

Abdominal Stretching Exercise for Low Back Pain in Traditional Weavers: A Pre-Post Intervention Study

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ABSTRACT

Weavers are often restricted from maintaining ergonomic postures due to static work activities and repetitive movements that can cause complaints of low back pain. The purpose of this study is to evaluate the effect of abdominal stretching exercise on reducing low back pain complaints. A quasi-experimental design (one-group pre-posttest) was used in this study with 45 weavers as a research sample, taken by total sampling technique. The Wilcoxon test results indicated a p-value of <0.001 , demonstrating a statistically significant decrease in low back pain complaints. After the intervention, the majority of respondents experienced a decrease in pain levels from moderate to mild. This study demonstrates the potential of abdominal stretching exercise as a non-pharmacological approach to managing low back pain in weaving workers; however, additional studies with more robust methodologies are required to substantiate these results.

Pekerja tenun dalam mempertahankan postur tubuh yang ergonomis seringkali terbatas akibat aktivitas kerja yang statis dan gerakan berulang sehingga dapat menimbulkan keluhan low back pain. Tujuan penelitian ini untuk mengetahui apakah dengan abdominal stretching exercise dapat menurunkan keluhan low back pain pada pekerja tenun di Desa Troso. Desain yang digunakan dalam penelitian ini adalah quasi-eksperimental (one group pre-post test) dengan 45 pekerja tenun menjadi sampel penelitian, yang diambil dengan teknik total sampling. Hasil penelitian menggunakan uji Wilcoxon dengan nilai "p-value 0,000" dimana "p-value $<0,05$ " yang artinya terdapat penurunan keluhan low back pain secara signifikan. Setelah dilakukan intervensi mayoritas responden mengalami penurunan tingkat nyeri dari kategori sedang menjadi ringan. Penelitian ini menunjukkan potensi abdominal stretching exercise sebagai pendekatan non-farmakologis untuk mengelola nyeri punggung bawah pada pekerja tenun, namun, diperlukan studi lanjutan dengan metodologi yang lebih kuat untuk menegaskan hasil ini

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Introduction

Weavers are individuals involved in the process of making woven fabrics. This job requires high precision and skill (Rika et al., 2022). Weavers use traditional weaving tools in the weaving process. Weavers insert and compact the yarn manually, resulting in repetitive movements of the arms. Weavers typically work in a seated position with straight, static legs on backless looms. Weavers work in a non-ergonomic posture for a relatively long period of time, averaging 8 hours/day, and this is repeated every day (Ones et al., 2021).

Research by Pridayanti et al., (2023) has shown that of all workers, 25% complain of back pain and 23% experience muscle pain caused by low back pain (LBP), which is a common but often overlooked health problem. Low Back Pain (LBP) is a complaint of pain felt in the lower back, originating from the spinal column

(lower back), muscles, nerves, and other surrounding structures (Hasmar et al., 2023). An imbalance in the back causes muscle and joint pain and injury. Low Back Pain (LBP) is caused by poor posture during activities, such as sitting in a non-ergonomic position for extended periods of time (Kristiana & Puspitasari, 2023).

Community nursing care can provide therapeutic interventions, such as abdominal stretching exercises (Amilsyah et al., 2023). Abdominal stretching exercises are part of physical training that involves stretching the muscles, especially in the abdomen, for approximately 10 minutes. This exercise aims to increase muscle strength, endurance, and flexibility and is specifically designed for this purpose. The movements of abdominal stretching exercises consist of stretching and strengthening movements such as cat stretches, lower trunk rotations, curl ups, and so on. The benefits of abdominal stretching exercises are to prevent or correct posture, especially in cases of hyperlordosis. Research indicates that this physical exercise can help reduce pain and alleviate lower back pain (Rifaah et al., 2020).

Previous studies have generally not directly provided abdominal stretching exercise interventions to workers, but have focused more on the general population, such as adolescents or pregnant women, with nonspecific pain complaints such as dysmenorrhea (Mansoben et al., 2021). Based on these issues, this study focuses on evaluating the effectiveness of abdominal stretching exercises in reducing low back pain (LBP) complaints among weavers in Troso Village. The research question is “Does abdominal stretching exercise have an effect on the level of low back pain complaints among weavers?” The hypothesis is that regular abdominal stretching exercises can reduce the level of low back pain (LBP) complaints in respondents. This study aims to provide scientific evidence regarding the effectiveness of non-pharmacological interventions and serve as a basis for the prevention and management of low back pain (LBP) in informal sector workers.

Research Methods

This study used a quantitative approach with a one-group pre-post test design. Data collection was conducted from April 7 to May 3, 2025. The population in this study consisted of 27 weavers at Batik Troso Lembah Karya and 23 weavers at Batik Troso Hj Nur Salim. With a population of 50 workers, total population sampling was used, and participants were selected based on inclusion and exclusion criteria. The inclusion criteria included weavers aged 20–65 years, with at least one year of work experience, experiencing low back pain (LBP) based on The Pain and Distress Scale (PAD) questionnaire, and willing to be respondents by signing an informed consent form. Meanwhile, exclusion criteria included workers with a history of spinal injury or surgery, severe neurological disorders, mobility limitations, or other musculoskeletal diseases that could affect the intervention results. Based on these criteria, 45 respondents were eligible and participated in this study. Furthermore, this study has undergone an ethical review process and obtained approval from the Research Ethics Committee with letter number 024/IV/EC/P3M/STIKES/2025. All respondents were provided with information regarding the objectives, benefits, and procedures of the study, and they expressed their willingness to participate by signing a consent form after receiving the information.

The data collection method used included a low back pain (LBP) complaint questionnaire consisting of 20 questions using a Likert scale, with the following categories: always score 4, often score 3, Rarely score 2, and Never score 1. This questionnaire is from The Pain and Distress Scale (PAD), which has been tested for validity and reliability. Validity testing indicated that all 20 questionnaire items were valid (calculated $r > 0.361$). Based on the reliability test, the Cronbach's alpha value was “0.89”, indicating high reliability. Based on these results, this questionnaire is suitable for use as an instrument for measuring the level of low back pain (LBP) complaints. Data analysis in this study was performed using the SPSS data processing program, specifically Univariate Analysis, Homogeneity Test, and Bivariate Analysis.

The intervention involved each respondent receiving 8 sessions of abdominal stretching exercises with a frequency of 2 times per week for 1 month, with each session lasting 10-15 minutes. The intervention included static and dynamic stretching focused on the abdominal, lower back, and pelvic muscles. The frequency and duration of the intervention were based on previous literature showing that a stretching exercise program with

a minimum duration of one month has been proven to increase muscle tissue elasticity, improve posture stability, and significantly reduce lower back pain intensity. Thus, although the data collection period was relatively short, the number of sessions and frequency of exercise applied were considered adequate to produce the expected physiological response. The data were then analyzed using the Wilcoxon test to examine the significance of changes in pain levels before and after exercise, given that the data were ordinal and not normally distributed. This study also followed ethical approval procedures through respondent consent forms and permission from relevant parties, as well as ensuring the confidentiality of participant data in accordance with ethical research procedures.

Table 1
Abdominal Stretching Exercise Protocol

No	Name of Movement	Position	Duration	Repetitions	Rest period	Purpose of Exercise
1	Cat Stretch	Position your hands and knees on the floor, arch your back, then move your stomach toward the floor.	10 seconds	3 times	10 Seconds	Reduces lower back muscle tension.
2	Cat Camel	Position your hands and knees on the floor, move your back upward, and lower your head toward the floor.	10 seconds	3 times	10 seconds	Improves spinal mobility and reduces back stiffness
3	Child's Pose	Position your hands and knees on the floor, then sit on your heels and extend both arms forward.	20 seconds	3 times	10 seconds	Relax the lower back, hips and shoulders
4	Lower Trunk Rotation	Lie on your back with your knees bent and feet flat on the floor, then slowly rotate to the right and left.	20 seconds	3 times	10 seconds	Improving spinal mobility
5	Abdominal Strengthening Curl Up	Lie on your back and bend your knees, arch your back toward the floor, then push up so your back is parallel to the floor	20 seconds	3 times	10 seconds	Strengthens the upper abdominal muscles and core
6	Lower Abdominal Strengthening	Lie on your back with your knees bent and arms stretched out, pull both knees toward your chest and pull your heels with the ball.	-	15 times	10 seconds	Strengthens the lower abdominal muscles and hip flexors
7	Bridge Position	Lie on your back with your knees and feet bent and your elbows on the floor, flatten your back on the floor, then lift your lower hips and back to form a straight line.	20 seconds	3 times	10 seconds	Strengthens the lower back and glute muscles

Results

The data from this study can be interpreted in the table below, which supports the objectives of this study.

Table 2
Homogeneity Test Based on Age and Length of Service

Respondent Characteristics	P-Value	Interpretation
Age	“0.170”	Homogeneous “p>0.05”
Length of Service	“0.001”	Not homogeneous “p<0.05”

As shown in Table 2, the age variable yielded a p-value of 0.170 ($p > 0.05$), indicating a homogeneous distribution across groups. The non-homogeneous distribution of length of service ($p = 0.001$) suggests variability in occupational exposure among respondents.

Table 3
Frequency Distribution Based on Age, Gender, and Length of Service

Respondent Characteristics	Frequency (f)	Percentage (%)
Age		
Early adulthood: 26-35 years old	10	“22.2%”
Late adulthood: 36-45 years old	16	“35.6%”
Early old age: 46-55 years old	13	“28.9%”
Late old age: 56-65 years old	4	“8.9%”
Senior age: >65 years old	2	“4.4%”
Total	45	100%
Gender		
Male	5	“11.1%”
Female	40	“88.9%”
Total	45	100%
Length of Service		
<1 year	0	“0%”
1-5 years	22	“48.9%”
6-10 years	21	“46.7%”
11-15 years	1	“2.2%”
16-20 years	1	“2.2%”
Total	45	100%

Table 3 shows the characteristics of respondents aged 36-45 years old, totaling 16 respondents “35.6%”, female respondents totaling 40 respondents “88.9%”, and the majority of respondents with 1-5 years of work experience totaling 22 respondents “48.9%”.

Diagram 1 Frequency Distribution of Low Back Pain (LBP) Complaints

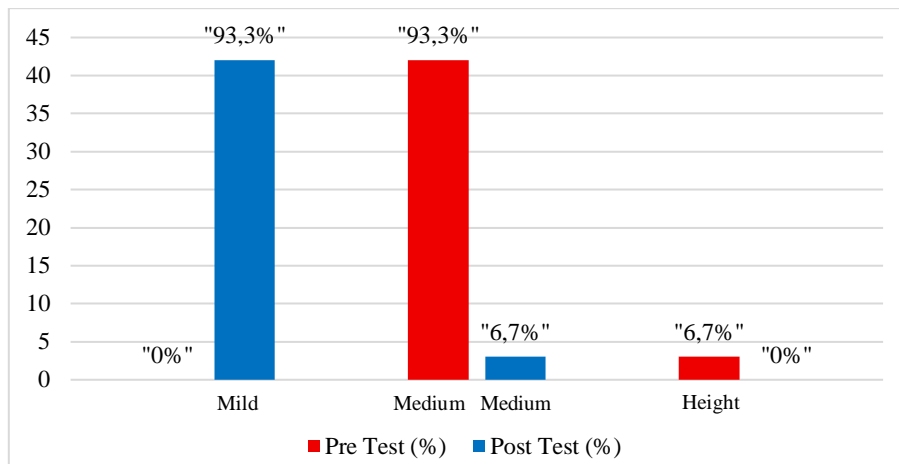


Diagram 1 shows the characteristics of low back pain (LBP) before intervention, with the majority of complaints being moderate in 42 respondents “93.3%”, and high in 3 respondents “6.7%”. After intervention, the majority of complaints were mild in 42 respondents “93.3%”, and 3 respondents “6.7%” had moderate complaints.

Table 4
Wilcoxon Test Results for Low Back Pain (LBP) Complaint Levels

Complaint Level	Negative Ranks	Positive Ranks	Ties	Z	P (P-Value)
Pre-Test Post-Test complaints of low back pain (LBP)	45	0	0	-6.708 ^b	“0.000”

Table 4 shows the results of the Wilcoxon test, which obtained a negative rank value (45), meaning that all 45 respondents experienced a decrease in low back pain (LBP) complaints after the intervention, as well as a Z (-6.708), indicating a decrease in pain levels after the abdominal stretching exercise intervention. The p-value was “0.000”, where “p<0.05”, leading to the conclusion that H0 is rejected and Ha is accepted, meaning that there is a significant effect of abdominal stretching exercises on the reduction of low back pain (LBP) complaints before and after the intervention.

Discussions

Weaving work is characterized by static postures and repetitive movements that limit trunk mobility and increase mechanical load on the lumbar region. The abdominal muscles play a crucial role in maintaining core stability and supporting the lumbar spine; inadequate flexibility or endurance of these muscles can contribute to the development of low back pain. Therefore, abdominal stretching exercises are considered relevant as an intervention to reduce muscle stiffness and improve spinal support in weavers.

The results of the study of 45 respondents showed that most of them experienced low back pain. Before the abdominal stretching exercise intervention, the number of respondents with low back pain in the high category was 3 respondents “6.7%”, while in the moderate category there were 42 respondents “93.3%”. After the abdominal stretching exercise intervention, low back pain complaints decreased in the moderate category to 3 respondents “6.7%”, and in the mild category to 42 respondents “93.3%”. In addition, the Wilcoxon test results obtained a p-value (Asymp. Sig 2 tailed) of “0.000”, where “p<0.05”, indicating that H0 was rejected and Ha was accepted. This shows that the abdominal stretching exercise intervention has a significant effect in reducing

low back pain complaints among weavers. This finding is in line with the research by Prastiwi et al. (2021), which proves that abdominal stretching exercises can increase the elasticity of the muscles, spine, and pelvis and help reduce low back pain.

The effectiveness of abdominal stretching exercises in this population can be explained through the biomechanical mechanism of each movement, namely the lower trunk rotation movement, which helps compensate for the static lumbar flexion position experienced by weavers when sitting for long periods at the loom, thereby reducing pressure on the intervertebral discs. The cat-camel and child's pose movements flex the spine and reduce the stiffness of the erector spinae muscles caused by static working positions. Strengthening exercises such as abdominal strengthening curl-ups and lower abdominal strengthening strengthen the core muscles that play a role in postural stabilization, thereby reducing the risk of injury. In addition, regular stretching improves blood circulation, accelerates the removal of pain-causing metabolites such as lactic acid, and helps relax muscles (Novayanti et al., 2021). Furthermore, it has benefits for increasing body elasticity, strengthening the back and pelvic muscles, and making the diaphragm more flexible and stronger in the oxygenation process (Fauziah, 2021). This exercise also helps reduce pain in the joints and lower back. This exercise also plays a role in maintaining estrogen hormone balance and reducing pain during dysmenorrhea (Unganlawar et al., 2023).

In a study by Suganda et al., (2021), late adulthood is a productive age that begins to show anatomical and physiological decline, especially in muscle strength, joint flexibility, and overall endurance. As individuals age, they tend to experience a decline in muscle mass, reduced bone density, and a lack of elasticity in connective tissue and ligaments. This condition increases the risk of muscle fatigue, injury, and complaints such as low back pain (LBP) and other musculoskeletal disorders. At this stage, anatomical conditions in late adulthood can be exacerbated by various risk factors, such as difficulty adapting to workloads. As a result, workers in late adulthood are more prone to low back pain and decreased productivity (Wahab, 2022). Low back pain is defined as pain felt in the lower back area, which can be localised or radiate to other parts of the body such as the legs. This pain is usually located between the lower ribs and the lower buttocks, especially in the lumbar or lumbosacral region (Dimiyati et al., 2024).

According to research conducted by Syaputra et al., (2022), women experience more low back pain (LBP) complaints than men. Although in general, men and women have the same chance of experiencing low back pain, in reality, gender can influence the emergence of these complaints. Males generally possess higher bone density and muscle mass, whereas females undergo estrogen fluctuations during menstruation, pregnancy, and menopause that can affect musculoskeletal stability, while women experience changes in estrogen hormones, especially during menstruation, pregnancy, and menopause (Octaviana, 2022). Estrogen hormones function to maintain joint balance, bone density, and muscle strength. Women entering perimenopause will begin to experience a gradual decline in estrogen hormones. During this period, the lower back bones become more vulnerable and at risk of back pain. This can cause the bones and muscles to be insufficiently strong to support the body, thereby increasing the risk of low back pain (LBP) (Mambu', 2022).

Work experience is one of the factors that can influence low back pain due to the body's adaptation process to new workloads and limited familiarity with ergonomic working practices. Workers with shorter employment duration often adopt inappropriate sitting or bending postures, whereas workers with longer employment duration may experience cumulative musculoskeletal strain due to prolonged exposure to repetitive activities (Aeni et al., 2022). According to Noli et al., (2021), work experience was not significantly associated with low back pain complaints, however, other occupational factors such as inadequate ergonomic knowledge and insufficient recovery time may contribute to pain among workers with shorter employment duration.

Work experience is one of the factors that can influence low back pain due to the body's adaptation process to new workloads and a lack of understanding of the work. This lack of experience often leads to poor posture when sitting, bending, or lifting loads. Therefore, the initial period of employment is an important period in the prevention of low back pain (LBP) (Aeni et al., 2022). According to a study conducted by Noli et al., (2021), 26 respondents "81.3%" had a work period of 1-5 years, with statistical test results showing that there was no

significant relationship between work period and low back pain (LBP) complaints. The study explained that workers with short employment periods are more prone to low back pain (LBP) due to other factors such as lack of work experience, not being accustomed to maintaining good work posture, lack of understanding of ergonomic work positions, and lack of rest time, which can cause lower back pain complaints. The homogeneity test showed that the length of employment variable was not homogeneous “ $p = 0.001$ ”, indicating a significant difference in distribution among respondents. This condition could be a confounding variable because workers with a short length of employment are more prone to low back pain (LBP) due to a lack of adaptation and understanding of ergonomics, while workers with a long length of employment may experience cumulative musculoskeletal damage. The wide range of work experience may potentially influence the response to the intervention and mask differences in effects between groups. Therefore, the results should be interpreted with caution, and further research is recommended to stratify respondents based on work experience or use multivariate analysis to control for confounding variables so that the internal validity of the study can be improved.

According to Novayanti et al., (2021), abdominal stretching exercises can reduce muscle stiffness and lower back pain complained of by workers. As stated, abdominal stretching exercises can reduce muscle spasms, increase joint flexibility and muscle strength, thereby improving the functional activities of respondents through these exercises. Additionally, these exercises can improve blood flow, help relax uterine muscles, and prevent anaerobic metabolism that triggers lactic acid production. Abdominal stretching exercises aim to improve posture and reduce excessive pressure on the lower back muscles. Furthermore, this exercise is more effective when performed twice a week to allow muscle recovery time, prevent excessive fatigue or injury, and a twice-weekly schedule is easier to implement consistently with busy daily activities (Dini, 2021). Abdominal stretching exercises are a simple and effective method that can be used as an alternative to non-pharmacological therapy to treat dysmenorrhea pain, maintain posture, and improve overall health, especially in adolescent girls (Tyas et al., 2023).

Statistically, the results demonstrated a significant reduction in pain ($p < 0.001$). However, the clinically significant reduction in pain from moderate to mild in the majority of respondents indicates a real impact on daily activities, quality of life, and work productivity among weavers. With reduced pain, workers can maintain their work positions longer, increase production efficiency, and reduce the risk of physical fatigue. Additionally, improved physical comfort can support work efficiency, improve posture, and enhance overall well-being. These findings confirm that abdominal stretching exercises are not only statistically significant but also provide clinically relevant benefits in the context of occupational health in the informal sector.

This study has important implications for community nursing. Community nurses can play an active role in educating, training, and promoting abdominal stretching exercises in informal work environments such as the weaving industry. These exercises are relatively simple, do not require special equipment, are easy to implement twice a week, and can be done independently after initial training. This intervention can be a cheap, safe, and effective non-pharmacological prevention and management strategy, while also supporting the promotion of occupational health in the informal sector (Sallo et al., 2023).

Although the results of Martatias et al., (2024) show a significant effect of abdominal stretching exercises on reducing low back pain (LBP) complaints, there are several methodological limitations that need to be considered. This study did not involve a control group, so it cannot be fully confirmed that the changes that occurred were solely due to the intervention provided. In addition, the diversity of the respondents' work experience may have influenced their response to the exercises. The short duration of the intervention and monitoring also limits understanding of the long-term effects. Therefore, the results need to be interpreted carefully and serve as a basis for further research with a stronger design and duration (Saputra, 2020).

Despite these limitations, the consistent reduction in low back pain observed after the intervention suggests that abdominal stretching exercises remain a promising non-pharmacological strategy for occupational health promotion among traditional weavers. Nevertheless, future studies employing controlled designs with

multivariate statistical adjustments are required to confirm the independent effect of the intervention after accounting for work experience and other occupational risk factors.

Study Limitations

This study has several limitations. First, the distribution of the length of service variable was not homogeneous ($p = 0.001$), indicating considerable variation in occupational exposure among participants. This variability may have influenced both baseline low back pain severity and individual responses to the intervention, thereby acting as a potential confounding variable. Consequently, the findings should be interpreted with caution, and their generalizability may be limited to populations with similar occupational characteristics and distributions of work experience. Future studies are encouraged to apply multivariate statistical analyses to control for work experience and other potential confounding variables, thereby improving the internal validity and generalizability of the findings.

Second, this study did not include a control group. Therefore, the Hawthorne effect may have influenced the results because participants were aware that they were being observed and received continuous attention and guidance throughout the intervention period. As a result, the observed improvements may have been partially attributable to behavioral or psychological responses associated with study participation rather than solely to the physiological effects of abdominal stretching exercises. Future studies should employ a randomized controlled trial (RCT) design with an appropriate comparison group, such as a sham-exercise or attention-control group, to better distinguish the specific physiological effects of abdominal stretching exercises from the psychological effects associated with researcher attention and participant expectations.

In addition, the use of self-report questionnaires may have introduced recall bias and social desirability bias. Finally, the relatively short follow-up period did not allow evaluation of the long-term effectiveness and sustainability of abdominal stretching exercises in reducing low back pain.

Conclusions

Low back pain is a common occupational health problem experienced by weavers due to repetitive activities and non-ergonomic positions. This study shows that abdominal stretching exercises can be an effective non-pharmacological treatment to reduce these complaints by increasing muscle flexibility and improving posture. These findings support the importance of preventing musculoskeletal disorders in informal workers. Further research is recommended using a stronger design, such as involving a control group that does not receive the intervention or receives a different type of intervention, extending the follow-up period, and employing multivariate statistical analyses to control for work experience and other potential confounding variables. These improvements would strengthen the validity and enhance the generalizability of future findings.

Conflict of Interest

The authors declare that there is no conflict of interest associated with the research, authorship, and/or publication of this article.

CrediT Author Statement

This research was performed by a team of researchers possessing complementary scientific expertise. The following is a breakdown of the roles and contributions of the research team. **Melania Putri Devitasari:** Conceptualization, methodology, formal analysis, validation, project administration, writing-original draft. **Prita Adisty Handayani:** Conceptualization, writing-review, editing, software, data curation, supervision, validation. **Siti Juwariyah:** Validation, software, data curation. **Swanny Trihajanti Widyaatmadja:** Validation, data curation.

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