

Effectiveness of Acupuncture and Infrared Therapies for Reducing Musculoskeletal Pain in the Elderly

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ABSTRACT

Background: According to the World Health Organization, the most frequent health problems experienced by the elderly is musculoskeletal pain. The common treatment for musculoskeletal pain is Non-Steroidal Anti-Inflammatory Drugs (NSAID) drugs. These drugs, however, give undesirable side effects such as disorders in digestion, renal function, and increased blood pressure. Acupuncture and infrared therapies have been widely known as cheap and safe for musculoskeletal pain. However, their relative effectiveness are not yet clear. This study aimed to determine the effectiveness of acupuncture and infrared therapies for reducing musculoskeletal pain in the elderly.

Subjects and Method: This was an experiment study with randomized controlled trials design. The study was conducted at the elderly integrated health post Klodran, Karanganyar, Central Java, in May, 2016. A total sample of 60 elderly was selected for this study using random sampling technique. This sample was randomized into 4 groups, each consisting of 15 study subjects: (1) acupressure; (2) acupuncture; (3) infrared; (4) acupuncture and infrared. The dependent variable was musculoskeletal pain. The independent variable was type of pain relief therapy. The data was analyzed by Kruskal Wallis Test, and post-hoc test using Mann-Whitney.

Results: Kruskal Wallis Test showed mean differences in the reduction of musculoskeletal pain between the four groups, and they were statistically significant, as follows: acupressure (mean= 1.3; SD= 0.5), acupuncture (mean= 2.3; SD= 0.5), infrared (mean= 1.6; SD= 0.6), and acupuncture and infrared (mean= 3.9; SD= 0.4). Mann-Whitney test showed the most effective treatment for reducing musculoskeletal pain was acupuncture and infrared combination therapy (mean difference= 2.53; $p < 0.001$).

Conclusion: Acupuncture and infrared combination is the most effective treatment for reducing musculoskeletal pain in the elderly.

Keywords: musculoskeletal pain, acupressure, acupuncture, infrared, elderly

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BACKGROUND

The elderly population in the world was around 524 million in 2010. It is expected to increase further in 2050 with threefold increase by 1.5 billion. The increase of the elderly population will occur in developing countries such as Indonesia (WHO, 2011; Yasamy et al., 2012). Indonesia is an old-structured country. It can be seen from the percentage of the elderly population in

2008, 2009, and 2012 reaching more than 7% of the total population of Indonesia. The percentage of the increase of elderly population in Central Java Province by 10.34% ranks third after Yogyakarta by 13.04% and East Java by 10.40% (Ministry of Health, 2013). Gradually, with the increasing number of elderly population in the world, it is possible if the world is inhabited by elderly compared to children. It indicates

that health problems which related to elderly will also increase every year (Barber and Gibson, 2009).

An elderly will experience many obstacles in her/his life when she/he gets older. These obstacles can affect the health of the elderly both physically and mentally. The health problems can lead to a decrease of quality of life of the elderly. Older age causes an elderly has many limitations such as limited movement, weak physical and mental health problems in life. Therefore, an elderly cannot live alone and needs good health care for a long duration. The mental and physical health of an elderly is closely related. If physical health is disrupted, it will affect mental health, and vice versa (Park, 2012).

According to the WHO (World Health Organization), health problems which are experienced by the elderlies are musculoskeletal pain. This is in line with the result of a report from WHO's Global Burden of Disease Study and The Bone and the Joint Monitoring Project in 2003 that the burden of the disease caused by musculoskeletal pain increases with age. Musculoskeletal pain that is experienced by many elderlies includes osteoarthritis, rheumatoid arthritis, osteoporosis, and lower back pain (Fejer and Ruhe, 2012).

The common treatment for musculoskeletal pain is NSAIDs (Non-Steroidal Anti-Inflammatory Drugs). Long-term therapy of non-steroidal drugs, especially in the elderly, can give undesirable side effects such as disorders in digestion, renal function, and increased blood pressure. Other musculoskeletal pain treatments are infrared light and acupuncture therapies. Acupuncture is an inexpensive therapy (White et al., 2012) and safe without causing harmful side effects (Kimet al., 2013).

A study of acupuncture treatment for musculoskeletal pain has been carried out

abroad and in Indonesia (Vickers and Foster, 2013). Several journals of study state that acupuncture therapy give a good effect for musculoskeletal pain (Madsen et al., 2009). This is in line with the result of a study conducted in Germany and the Netherlands, that by doing acupuncture therapy routinely, musculoskeletal pain can be handled properly, so that the quality of life of patients will also increase (Berg et al., 2010).

Pain management using infrared therapy has been carried out since decades ago. It is evidenced by several studies conducted by Stelican et al., (1992) and Branco et al., (1999) about the effectiveness of using infrared therapy for pain treatment especially musculoskeletal pain. Another study conducted by Pallotta et al. (2012) show that infrared therapy is also effective in reducing pain in knee inflammation in mice.

The use of acupuncture and infrared therapy is equally effective in treating musculoskeletal pain. However, studies which have used combination of both therapies for treating musculoskeletal pain have never been carried out. Therefore, this study needs to be carried out to determine the effectiveness of acupuncture, infrared, and combination of both therapies for reducing musculoskeletal pain in the elderly.

Colomadu II community health center in Karanganyar has working areas in five villages. One of the villages that have integrated health post for elderly is Klodran village. Elderly participants in this village are regularly participates in activities in the integrated health post every month. Based on the previous studies that have been carried out, 84% of the 89 participants in Klodran community health center complained musculoskeletal pain. It encouraged the researchers to conduct study on

the provision of acupuncture and infrared therapies for reducing musculoskeletal pain in the elderly in Klodran Colomadu Village, Karanganyar.

This study aimed to analyze the effects of acupuncture and infrared therapies in reducing musculoskeletal pain in the elderly.

SUBJECTS AND METHOD

1. Study Design

This study was an experiment study using randomized controlled trials design.

2. Population and Samples

The target population was elderly patients who experienced musculoskeletal pain. The accesible population in this study was 75 elderlies in integrated health post for elderly in Klomran Colomadu, Karanganyar, who experienced musculoskeletal pain. There were 60 elderlies as the samples of the study which were collected by simple random sampling. There were 60 people as the subjects of the study which were divided into 4 treatment groups. Each group consisted of 15 people.

The dependent variable was musculoskeletal pain. The independent variables were pain relief therapies such as acupuncture, infrared, acupressure, and combination of acupuncture and infrared therapies.

3. Operational Definition of Variables

Musculoskeletal pain came from the musculoskeletal system, which consisted of bones, joints, and soft tissues such as muscles, ligaments, tendons, and bursae.

Pain relief therapy was a therapy which its ability would be examined and compared in reducing musculoskeletal pain through 4 types of treatment. The first treatment was acupuncture therapy. It was a treatment by inserting needles at acupuncture points that have been mapped on the human body. It was carried out using filiform needles until the subjects of the

study felt the De Qi sensation (heavy sensation, numbness, and pain) at the injected point areas.

The second treatment was infrared therapy. It was a therapy in the field of Physical Medicine and Rehabilitation that used infrared electromagnetic waves with the characteristics of wavelengths by 770 nm-106 nm. This therapy used infrafill. This therapy was carried out by irradiating the complaints area of the subjects of the study. The irradiation was carried out until the skin of the subjects of the study was warm and appears erythema.

The third treatment was the combination of acupuncture and infrared therapies which was irradiated with infrared light after doing acupuncture therapy. The fourth treatment was acupressure therapy, which was a treatment therapy with massage/press on acupuncture points that have been mapped on the human body. The massage/press was carried out using the fingers.

4. Data Collection

The type of data of this study was primary data taken directly by the researcher on the subjects of the study before and after the study. Data taken were in the form of the characteristics of the subjects of the study and the decrease of VAS value at the time, before, and after treatment. Data collection was carried out through 3 stages, as follows:

a. Managing Licensing

Managing licensing was carried out after the proposal of the study has been approved by the examiner. The researcher would submit permission to the ethical committee regarding ethical clearance. After that, the researchers would manage letter for permission to conduct a study from Public Health Study Program which was used for permission to conduct a study at Colomadu II community health center.

b. Preparation Phase

The subjects of the study who would be given therapy treatment were required to sign an informed consent after receiving an explanation from the researcher. The therapy treatment would be done 12 times which were divided into 3 times per week. The subjects of the study would be divided into 4 treatment groups. The first group would be given acupuncture therapy, the second group would be given infrared therapy, the third group would be given acupuncture therapy with infrared therapy, and the fourth group was the control group that would be given acupressure therapy. The pain scale of the subjects of the study would be measured using VAS (Visual Analog Scale) before treatment and after 12 treatments. The results of the pain scale measurement would be recorded and analyzed.

c. Implementation Phase

The acupuncture therapy was given to the first group, the infrared therapy was given to the second group, the combination of acupuncture and infrared therapies were given to the third group, the acupressure therapy was given to the fourth group.

5. Data Analysis

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 frequency (n) and percentage (%).

Bivariate analysis was carried out to analyze:

- 1) The difference in the effect of intervention on musculoskeletal pain was tested statistically by parametric test namely One Way ANOVA 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 Kruskal Wallis.

- 2) The homogeneity of the frequency of musculoskeletal pain was tested using Levene test. The result of the test was homogeneous or the data variance was the same if 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 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 Post Hoc test. It was the test conducted after One Way ANOVA using LSD (Least Significant Difference) test.
- 5) If the distribution of data frequency of musculoskeletal pain was not normal and not homogeneous, the pairs of groups was tested by Dunnett C. test.

6. Ethical Approval

This study has obtained permission from the ethics commission of Dr. Moewardi Hospital/Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Number: 401/-V/HREC/2016, on May 3, 2016.

Data related to the subjects of the study were only used for study purposes. The subjects of the study signed an informed consent before treatment.

RESULT

There were 60 elderly subjects of the study who suffered from musculoskeletal pain complaints. There were 45 elderly subjects of the study in the treatment group. There were 15 subjects of the study who received acupuncture therapy, 15 subjects of the study who

received infrared therapy, 15 subjects of the study who received a combination of acupuncture and infrared therapies. In addition, there were 15 elderlies with musculoskeletal pain in the control group who were given acupressure therapy.

1. Sample Characteristics

Table 1 shows the characteristics of the subjects of the study based on gender

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

Variables	Frequency	Percentage
Gender		
Male	21	35%
Female	39	65%
Age		
45-59 years	7	11.7%
60-74 years	45	75%
≥75 years	8	13.3%
Types of pain		
Shoulder	17	28.3%
The waist that spreads to the thigh	5	8.3%
Head	1	1.7%
Lower waist	12	12%
Knee	13	13%
Angkle	3	3%
Wrist	5	5%
Hand	1	1%
Nape	3	3%

dominated by 39 females (65%) and 21 males (35%). Based on characteristics of age, the highest frequency aged 60-74 years by 45 people (75%). Based on the type of pain felt by the subjects of the study, the most types of pain was shoulder pain by 17 people (28.3%), knee pain by 13 people (13%), and lower back pain (LBP) by 12 people (12%).

Table 2 shows the oldest age of the subjects of the study was 88 years old, while the youngest age was 50 years old with an average age of 68.7 years old. Based on the result of the decrease of pain score (VAS), the decrease in the maximum VAS value

was in the acupuncture and infrared groups by 4. The minimum decrease in this group was also the biggest of the other groups which was 3.

Table 2. The description of the characteristics of the study subjects on continuous variables

Variables	mean	SD	Maximum	Minimun
Age	68.65	6.4	88	50
The decrease of VAS	2.3	1.1	4	1
Acupuncture	2.3	0.5	3	2
Infrared	1.6	0.6	3	1
Acupuncture dan infrared	3.9	0.4	4	3
Acupressure	1.3	0.5	2	1

2. Bivariate Analysis

The difference in the effect of intervention on musculoskeletal pain was tested

statistically by parametric test, namely One Way ANOVA. The requirements in the One Way ANOVA test were the data must be

normally distributed and homogeneous. The Kolmogorov-Smirnov test in Table 3 shows p value by <0.05 , so that the data were not normally distributed. Meanwhile, the homogeneity test with the Levene test

obtained p value by <0.05 , so that it could be concluded that the data were not normally distributed and not homogeneous. Therefore, the next analysis test used Kruskal Wallis Test.

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

Groups	Kolmogorov-Smirnov Test			
	n	Mean	SD	p
Pain before treatment	60	5.2	0.8	
Accupresure groups	15	4.9	0.9	0.012
Acupuncture groups	15	5.2	1.4	0.100
Infrared groups	15	4.6	1.9	0.091
Infrared and acupuncture groups	15	6.1	1.4	0.133
Pain after treatment	60	2.9	1.2	
Accupresure groups	15	3.5	0.6	<0.001
Acupuncture groups	15	2.9	0.8	0.001
Infrared groups	15	3.0	1.1	0.027
Infrared and acupuncture groups	15	2.2	1.8	0.070
The decrease of pain	60	2.3	1.1	
Accupresure groups	15	1.3	0.5	<0.001
Acupuncture groups	15	2.3	0.5	<0.001
Infrared groups	15	1.6	0.6	0.001
Infrared and acupuncture groups	15	3.9	0.4	<0.001

Table 4 The result of Kruskal Wallis test

Groups	n	Mean Rank	p
The decrease of pain			<0.001
Accupresure groups	15	15.5	
Acupuncture groups	15	33.5	
Infrared groups	15	20.4	
Infrared and acupuncture groups	15	52.6	

Based on the result of Kruskal-Wallis test, p value was <0.05 . It can be concluded that there were differences in the effect of intervention between acupuncture therapy, infrared therapy, the combination of acupuncture and infrared therapies, and acupresure therapy to reduce musculo-skeletal pain in the elderly. Table 4 shows

that the highest mean rank value was in the acupuncture and infrared groups by 52.6. It can be concluded that the decrease of VAS in the combination of acupuncture and infrared therapies was the most effective therapy compared to acupuncture therapy, infrared therapy, and acupresure therapy.

Table 5. The result of Mann-Whitney test

Groups	n	Mean Difference	p
Acupuncture Infrared	15	0.73	0.006
Acupuncture Acupuncture and Infrared	15	-1.53	<0.001
Acupuncture Acupresure	15	1.00	<0.001
Infrared Acupuncture and Infrared	15	-2.27	<0.001
Infrared Acupresure	15	0.27	0.305
Acupuncture and infrared Acupresure	15	2.53	<0.001

The Mann-Whitney test was used to determine differences in pain reduction of intergroups. Table 5 shows that there was a significant difference in the decrease in musculoskeletal pain between the acupuncture group and the infrared group, the acupuncture group and the combination of acupuncture and infrared groups, the acupuncture group and the acupressure group, the infrared group and the combination of acupuncture and infrared groups, the combination of acupuncture and infrared groups and the acupressure group. However, there was no significant difference in the infrared group and the acupressure group for decreasing musculoskeletal pain.

DISCUSSION

1. The effects of acupuncture therapy on the decrease of musculoskeletal pain compared to acupressure therapy

Acupuncture therapy is a therapeutic treatment by inserting needles at acupuncture points (acupoint) which is an electric active cell that has low electrical resistance and high electrical conductivity, so that the acupuncture points will deliver electricity faster than other cells (Saputra and Sudirman, 2009).

Based on the result of the study, the decrease of musculoskeletal pain with acupuncture therapy was more effective than acupressure therapy. This is in line with a study conducted by Molsberger et al., (2010) and Itoh et al. (2014), that acupuncture therapy can reduce VAS values better than the provision of orthopedic therapy for reducing shoulder pain. It is also supported by Coeytaux and Garland (2013) that acupuncture therapy is a great way for dealing with various types of pain, especially chronic pain. Based on a study conducted by Mori et al. (2013) in Japan, acupuncture therapy can also increase the

number of lymphocytes and granulocytes in patients with shoulder, lower back pain, and knee pains. It is caused by the stabbing of acupuncture points can affect nociceptive, proprioceptive, and autonomic nerve pathways. Acupuncture therapy can increase enkephalin and dinorphine in the spine and midbrain, thus increasing endorphin in the hypothalamic pituitary complex. Enkephalin flow in the midbrain can also stimulate the release of monoamine, serotonin, and norepinephrine in the spine, thus inhibiting pain, including musculoskeletal pain (Audette and Ryan, 2004).

A study on acupressure therapy for reducing pain has been carried out and proven. This is in line with a study conducted by (Levett et al., 2014) that acupressure therapy is very useful for reducing pain during labor. In addition, acupressure therapy can also cure lower back pain of office workers (Purepong et al., 2015). However, in this study, the effects of acupressure therapy are still not as good as acupuncture therapy. The decrease of pain in VAS values with acupressure therapy has the same mechanism as acupuncture therapy, but the media used is different. Acupressure therapy uses the therapist's fingers while acupuncture therapy uses needles. Stimulation uses the therapist's fingers only on the superficial surface while needles stimulation directly penetrates the skin and give direct effects on the immunological, neurochemical, and neurbiological systems (Bell and Preston, 2006; Nani, et al., 2015; Wong, 2010).

2. The effects of infrared therapy compared to acupuncture therapy on the decrease of musculoskeletal pain

Infrared therapy is a therapy that uses infrared electromagnetic waves which can directly affect capillary blood vessels,

lymph vessels, nerve endings, and other tissues under the skin (Porter, 2008).

Based on the result of the study, the decrease of musculoskeletal pain with infrared therapy was not better compared to acupressure therapy. This is in line with a study conducted by Nitz and Nitz (2014) that heating techniques using infrared can be carried out for reducing pain. The results of this study are also in accordance with Rayegani et al., (2012) that heating techniques can reduce the VAS values in patients with osteoarthritis. This decrease in VAS values which is caused by infrared can give the effect of reducing muscle tension, reducing joint stiffness, increasing blood flow, and relaxing the nervous system. The reduction in pain using infrared is also affected by the effects of endorphin which comes out, increased serotonin and anti-inflammatory effects (Hawkins and Abrahamse, 2007).

In this study, the best therapy between the provision of infrared and acupressure therapy can not be distinguished significantly. It is because heating using infrared therapy is carried out for 10 minutes. A study conducted by Haryanto (2003) shows that giving infrared therapy for 15 minutes can increase the pain threshold in healthy subjects. The conclusion of this study is giving infrared therapy which was only carried out for 10 minutes did not give maximum analgesic effect. In addition, the stimulation of acupressure therapy is carried out superficially, so that the effects of reducing pain produced is not as good as acupuncture therapy and is not better than infrared therapy (Bell and Preston, 2006).

3. The effects of the combination of acupuncture therapy and infrared therapy on the decrease of musculoskeletal pain compared to acupuncture therapy, infrared therapy, and acupressure therapy

Based on the result of the study, the combination of acupuncture and infrared therapies could reduce musculoskeletal pain effectively compared to acupuncture therapy, infrared therapy, and acupressure therapy. Acupuncture therapy which was combined with infrared therapy had a dual effect in reducing musculoskeletal pain.

Acupuncture therapy works through four domains: 1) local inflammatory reaction, 2) intercellular meridian transduction, 3) cutaneous somatoviscera reflex, and 4) neural to brain transmission (neuro acupuncture). Local inflammatory reactions are characterized by vasodilation. Intercellular meridian transduction is characterized by electric ion exchange in the meridian pathway. Cutaneous somatoviscera reflexes are characterized by activating the pain modulation system by suppressing transmission and perception of pain stimuli at different levels of the central nervous system (Gellman, 2006; Saputra and Sudirman, 2009 and Yun et al., 2005). Meanwhile, the infrared mechanism in reducing pain can occur through mild heating which causes a sedative effect on sensory superficial nerve endings while strong heating can cause counter irritation, so that pain can reduce (Vincket al., 2006). Therefore, the combination of acupuncture and infrared therapies is effective in reducing musculoskeletal pain. Study which is related to the use of combination of acupuncture and infrared therapies for the reducing musculoskeletal pain has never been carried out. However, there are studies in China which state that acupuncture and infrared therapies are the two most preferred thera-

py options for patients with low back pain (Chen et al., 2015). Therefore, this combination of therapies is very good in reducing musculoskeletal pain.

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