

# Effectiveness of Side-bridge and Prone-bridge Exercise on Reducing Pain and Disability of Individuals with Non-specific Chronic Low Back Pain

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## Abstract

**Background:** *Non-specific low back pain (NSLBP) has become a major public health problem worldwide. Generally, most of us will experience at least one episode of low back pain during our life and the highest occurrence in the third decade of life. Core muscle strengthening is one of the recommended exercises to treat pain and disability in individuals with low back pain.*

**Objective:** *The objective of this study is to compare the efficacy of side-bridge and prone-bridge exercises on reducing pain and disability of individuals with non-specific chronic low back pain.*

**Methodology:** *30 young adults were enrolled and divided equally into two groups: Group 1 (prone-bridge exercise) and Group 2 (side-bridge exercise). The exercises were performed for 10 repetitions, 3 sets per day for 4 weeks. The outcome measure used for pain intensity was Numerical Rating Scale (NRS) and Modified Oswestry Low Back*

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*Pain Disability Questionnaire (MOLBPDQ) was for disability. Pain intensity and disability were measured at beginning and end of study.*

**Results:** *Both Group 1 and Group 2 showed significant differences in reducing pain ( $p < 0.001$  respectively) for NSCLBP. However, there was no significant difference ( $p = 0.642$ ) between the improvements of both groups. The results also showed that both groups had significant differences in improving disability ( $p = 0.001$ ;  $p = 0.002$ ) for NSCLBP. Nevertheless, there was also no significant difference ( $p = 0.902$ ) in improvement of disability for both the groups.*

**Conclusion:** *The results of current study showed significant improvement in pain and disability for both two exercise groups, but there was no difference between groups. Prone-bridge and side-bridge exercises were safe and beneficial exercise to alleviate pain and improve disability in populations with chronic low back pain.*

**Keywords:** low back pain, non-specific chronic low back pain, core strengthening exercise, plank exercise, side plank exercise.

## BACKGROUND

Low back pain is explained as pain occurred in the range from 12th rib to the lower border of gluteal folds, with or without pain radiating to the leg, and which most conditions are non-specific (de Oliveira et al., 2019; Krismer & van Tulder, 2007). Non-specific low back pain (NSLBP) has become a topmost public health problem all over the world (Balagué F, Mannion AF, Pellisé F, 2012). Generally, most of the individuals will experience at least one experience of pain during their life and the highest occurrence was during the third decade of life (Ganesan, Acharya, Chauhan, & Acharya, 2017; Rehtine, 1992). It can happen in all ages group from children to adolescents (Waseem, Karimi, Amir, & Hassan, 2018; Balagué, Troussier, & Salminen, 1999).

Based on the World Health Organization (WHO), the non-specific low back pain lifetime prevalence is estimated at the range of 60% to 70% in industrialized countries meanwhile the lifetime prevalence was 84% as according to Ribeiro, Sedrez, Candotti, & Vieira, (2018). According to Hartvigsen et al., (2018), globally the number of years lived with low back pain and the disability caused by it increased

54% from 1990 to 2015, mainly caused by the increase and ageing of population, the biggest growth seen in low-income and middle-income countries where it was once considered prevalent in industrialized countries only (Banerjee & Geoff, 2015). Meanwhile the prevalence of low back pain in Malaysia was found to be 12%. The public and private primary healthcare clinics rated low back pain as the ninth and fifth most common complaint respectively in the period between August to November 2012 (Hani & Liew, 2018). In addition to the high prevalence, the sources of pain in most of the individuals who suffering from back pain are not well-established, and this group of people were often described by the word 'non-specific low back pain' (Lim, Poh, Low, & Wong, 2011).

One of the world's most significant burdens is non-specific chronic and persistent low back pain (Banerjee & Geoff, 2015). It can cause loss of function and health condition in terms of symptoms, activity limitation and participation restriction but it does not induce structural changes by definition (Krismer & van Tulder, 2007). The risk factors of low back pain including sedentary lifestyle, excessive coffee consumption in medical staffs in North-East Poland significantly increased incidence and the chances of recurrent non-specific low back pain was high and estimated to be within the range from 25% to 70% in different populations (Citko et al., 2018). The authors also defined sedentary lifestyle as long duration of sitting during working, during rest time and when moving as long as these activities done required energy expenditure that less than 1.5 METS. The chances of developing pain in the lumbar spine region are high in the nurses and paramedics as their work often include excessive strain on the low back. This required them to maintain a forced body position, also known as postural stress. Taspinar, Taspinar, Cavlak, & Celik, (2013) also concluded the factors such as smoking, attending long duration of classes, age, increased sitting periods during working and using lumbar support while sitting were the reasons that caused NSLBP in university students. In addition, the backpacks usage during school time and there was correlation between backpack weights with back pain (Sheir-Neiss, Kruse, Rahman, Jacobson, & Pelli, 2003). Their study on relationship between backpack use and back pain in teenagers suggested that backpack users that having back pain, they might

encounter more problems in general health, physical functioning and bodily pain.

Exercise intervention programs including strengthening of muscles, flexibility or aerobic fitness are favourable choices as treatment regimen for individuals with non-specific chronic low back pain but not acute low back pain (Gordon & Bloxham, 2016). There are numerous ways to treat low back pain but in general, exercise is considered an effective management strategy for NSCLBP (Waseem et al., 2018) and is advocated as main part of treatment (Salamat et al., 2017). There is study by Gordon & Bloxham (2016) showed that aerobic exercise, muscles strengthening and stabilisation exercises and flexibility training are beneficial in alleviating non-specific chronic low back pain. However, the best choices of treatment to treat low back pain still remains unknown (Mayer, Mooney, & Dagenais, 2008). Meanwhile, in strengthening exercise contains a lot of exercises that improve muscle strengths to reduce and overcome low back pain.

Pain with unclear pathoanatomical cause defined as NSLBP, thus reducing pain and its consequences are what the treatment usually emphasizes on (Maher, Underwood, & Buchbinder, 2017a). Rehtine (1992) mentioned that pain and disability are the most vital symptoms of non-specific low back pain. Meanwhile, strengthening of muscles is one of the recommended exercises to reduce low back pain. Exercise is effective in preventions of low back pain according to (Henchoz & Kai-Lik So, 2008). Core strengthening exercise can prevent injuries occur in sports and during treatment by make use the most of muscle strength and endurance (Escamilla et al., 2010). There are a few exercises used to improve core muscles strength which including the crunches exercise, plank exercise and s bridging exercise (Ekstrom, Donatelli, & Carp, 2007). Among these three exercises, plank exercise strengthens the stability of core muscles the most (Lee et al., 2016a). To prevent injuries to the knees, hip joints and also the lumbar spine, the author suggested that core muscle stability needs to be taken into consideration. In addition, by maintaining the proper posture of body and gait alignment, it helps in alleviating back pain (Mok et al., 2015). Exercise is an appropriate way as treatment for easing disability and pain severity at the same time improving body fitness and occupational status in individuals who suffering from subacute, chronic or recurrent low back pain.

The purpose of this study is to find out the effectiveness of side-bridge and prone-bridge exercises on alleviating pain and disability of individuals with non-specific chronic low back pain as according to (Franca, Burke, Hanada, & Marques, 2010), weakness of trunk muscles is one of the essential risk factor that causing low back pain. The authors also stated that due to the combination of different exercises and strategies in most clinical interventions, it is difficult to isolate the effectiveness of a specific technique in treating low back pain. According to Lawrence (2013), it is important to improve core muscles strengths which can help to improve postures which are often the fundamental to overcome injuries to the lower back and spine.

Exercises that have the highest rectus abdominis (RA) muscle activity are chosen for comparison between the effectiveness of respective exercise on easing pain and improving disability of individuals with NSCLBP. The exercises chosen are the side-bridge (mean  $\pm$  SD, 34%  $\pm$  13%MVIC) and prone-bridge (43%  $\pm$  21%MVIC) since both are having the greatest RA muscle activity (among 9 rehabilitation exercises) without significant difference in EMG signal amplitude between them ( $P = 0.430$ ) as according to a study done by Ekstrom et al., (2007). They also mentioned that the results suggest exercises that have been analysed could be used for core rehabilitation or performing enhancement program depending on individual needs.

According to Foster, Williams, & Ed, (2016), further studies should be carry out to highlight the benefit of treatment such as core strengthening independently in treating low back pain. Exercise that strengthens the core is easier to perform and learn by patients with low back pain compare to usual resistance training which might easily bring harms to those with low back pain. Therefore, patients can perform these exercises at home as home programme as no special equipment is required (Chang, Lin, & Lai, 2015). Strengthening exercise is one of a cheap and low-cost way for low back pain relief.

## **METHODOLOGY**

This study used a quasi-experimental study design. It was aimed to compare the effectiveness between side-bridge and prone-bridge exercises on reducing the pain and disability of individuals with non-specific chronic low back pain. A total of 30 subjects with non-specific

chronic low back pain from Universiti Tunku Abdul Rahman, Malaysia were recruited by using convenience sampling method. Individuals who met the inclusion criteria were chosen and recruited to join this study.

### **Inclusion Criteria**

1. Individuals aged 18-25 years with non-specific chronic low back pain
2. Individuals with low back pain without specific pathology

### **Exclusion Criteria**

1. Individuals with previous spinal/abdominal surgery (Traeger et al., 2014)
2. Individuals with radicular low back pain (Cho et al., 2014)
3. Individuals with pain and on analgesics, NSAIDs and/or muscle relaxants

A short briefing regarding participating in this research was given to all participants at the research setting. The briefing included the title, purpose of current research, procedures of research, allocation of exercise and method of performing intervention training. The participants were also asked to fill up the consent form, form of demographic data, NRS and MOLBPDQ. Participants were assessed for subjective pain assessment and abdominal manual muscle testing (MMT) by examiner before recruited and allocated to exercise group.

Participants that recruited were then assigned into two different groups (Group 1 and Group 2) by simple drawing method through mobile application "Lucky Wheel Lucky Draw" version 2.5. The participants were allocated into two different groups by the researcher by pressing spin on the application to generate the group allocation result. There was chance of repeating the result as previous round result to prevent bias in this research. The sequences of participants list were based on the date and time when participants were recruited.

### **Intervention Training Program**

Participants were informed by researcher which intervention training group they were allocated in. A brief explanation regarding the exercise they need to perform, how to perform, starting position, duration and repetition of exercise were informed to participants before they started.

The participants were divided into two groups with different exercise respectively, Group 1 (Prone-bridge) and Group 2 (Side-bridge). Both exercises were performed by participants on yoga mat with or without towel stabilizing or supporting the arms provided by researcher.

For Group 1 exercise which was prone-bridge exercise, participants were taught to lie on stomach with forearms on mat as starting position. Then, participants were asked to rise up so that they are resting on forearms and toes with neutral spine as shown in Figure 1. They were required to hold this position for 30 seconds, repeated 10 repetitions for 3 sets.



**Figure 1: Participant performing prone-bridge exercise**

For Group 2 exercise which was side-bridge exercise, participants were taught to lie on one side with elbow underneath them and rose up so that they are resting on one elbow, forearm and foot on same side with neutral spine as shown in Figure 2. They were also required to hold this position for 30 seconds, repeated for 10 repetitions for 3 sets. Participants were required to perform for both sides.



**Figure 2: Participant performing side-bridge exercise**

The duration to perform both exercises respectively was 30 seconds hold for exercise. Participants were informed to contract the abdominal muscles and not to hold breath throughout the period of performing the exercises. The resting intervals were 30 seconds rest between repetitions and 60 seconds rest between sets. The duration for each exercise session was 15 minutes to 30 minutes depends on which group the participants were in. Both group exercises will be conducted 1 session per day, 3 days per week and for 4 weeks (Akhtar, Karimi, & Gilani, 2017).

All participants were requested to fill in NRS and MOLBPDQ again after all the sessions of exercises were completed after 4 weeks. Manual muscle testing for abdominal muscle also has been assessed again to check for any improvement in abdominal muscle strength. NRS also was rated with scoring from 0 to 10 while MOLBPDQ was rated with percentage (%).

## **ETHICAL CONSIDERATION**

Ethical clearance form was submitted to UTAR Scientific and Ethical Review Committee (SERC) prior to the conduction of the study and the approval was received to progress with the study. A letter of cooperation written from the respective department to the institute where data collection was taken was involved in this study prior to the data collection period. Targeted participants were recruited and the further procedure of the study were only progressed in participants with qualified inclusion criteria. The details of the research study were explained to all participants before the intervention, which included the purpose of the study, brief procedure, anticipated risk and benefits that could be anticipated from the study. After the brief description of the study, the consent form was given to the participants before participating in the research. They were instructed to read the consent form thoroughly before they fill in their details and sign the form. Personal information of the participants was kept confidential. Ethics was maintained strictly throughout the study.



## **DISCUSSION**

The purpose of current research is comparing the effects among side-bridge and prone-bridge exercises on alleviating pain and decreasing disability of individuals with non-specific chronic low back pain. A total of 30 participants (8 male and 22 female) that having non-specific chronic low back pain were enrolled and completed current study. The participants were distributed into two groups of core strengthening exercise respectively, Group 1 performing the Prone-bridge exercise and Group 2 performing the Side-bridge exercise.

According to Cholewicki & Pm (1996), muscles around spine that were not coordinated well and lacking of core strength are the major factors causing LBP. Core muscle weakness may also cause excessive anterior pelvic tilt which can increase the stress on facet joints and thoracolumbar fascia tightness (Kline, Krauss, Maher, & Qu, 2013) Therefore in this study, after performed the core strengthening exercises, the results showed there were improvements between Pre and Post MMT for both Group 1 and 2 correspondingly. The results of both groups showed significant differences. It is important to improve the strength of core muscles and stability so that they can support the body in upright posture while sitting as there was association between poor sitting posture and LBP (Gordon & Bloxham, 2016). Most of the participants in current study claimed that one of the aggravating factors of LBP was prolonged sitting duration when subjective pain assessment was done.

On the other hand, there were no significant differences between the improvements for MMT when the two groups were compared. Both the groups were performing core strengthening exercise in current study. Kline et al. (2013) suggested that dynamic strengthening exercises (same exercises as HEP but performed using dynamic sling system) were more effective to improve core strength and reducing pain and disability in LBP patients especially ballet dancers when compared to traditional home exercise program (HEP) of core strengthening exercises and can be performed without adverse effects. Moreover, Narr & Sco, (2014) studied on comparison between plank variations performed with or without instability devices and showed that the EMG activity in muscles is higher while performed with instability devices compared with traditional plank. Moreover, more

rehabilitation, strength and conditioning programs are choosing to increase core strength and endurance through plank utilization instead of traditional plank.

Wang, Guo, Lu, & Ni, (2016) suggested that non-surgical treatment such as patient education, specific exercises and joint manipulation are generally claimed to be effective in short term and recommended as treatment for chronic low back pain (CLBP) as according to the present study, the results showed that there was significant difference in Pre and Post NRS for both Group 1 and Group 2 exercises. There were sufficient evidences regarding exercise therapy that showed more effectiveness when compared to no treatment for patients with CLBP in a systemic review by Van Tulder, Malmivaara, Esmail, & Koes (2000). A review about comparison between core stability and general exercise for CLBP was done by Coulombe, Games, Neil, & Eberman (2017). They concluded that the reduction in pain intensity showed significant and more effective at 3 months' time in core stability exercise group compared to general exercise group. Another study demonstrated that when core muscle strengthening exercises were compared with spinal flexion exercises, it would be a better choice on reducing pain in CLBP patients (Chaturvedi, 2018).

However, there was no significant difference between the improvements in NRS of Group 1 (prone-bridge) and Group 2 (side-bridge) exercises. This can be supported by any kind of exercise therapy for example exercises, motor control exercises, Tai Chi, Yoga, Pilates, psychological therapies, multidisciplinary rehabilitation, acupuncture, massage and spinal manipulation (Qaseem et al., 2017) can be used to treat chronic low back pain (Federico et al., 2012). There are also numerous ways of therapies which help in pain management, conversely, not all intervention strategies are having the same levels of effectiveness (Cuesta-Vargas, Gonzalez-Sanchez, Labajos-Manzanares, & Galn-Mercant, 2012). There was also absent of proven studies which shown that one type of exercise is more effective than the other, thus guidelines are available in choosing exercise according to one's requests, preferences and competences (N. E. Foster et al., 2018). As per suggested by Almeida, Saragiotto, Richards, & Maher (2018), another recommended treatment for more complicated presentations for chronic LBP patients was combination of exercise and/or cognitive

behavioural therapy with multidisciplinary approach instead of exercise therapy only.

There was also significant difference in Pre and Post Disability for both Group 1 and Group 2 after the intervention. There was study suggesting few recommended physical treatments such as graded activity or exercises no matter in the form of alone or combination which targeting enhancements in function and prevent disability from getting worse mainly in persistent low back pain (N. E. Foster et al., 2018). Wang, Guo, Lu, & Ni (2016) also suggested that patients who undergone non-invasive treatment such as specific exercises, patient education and spinal manipulation combined with trunk-stabilization, stretching and muscle strengthening exercises, showed better outcomes in reducing disability when compared to patients who chosen surgical intervention. Another review about stability exercise of the core versus general exercise for CLBP done by Coulombe, Games, Neil, & Eberman (2017) also mentioned that stability exercise for the core had greater effectiveness in reducing disability in LBP patients when compare to general exercise at 3 months' time but not at 6 or 12 months. The exercises included in core stability and general exercises were not mentioned specifically in the review. Moreover, core stabilization exercises including pressure feedback core exercise in supine and prone, exercise for multifidus, plank and side plank exercise, pelvic floor exercises, strengthening exercises for diaphragm, standing with one leg on foam and tandem standing with perturbation showed larger reduction in disability compared to patients who performed routine physical therapy (Waseem et al., 2018).

Conversely, results from a randomized controlled trial about 12 weeks digital care program in treating low back pain by Shebib et al. (2019) suggested that multi-model non-invasive care approaches including aerobic exercise, sensor-guided physical therapy-like exercises, education of patient and cognitive behavioural therapy would show improvement in pain and disability score. In addition, most clinicians will prescribe exercises which are easy to learn and perform by LBP patients through a combination of four forms of exercise therapy; exercises for posture, aerobic exercises, flexibility exercises and stabilization exercises for the core (Majeed et al., 2019) instead of core strengthening exercise only. Stankovic et al. (2012) also recommended that intervention that combined of core stability and core

muscle strengthening exercises was more effective than core strengthening exercises alone in reducing NSCLBP.

Nevertheless, the results indicated no significant difference in improvements of disability between both groups exercise. According to review done by Van Middelkoop et al. (2013), they mentioned that they found nine studies which showed no significant differences between various form of exercises intervention protocols in reducing pain and disability which agreed with the result of current study. Dundar et al. (2009) also mentioned that there were strong evidences proving that exercise therapy is as effective as other conservative interventions for reducing pain and disability in CLBP patients. Moreover, numbers of guidelines are available in recommending exercises for treating CLBP and now also including various types of exercises such as Tai Chi, Yoga, aerobic instead of exercise program only (National Guideline Centre, 2016; Qaseem, Wilt, McLean, & Forcica, 2017). But, the type of exercise seems less important for effectiveness in reducing pain and disability than how well the exercise program is structured (National Guideline Centre, 2016; Van Wambeke Leuven et al., 2017).

## **CONCLUSION**

Pain and long-term disability caused by CLBP are very common (Liddle, Baxter, & Gracey, 2004). It can also cause other difficulties such as movement restriction, participation restriction during physical activity and effects on career (Wenig, Schmidt, Kohlmann, & Schweikert, 2009). Therefore, the most favour interventions are usually physical therapy and various forms of exercise (Wang et al., 2016). However, the most suitable specific intervention for treating NSCLBP patients is often remaining uncertain (Gordon & Bloxham, 2016).

In conclusion, the results of current study indicated significant improvement in pain and disability for both two groups, but there was no difference between the two groups. Both exercises in this study can be used to improve core strength, reduce pain and disability in individuals with non-specific chronic low back pain.

## RECOMMENDATION

A study with greater sample size shall be conducted to be more generalized representing larger population that are having non-specific chronic low back pain. Next, further research provided with adequate study period shall be carried out to find out the long-term effects of prone-bridge and side-bridge exercises on alleviating pain and decreasing disability of individuals with non-specific chronic low back pain.

### Conflict of interest

Authors have declared that there is no conflict of interest.

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This study was self-sponsored by the researchers.

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