

## **INFRA-RED THERAPY REDUCES LOWER EXTREMITY PAIN IN ELDERLY WITH OSTEOARTHRITIS**

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### **ABSTRACT**

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#### **Keywords:**

elderly  
infra red  
knee pain  
osteoarthritis

Elderly is someone who because of his advanced age experiences biological, physical, psychological and social changes. One of the physical changes that occur in the elderly is a problem with decreased area of motion, one of which is osteoarthritis which often affects several joints, such as the joints of the fingertips, thumbs, knees, hips, heels and causes joint pain. Pain is very disturbing and makes it difficult for the elderly to do their activities, so the need for proper treatment is to reduce the pain that occurs due to osteoarthritis. One therapy that can be recommended is non-pharmacological therapy, namely infrared therapy. This study aims to determine the effect of infrared therapy on the reducing of lower extremity pain in the elderly with osteoarthritis. The design of this study is a quasi experimental design with a pre-post-test control group design. This research was conducted at PSTW Wana Sraya Denpasar. The sampling technique was total sampling with a total sample of 30 respondents divided into two groups, namely the treatment group who was given infrared therapy with 15 respondents and the control group who did not get infrared therapy with 15 respondents. Data taken in the form of the characteristics of the research subject and the value of lower extremity pain reduction using Visual Analog Scale before and after treatment in the treatment group and the control group. The data analysis test used the Man Withney U-Test to determine the difference in influence between the experimental group and the control group. The results of this study showed that most of the elderly > 65 years were 63.3% and 66.6% female. The elderly mostly experience pain scale 4-6 (moderate pain) in the lower extremities. The results of statistical tests showed that giving infrared therapy had an effect on reducing the pain scale in the lower extremities in the elderly with OA ( $p=0.000$ ). There was a decrease in the pain scale before and after infra-red administration and there was a significant effect on reducing lower limb pain in the elderly with osteoarthritis who were given infrared 8 times a week for 3 weeks.

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### **BACKGROUND**

Old age is the last human life cycle. During this period, a person experiences physical, mental, and social setbacks (Muwarni, 2010). Aging is not a disease but a process of decreasing the body's resistance in facing stimuli from within and from outside the body (Nugroho, 2012). The epidemiological impact of the disease in the elderly tends to be degenerative. One of them that is commonly found in the elderly is a disease that is closely related to the area of motion in the elderly knee joint. The area of mo-

tion of the joints in the elderly who are not disturbed will have an important impact on daily bodily functions. Among them are problems of dependence on other people and the quality of life of the elderly. The problem that is often encountered in the sentence with a decrease in the area of motion is osteoarthritis which often affects several joints of the lower extremities, such as the joints of the fingertips, the knee, and the heel (Muwarni, 2010).

Osteoarthritis is a disease of joint failure, in which all joint structures undergo pathological changes, are chronic in nature and the main cause of

pain. Osteoarthritis can also affect the small joints of the fingers (especially the thumb), toes, ankles, and neck (Muwarni, 2010). The increase in the number of elderly people aged 65 years will certainly be complemented by an increase in the incidence of diseases based on the elderly, especially osteoarthritis. It is estimated that by 2040, the prevalence rate of osteoarthritis will reach 95% of the total population (Fransen, 2011). Based on data from the Bali Provincial Health Office in 2015, osteoarthritis is grouped into diseases of the muscles and connective tissue which are part of the ten most disease patterns in patients at puskesmas, with a number of cases of 57,124 cases in 2015 (Widowati, 2017). In the city of Denpasar, the number of osteoarthritis patients was 7,894 cases, where the highest number of cases occurred in women as many as 4,546 cases, in men as many as 3,348 cases (Fransen, 2011).

Pain in the extremities can affect any part of the body, either the upper extremities or lower extremities. In the lower extremities, the most common pain is in the knees and ankles. This pain is also sometimes caused by psychological or lifestyle factors. The main symptom of pain that appears at the lower extremities is numbness; Throbbing; Fever; Inflammation of the joints or muscles Limited movement; Reduced quality of life; Nausea and vomiting Fatigue (Hawker, 2011). Non-pharmacological interventions in reducing pain have a very low risk compared to pharmacological interventions.

Infrared therapy is a non-pharmacological intervention for pain management. The pain is caused by the accumulation of metabolic waste products called "P" substances that accumulate in the tissues. With the presence of infrared rays which facilitate blood circulation, the substance "P" is also wasted so that the pain is reduced or lost. Muscle relaxation is easily achieved when the muscle tissue is warm (Alimah, 2008). Research conducted by Widowati, R in 2017 stated that the combination therapy of acupuncture and infrared is the most effective therapy in reducing musculoskeletal pain in the elderly and without harmful side effects (Widowati, 2017). Pain management can use heating techniques using infrared (Rayegani, 2012). Heating techniques can reduce the VAS value in osteoarthritis sufferers. The decrease in VAS value caused by infrared can have the effect of reducing muscle tension, reducing joint stiffness, increasing blood flow and relaxing the nervous system (Widowati, 2017).

## METHODS

The design of this study is a quasi experimental design with a pre-post-test control group design. This research was conducted at PSTW Wana Sraya Denpasar, with the length of the research period from July 20 to August 7, 2020. The sampling technique was total sampling with a total sample of 30 respondents divided into two groups, namely the treatment group who was given infrared therapy with 15 respondents and the control group who did not get infrared therapy with 15 respondents. The criteria of respondents is elderly with osteoarthritis; feeling pain in the lower extremities.

The Treatment group was given Infrared therapy 8 times for 3 weeks with a duration of 10 minutes, but the control group was not given Infrared therapy. Data taken in the form of the characteristics of the research subject and the value of lower extremity pain reduction using Visual Analog Scale before and after treatment in the treatment group and the control group.

The data normality test used Shapiro-Wilk because the sample was less than 50 samples. Paired sample effect test used Wilcoxon test in the intervention group and paired t test in the control group. Different test to determine the effect between the intervention group and the control group using the Mann Whitney U-Test. This research has passed the Ethical Feasibility Number: 1019 / UN14.2.2.VII.14 / LT / 2020 dated 14 May 2020.

## RESULTS

Based on the table above shows that the characteristics of the elderly by age, most respondents are in the age range > 65 years as many as 19 respondents (63.3%). Elderly over the age of 65 years usually have physical problems that result in pain. This is due to the thinning of the cartilage resulting in pain, stiffness, limitation in movement due to decreased synovial fluid production, causing joint inflammation and complaints of pain. Gender characteristics indicate that the largest number of respondents is female, as many as 20 respondents (66.6%). Elderly women will experience a loss of bone mass by 40-50%.

Table 2 shows that the pain scale in the elderly with knee pain pretest result being given infrared therapy in treatment group was 8 respondents (53.3%) with a pain scale of 4-6 (moderate pain), 6 respondents (40%) with a pain scale of 7-10 (pain weight) and 1 respondent (6.7%) with a pain scale of

Table 1. Characteristics of Elderly

Characteristics	Group				Total %
	Treatment		Control		
	f	%	f	%	
<b>Age (year):</b>					
Age 45-55	0	0	5	33,3	16,6
Age 56-65	1	6,7	5	33,3	20
Age >65	14	93,3	5	33,3	63,3
<b>Gender:</b>					
Male	4	26,7	6	40	33,3
Female	11	73,3	9	60	66,6

Table 2. Pretest and Posttest Lower Extremity Pain Scale in the Elderly

No	Pain Scale	Treatment Group				Control Group			
		f		%		f		%	
		Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test
1	0 (No pain)	0	4	0	26,7	0	0	0	0
2	1-3 (Mild Pain)	1	11	6,7	73,3	2	4	13,3	26,6
3	4-6 (Moderate Pain)	8	0	53,3	0	12	9	80	60
4	7-10 (Severe pain)	6	0	40	0	1	2	6,66	13,3

Table 3. Normality Test

Group	Shapiro-Wilk	
	df	Sig
Pre Test Treatment	15	0.455
Post Test Treatment	15	0.006
Pre Test Control	15	0.181
Post Test Control	15	0.100

Table 4. Pre-Post Test in the Elderly

Group	Extremity Pain		p value
	Pre test	Post test	
	Mean $\pm$ SD	Mean $\pm$ SD	
Treatment Group	6.07 $\pm$ 1.90	1.07 $\pm$ 0.79	0.001*
Control Group	5.00 $\pm$ 1.19	4.93 $\pm$ 1.58	0.719**

\*Wilcoxon test

\*\*Pair t test

Table 5. Mann Whitney Test

Delta Value	Group		p value
	Intervention Mean±SD	Control Mean±SD	
Pain Scale	5.0±1.19	0.07±0.70	0.000

1-3 (mild pain). Posttest result being given infrared therapy 8 times a week for 3 weeks, the results obtained were 11 respondents (73.3%) with a pain scale of 1-3 (mild pain) and 4 respondents (26.7%) said they were not in pain. The pain scale in the elderly with knee pain pretest result without being given infrared therapy in the control group was 12 respondents (80%) with a pain scale of 4-6 (moderate pain), 1 respondent (6.66%) with a pain scale of 7-10 (severe pain) and 4 respondents (13.3%) with a pain scale of 1-3 (mild pain). The posttest results as many as 9 respondents (60%) with a pain scale of 4-6 (moderate pain), 4 respondents (26.6%) with a pain scale of 1-3 (mild pain) and 2 respondents (13.3%) stated the scale pain 7-10 (severe pain).

Before conducting the analysis test, the analysis prerequisite test is carried out to determine whether the data is normally distributed or not with the Shapiro-Wilk test.

The statistical test results show that the significance value for the pre-test data for the treatment group is normally distributed, while the post-test data for the intervention group is not normally distributed, so it uses a non-parametric test. While the pre and post data of the control group were said to be normally distributed and the test used was the parametric test.

Based on table 4 above shows that there is a decrease in the mean pain scale in the intervention decrease in the mean pain scale in the intervention group after giving infrared therapy (post test), namely the mean ± SD (1.07 ± 0.79), while the control group shows a decrease in the mean post test with a value (4.93 ± 1.58) . A decrease in the mean value in the intervention group indicates a decrease in the pain scale in the elderly with limb pain. The Wilcoxon test results showed a significant value in the intervention group (p = 0.001) and insignificant value in the control group (p = 0.719).

The results of table 5 show a significant value, so it means that there is a significant difference in the intervention group and the control group after being given infrared therapy intervention 8 times a week for 3 weeks.

**DISCUSSION**

**Decrease in Lower Limb Pain in the Elderly with Osteoarthritis Before and After Infrared Therapy**

Osteoarthritis a degenerative disease, which affects nearly 3 out of 4 older adults and OA often holds joint pain in the lower joint which is the most commonly attacked [20]. Most of the respondents were more than 65 years old (63.3%) and female (66.6%). This is in line with studies which reported that among people aged 50 years and over, 13% of women and 7% of men were diagnosed with knee osteoarthritis and 24% of women and 17% of men had persistent knee pain (Lau, 2000).

Musculoskeletal disorders experienced by the elderly generally provide symptoms or complaints of pain, from mild to severe. Complaints of pain felt by the elderly can interfere with daily activities because the elderly feel uncomfortable. Therefore, the first treatment for musculoskeletal disorders is to reduce the pain or symptoms that appear (Lau, 2000). Elderly with female gender are at risk of injury. In women over 50 years of age will experience decreased flexibility in the muscles caused by knee pain. Osteoarthritis occurs due to damage to the cartilage that protects and provides cushion for joints. This causes the bones to tend to come into contact with each other so that they rub against each other as they move, causing pain and stiffness. Most people who suffer from this disease have limited movement while the rest are unable to carry out their daily activities.

The knee is more prone to Osteoarthritis. Radiographs of knee Osteoarthritis were deemed to have a Kellgren Lawrence (K-L) value of 2 or more and symptomatic Osteoarthritis was defined as a symptom of one knee along with radiographic features of Osteoarthritis. The National Health and Nutrition (NHANES) III reported radiographic prevalence of knee OA in 2,415 persons and symptomatic knee Osteoarthritis in 2,394 persons aged > 60 years (Anderson, 2010). Another study conducted by Deshpande BR, et al. Obtained similar results, namely a high prevalence of knee Osteoarthritis, especially

at the age of 55 - 64 years, where there was an increase in the prevalence of knee Osteoarthritis with age (Despande, 2016).

Osteoarthritis usually occurs in adults aged 55 years and over, often experiencing symptoms in the knees, joints of the hands, back, and hips (especially in the lower back). Osteoarthritis can also affect the small joints of the fingers (especially the thumb), toes, ankles, and neck (Yar, 2014)

The results of the study, which was conducted for three weeks, where respondents were given infrared therapy three times a week, showed a reduction in pain in the lower extremities. The heat that is delivered from infrared therapy will change the elasticity of muscles and tissues. This is in line with studies that provided Infrared therapy on lumbar pain showed a statistically significant effect on all outcomes of pain, function, lumbar flexion extension ROM and back extensor endurance. Infrared is effective in reducing pain and improving function, lumbar ROM and back endurance (Ansar, 2014).

### **Effect of Infrared Therapy on Lower Limb Pain Reduction in Elderly with Osteoarthritis**

The results showed that there was an effect of infrared therapy on reducing lower limb pain, in this case, knee pain in the elderly with OA. Infrared is an electromagnetic wave that produces thermal effects including an increase in microvascular and an increase in regional tissue temperature. Infrared radiation, a form of radiant energy, is emitted from any substance with a temperature higher than absolute zero. Infrared is the part of the electromagnetic spectrum that is adjacent to the lower-frequency end of the wavelength spectrum. Infrared produces heat by inducing vibration molecules. Luminous infrared heat lamps emit radiation in the near infrared spectrum (wavelength 770e1500 nm) (Chen, 2013).

Infrared rays that are absorbed by the skin can generate heat in the area that has been illuminated. The heat that has been entered increases the increase in metabolic processes. Van Hoff's law states that a chemical reaction will be rapidly accelerated in the presence of heat or a specified temperature increase. Therefore, irradiation with infrared light will increase the metabolic process which results in an increased flow of oxygen and nutrients to the tissue so that it can accelerate tissue repair if someone is damaged. Infrared rays can also increase vasodilation of blood vessels so that after irradiation, the skin will look reddish or commonly known as erythema. This problem is caused by the presence of heat energy received by sensory nerve endings which then

affects the heat regulator. Vasodilation causes blood circulation to increase so that white blood cells (leukocytes) and immunoglobulins increase. The vasodilating effect of infrared radiation can alleviate the inflammatory reaction (Widowati, 2017)

Light heating with infrared light has a sedative effect on the sensory nerve endings. The increase in temperature due to irradiation can help the relaxation occur as well as increase the muscle's ability to contract. Muscle spasm that occurs due to lactic acid buildup can be relieved by heating. The therapeutic effect of infrared light is to reduce and even eliminate pain. The pain reduction mechanism can occur through mild heating which causes a sedative effect on the superficial sensory nerve endings while strong heating can cause counter irritation so that pain can be (Widowati, 2017)

Infrared has a warm effect that can increase the local temperature of the tissue which causes vasodilation of surrounding blood vessels, whereas vasodilation of blood vessels can also accelerate the removal of several pain-stimulating chemicals including: bradykinin, serotonin, histamine, and proteolytic enzymes. As well as prostaglandins and substance P which increase the sensitivity of the ends of the pain fibers, so that in the end infrared can reduce the intensity of pain in Osteoarthritis knee patients (Ojoaowa, 2015)

This is in line with study (Chen, 2013). In which the administration of significant infrared therapy was given to patients with neck pain. In this study, the skin is exposed to infrared, the skin is directly heated, the researcher can postulate that infrared changes the viscoelastic properties of the irradiated tissue because muscles and tissues can experience elasticity, and can further extend the connective tissue of the knee including muscle and skin enhancement of the knee including muscle and skin enhancement. Muscle relaxation and increased tissue extensibility following infrared therapy may have a role in increasing blood flow by decreasing the pressure from the muscles in the blood vessels (Ansari, 2014). Another mechanism for increasing extensor resistance in muscles could be to increase circulation due to an increase in tissue temperature and a subsequent increase in tissue temperature and a subsequent increase in oxygen delivery and removal of substances that cause fatigue or pain triggers. The heat generated by infrared stimulated to the surface of the body is reduced by muscle rigidity which inhibits sympathetic activity and stimulates parasympathetic activity. Reduced muscle tension can reduce pain and fatigue (Chen, 2013).

**CONCLUSION**

The pain scale in the elderly with lower extremity pain before being given infrared therapy is mostly the pain scale. After being given infrared therapy 8 times for 3 weeks, the results were mostly with a mild pain scale.

The test results show a significant value in the control group (p=0.001) and a significant value in the group (p=0.719). While the difference test shows a significant value (p=0.000), so it means that there is a significant difference in the intervention group and the control group after being given infrared therapy intervention as much as 8 times for 3 weeks with a time offering of 10 minutes.

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