

*Original article***Differences in the Effectiveness of Infrared Therapy for Reducing Musculoskeletal Pain in the Elderly**Ida Untari<sup>1\*</sup>, Ipin Prasajo<sup>2</sup>, Siti Sarifah<sup>3</sup>

**Objective:** A health problem that is a priority for medical care and treatment for the elderly is pain in the musculoskeletal system. Non-pharmacological management in the form of treating musculoskeletal pain in the elderly, one of which is infrared therapy. Infrared therapy is able to reduce pain in the elderly and requires close supervision because the elderly experience a decrease in skin sensitivity to heat. The effectiveness of reducing pain varies in the elderly. One of the influencing factors is age. This study's objective is to determine differences in the effectiveness of infrared therapy to reduce musculoskeletal pain in the elderly group. **Materials and methods:** This study used an experimental research method with a nonrandomized pretest-posttest control group design. The research location was conducted at the Posbindu Institut Teknologi Sains dan kesehatan PKU Muhammadiyah Surakarta, in September - October 2022. A sample of 50 elderly people was divided into elderly (> 60 years: 30) and pre-elderly (45-60 years: 20) selected using a purposive technique sampling. The dependent variable is musculoskeletal pain. The independent variable is infrared therapy. Data were analyzed by Wilcoxon and Mann-Whitney test. **Results and Discussion:** The Wilcoxon test showed that there was an effect of infrared therapy in reducing musculoskeletal pain in the elderly and pre-elderly groups (p value <0.001 and <0.001). The average reduction in pain in the elderly group = 3.1; SD = 1.3 and pre-elderly = 2.95; SD = 1.2. The Mann-Whitney test showed no difference in reducing musculoskeletal pain using infrared therapy in the elderly and pre-elderly (p = 0.712). **Conclusion:** Infrared therapy is effective in reducing musculoskeletal pain and reducing musculoskeletal pain for the two elderly groups are similar

**Keywords:** Elderly, Infrared Therapy, Pain. on

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**A. Introduction**

People globally are living longer. Most people nowadays can manage to live into their sixties and beyond. The share of older persons in the population and their number are rising in every nation on earth. By the year 2030, one in six people around the world will be 60 or older. By this point, people over the

age of 60 will reach 1.4 billion, up from 1 billion in 2020. By 2050, the number of individuals over 60 worldwide will double (to 2.1 billion). Between 2020 and 2050, the number of people 80 and older is anticipated to treble, reaching 426 million<sup>1</sup>.

In 2020, there will be 727 million persons worldwide who are 65 or older. In 2050, this figure is anticipated

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to increase to 1.5 billion. In addition, by 2050, it is predicted that there will be 33 countries with an elderly population of more than 10 million people, of which 22 are developing countries. The proportion of the population around the world aged 65 years or over has risen from 6 percent in 1990 to 9.3 percent in 2020. It is anticipated that this proportion will continue to increase, reaching 16 percent by 2050<sup>(2)</sup>. In terms of the elderly population in Indonesia in 2021, there are eight provinces that have entered the old population structure, that is, where the percentage of the elderly population is greater than ten percent. Those provinces are DI Yogyakarta (15.52%), East Java (14.53%), Central Java (14.17%), North Sulawesi (12.74%), Bali (12.71%), South Sulawesi (11.24%), Lampung (10.22%), and West Java (10.18%)<sup>2</sup>

Musculoskeletal health refers to the functionality of the locomotor system, which is made up of sound muscles, bones, joints, and supporting connective tissues. Musculoskeletal impairments, which are defined by concerns with the muscles, bones, joints, and adjacent connective tissues and can result in temporary or permanent limitations in functioning and participation, are caused by more than 150 different diseases and conditions that impact the body. Constraints in mobility and flexibility, as well as discomfort that is frequently persistent, are early signs of musculoskeletal disorders. People struggle to make a living and participate in social events because of these symptoms. Distress in musculoskeletal structures is the most frequent sort of non-cancer pain<sup>3</sup>.

Reduced bodily functioning and structural alterations, which can lead to discomfort, are among the physiological processes experienced by elderly people. Elderly people with musculoskeletal pain have difficulty performing simple tasks or caring for themselves, which reduces their level of independence<sup>4</sup>. The most typical locations for chronic musculoskeletal pain are the back and joints, which are also linked to injury, a high risk of falling, sleeping problems, depression, and a lower quality of life in terms of one's health. Fear is also linked to increased bodily awareness and pain hypervigilance<sup>5</sup>. To effectively treat the elderly, medical experts must create better pain management techniques and intervention alternatives. Worldwide, musculoskeletal diseases among the elderly result in excruciating pain, a gradual loss of range of motion, and long-term impairment<sup>6-10</sup>. Reduced abilities may

make people feel more isolated from others, which can lead to despair and other problems. Musculoskeletal pain brought on by cancer, osteoporosis, rheumatoid arthritis, gouty arthritis, and osteoarthritis can impede movement and increase the risk of falling<sup>9,11</sup>.

Among older persons, multisite pain is a significant contributor to impairment. Pain that lasts longer than the standard healing time, usually for more than three to six months, is referred to as persistent pain. Musculoskeletal disorders are acknowledged as a significant risk to maintaining health in older age groups due to their links to falls, frailty, sadness, anxiety, sleep issues, limited mobility, and impaired cognitive function<sup>3</sup>. Also, it has been calculated that the United States spends about \$300 billion yearly on medical treatments for pain, and this expense is rising. Unfortunately, pain may go untreated or be handled improperly in older adults for a variety of reasons, including inadequate pain identification, the misconception that pain is a natural part of aging, cognitive impairment with varying pain presentations, underreporting by patients, and a lack of time in clinical practice to address pain among other comorbid conditions<sup>3</sup>. Due to issues including possible drug side effects on their premorbid medical illnesses, older persons with multimorbidity were also denied access to viable treatment alternatives in addition to dealing with physical and biopsychosocial challenges<sup>8</sup>. This emphasizes how crucial it is to comprehend the unique factors that should be taken into account while assessing and treating older persons with persistent musculoskeletal pain. The severity of the pain was thought to have an impact on how well diseases were controlled.

Geriatric disorders should be taken into account when looking at persistent pain. For instance, prolonged pain is frequently associated with falls, frailty, cognitive deterioration or dementia, and sleep disturbance. In older persons who live in the community, studies have linked moderate to severe pain to rapid memory loss, attention and executive function problems, and other problems. Some doctors consider persistent pain in older persons to be a geriatric syndrome due to the large number of underlying causes and its close connection to geriatric disorders<sup>12</sup>. Since they are linked to discomfort, mobility issues, an elevated risk of falls and fractures, and a reduced ability or inability to carry out daily life activities, musculoskeletal disorders are crippling conditions that seriously impair the health condition, particularly in senior persons. Given that they are

linked to pain, mobility issues, an elevated risk of falls and fractures, and a reduced ability or inability to carry out activities of daily living, musculoskeletal disorders are crippling conditions that substantially worsen the health situation, particularly in elderly subjects<sup>13</sup>.

Humanity has always attempted to cure musculoskeletal disorders physically. The utilization of infrared radiation has been the subject of an expanding amount of research over the past few decades (IR). IR, also referred to as infrared light, is electromagnetic radiation having wavelengths between 750 nm to 1 mm, which are shorter than microwave radiation and longer than visible light<sup>4</sup>. Since IR is created from thermal energy, it can be produced by material bodies that give off heat. Infrared radiation (IR) with a higher frequency and shorter wavelength is produced in greater quantities at higher temperatures<sup>14,15</sup>. According to its physical characteristics, infrared (IR) has been split into three bands by the International Council on Illumination (CIE): near-infrared (IR-A, 700-1400 nm), mid-infrared (IR-B, 1400-3000 nm), and far-infrared (IR-C, 3000 nm–0.1 mm) (14–16) IR seems to be a secure and efficient supplemental therapy for several musculoskeletal issues (14). The objective of the study was to determine whether there were any variations in how well infrared treatment reduced musculoskeletal pain in senior patients.

## B. Research Methods

This was a nonrandomized pretest-posttest control group design study of 50 elderly people, divided into elderly (> 60 years: 30) and pre-elderly (45-60 years: 20), chosen using a purposive sampling technique in Surakarta, Central Java, Indonesia. The data collection was carried out in September–October 2022. The research was carried out at Posbindu (an integrated coaching post) at Institut Teknologi Sains dan Kesehatan PKU Muhammadiyah Surakarta. The dependent variable is musculoskeletal pain. The independent variable is infrared therapy. The data were analyzed using the Wilcoxon and Mann-Whitney tests. Operational definition: Musculoskeletal pain comes from the musculoskeletal system, which consists of bones, joints, and soft tissues such as muscles, ligaments, tendons, and bursae that cause discomfort in the elderly as measured using the VAS (Visual Analog Scale). Infrared therapy was a type of physical medicine and rehabilitation therapy that used infrared electromagnetic waves with wavelengths ranging from 770 nm to 106 nm.

This therapy uses infrafill. This therapy was carried out by irradiating the complaint areas of the subjects of the study. The irradiation was carried out until the skin of the subjects of the study was warm and appeared erythematous. The infrared and skin irradiation distance is 50 cm. The type of data used in this study was primary data taken directly by the researcher from the subjects of the study before and after the study. The data taken were in the form of the characteristics of the subjects of the study and the decrease in VAS value at the time, before and after treatment. Data collection were carried out in three stages, as follows:

- a. Managing licensing was carried out after the proposal of the study was approved by the examiner. The researcher would submit permission to the ethical committee regarding ethical clearance. Following that, the researchers would manage a letter for permission to conduct a study from the Rector Institut Teknologi Sains dan Kesehatan PKU Muhammadiyah Surakarta and the Head of RW 8 and RW 9 as well as the Head of Elderly Posyandu Cadres in the Kadapiro Village Banjarsari Surakarta, which was used for permission to conduct a study at Posbindu Institut Teknologi Sains dan Kesehatan PKU Muhammadiyah Surakarta.
- b. Preparation Phase The subjects of the study who would be given therapy treatments were required to sign an informed consent form after being given an explanation from the researcher. The therapy treatment would be administered six times, three times per week. The subjects of the study would be divided into two treatment groups. The first group is pre-elderly (aged 45–59 years) and elderly (aged > 60 years). The subjects' pain scales would be measured using the VAS (Visual Analog Scale) before treatment and after six treatments. The results of the pain scale measurement would be recorded and analyzed.
- c. Implementation Phase: The infrared therapy was given to the two groups, the lansia and the pre-lansia. The characteristics of the continuous data samples were presented in the mean, median, standard deviation (SD), minimum

value, and maximum value. The characteristics of categorical data were presented or described in terms of frequency (n) and percentage (%). A bivariate analysis was carried out to analyze: 1) The difference in the effect of intervention on musculoskeletal pain was tested statistically by a parametric test, namely the T test, if the data distribution on the frequency of musculoskeletal pain were normal and homogeneous. If the distribution of the frequency data were not normal and not homogeneous, it would be tested by a non-parametric test, namely the Wilcoxon test and the Mann-Whitney U test. 2) The homogeneity of the frequency of musculoskeletal pain was tested using the Levene test. The result of the test was homogeneous, or the data variance was the same, if the p value was > 0.05. 3) The statistical significance of the difference in the effect of intervention on musculoskeletal pain was determined by the p value. 4) If the distribution of data on the frequency of musculoskeletal pain was normal and homogeneous, the difference in the effect of intervention on musculoskeletal pain between the pairs of groups was tested by the T test. If the distribution of data on the frequency of musculoskeletal pain was not normal and not homogeneous, the pairs of groups were tested by the Wilcoxon test. 6. Ethical Approval This study has obtained permission from the ethics commission of Institut Teknologi Sains dan Kesehatan PKU Muhammadiyah Surakarta, Number: 159/LPPM/ITS.PKU/VII/2022, on July 22, 2022. Data related to the subjects of the study were only used for study purposes. Before receiving treatment, study participants signed informed consent forms.

**C. Result and discussion**

The study included 50 elderly people who had musculoskeletal pain complaints and were divided into two groups: elderly (30) and pre-elderly (20).

description of the research subjects' characteristics

Table 1 shows the characteristics of the subjects of the study based on gender, with 39 females (82%) and 9 males (18%). People over the age of 60 had the highest frequency (30%) based on age characteristics. The most common types of pain felt by the study's subjects were: the waist that spreads to the thigh by 18 people (36%), knee pain by 14 people (28%), shoulder by 6 people (12%), knee and ankle

by 5 people (10%), and hand and nail by 1 person (2%) each.

**Table 1.** The description of the characteristics of the study subjects based on gender, age, and types of pain as the categorical variables

Variables	Frequency	Percentage (%)
Gender		
Male	9	18
Female	41	82
Age		
45-59 yeas	20	40
>60 years	30	60
Type of pain		
Shoulder	6	12
The waist that spreads to the thigh	18	36
Knee	14	28
Angkle	5	10
Wrist	5	10
Hand	1	2
Nape	1	2

Table 2 shows the oldest age of the subjects of the study was 81 years old. On the other hand, the youngest age was 45 years old, with an average age of 51,1 years old. Based on the result of the decrease in pain score (VAS), which was 3, the decrease in the maximum VAS value was 6. The minimum decrease was 1.

**Table 2.** Description of the characteristics of research subjects on continuous variables

Variables	mean	SD	Maximum Score	Minimum Score
Age (year)	61,1	4,8	81	45
<b>Pain reduction with VAS</b>				
Pretest pain	4,8	1,37	8	2
Posttest pain	1,8	1,3	5	9
Pain reduction	3	1,25	6	1

**Bivariate Analysis**

The difference in the effect of intervention on musculoskeletal pain was tested statistically by a parametric test, namely the T test. The T test stipulated that the data must be normally distributed and homogeneous. The Shapiro-Wilk test in Table 3 shows a p value of 0.05. Hence, the data were not

distributed normally. Meanwhile, the homogeneity test with the Levene test obtained a p value of 0.05, so that it could be asserted that the data were not normally distributed and not homogeneous. Therefore, the next analysis test used the Wilcoxon and Mann-Whitney tests.

Table 3. The test of data normality of the distribution of pain score

Groups	Shapiro Wilk Test			
	n	Mean	SD	p
<b>Pretest pain</b>	60			
Elderly	30	4,9	1,56	0,216
Pre elderly	20	4,65	1	0,048
<b>Posttest pain</b>	60			
Elderly	30	1,8	1,45	0,001
Pre elderly	20	1,7	1,03	0,017
<b>Pain reduction</b>	60			
Elderly	30	3,1	1,27	0,037
Pre elderly	20	2,95	1,23	0,039

Table 4 shows that the p value was 0.05 based on the Wilcoxon test results. Thus, there were differences in the effects of interventional infrared to reduce musculoskeletal pain in the elderly.

Table 4. Wilcoxon Test Results

Effect of TIR on pain	n	Mean rank	p
<b>Groups</b>			
Elderly	30	15,5	<0,001
Pre elderly	20	10,5	<0,001

Table 5 shows that the difference in pain before therapy between the elderly and pre-elderly groups was >0.05, meaning that there was no difference in pain between the two groups. Likewise, pain after therapy showed a p-value > 0.05, meaning no difference was found. There was no difference in pain reduction between the two groups. This means that infrared therapy is equally able to reduce pain in all groups of the elderly, and the reduction in pain is the same between the two groups.

### Discussion

Based on research results, infrared can reduce musculoskeletal pain in all elderly groups. The results of this study have been proven in many previous studies that infrared can reduce pain in the musculoskeletal system, such as in cases of temporomandibular disease pain, osteoarthritis, low

Table 5. Results of the Mann-Whitney test on pain reduction

Group	n	Mean rank	p
<b>Pretest pain</b>			
Elderly	30	26,45	0,562
Pre Elderly	20	24,08	
<b>Posttest pain</b>			
Elderly	30	25,00	0,758
Pre Elderly	20	26,25	
<b>Pain reduction</b>			
Elderly	30	26,10	0,712
Pre Elderly	20	24,60	

back pain (LBP), knee pain, and others<sup>17-23</sup>. Even various other conditions can be treated with infrared therapy by combining it with other therapies such as muscle training, acupuncture, and others<sup>19-24</sup>. Other health problems that can be treated with infrared besides the musculoskeletal system are mantle cell lymphoma (MCL), comfort in turkeys, and finding difficult veins in children and the elderly<sup>25-27</sup>. Infrared therapy in the elderly has been shown to improve geriatric syndromes such as weakness and the severity of the elderly's condition<sup>26</sup>.

Infrared therapy is a therapy that uses infrared electromagnetic waves, which can directly affect capillaries, lymph vessels, nerve endings, and other tissues under the skin and can increase the effectiveness of therapy<sup>16,28</sup>. Infrared therapy can be an option because it is non-invasive, easy to apply, requires a relatively short time, and has minimal contraindications. Although infrared therapy is gaining interest in the world of health, it is also very limited, especially in detecting and treating diseases associated with non-musculoskeletal conditions. The effect received by the skin from the use of infrared device therapy causes superficial heat around the skin area being treated<sup>22</sup>. Heating techniques can reduce VAS values. This infrared-induced decrease in VAS value may have the benefits of alleviating tension in the muscles and joints, promoting blood flow, and calming the neurological system. Pain reduction using infrared is also influenced by the effects of endorphins released, increased serotonin, and anti-inflammatory effects. Heating using infrared therapy can be done for 10 minutes to 30 minutes<sup>28-29</sup>. Other research has shown that giving infrared therapy for 15 minutes can increase the pain threshold in healthy subjects<sup>13,15,19</sup>. The therapeutic effect of infrared devices with the appropriate dose, intensity, duration,

and frequency will be able to provide effective care and treatment for various conditions, but at an intensity that is too strong, it can cause irritation in the form of sunburn. This requires special attention and the development of a safe infrared therapy tool in the health sector.

#### D. Conclusion

The conclusion of this study is Infrared therapy is effective in reducing musculoskeletal pain and reducing musculoskeletal pain for the two elderly groups are the same.

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#### Author's contribution:

Data gathering and idea owner of this study: Ida Untari

Study design: Ida Untari, Ipin Prasajo

Data gathering: Ida Untari, Ipin Prasajo, Siti Sarifah

Writing and submitting manuscript: Ida Untari

Editing and approval of final draft: Ida Untari, Ipin Prasajo, Siti Sarifah

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