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THE EFFECTIVENESS OF BACK MASSAGE AND ULTRASOUND THERAPY COMBINED WITH HOME-BASED EXERCISE IN REDUCING DISABILITY IN MECHANICAL LOW BACK PAIN

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ABSTRACT

Low back pain **(**LBP**)** is a common problem and a leading cause of disability worldwide. Mechanical LBP is a cumulative process caused by physical workloads, errors when lifting, and poor posture while working, which causes the lower back to experience heavy mechanical stress. This can result in pain and limitation of motion in the lumbar spine, thereby increasing the level of disability. The combination of ultrasound therapy with back massage is often used in general to treat mechanical LBP. The addition of home-based exercise to this combination is expected to accelerate tissue repair, reduce pain, and increase the range of joint motion, and it is expected that disability will decrease. This study aimed to compare the combination of back massage and ultrasound therapy with or without home based exercise in reducing disability due to mechanical LBP. This single blinded randomized controlled trial was conducted for 4 weeks involving 24 subjects with mechanical LBP, who were randomly assigned to a treatment group or control group. Disability due to mechanical LBP was measured using the Modified Oswestry Disability Index (MODI), which was assessed at baseline and after the last treatment was given. After treatment, between-group analysis using the independent t-test found the mean reduction of MODI score significantly different between the intervention and control group after receiving the intervention. Therefore, it can be concluded that the addition of home-based exercise to back massage and ultrasound therapy can significantly reduce disability due to mechanical LBP.

Keywords: back massage; disability; home-based exercise; mechanical low back pain; ultrasound therapy

INTRODUCTION

Low back pain (LBP) is pain that is felt in the lower back where there is stress on the back, which affects the components of the muscles and surrounding tissues in the lumbar and pelvic regions due to excessive use[1.] Demographic factors such as age and occupation, and other factors such as repeated heavy lifting, poor lifestyle, weakness of the abdominal wall muscles, obesity, and smoking are some of the factors that can cause LBP[2,3].

Approximately 11-12% of patients experience disability due to LBP, which has a 26-37% tendency to relapse. It affects work productivity[4]. Work-related LBP is a major cause of musculoskeletal injuries that not only have an impact on global health but also have an impact on the economy. The number of LBP cases that occur in the community indicates that the treatment of LBP has not been maximized, thus requiring appropriate and effective interventions in overcoming LBP complaints[5].

LBP that is related to mechanical factors is often referred to as mechanical LBP. Mechanical LBP is experienced when a person often complains of discomfort starting from the lumbosacral area with or without pain radiating to the legs[6]. Mechanical LBP arises due to soft tissue injury with pain on the lateral side of the spine[4]. Mechanical LBP is a cumulative process resulting from poor posture that causes the lower back to experience heavy mechanical stress[7]. Mechanical LBP often causes limitations in movement

caused by physical workloads, errors when lifting, and posture while working. The movement of lifting heavy weights in a repetitive manner without being aware of ergonomic aspects can cause chronic injuries. Bad posture habits result in tension in the lumbar muscles. This can cause pain and limitation of motion in the lumbar spine, thereby increasing the level of disability[8].

Based on interviews with 5 patients who experienced mechanical LBP at a private physiotherapy practice, it was revealed that their LBP complaints appeared intermittently. At one time, the pain worsened causing them to not work for 1-3 days, thus affecting productivity and income. An appropriate intervention is needed to overcome this problem.

Physiotherapy treatments that can be given for mechanical LBP can be in the form of modalities therapy such as ultrasound therapy[9] and manual therapy such as massage[10]. The combination of ultrasound therapy with back massage is an intervention that is often used in general to treat mechanical LBP[11]. This combination of interventions aims to reduce muscle spasm, overcome scar tissue adhesions and rearrange muscle fibers and ligaments into a more bio-functional pattern. Back massage is a type of massage with slow strokes in a certain direction and time. This technique causes the release of endorphins, thereby blocking the transmission of painful stimuli so that disability will decrease[12]. In addition, the addition of home-based exercise to the combination is expected to accelerate tissue repair, reduce pain, and increase the range of joint motion, and it is expected that disability will decrease[13].

METHODS

a. Methodology

Study design

This was an experimental study with randomized pre-test and post-test control group design (single blinded randomized controlled trial/RCT), which aimed to compare the combination of back massage and ultrasound therapy with or without home based exercise in reducing disability due to mechanical LBP. This study received ethical approval by the Faculty of Medicine, Udayana University/Sanglah General Hospital, Denpasar with ethical clearance number 2080/ UN14.2.2.VII.14/LT/2021. The research was conducted in private physiotherapy practices in Denpasar and Badung, Bali starting from Agustus – September 2021.

Subject recruitment

The inclusion criteria included individuals (male and female) aged 30-60 years who experienced complaints of mechanical LBP and experienced limitations in lumbar movement based on the assessment carried out, individuals willing to participate in the study from the beginning to the end by signing an agreement letter stating that they were willing to be the research sample, and individuals who are able to communicate well and cooperatively. The exclusion criteria in this study were individuals with neurological disorders, lumbar HNP, lumbar vertebral fracture, cardio disorders, diabetes mellitus, spondylolisthesis, spondylosis, lumbar canal stenosis, neuropathy, psychogenic stress disorder, pregnancy, and patients who had received intervention with other modalities and medication.

Sampling technique

This study was using simple random sampling technique involving 24 subjects. Sampling was carried out based on the following inclusion and exclusion criteria. The research assistant conducted randomization using envelopes. Participants who received card number 1 entered the control group and participants who received card number 2 entered the treatment group. This was a single blinded randomized controlled trial study. The researchers as a data collectors and outcome adjudicators were blinded to ensure unbiased ascertainment of outcomes, while the participants were not blinded.

b. Material and procedure

Material

Some of the equipments needed in this study included massage oil, ultrasound therapy and gel, and the Modified Oswestry Disability Index (MODI) for measuring disability due to mechanical LBP.

Procedures

The researcher applied for ethical approval and conducted the licensing process at the institution where the study was conducted. The researcher made an informed consent that the subjects had to sign, and was approved by the physiotherapist supervisor, which stated that the subject was willing to participate this study until study completion. The researchers provided education to the subjects about the benefits, objectives, procedure, and the importance of doing this research. After the examination, the subjects were randomly allocated into two groups. Both groups were equally measured for disability using the MODI at baseline (before receiving treatment) and after the intervention. After 12 evaluations and obtaining complete data, the researchers then analyzed the data and compared the results before and after the intervention in the two groups. Group 1 as control group were treated with back massage and ultrasound while group 2 as the treatment group were given with the same treatment combined with home based exercise. Exercise were done were done every day, once a day, 3 to 5 repetitions each movement. the exercise consists of cat and camel pose, cobra pose, back flexion with knee bended, hamstring stretch, gluteal stretch.

c. Assessment

To perform an assessment of mechanical LBP, the following tests were carried out:

Table 1. Assessment of Mechanical Low Back Pain

No.	Assessment	Assessment focus	Results
1	Anamnesis	Age, Complaint, Location	Pain in the lower back, buttock, pain when moving
2	Inspection	Posture	Antalgic gait
3	Palpation	Palpation of the lower back muscles	Pain and muscle spasm
4	Quick Test	Actively perform lumbosacral extension flexion movements	Pain and limited movement of the lumbosacral joint
5	Basic motor function test	Active motion in the lumbosacral	Pain and limited movement of the lumbosacral joint
6	Specific test	Lowback Manuver	There are no neurological abnormalities/radiating pain in lower limbs

Before and after the intervention, both groups were equally measured for disability using the MODI. The pre-test was carried out the day before the administration of treatment and post-test was carried out on the same day, after the last intervention was given.

d. Data analysis

Data analysis was carried out to determine the level of reduction in lower back disability using the Statistical Program for Social Science (SPSS) program. For within-group analysis, the paired t-test was used, while the independent t-test was used for between-group analysis.

RESULTS

Table 1. The Characteristic of Samples

Data	Group 1	Group 2
Age (year)*	39,67±4,75	40,33 ±4,07
Gender**:		
Male	8 (66,7)	5 (41,7)
Female	4 (33,3)	7 (58,3)

Based on Table 1, research subjects have a mean age of 39.67±4.75 years in Group 1 and 40.33±4.07 years in Group II. It can be seen that the age range of the subject ranges from 30 to 50 years old. With regards to the subject's gender, it can be seen that from the 24 subjects, 12 were male and 12 were females. In Group 1, 66.7% were male subjects and 33.3% were females. In Group 2, there were 41.7% were males and 58.3% were females.

Table 2. The Efficacy of Intervention to Mechanical *LBP*

Data	Group	Pre	Post	p *
	1	22,08±2,19	7,92±1,08	<0,001
MODI	2	22,25±1.76	5,59±0,99	<0,001
	p **	0,839	<0,001	

**with paired t-test*
***with independent t-test*

Table 2 shows the results of hypothesis testing conducted to determine the within-group difference in disability due to mechanical LBP before and after treatment in Group 1 and Group 2 using the paired t-test. The results obtained was p<0.001 in Group 1, meaning that there was a significant difference in the decrease in disability before and after the combination intervention of back massage with ultrasound on mechanical LBP, with an average decrease of 7.92±1.08 in the MODI score. In Group 2, a p-value of <0.001 was also

obtained, indicating that there was also significant difference in the decrease in disability before and after the combination intervention of back massage with ultrasound on mechanical LBP ($p<0.05$). From the results of the average table group 2 shows a decrease in disability to 5.59±0.99.

Based on Table 2, between-group analysis using the independent t-test obtained a p-value of <0.001, which indicates that there was a significant difference in the average reduction of MODI score between the intervention and control group after receiving the intervention. This implies that the addition of home-based exercise to back massage and ultrasound therapy significantly reduces disability due to mechanical LBP more than back massage and ultrasound therapy without home-based exercise.

DISCUSSION

The results of this present study have proven that back massage with ultrasound therapy can significantly reduce disability cause by mechanical LBP. This effect could be due to increased elasticity produced by the effects of cavitation and microstreaming from ultrasound therapy. This is in accordance with the theory of the mechanical effect of ultrasound where cavitation and microstreaming will stimulate an increase in plasma fluid flow and an increase in cell membrane permeability, especially to calcium and sodium ions, so that it will stimulate the physiological inflammatory process. An increase in the amount of calcium will stimulate the transport of mast cells and histamine which aims to clean debris and stimulate monocytes to secrete chemotactic agents and growth factors to stimulate endothelial cells and fibroblasts which will stimulate the formation of collagen which is rich in vascularity and tissue substance to accelerate the process of tissue repair[14].

In addition, the results of studies relevant to research conducted using ultrasound have proven that ultrasound is able to accelerate the process of tissue repair in cases of mechanical LBP because the effect of microstreaming, which will result in an increase in the amount of fluid in the cells causing the release of adhesions and an increase in tissue elasticity[15].

The results of this study are relevant with the theory of Orthopedic Massage, which states that Slow Stroke Back Massage can reduce pain in musculoskeletal disorders (MSDs) by stimulating sensory fibers[16]. This subtle stimulus is received by the sensory system which is then carried to the brain and returned to the effector for the release of endorphins. This hormone is responsible for creating a state of relaxation in the body as well as helping in inhibiting pain. There are several effects of massage and their relationship in reducing pain, among others, massage techniques can affect the mechanics of fluids in the body which are often responsible for the appearance of pain. The movement of fluids in the body is generally produced by a pump mechanism in the veins produced by the contraction of the surrounding muscles. In muscles that experience stiffness, this mechanism is not smooth so that in some cases, fluid can build up around the area, increasing pressure in the area and causing pain. Massage through gentle pressure techniques has been shown to help the movement of these parts[17].

The results of this study are also strengthened by the results of other studies that explain the relationship between massage techniques, pain quality, and the autonomic nervous system. In one study, it was shown that there was a significant difference in the complaints experienced by LBP patients with anxiety before and after giving Slow Stroke Back Massage[18]. Likewise, a different study also found similar results, where there were improvements in pain levels and functional abilities of patients with LBP in 9 out of 10 respondents after receiving massage therapy for 20 consecutive days, measured using the Oswestry Low Back Pain Scale[19].

The presence of disability due to adhesions and scar tissue formation plays a role in causing muscle tension due to poor posture. The presence of muscle adhesions, muscle stiffness and spasms that occur due to the wrong body biomechanics when working can reduce muscle flexibility and home-based exercise can overcome this. Based on the results of this current study, the addition of home-based exercise to back massage and ultrasound therapy is more effective than just back massage and ultrasound therapy in reducing disability in subjects with mechanical LBP.

The results of this study are in accordance with research conducted by Kanas et al. that reported a home exercise program showed for 8 weeks with a guidebook had an effect in overcoming pain levels, functional capacity and quality of life in non-specific LBP patients[13]. The home-based exercise given was in the form of active stretching performed by the patient[13]. This results of this study is also similar to a study conducted in 2010 by Shirado et al., which showed that home-based exercise prescribed and monitored by a board-certified orthopedic surgeon was more effective than non-steroidal anti-inflammatory drugs (NSAIDs) for patients with chronic LBP in Japan[20]. The present study is supported by a study conducted by Quentin et al. in 2021, which stated that home-based exercise training improved pain intensity and functional limitation parameters in LBP cases[21]. Pensri and Janwantanakul stated that a combination of short education and a home exercise program could reduce the pain intensity of office workers with chronic non-specific LBP[22].

However, some argue that further studies are needed to confirm the effectiveness of home-based exercise; a study conducted by Anar in 2016 showed that all the parameters studied had improved at the final evaluation, yet the patient's level of compliance when recommending home-based exercise was questionable. Moreover, there is a possibility that exercises prescribed to be done at home may be performed inaccurately when supervision is not provided[23].

CONCLUSION

This study aimed to compare the combination of back massage and ultrasound therapy with or without home based exercise on reducing disability due to mechanical LBP, which was measured using MODI. It was found that there was a significant difference in the MODI results between the intervention and control group after the intervention. Therefore, it can be concluded that the combination of home-based exercise with back massage and ultrasound is more effective in reducing disability caused by mechanical LBP compared to the combination of back massage and ultrasound without home based exercise. Future research should control the level of physical activity performed by the subjects and improve the monitoring of the home-based exercise, which would help increase the subject's compliance in performing the home-based exercise.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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