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Original Research

Effectiveness of Infrared and William's Flexion Exercise on Reducing Pain and Increasing Flexibility in Patients with Low Back Pain



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Article Info	Abstract
Article history: Received: 30 May 2023 Accepted: 27 July 2023	<p>Introduction: The condition of low back pain is a musculoskeletal problem without an age limit. Patients with lower back pain tend to take analgesic drugs to reduce pain. Apart from pharmacological consumption, the tendency for low back pain sufferers to seek other alternatives, namely; physiotherapy treatment. One of the physiotherapy treatments for low back pain is giving infrared and William's flexion exercise or a combination of both. This study aims to determine the effectiveness of infrared and William's flexion exercise in reducing pain and flexibility of the lumbar muscles.</p> <p>Methods: The research design is quasi-experimental pre-posttest with a control group. The study population consisted of 44 patients with low back pain at Physiomar Clinic by dividing 40 samples into intervention groups (William's flexion exercise) and control group (Infrared and William's Flexion Exercise) 2 times/week for 1 month. The pain level measured by using the Visual Analog Scale (VAS) and flexibility using the Modified Schober Test (MST). The data was analyzed by Wilcoxon and Mann-Whitney test ($\alpha \leq 0.05$).</p> <p>Results: In this study, the intervention group showed a median pre-post pain score of 6.00-5.00 and a median pre-post flexibility value of 3.00-3.00 ($p=0.000$); while the control group showed a median pre-post pain score of 6.00-2.00 and a median pre-post flexibility value of 2.50-10.00 ($p=0.000$).</p> <p>Conclusion: The combination of infrared and William's flexion exercise is better than William's flexion exercise alone for changes in pain and flexibility in low back pain patients at the Physiomar clinic.</p>
Keywords: low back pain, infrared, William's flexion exercise, flexibility	

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INTRODUCTION

Low back pain (LBP) is a common medical problem that affects more than 80% of the world's population [1]. Approximately 7.6% to 37% of low back pain complaints occur in Indonesia. This condition occurs idiopathic and significantly affects a person's productivity [2]. The causes of low back pain are related to factors such as sitting posture, prolonged sitting, prolonged standing, improper lifting, and bending. Consequently, LBP progressively leads to excessive muscle use, spasms, strains, and injuries to the spinal discs, resulting in low back pain or other health issues [3]. Musculoskeletal problems can affect muscles, ligaments, tendons, and bones. Generally, musculoskeletal complaints begin to be felt between the ages of 25 and 65 and continue to increase with age. If musculoskeletal pain is continuous, it can cause muscle pain, limited lumbar mobility, and muscle contracture [4]. Some individuals with LBP consume analgesic medications to alleviate the discomfort, but it does not alleviate the musculoskeletal complaints in the lumbar region. As a result, musculoskeletal conditions such as spasms are not properly addressed. This can also lead to other conditions such as lumbar muscle contractures, postural deformities due to pain, and other neuromusculoskeletal disorders [5]. LBP complaints can occur to anyone regardless of social, economic, and cultural status, as happened in Physiomar clinics, most LBP sufferers are of productive age with LBP and suspected due to malposition at work, which is exacerbated by prolonged sitting activities and triggers

tension in the low back muscles which causes severe pain and disrupts work routines [6].

In addition to pharmacological treatments, such as the use of pain-relieving medications, non-pharmacological management of LBP can also be done through physiotherapy. Physiotherapy plays a role in the recovery and maintenance of movement and functional mobility. One of the treatments provided in physiotherapy is the William's flexion exercise, which aims to stretch the low back muscles, reduce pain, and restore the range of motion in the lumbar joints of LBP patients. Another physiotherapy intervention that can be applied is the use of infrared therapy, which improves blood circulation and reduces tension in the back muscles, thus alleviating pain. Non-specific low back pain can be effectively reduced and muscle flexibility increased by combining infrared therapy with William's flexion exercises [2]. Previous research has been conducted on the effect of a combination of infrared and William's flexion exercise on reducing pain and increasing flexibility in patients with low back pain, the results of the research found that the combination of infrared and William's flexion exercise can reduce pain and increase flexibility in patients with low back pain [2]. A study by Lubkowska (2018) on infrared light on motor unit activity stated that there were no statistically significant changes in pain sensitivity and range of motion after irradiation was applied [7]. So, the purpose of this study is to determine the efficacy of William's flexion exercise with or without infrared. Researchers want to know whether it is true that what can reduce pain and increase flexibility is a combination of

infrared and William's flexion exercise or only William's flexion exercise, then this research was conducted to examine the effect of William's flexion exercise with and or without infrared. This research aims to investigate the comparative effect of William's flexion exercise with a combination of infrared therapy and William's flexion exercise on reducing pain and increasing flexibility in patients with low back pain at the Physiomar Clinic. Most patients experiencing low back pain are of working age, possibly due to ergonomic issues in their positions. The significance of this study lies in comparing the two interventions to establish an evidence-based foundation in the field of physiotherapy.

METHODS

The research design is a quasi-experimental pre-posttest with a control group. The study population consisted of 44 patients with low back pain at Physiomar Clinic. Using the Slovin's formula with a confidence level of 95%, a sample of 40 people was obtained using a purposive sampling technique based on the inclusion and exclusion criteria. The inclusion criteria were low back pain sufferers, both men and women who were willing to become respondents, while the exclusion criteria were patients who had a history of fractures.

The Sample was divided into two treatment groups as follows: (1) Intervention group received the William's Flexion Exercise treatment, which included pelvic tilt, single knee to chest, double knee to chest, partial sit-up, and hamstring stretches. Each movement

was held for 5-10 seconds with a 5-second pause, repeated 3-4 times, totaling 4 sets of 20 samples. (2) Control group received a combination of infrared therapy for a duration of 10-15 minutes, with the infrared source positioned 20-30 cm away from the lumbar surface, along with the same William's Flexion Exercise routine as the intervention group. This study was conducted from March 1st to April 30th, 2023. And the treatment of control and intervention groups in each patient was carried out 2 times/week for 1 month with a total of 20 low back pain patient visits per day and 5 new low back pain patient visits per week.

The pain level was measured by using the Visual Analog Scale (VAS) and flexibility using the Modified Schober Test (MST). The data was analyzed by Wilcoxon and Mann-Whitney test. Processing and analysis of data using SPSS then presented in the form of tables and narratives. This research was conducted from March to April 2023. This research has been reviewed and accepted by the Ethics Committee of KEPK IIK Strada Indonesia with number 2840/KEPK/II/2023 on February 20th, 2023.

RESULTS

This study was conducted for 1 month with a total sample of 40 respondents: intervention group (n=20) and control group (n=20). None of the patients dropped out of the research.

Table 1. The results show that in the group with the combination of Infrared and William's Flexion Exercise, low back pain incidence was more dominant in the female (65,5%) compared to the male (35,5%). Based

on the age category, respondents aged 31-40 years old (50%) dominated the incidence of low back pain. Whereas in William's Flexion Exercise group, females and males who experienced low back pain were 10 people each (50,0%). Based on the age category, respondents aged 31-40 years old (60,0%) dominated the incidence of low back pain.

The results of the Wilcoxon test in Table 2 show that the VAS value of the William's Flexion Exercise intervention group had a median difference in pre and post pain reduction of 1.00, the p-value shows a significance of $0.00 < 0.05$. While the VAS value in the combined intervention of Infrared and William's Flexion Exercise group had a median difference in pre and post pain reduction of 4.00, the p-value shows a significance of $0.00 < 0.05$ towards reducing low back pain.

The results of the Wilcoxon test in Table 3 show Schober test value of William's Flexion Exercise intervention group had a median difference in pre and post, there was no change in flexibility, and the p-value shows a significance of $0.00 < 0.05$. While the Schober test value in the combined intervention of

Infrared and William's Flexion Exercise group had a median difference in pre and post, there was an increase in flexibility of 7.50, the p-value shows a significance of $0.00 < 0.05$ towards increasing lumbar muscle flexibility.

The results of the comparative analysis presented in Table 4 indicate significant differences in both pain reduction and lumbar muscle flexibility between the William's Flexion Exercise group and the combination of Infrared and William Flexion Exercise group, with a value of $0.000 (p < 0.005)$. This implies that the null hypothesis (H_0) is rejected, indicating that there is a difference in the effects between the William's Flexion Exercise group and the combination of Infrared and William Flexion Exercise group regarding the reduction of pain and the improvement of lumbar muscle flexibility in patients with low back pain. Even though these two interventions both reduced pain and increased lumbar muscle flexibility, it can be seen from the difference in the values of the two groups (table 3) that the combination of infrared and William flexion exercise is better than without the combination of infrared.

Table 1

Demographics Data (n=40)

	<i>William's Flexion Exercise (Intervention group)</i>		<i>Combination of Infrared and William's Flexion Exercise (Control group)</i>	
	n	%	n	%
Gender				
Male	10	50,0	7	35.5
Female	10	50,0	13	65.5
Age (y/o)				
21-30	6	30,0	6	30
31-40	12	60,0	10	50
41-50	2	10,0	4	20
Total	20	100	20	100

Table 2

Distribution of Pain Scores Before and After Physiotherapy Intervention

Physiotherapy Intervention	Measurement	n	min-max	Mean ± S.D	p
<i>William's Flexion Exercise</i>	VAS value of Pre-intervention	20	5,00-8,00	6,20±1,005	0,000
	VAS value of post intervention	20	4,00-8,00	5,60±1,231	
<i>Combination of Infrared and William's Flexion Exercise</i>	VAS value of Pre-intervention	20	5,00-9,00	6,50±1,147	0,000
	VAS value of post intervention	20	1,00-3,00	1,62±0,725	

Table 3

Distribution of lumbar flexibility values before and after physiotherapy interventions (N=40)

Physiotherapy Intervention	Measurement	n	Min-max	Mean ± S.D	p
<i>William's Flexion Exercise</i>	Schober test value of pre intervention	20	2-5	2,90±0,912	0,000
	Schober test value of post intervention	20	1-5	2,95±1,146	
<i>Combination of Infrared and William's Flexion Exercise</i>	Schober test value of pre intervention	20	2-5	2,80±0,951	0,000
	Schober test value of post intervention	20	8-12	10,05±1,432	

Table 4

Results of the hypothetical test analysis on the distribution of pain scores and the flexibility of providing physiotherapy interventions

Criteria	Physiotherapy Intervention	n	Mean different (pre-post)	P
Pain	<i>William's Flexion Exercise</i>	20	0,60	0.000
	<i>Combination of Infrared and William's Flexion Exercise</i>	20	4,88	
lumbar muscle flexibility	<i>William's Flexion Exercise</i>	20	0,05	0,000
	<i>Combination of Infrared and William's Flexion Exercise</i>	20	7,25	

DISCUSSION

The characteristics of patients with low back pain (LBP) in this study were predominantly females compared to males. This is consistent with research indicating a higher prevalence of women experiencing LBP [8]. This study aligns with the findings of Wang et al. (2016) reported that nearly 90% of participants complaining of LBP were women. In addition to gender, age also affects the prevalence of LBP [9]. Fadilawati et al. (2022) reported that most LBP patients were in the age range of 51-60 years (52.6%), followed by 41-50 years (34.2%), and the least common age range was 30-40 years (13.2%) [10].

The results of this study (Table 1) indicate that William's Flexion Exercise, with or without infrared therapy, influences pain reduction. Theoretically, the principle of William's Flexion is to facilitate lumbar flexion and strengthen the abdominal and gluteal muscles to relieve LBP symptoms. Facilitation of lumbar flexion widens the intervertebral foramen and stretches the spinal extensors and facet joints. Exercises suggested by

Williams include the following: Pelvic tilts, partial crunches, single and bilateral knees to the chest, hamstring stretches, lunges, seated trunk flexion, and full squats. Spinal flexion itself is safe; it can even increase the strength of the intervertebral discs with the right regimen [11]. William's flexion exercise stretches the extensor trunk muscles and strengthens the abdominal muscles simultaneously, improves posture, and prevents muscle imbalance thereby reducing low back pain.

Infrared increases circulation so that blood can carry back irritants and metabolic waste, which can enhance nociceptive conductivity (bradykinin, histamine, and others). As a result, the decrease in these irritants can slow down nociceptive conductivity, ultimately reducing pain and spasms. On the other hand, according to the gate control theory mechanism, the comfortable thermal effect provides a sedative effect on sensory nerve endings, thereby dampening the activity of nociceptive pathways that transmit pain impulses, leading to a reduction in pain [12]. According to Amila

et al. (2021), William's flexion exercises are designed to reduce back pain by strengthening the muscles that support the lumbosacral spine, particularly the abdominal and gluteus maximus muscles, and stretching the extensor muscle group [13]. This study is consistent with several research studies stating that William's flexion can significantly reduce pain [14][15][16]. The administration of infrared reduces pain by increasing endorphin secretion, immunological reactions, accelerating metabolism, and regulating the activity of the autonomic nervous system in terms of muscle tension control [17]. This is why the treatment group with infrared and William's flexion exercise showed better results compared to the William's flexion group. This study is in line with research conducted by Ansari et al (2014) which states that infrared is effective in reducing pain in patients with low back pain [18].

In principle, William's Flexion Exercise aims to strengthen the abdominal muscles while stretching the low back muscles. Sensitive tendon stretching receptors are triggered during trunk movements, causing muscles to contract concentrically and eccentrically. This contraction leads to relaxation, resulting in the development of the reciprocal inhibition mechanism, which is the action mechanism of agonist and antagonist muscles that enhances muscle flexibility [19]. This study is in line with research stating that William's Flexion improves the flexibility of the lumbar and hip muscles as well as lumbar mobility [16][15]. William's Flexion Exercise is based on the principle of strengthening the abdominal muscles while stretching the low

back muscles. Sensitive tendon stretching receptors are triggered during trunk movements, causing muscles to contract concentrically and eccentrically. This contraction leads to relaxation, resulting in the development of the reciprocal inhibition mechanism, which enhances muscle flexibility. The therapeutic effect of infrared (IR) is local vasodilation, which leads to a decrease in spasms and an increase in muscle flexibility [17]. This study also aligns with the research conducted by Kusuma & Wulandari (2022), which states that there is an influence of infrared and William's Flexion on increasing the range of motion in patients with low back pain. Infrared causes local hyperemia, which reduces muscle tension and increases muscle flexibility. Local heating reduces the stiffness of muscle fibers, and inhibits muscle tone by increasing the release of Golgi tendon organ-induced Ib nerve impulses, which decreases muscle spindle contraction and secondary terminal excitation. The extensibility of muscle fibers and fascia increases with the inhibition of nerve components in the muscles, enhancing the collagen extensibility of fascia and muscle fiber extensibility, resulting in muscle flexibility [20].

The results of the hypothesis test indicate that the combination of infrared and William's Flexion Exercise is better than William's Flexion Exercise. Therefore, it can be concluded that the combination of IR intervention with the movements of William's Flexion Exercise has a positive effect on cases of low back pain related to local heating, which causes vasodilation of blood vessels and activates endorphins due to the

movements of William's Flexion Exercise. This involvement of agonist and antagonist muscle adaptation reduces pain [2]. The combination of infrared intervention and William's Flexion Exercise has a positive impact on cases of low back pain. This is related to local heating, which leads to vasodilation of blood vessels and activates endorphins. The addition of William's Flexion Exercise movements also involves the adaptive capacity of agonist and antagonist muscles, thereby reducing pain. The combination of infrared and William's Flexion Exercise reduces pain by increasing blood circulation in the tissues, improving oxygenation, and converting lactic acid, which stimulates nociceptors and causes pain, into pyruvic acid. Pyruvic acid is then converted back into glucose and energy. With the reduction of lactic acid, pain is reduced. The same applies to the effect of these interventions on muscle flexibility. The administration of infrared causes stretching of muscle spindles, and muscle tone relaxes, inhibiting Ib nerve induction [13]. The inhibited nerve components in the muscles increase the extensibility of muscle fibers and fascia, thus enhancing the flexibility of fascia collagen and muscle fiber extensibility, resulting in muscle flexibility [2]. This study is consistent with the research by Halimah et al. (2022) which states that there is an influence of the combination of infrared and William's Flexion Exercise on increasing flexibility in patients with low back pain [2]. Therefore, the positive effects of Infrared and William's Flexion Exercise are derived from the stretching of muscle spindles after the application of thermal effects from Infrared

and the improvement of muscle fiber extensibility. The addition of muscle flexor relaxation in William's Flexion Exercise also restores lumbar mobility and enhances flexibility. This is why the combination of Infrared and William's Flexion Exercise is better than William's Flexion Exercise.

LIMITATION

The limitations of the short research period can be seen that the increase in joint motion area is still very minimal, besides that the researcher cannot control the respondent's behaviour during daily activities. Future research is expected to conduct research over a long period of time, as well as adding stricter exclusion and inclusion criteria

CONCLUSION

Treatment with William's Flexion Exercise and treatment with a combination of Infrared and William's Flexion Exercise can reduce pain and increase muscle flexibility. However, treatment with Infrared and William's Flexion Exercise has a better effect than treatment with William's Flexion Exercise alone. It can be concluded that the provision of William's Flexion Exercise physiologically involves the adaptability of agonist and antagonist muscles to reduce pain so as to restore lumbar mobility and increase flexibility. With the combination of infrared before William's Flexion Exercise, it has been proven that the role of heating can relax muscle spindles and muscle tone as a preliminary exercise so that the combination of the two interventions can reduce pain and increase lumbar muscle flexibility more optimally.

CONFLICT OF INTEREST

No conflict of interest has been declared by any of the authors.

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