivandrum Community-based Core Stabilisation) for community-based intervention in chronic non-specific low back pain. *Journal of Orthopaedic Surgery and Research, 14*, 1–8.

Nadler, S. F., Malanga, G. A., Bartoli, L. A., Feinberg, J. H., Prybicien, M., & DePrince, M. (2002). Hip muscle imbalance and low back pain in athletes: Influence of core strengthening. *Medicine & Science in Sports & Exercise, 34*(1), 9–16.

Paungmali, A., Joseph, L. H., Sitilertpisan, P., Pirunsan, U., & Uthaikhup, S. (2017). Lumbopelvic core stabilization exercise and pain modulation among individuals with chronic nonspecific low back pain. *Pain Practice, 17*(8), 1008–1014.

Puntumetakul, R., Areeudomwong, P., Emasithi, A., & Yamauchi, J. (2013). Effect of 10-week core stabilization exercise training and detraining on pain-related outcomes in patients with clinical lumbar instability. *Patient Preference and Adherence*, 1189–1199.

Ramalingam, V., Jagatheesan, A., & Suganthirababu, P. (Eds.). (2023). *Proceedings of International Physiotherapy Conference – Stride'23*. International Journal of Physiotherapy and Occupational Therapy (pp. 1–143). https://ijpot.com/conference.html

Rozenberg, S. (2008). Chronic low back pain: Definition and treatment. *La Revue du Praticien, 58*(3), 265–272.

Suh, J. H., Kim, H., Jung, G. P., Ko, J. Y., & Ryu, J. S. (2019). The effect of lumbar stabilization and walking exercises on chronic low back pain: A randomized controlled trial. *Medicine, 98*(26).

Swetha, S., Prathap, S., Vinodhkumar, R., Vignesh, S., Kumaresan, A., & Jagatheesan, A. (2023). Effect of neck and upper trunk exercises in the management of mechanical low back pain. *INTI Journal, 2023*(18), 1–7.

Tayshete, I., Akre, M., Ladgaonkar, S., & Kumar, A. (2020). Comparison of effect of proprioceptive training and core muscle strengthening on the balance ability of adolescent taekwondo athletes. *International Journal of Health Sciences and Research, 10*(6), 268–279.

Valenza, M. C., Rodríguez-Torres, J., Cabrera-Martos, I., Díaz-Pelegrina, A., Aguilar-Ferrándiz, M. E., & Castellote-Caballero, Y. (2017). Results of a Pilates exercise program in patients with chronic non-specific low back pain: A randomized controlled trial. *Clinical Rehabilitation, 31*(6), 753–760.

Van Middelkoop, M., Rubinstein, S. M., Verhagen, A. P., Ostelo, R. W., Koes, B. W., & Van Tulder, M. W. (2010). Exercise therapy for chronic nonspecific low-back pain. *Best Practice & Research Clinical Rheumatology, 24*(2), 193–204.

Vianin, M. (2008). Psychometric properties and clinical usefulness of the Oswestry Disability Index. *Journal of Chiropractic Medicine, 7*(4), 161–163.

Waseem, M., Karimi, H., Gilani, S. A., & Hassan, D. (2019). Treatment of disability associated with chronic non-specific low back pain using core stabilization exercises in Pakistani population. *Journal of Back and Musculoskeletal Rehabilitation, 32*(1), 149–154.

You, J. H., Kim, S. Y., Oh, D. W., & Chon, S. C. (2014). The effect of a novel core stabilization technique on managing patients with chronic low back pain: A randomized, controlled, experimenter-blinded study. *Clinical Rehabilitation, 28*(5), 460–469.

Zhang, Y., Tang, S., Chen, G., & Liu, Y. (2015). Chinese massage combined with core stability exercises for nonspecific low back pain: A randomized controlled trial. *Complementary Therapies in Medicine, 23*(1), 1–6.