THE EFFECTS OF CORE STRENGTH TRAINING ON LOWER BACK PAIN IN WORKERS

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Abstrak

Nyeri Punggung Bawah (NPB) merupakan salah satu masalah kesehatan yang paling umum dialami oleh pekerja di berbagai sektor dan di berbagai usia. NPB memiliki prevalensi tertinggi di dunia di antara kondisi muskuloskeletal dan juga penyebab utama kecacatan di seluruh dunia yang membutuhkan rehabilitasi bagi sebagian besar penderitanya. Lingkungan dan jenis pekerjaan yang melibatkan posisi duduk berkepanjangan atau sedentary work, pengangkatan beban berat, atau postur tubuh yang tidak ergonomis sangat berkontribusi terhadap prevalensi NPB. NPB sering kali menjadi penyebab utama absensi, penurunan produktivitas, serta penurunan kualitas hidup pekerja. Program latihan kekuatan otot inti atau Core Strength Training (CST) adalah salah satu pendekatan yang semakin banyak mendapat perhatian. CST dianggap sebagai intervensi yang efektif untuk memperkuat otot-otot inti, meningkatkan stabilitas, serta mengurangi ketegangan pada punggung bawah. Penulis ingin mengevaluasi efek CST terhadap NPB pada pekerja, dengan mengetahui manfaat spesifik dari CST ini, diharapkan dapat dikembangkan rekomendasi yang lebih efektif untuk mencegah dan mengelola NPB, sehingga meningkatkan kesehatan dan produktivitas pekerja serta menghindari kecacatan di masa tua. Penelitian ini bertujuan untuk mengevaluasi efektivitas CST dalam mengurangi intensitas NPB pada pekerja. Penelitian ini akan menggunakan desain mix methods dengan pendekatan pra-eksperimental menggunakan one group pretest posttest design untuk analisis kuantitatif dan wawancara mendalam untuk analisis kualitatif. Populasi dalam penelitian ini adalah warga Kelurahan Tlogosari Kulon dan warga Kelurahan Tlogosari Wetan masih aktif bekerja dan mengalami NPB. Waktu pengumpulan data dilaksanakan selama 6 minggu dengan 2x latihan setiap minggu. Instrumen penelitian adalah tim peneliti sendiri, sedangkan alat bantu instrumen yang digunakan adalah berupa skala nyeri Numerical Rating Scale dan lembar observasi dengan metode mnemonic PQRST, yaitu Provokes (Penyebab) dan Palliative (Yang Meredakan), Quality (Kualitas), Radiates (Penyebaran), Severety (Keparahan), time (Waktu). Analisis Kuantitatif menggunakan uji normalitas data yaitu Kolmogorov-Smirnov. Analisis Kualitatif dalam penelitian ini menggunakan metode analisis tematik. Triangulasi data dilakukan dengan membandingkan hasil wawancara dengan data kuantitatif.

Kata Kunci: *Otot Inti Tubuh, Nyeri Punggung Bawah, Pekerja*

Abstrac

Low Back Pain (LBP) is one of the most common health problems experienced by workers across various sectors and across all ages. LBP has the highest prevalence among musculoskeletal conditions worldwide and is also a leading cause of disability worldwide, requiring rehabilitation for most sufferers. Work environments and types involving prolonged sitting or sedentary work, heavy lifting, or non-ergonomic postures significantly contribute to the prevalence of LBP. LBP is often a major cause of absenteeism, decreased productivity, and a reduced quality of life for workers. Core Strength Training (CST) programs are one approach that is gaining increasing attention. CST is considered an effective intervention for strengthening core muscles, increasing stability, and reducing strain on the low back. The authors aimed to evaluate the effects of CST on LBP in workers. By understanding the specific benefits of CST, it is hoped that more effective recommendations for preventing and managing LBP can be developed, thereby improving worker health and productivity and avoiding disability in old age. This study aimed to evaluate the effectiveness of CST in reducing the intensity of LBP in workers. This study will employ a mixed methods design with a pre-experimental approach, employing a one-group pretest-posttest design for quantitative analysis and in-depth interviews for qualitative analysis. The population comprised residents of Tlogosari Kulon and Tlogosari Wetan who were still actively working and experiencing low back pain. Data collection was conducted over six weeks, with two weekly training sessions. The research instrument was the research team itself, while the instruments used were a Numerical Rating Scale (NRS) and an observation sheet using the PQRST mnemonic method: Provokes (Causes) and Palliatives (Relieves), Quality (Quality), Radiates (Radiates), Severity (Severity), and Time (Time). Quantitative analysis used the Kolmogorov-Smirnov test for data normality. Qualitative analysis employed thematic analysis. Data triangulation was performed by comparing interview results with quantitative data.

Keywords: *Core Strength Training, Low Back Pain, Workers*

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INTRODDUCTION

Low Back Pain (LBP) is one of the most common health problems experienced by workers in various sectors and across all ages. It has the highest prevalence worldwide among musculoskeletal conditions and is also a leading cause of disability worldwide, requiring rehabilitation for most sufferers. According to the WHO, approximately 619 million people suffered from low back pain in 2020, a 60% increase since 1990. This figure is expected to increase to approximately 843 million by 2050, with the largest increases expected in Africa and Asia, the most populous regions and where life expectancy is also increasing. People of all ages can experience LBP, including children and adolescents. The highest number of cases occurs in those aged 50-55, with women experiencing LBP more often than men. The greatest prevalence and disability impact of LBP occurs in those aged 80-85. In the European Union, musculoskeletal disorders are the most common health problem, with 25–27% of workers complaining of back pain and 23% of workers complaining of muscle pain (Suryanto et al., 2020). Meanwhile, in Indonesia, provinces with a higher prevalence of joint disease than the national average are Nanggroe Aceh Darussalam, West Sumatra, Bengkulu, West Java, Central Java, East Java, Bali, West Nusa Tenggara, East Nusa Tenggara, South Kalimantan, and Papua, a total of 11 provinces. The prevalence of musculoskeletal disorders in Central Java alone reaches 18.9% (Riskesdas, 2013, Santosa, 2016).

In the workplace, LBP is often a major cause of absenteeism, decreased productivity, and decreased quality of life for workers. Work involving prolonged sitting or sedentary work, lifting heavy loads, or non-ergonomic postures significantly contribute to the prevalence of LBP. A 2025 study by Krisandi Al Fiqih and Abdurrozzaq Hasibuan suggested that ergonomics in the workplace will affect worker productivity. If workplace ergonomics are adapted to workers' conditions, it will reduce musculoskeletal complaints by 40%, reduce absenteeism by up to 30%, and increase efficiency by up to 30%. In an effort to reduce the prevalence of LBP, various approaches have been developed, including work environment modifications, ergonomic training, and physical exercise programs. Other research also shows that core muscle weakness can increase the risk of low back injury due to a lack of spinal stability. The aforementioned low back pain (LBP) and its impact on work are also frequently experienced by residents of Tlogosari Kulon and Tlogosari Wetan (Pedurungan District, Semarang) who are still actively working and range in age from 40 to 70.

Physical exercise programs are one approach that is gaining increasing attention for addressing this low back pain. The physical exercise in question is core strength training (CST). Dr. Budi Sugiarto Widjaja, MD, in his article in Spine Clinic Family Holistic (2024), stated that the core muscles include the muscles in the abdomen, lower back, pelvis, and buttocks. They play a crucial role in maintaining posture, balance, and spinal stability. Core strength training (CST) is considered an effective intervention for strengthening core muscles, improving stability, and reducing strain on the lower back.

A 2022 study by Meutiah Mutmainnah Abdullah et al. found significant changes before and after Core Strengthening Training, as evidenced by a reduction in pain and an increase in Activity of Daily Living (ADL) in patients with low back pain. The sample size in that study was limited to 15 individuals aged 25-65, but this study will not be age-restricted because there are workers aged 65 and over. A 2020 study by Pongsatorn Saiklang et al. found that dynamic lumbar extension supported by the Abdominal Drawing-In Maneuver technique appears to prevent increased pain intensity during prolonged sitting in patients with chronic low back pain. Furthermore, patients with low back pain (LBP) are prevalent in Tlogosari Kulon and Tlogosari Wetan villages, ranging from acute to chronic.

Based on this gap, there is still limited empirical evidence regarding the effectiveness of CST training programs, especially in workers of all ages who are still productive and with various levels of low back pain.

The aim of this study is to evaluate the effectiveness of CST in reducing the intensity of LBP in workers of various ages and at various levels of LBP. The benefits of this study are theoretically to provide scientific contributions regarding the benefits of CST in reducing the intensity of LBP, and practically to provide guidance for workers and companies in implementing physical exercise programs that can improve core and spinal muscle health.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Low Back Pain (LBP)

Low back pain (LBP) is a common condition characterized by pain or discomfort in the lower back or lower lumbar region, including the lower spine, waist, and pelvis, and can radiate to the buttocks or legs. According to the World Health Organization (WHO) in 2023, LBP can be acute (lasting less than 6 weeks), subacute (6–12 weeks), or chronic (lasting more than 12 weeks). Various symptoms that indicate LBP include pain or soreness in the lower back, sharp or stabbing pain in the buttocks, soreness or pain radiating to the buttocks or back of the legs, excessive pain that occurs at certain times (such as before menstruation), soreness or pain that worsens after prolonged standing or sitting, pain that suddenly appears after lifting heavy objects, and lower back discomfort in certain positions (such as bending or squatting).

In most cases of acute NPB, symptoms resolve on their own, and most people recover well. However, in some people, symptoms persist and become chronic pain. People with NPB may also experience leg pain related to the spine (sometimes called sciatica or radicular pain). According to the Texas Back Institute (2025), radicular pain occurs when nerve roots in the spine become inflamed or irritated. Underlying symptoms include tingling, numbness, and muscle weakness. The pain can

range from a dull, hard-to-locate ache to a sharp, stabbing, burning sensation.

According to an article by Mitra Keluarga Hospital (2024), some causes of LBP are:

a. Torn Muscle or Ligament. The most common cause of LBP is a torn or pulled muscle or ligament. This can occur when someone suddenly sprains or strains their back, repetitive movements involving the lower back muscles, or strains, which occur when excessive stretching and tearing affect the ligaments, which connect bones together. Sprains and strains that trigger lower back pain can be caused by several factors, such as lifting heavy objects or twisting the spine while lifting, sudden movements that put too much pressure on the lower back (such as falls), poor posture over time (such as sitting for too long, habitually slouching), and sports injuries (especially sports that involve twisting or strong impacts).

b. Joint and Bone Disorders. Some joint and bone disorders that can cause lower back pain include osteoarthritis, joint dysfunction, herniated discs, spinal stenosis, and compression fractures.

c. Pinched Nerves. A pinched nerve is a condition where pressure is exerted on a nerve by another part of the body. Someone experiencing this will definitely feel pain.

d. Autoimmune Disease. Autoimmune disease is a condition where the immune system mistakenly recognizes and attacks healthy cells. Many types of autoimmune diseases can cause back pain, including rheumatoid arthritis, ankylosing spondylitis, lupus, Crohn's disease, and fibromyalgia.

e. Tumors. Tumor growths in various parts of the body can also cause back pain. Tumors that cause back pain usually originate in the breast, prostate, kidney, thyroid, or lungs.

According to the medical team from Siloam Hospital (2025), if LBP is caused by muscle tension, the pain will appear gradually. Meanwhile, LBP caused by injury will cause sudden pain. Certain factors can also trigger LBP, including being overweight or obese, pregnancy, and spinal abnormalities.

LBP can limit a person's movement or activity, thus affecting work and community involvement. Psychosocial factors such as work stress and job dissatisfaction can also exacerbate LBP symptoms. According to WHO (2023), LBP is one of the leading causes of global disability that impacts individuals' quality of life as well as work productivity.

Core Muscles

The core muscles consist of the muscles located in the center of your body, or trunk, surrounding your spine and pelvis. These muscles include the abdominal muscles in the front, the muscles in your lower back, and the muscles around your sides.

Figure 1: Core Muscles (Spine Clinic Family Holistic 2024)

Compared to other muscles in the body, the core muscles are not the strongest, but they play a crucial role in supporting and stabilizing the spine and pelvis. They also prevent the spine from excessive stress and are essential for movement between the upper and lower body. They are also key to maintaining good posture. According to Dr. Budi Sugiarto Widjaja, MD, in his article in Spine Clinic Family Holistic 2024, the function of core muscles is to facilitate movement throughout the body and prevent back injuries. Core muscles are used in daily activities such as getting up from a chair, standing, walking, sweeping the floor, mopping, lifting, and athletic movements such as running, jumping, and lifting weights. Unfortunately, most people neglect these core muscles and never train their strength.

Core Strength Training

In the medical world, there are various treatments for low back pain (LBP). The most common methods include rest, pain relief or muscle relaxants, braces, physiotherapy, and, if the condition is too severe, surgery. However, these approaches will not completely resolve low back pain, as the root of the problem lies in weak core muscles. Dr. Budi Sugiarto Widjaja, MD, in his article in Spine Clinic Family Holistic (2024), stated that strengthening core muscles is crucial for its benefits: (a) Improving Balance and Stability. Strengthening core muscles improves balance and stability, making everyday movements such as walking, running, and sitting easier. Strong core muscles support the body, reducing the risk of injury and keeping the body in a straight line from the neck to the hips, thus minimizing muscle and joint spasms. This is also crucial for the elderly to reduce the risk of falls. (b) Relieving Back Pain. Maintaining an upright posture reduces the risk of back pain. If the core muscles are weak, the other back muscles have to work harder to support the body, which can lead to muscle tension and back pain. (c) Upright Posture. Good posture reduces friction between the vertebrae, allowing for deeper breathing and easier oxygen flow to the muscles, allowing them to contract properly. Furthermore, maintaining an upright posture makes sitting or standing more manageable for longer periods.

A well-designed core strength training program, using proper exercise techniques, is safe for both healthy and older adults. A well-designed exercise program can also improve muscle strength, power, and neuromuscular function in older adults. A 2019 study by Maren S. Fragala, Eduardo L.

Cadore, Sandor Dorgo, Mikel Izquierdo, William J. Kraemer, Mark D. Peterson, and Eric D. Ryan found that a properly designed resistance training program can counteract age-related changes in contractile function, atrophy, and morphology of aging human skeletal muscle. A well-designed resistance training program can counteract age-related changes in contractile function, atrophy, and morphology of skeletal muscle in aging humans. It is also stated that a resistance/muscle strength training program for older adults should include an individualized and periodized approach working towards 2–3 sets of 1–2 multijoint exercises per major muscle group, achieving an intensity of 70–85% of 1-repetition maximum (1RM), 2–3 times per week, including strength training performed at higher speeds in concentric movements at moderate intensity (i.e., 40–60% of 1RM). The training program should also follow the principles of individualization, periodization, and progression. This can be seen in Table 1 below.

Tabel 1. Resistance Training Program for Healthy older adults

Resistance training general recommendations for healthy older adults.†

Program variable	Recommendation†	Details
Sets	1-3 sets per exercise per muscle group	1 set for beginners and older adults with frailty progressing to multiple sets (2-3) per exercise.
Repetitions	8-12 or 10-15	Perform 6-12 reps with variation for muscular strength for healthy older adults. Perform 10-15 repetitions at a lower relative resistance for beginners.
Intensity	70-85% of 1RM	Begin at a resistance that is tolerated and progress to 70-85% of 1RM using periodization. Lighter loads are recommended for beginners, or individuals with frailty, or special considerations such as cardiovascular disease and osteoporosis. Exercises should be performed in a repetition-range intensity zone that avoids going to failure to reduce joint stress.
Exercise selection	8-10 different exercises	Include major muscle groups targeted through multijoint movements (e.g., chest press, shoulder press, triceps extension, biceps curl, pull-down, row, lower-back extension, abdominal crunch/curl-up, quadriceps extension or leg press, leg curls, and calf raise).
Modality	Free-weight or machine-based exercises	Beginners, frail older adults, or those with functional limitations benefit from machine-based resistance training (selectorized weight or pneumatic resistance equipment), training with resistance bands, and isometric training. High functioning older adults gain added benefit from free-weight resistance training (e.g., barbells, dumbbells, kettlebells, and medicine balls).
Frequency	2-3 days per week, per muscle group	Perform on 2-3 nonconsecutive days per week, per muscle group, may allow favorable adaptation, improvement, or maintenance.
Power/explosive training	40-60% of 1RM	Include power/explosive exercises where high-velocity movements are performed during the concentric phase at moderate intensities (i.e.,40-60% of 1RM) to promote muscular power, strength, size, and functional tasks.
Functional movements	Exercises to mimic tasks of daily living	Healthy, high functioning older adults benefit from the inclusion of multijoint, complex, and dynamic movements, with base of support or body position variations.

*RM 5 repetition maximum.
†General guidelines are provided. Resistance training programs should include variation in intensity and program variables. Strength exercises should be performed before endurance training during concurrent training sessions to optimize strength gains.

Regular practice of these exercises results in beneficial neuromuscular adaptations in both healthy older adults and those with chronic conditions. These adaptations translate into functional improvements in activities of daily living.

The core strength training in this study used a chair as a support because weak core muscles, especially the lower back muscles, can cause the body to overcompensate by using the knees, leading to further pain and discomfort.

The Effect of Core Strength Training on Low Back Pain

Several studies have shown that Core Strength Training can contribute to reducing the intensity of low back pain. A 2022 study by Meutiah Mutmainnah Abdullah et al., titled "Core Strength Training on Changes in Pain and Daily Living Activities in Low Back Pain Patients," found significant changes before and after Core Strengthening Training, as evidenced by a decrease in pain and an increase in Daily Living Activities in low back pain patients. The study sample size was limited to 15 participants aged 25-65 years.

Su Su Hlaing et al., in their 2021 research article titled "Effects of Core Stabilization Exercise and Strengthening Exercise on Proprioception, Balance, Muscle Thickness, and Pain-Related Outcomes in Patients with Subacute Nonspecific Low Back Pain: a Randomized Controlled Trial," concluded that Core Strength Exercise, as an optimal treatment, improved proprioception, balance, and percentage change in muscle thickness while reducing functional disability and fear of movement in patients with subacute nonspecific low back pain. Participants in the study were aged 20-50 years.

Several studies have shown that CST can contribute to reducing LBP intensity, but the authors would like to know more about the contribution of CST in a more mature age range, namely those over 40 years who are still actively working.

Pain Assessment

Gustinerz.com (2020), a website that provides information about nursing, health, medicine, technology, and science, pain is an unpleasant sensory and emotional experience caused by actual or potential tissue damage. Pain is a common complaint among patients upon hospital admission. Therefore, assessing pain in patients requires the use of appropriate instruments or measurement tools. Several pain assessment tools have been researched and can be used for pain assessment. This study will use the PQRST mnemonic method and the NRS (Numeric Rating Scale).

The PQRST mnemonic method stands for Provokes (Cause) and Palliative (Relief), Quality (Quality), Radiates (Radiation), Severity (Severity), and Time (Time).

Table 2. PQRST mnemonic for pain assessment

Singkatan	Pertanyaan
P : provokes, palliative (penyebab)	Apa yang menyebabkan rasa sakit/nyeri; apakah ada hal yang menyebabkan kondisi memburuk/membaik; apa yang dilakukan jika sakit/nyeri timbul; apakah nyeri ini sampai mengganggu tidur.
Q : quality (kualitas)	Bisakah anda menjelaskan rasa sakit/nyeri; apakah rasanya tajam, sakit, seperti diremas, menekan, membakar, nyeri berat, kolik, kaku atau seperti ditusuk (biarkan pasien menjelaskan kondisi ini dengan kata-katanya).
R : Radiates (penyebaran)	Apakah rasa sakitnya menyebar atau berfokus pada satu titik.
S : severety (keparahan)	Seperti apa sakitnya; nilai nyeri dalam skala 1-10 dengan 0 berarti tidak sakit dan 10 yang paling sakit. Cara lain adalah menggunakan skala FACES untuk pasien anak-anak lebih dari 3 tahun atau pasien dengan kesulitan bicara.
T : time (waktu)	Kapan sakit mulai muncul; apakah munculnya perlahan atau tiba-tiba; apakah nyeri muncul secara terus-menerus atau kadang-kadang; apakah pasien pernah mengalami nyeri seperti ini sebelumnya, apabila "iya" apakah nyeri yang muncul merupakan nyeri yang sama atau berbeda.

The Numeric Rating Scale (NRS) is a frequently used method for subjectively assessing pain in conscious patients. The method uses a scale of 0-10. Using the NRS, we can determine the patient's pain level: 0 (no pain), 1-4 (mild pain), 5-6 (moderate pain), and 7-10 (severe pain).
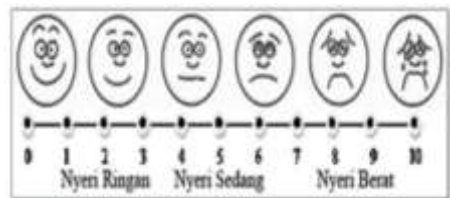

Figure 2. *NRS (Numeric Rating Scale)*

Information:

Scale 0	No pain
Scale 1-3	Mild pain/pain that can still be tolerated and does not interfere with the sufferer's activities
Scale 4-6	Moderate pain/slightly strong pain that can interfere with the patient's activity patterns
Scale 7-10	Severe pain/very strong pain, usually requires medical therapy and the sufferer cannot carry out independent activity patterns.

METHODS

Research Type and Design

This study will employ a mixed methods design with a pre-experimental approach, employing a one-group pre-test-post-test design for quantitative analysis and in-depth interviews for qualitative analysis.

Population and Sample

The population in this study is residents of Tlogosari Kulon and Tlogosari Wetan Villages of any age who experience low back pain and are still working. The sample size was 30 people using a purposive sampling technique.

Observed Variables

The independent variable in this study is Core Strength Training, and the dependent variable is the intensity of low back pain.

Research Location

This research was conducted in Tlogosari Kulon and Tlogosari Wetan Villages, Pedurungan District, Semarang.

Data Collection Period

Data collection in this study was conducted over 10 weeks, consisting of 2 weeks for the pre-test, 2 weeks for the post-test, and 6 weeks for the intervention (a 6-week intervention with two exercises per week).

Research Instruments

The research instruments were provided by the research team itself, while the instruments used were a Numerical Rating Scale (NPS) and an observation sheet using the PQRST mnemonic method, which includes Provokes (Causes) and Palliatives (Relievers), Quality (Quality), Radiates (Radiates), Severity (Severity), and Time (Time). Other supporting tools included a mobile phone to record the interviews and writing utensils.

Data Analysis

Quantitative Analysis

Data normality was tested using the Kolmogorov-Smirnov test. Differences between pretest and posttest data within a group were analyzed using a paired t-test if the data were normally distributed, or a Wilcoxon signed-ranks test if not normally distributed.

Qualitative Analysis

Qualitative data were collected through in-depth interviews with participants regarding their experiences with low back pain before and after the experiment. Interview transcripts were analyzed using thematic analysis to identify patterns, themes, and participants' feelings regarding the effectiveness of exercise for low back pain. Data triangulation was performed by comparing the interview results with the quantitative data.

RESULTS AND DISCUSSION

Respondent Characteristics

Table 3. Respondent Characteristics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
JENIS KELAMIN	45	1	1	1.00	.000
USIA	45	49	71	60.69	5.476
PRE_TEST	45	1	10	4.84	2.804
POST_TEST	45	0	9	2.49	2.735
Valid N (listwise)	45				

Respondents numbered 45 people (N) with a minimum age of 49 years and a maximum age of 71 years, while the average age of respondents was 60.7 years. The minimum pre-test score was 1, the maximum score was 10, the average pre-test score was 4.84. The minimum post-test score was 0, the maximum score was 9, the average post-test score was 2.49. The average type of work was self-employed, as many as 42 respondents, some had clothing stores, aluminum stores, private tutors, opened food stalls, sold food, made souvenirs and so on, 3 respondents worked as employees of Pertamina partner companies, household assistants, and multilevel marketing.

Normality Test

Table 4. Normality Test

One-Sample Kolmogorov-Smirnov Test

		PRE_TEST	POST_TEST
N		45	45
Normal Parameters[a,b]	Mean	4.84	2.49
	Std. Deviation	2.804	2.735
Most Extreme Differences	Absolute	.167	.218
	Positive	.167	.218
	Negative	-.096	-.181
Test Statistic		.167	.218
Asymp. Sig. (2-tailed)		.003[c]	.000[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

The Kolmogorov-Smirnov test results show that the pre-test significance value is 0.003 and the post-test significance value is 0.000, which is less than 0.05. This indicates that the data is not normally distributed.

Wilcoxon Difference Test Results
Table 4. Wilcoxon Difference Test Results

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
POST_TEST - PRE_TEST	Negative Ranks	45[a]	23.00	1035.00
	Positive Ranks	0[b]	.00	.00
	Ties	0[c]		
	Total	45		

a. POST_TEST < PRE_TEST
b. POST_TEST > PRE_TEST
c. POST_TEST = PRE_TEST

First Output "Ranks"
Negative Ranks, or the negative difference between the pre-test and post-test results, are 23.00 for both the N value, Mean Rank, and Sum Rank. This value of 20.00 indicates a decrease from the pre-test to the post-test score. There are 45 negative (N) data points, meaning all 45 respondents experienced a decrease in lower back pain from the pre-test to the post-test score. The mean rank, or average, of this decrease is 23.00, while the sum of positive ranks, or Sum of Ranks, is 1035.00.

Positive Ranks, or the positive difference between the pre-test and post-test results, is 0.00, indicating no increase in lower back pain among all respondents. The sum of positive ranks, or Sum of Ranks, is 0.00.

Ties are the similarities between the pre-test and post-test scores. Here, a tie is zero (0), indicating that there are no identical scores between the pre-test and post-test scores.

Test Statistics[a]

	POST_TEST - PRE_TEST
Z	-5.924[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

Second Output: "Test Statistics"
In our hypothesis testing, we use the second SPSS output, the "Test Statistics" output. Before analyzing the results above, we first need to understand the decision-making process used in the Wilcoxon test to serve as a guideline.

Decision-Making Process in the Wilcoxon Test :
1. If the Asymp.Sig. (2-tailed) value is less than <0.05, then Ha is accepted.
2. Conversely, if the Asymp.Sig. (2-tailed) value is greater than >0.05, then Ha is rejected.

Based on the "Test Statistics" output above, the Asymp.Sig. (2-tailed) value is 0.000. Since 0.000 is less than <0.05, we can conclude that "Ha is accepted." This means that there is a difference between the intensity of lower back pain for the Pre Test and Post Test, so it can also be concluded that "There is an influence/effect of core muscle strength training on the intensity of lower back pain in workers."

Discussion
The results of the aforementioned study indicate that core muscle strength training twice a week for 6 weeks (12 workouts), using low to moderate intensity, significantly reduced the intensity of lower back pain in all respondents.

These results align with research conducted by Isma Ningsih et al. in 2023, which found that strengthening exercises have been shown to be a significant program because this type of exercise improves lumbar muscle extensors in elderly people with low back pain.

This study involved 45 respondents, and all experienced a reduction in the intensity of their lower back pain. Three respondents experienced only a slight reduction in pain, or a reduction of only one level. This was because of these three respondents: two were obese, and one already had various back problems such as spondylolisthesis, spondylosis, scoliosis, symptoms of a herniated nucleus pulposus, and osteoarthritis of the sacroiliac joint. In the two obese respondents, this can be explained through research by Ingrid Heuch et al. in 2024 which stated that the risk of chronic lower back pain will increase along with a higher Body Mass Index value, so the level of pain reduction is very small so that future evaluations must be reduced Body Mass Index if you want a greater reduction in pain. Furthermore, in one respondent who experienced various problems in his back mentioned above, one of which was scoliosis or a sideways curvature of the spine, forming the letter "C" or "S", according to Dr. Regina Varani through her article in Spine Clinic 2025, the best and highly recommended exercise for scoliosis patients is Schroth exercise. This exercise method focuses on balancing muscle strength on the weak side and improving overall posture. Strength training for scoliosis sufferers must be different because the exercise must be adjusted to strengthen the muscles that support the spine and correct imbalances. Therefore, the reduction in pain for respondents with scoliosis is very small.

CONCLUSION
Core muscle strengthening exercises performed twice a week for 6 weeks (12 workouts), using low to moderate intensity, significantly reduced lower back pain in workers.

The authors recommend that further research on core muscle strengthening exercises in obese or scoliosis-affected individuals is needed to achieve better results.

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