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## "EFFECTIVENESS OF PROVIDING ULTRASOUND AND BACK EXERCISE INTERVENTION TO REDUCE PAIN IN LOW BACK PAIN CONDITIONS"

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### ABSTRACT

Low Back Pain is a condition characterized by pain in the lower back muscles, commonly caused by excessive daily activities such as prolonged standing, lifting heavy loads, or sitting for extended periods. These activities can lead to muscle strain, while aging further contributes to decreased physical activity and mobility, resulting in weakened back and abdominal muscles. The prevalence of LBP in Indonesia is estimated at 18% and increases with age. Approximately 85% of LBP cases are nonspecific, often related to soft tissue abnormalities such as injuries, muscle spasms, or fatigue. To address these problems, interventions such as Ultrasound and Back exercise can be applied. This study aimed to investigate the effectiveness of Ultrasound and Back exercise in reducing pain among patients with LBP. This experimental research employed a pre-test and post-test group design, comparing pain intensity before and after a six-week intervention. From a total population of 25 participants screened based on inclusion and exclusion criteria, 20 participants were eligible and selected as the study sample. Pain levels were measured using the Numerical Rating Scale (NRS). The results of the paired comparison analysis showed a significant reduction in pain ( $p = 0.002$ ,  $p < 0.05$ ), indicating that Ultrasound and Back exercise were effective in alleviating pain associated with Low Back Pain. This study demonstrates that the combination of Ultrasound and Back exercise provides a significant reduction in pain among patients with Low Back Pain.

**Keywords:** Low Back Pain, Pain, Ultrasound, Back exercise, Numerical Rating Scale

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### INTRODUCTION

*Low back pain* is a condition where there is a muscle disorder in the lower back area caused by excessive daily activities, such as standing for too long, lifting heavy loads and sitting for too long (Magee, 2013). Low back pain is a musculoskeletal disorder caused by incorrect ergonomics. The main symptom of low back pain is

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pain in the back spine. In general, this pain is caused by muscle stretching and increasing age which will cause the intensity of exercise and movement to decrease. Low back pain is defined as a non-specific condition that refers to complaints of acute or chronic pain and discomfort near the lumbosacral area caused by inflammation, degenerative processes, gynecological disorders, trauma and metabolic disorders(Sari et al., 2015). Lower back pain is felt between the corners of the lower ribs to the lower buttocks, namely the lumbar or lumbosacral area and is often accompanied by pain in the legs and feet. Low back pain that lasts more than 6 months is called chronic(Tanjung, 2009). This will cause the back and abdominal muscles to become weak(Umami et al., 2014). The prevalence of low back pain in Indonesia is 18% and is predicted to continue to increase as a person ages. Low back pain generally occurs in the second decade to the beginning of the fourth decade, for example, cases of lower back pain in East Nusa Tenggara province based on data obtained from the morbidity of outpatients at RSUD Prod. Dr. WZ Johannes in the period from January to December 2018 reported that there were 1371 cases of low back pain. The cause of the majority of lower back pain cases, amounting to 85%, is nonspecific. This can occur due to abnormalities in soft tissue in the form of injury, muscle spasms, and muscle fatigue (Pandjukang et al., 2020).

Treatments given to reduce complaints of low back pain include ultrasound and back exercise . *Ultrasound* is a therapeutic modality using high-frequency sound waves (above 20,000 Hz) applied to body tissues to produce therapeutic effects, both thermal (heat) and non-thermal. This modality is often used in the treatment of various musculoskeletal conditions such as Low Back Pain, soft tissue injuries, and joint stiffness (Ebadi et al., 2014; Van at al. 1999).

Interventions aimed at reducing pain and improving patient function. Ultrasound therapy utilizes high-frequency sound waves transmitted to tissue through a gel medium(Watson, 2008). These waves produce thermal and non-thermal effects on the tissue. The thermal effect, which increases deep tissue temperature, can help increase blood flow, reduce muscle spasms, and improve soft tissue elasticity. Meanwhile, the non-thermal effect plays a role in accelerating tissue healing and reducing inflammation. In practice, ultrasound is typically applied to the lumbar area with the patient in a prone position for approximately 5–10 minutes, using a frequency and mode tailored to the patient's condition(Robertson et al., 2006).

After ultrasound, the intervention can be followed by back exercise to maximize the therapeutic effect. Back exercise helps reduce muscle tension, decrease pain perception, and improve patient comfort. Furthermore, back exercise has a relaxing effect on the nervous system, contributing to overall pain reduction(Cameron, 2013).

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The combination of ultrasound therapy and back exercises is frequently used because they produce complementary effects. Ultrasound plays a role in preparing the tissues by increasing temperature and reducing pain, allowing back exercises to be performed more effectively and comfortably. This approach has been shown to result in faster pain reduction compared to using a single intervention alone. However, the effects tend to be temporary or symptomatic. Therefore, to achieve optimal and long-lasting outcomes, this intervention should be combined with therapeutic exercises aimed at improving muscle strength and spinal stability (O'Sullivan et al, 2019).

Based on the background of Low Back Pain conditions, several approaches can be undertaken, including promotive, preventive, curative, and rehabilitative efforts. In physiotherapy practice, in addition to using physiotherapy modalities, manual therapy techniques such as ultrasound and back exercise can also be applied in the management of Low Back Pain. In this study, the researcher applied ultrasound and back exercise interventions to reduce pain levels, measured using the Numerical Rating Scale, in patients with Low Back Pain.

### METHOD

This research design uses a One Group Experiment pre and post test group design which aims to determine the effect of providing physical rehabilitation therapy with Ultrasound and Back exercise methods in reducing pain in low back pain conditions. This research was conducted at the Padang City Physiotherapy Laboratory. The approach method in this study uses a pre-test and post test design to determine how much the administration of Ultrasound and Back exercise methods affects pain reduction in low back pain. The data obtained using the ANOVA method SPSS Version 25. The sample criteria used were patients who experienced pain in the lower back, did not undergo surgery on the waist. The number of samples in this study was 20 people who experienced pain in the lower back due to low back pain.

### RESULTS AND DISCUSSION

	N	Mean Std. Deviation±	Std. Error
Age	20	48.4 2.77±	0.55
Height	20	165.9 12.35±	4.45
Weight	20	59.6 8.25±	2.54
BMI	20	34.47 4.26±	2

Table 1. Characteristics of research subjects

Based on the table above, the results of the research based on age obtained results with an average and standard deviation, namely  $48.4 \pm 2,77$  which means that the age in this condition is dominated by 23 years old with a total of 4 people, 24 years old with a total of 2 people, 25 years old with a total of 4 people, 26 years

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old with a total of 2 people and 30 years old with a total of 8 people. For height, the average and standard deviation are  $165.9 \pm 12.35$  where the patient's height range starts from 150 cm-170 cm. Body weight with average value and standard deviation is  $59.6 \pm 8.25$ . The weight range is 50 kg to 80 kg. The BMI value obtained is the average value and standard deviation, namely  $34.47 \pm 4.26$ .

### Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Standard Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pretest - Posttest	1,300	,823	,260	,711	1,889	4,993	9	,002

Table 2. Paired Samples Test table

Based on the Independent samples t-test, the sig. (2-tailed) value is  $0.000 < 0.05$ , so it can be concluded that  $H_0$  is rejected and  $H_a$  is accepted. Thus, it can be concluded that there is a significant positive influence.

Ultrasound and back exercise have a significant effect on low back pain conditions, with a significant difference between the groups being compared.

## RESULTS AND DISCUSSION

### Discussion

Ultrasound is a physiotherapy modality widely used in the management of low back pain, primarily to reduce pain and improve soft tissue conditions. This therapy utilizes high-frequency sound waves transmitted into body tissue through a gel medium. These waves produce physiological effects, including thermal and non-thermal effects, that play a crucial role in the healing process.

The thermal effect of ultrasound is characterized by an increase in deep tissue temperature, which can increase local blood flow, reduce muscle spasms, and improve collagen tissue elasticity. This is particularly helpful for patients with low back pain, who frequently experience stiffness and muscle tension in the lumbar region. Increased tissue flexibility makes it easier for patients to perform advanced movements and exercises. Furthermore, non-thermal effects such as cavitation and microstreaming contribute to increased cell membrane permeability, accelerated tissue regeneration, and reduced inflammation.

In clinical practice, ultrasound is typically applied to the lower back with the patient in the prone position. Parameters such as frequency, intensity, and mode are selected based on the patient's condition. A frequency of 1 MHz is used for deeper tissue, while 3 MHz is used for superficial tissue. Continuous mode is more often

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used to produce a heating effect, while pulsed mode is used in acute conditions to minimize the heating effect and emphasize tissue healing(Beck, 2013).

Although ultrasound has various physiological benefits, its effectiveness in reducing pain in low back pain remains controversial. Some studies suggest that ultrasound can provide pain relief, especially in the short term. However, recent scientific evidence suggests that the effects of ultrasound as a single intervention tend to be limited and do not provide significant differences compared to placebo therapy in some cases(Rattray & Ludwig, 2000). Therefore, the use of ultrasound is more recommended as an adjunct therapy, combined with other interventions such as therapeutic exercise and manual therapy.

Thus, it can be concluded that ultrasound plays a role in helping reduce pain and improve tissue condition in patients with low back pain, primarily through its thermal and non-thermal effects. However, to achieve optimal and sustainable results, its use should not be used alone but rather in combination with a more comprehensive physiotherapy approach.

Back exercise is a form of physical training aimed at strengthening the stabilizing muscles of the back. It is commonly prescribed for individuals with low back pain, as it helps reduce pain in the lower back region. Back exercises also assist workers in alleviating back pain caused by repetitive and static work activities<sup>14</sup>.

Suharjana (2013), as cited in Wanti (2023), explains that back exercise provides several benefits, including improving physical fitness by facilitating the transport of essential substances within the body, reducing the risk of musculoskeletal injuries, and strengthening the abdominal and back muscles, thereby supporting proper physiological posture. Increased muscle strength also enhances the body's ability to withstand both static and dynamic movements or loads(Furlan et al., 2015).

Various studies have shown that back exercise is effective in reducing pain in low back pain, especially in the short term. Back exercise can also improve patient function and flexibility, thus helping to optimize daily activities(Perlman at al, 2019). However, the resulting effects tend to be temporary if not accompanied by other interventions. A systematic review showed that back exercise provides significant benefits in reducing pain and improving function in patients with low back pain, although long-term results still require combination with other therapies such as exercise therapy(Furlan et al, 2002).

Thus, back exercise plays a crucial role as an intervention to reduce pain and promote muscle relaxation in low back pain. However, to achieve optimal and sustainable results, back exercise should be used as part of a comprehensive therapeutic approach and combined with therapeutic exercises.

The results of this study were conducted on Low Back Pain conditions, with a

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sample of 20 people who were given Ultrasound and Back exercise interventions. The results of the paired sample t test were obtained with a statistical value of  $p < 0.002$  where  $p < 0.05$ , so it can be concluded that providing Ultrasound and Back exercise interventions can reduce lower back pain or Low Back Pain.

## CONCLUSION

Based on the analysis and discussion of the study, it can be concluded that the application of ultrasound therapy and back exercise is effective in reducing pain in patients with Low Back Pain. With a frequency of three sessions per week over a period of 12 weeks, the implementation of this treatment model showed a significant effect in decreasing pain levels among the research participants.

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