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Original Research

Red Ginger (*Zingiber officinale var. rubrum*) Massage Reduces Stiffness and Functional Disability in Elderly with Osteoarthritis

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ABSTRACT

Introduction: Recent research has provided data on the efficacy of the massage therapy and the role of essential oil in the management of osteoarthritis (OA) symptoms. Although both areas of research have demonstrated strong evidence that the muscles and massage with essential oil may affect OA symptoms, massage with essential oil applied on the quadriceps muscle has received no attention. The purpose of this study was to identify the effect of red ginger massage on joint stiffness and functional disability in elderly with osteoarthritis.

Methods: This study was a randomized control group pre-test and post-test experimental study design involving 62 elderly with osteoarthritis divided into two groups namely red ginger massage and control groups by random cluster sampling. The instrument used was Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Statistical test used were paired t-test and MANCOVA.

Results: Baseline value of stiffness and functional disability in intervention group were 4.47 ± 1.717 and 35.93 ± 12.806. After 8 weeks stiffness and functional disability became 2.40 ± 1.380 and 19.50 ± 9.420 Stiffness and functional disability were decreased on intervention group with p-value 0.000 and 0.004. It means there was influenced by red ginger massage on stiffness and functional disability in elderly with osteoarthritis.

Conclusion: Red ginger massage can be applied as a complementary treatment to help reduced joint stiffness and functional disability in addition to standard drug treatment usage in osteoarthritis disease.

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chronic disease; elderly; functional disability; osteoarthritis; red ginger massage; stiffness

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INTRODUCTION

Osteoarthritis is a progressive chronic disease which affected 178,415 elderly in Indonesia (Linton, 2012; Ministry of Health, 2013b). Factors causing osteoarthritis are obesity, aging, trauma, genetic predisposition and work (Amin, 2015; Kruger, Khumalo, & Nadene, 2017). The prevalence of osteoarthritis was 45% in age 55-64 years old, 51,9% in age 65-74 years old and 54,8% in age more than 75 years old (Ministry of Health, 2013a). The majority of people with osteoarthritis worked as laborers (31.2%) professions (23.4%), employees (15.4%), self-employed (23.7%) and others (24%) (Ministry of Health, 2016).

Management of osteoarthritis disease usually focuses on reducing pain and joint stiffness in which non-pharmacological treatment became the first priority (Amin, 2015; Pawanti, Untari, & Nansy, 2015). The therapy include educating clients about diseases, diet overweight counselling, physical therapy, use of tools and orthotics such as sticks, and surgical procedures (Hamijoyo, 2012). If necessary, drug therapy may be administered to clients with osteoarthritis including analgesic drugs such as Paracetamol and Acetaminophen as first line therapy which is considered to be safest for long-term consumption (Amin, 2015; Dewanto, 2003). However, if not successful, it will be replaced by Non-Steroidal Anti-Inflammatory Drugs or NSAIDs though it has adverse effects on liver and kidney organs (Sukandar et al., 2013). The mildest side effects that may arise are nausea, gastric pain and dyspepsia and the most serious is lesions, bleeding

and perforation of the gastrointestinal tract (Hussain & Farnaz, 2013). These adverse effects encourage researchers to develop management of osteoarthritis without causing harmful effects to the patient. One of them is the utilization of ginger massage as a complementary treatment option.

Currently, there has been a trend in Indonesian society, especially in urban communities to utilize traditional health services as they prefers a proactive approach for their well-being (Hussain & Farnaz, 2013; Widowati & Nurhayati, 2017). One of the alternatives is traditional medicine using herbs, including ginger that has been used in many parts of the world even since antiquity (Dhanik, Arya, & Nand, 2017). Red Ginger with scientific name *Zingiber officinale var. rubrum* has been used as a remedy in the Chinese herbal tradition, Ayurveda and Tibb-Unani (Ali, Blunden, Tanira, & Nemmar, 2008). Among the benefits of red ginger, the effects of anti-inflammatory and circulatory stimulants are the most important for clients with osteoarthritis (Ali et al., 2008). Several experimental studies have shown that the gingerol content of red ginger inhibits the synthesis of pro-inflammatory mediators Prostaglandin-E4 (PGE4) (C. Shen, Hong, & Kim, 2005) and nitric oxide in chondrocytes and leukotriene-B4 (LTB4) in vitro (Blumenthal, 2003). In clinical explanations, it may decrease the level of pain and inflammation associated with osteoarthritis (Leach & Kumar, 2008). Part of the ginger plant used is rhizomes, fresh, dried or extracted (Dhanik et al., 2017).

A study found that the use of moxibustion along with fresh mash ginger at the acupuncture point provides beneficial therapeutic effect for clients with arthritis (Xie & Lei, 2008). Ding, Leach, Hons, & Bradley (2013) mentioned that research on topical ginger application has been done on several different conditions including osteoarthritis and no adverse event being reported. However this review cannot conclude about the effectiveness of topical use of ginger for osteoarthritis.

Massage is known as the easiest affordable complementary treatment options in the community and has been used for many years due to its effectiveness (Ali et al., 2017). Massage is defined by Fitzgerald & Oatis (2004) as passive movements given in order to improve joint movement ability or decrease joint stiffness. Massage is useful for supporting circulation and reverse veins, providing neurological effects, modifying muscle physiology in overcoming hypertonicity, spasm and decreasing musculoskeletal pain (Green, 2013). Field (2016) says that massage can be done to reduce the pain of osteoarthritis joints. The functioning massage generates the meridians, warms the deep ducts, removes the cold, and improves blood circulation, and makes significant improvements to knee function (Shen & Cui, 2015).

Aromatic massage with a mixture of orange and ginger essential oils in the elderly with osteoarthritis has been done by Bing, Chung, & Tam (2008) found that massage was able to have a positive effect on the signs and symptoms of osteoarthritis (pain, stiffness and functional disability). Atkins & Eichler (2013) found that the dose of an effective massage for the elderly with knee osteoarthritis was 8 weeks in 2 sessions each week. Additionally, the research conducted by Nasiri, Azim, & Nobakht (2016) showed that the administration of aroma massage with essential oils as much as 3% was able to give positive effect to clients with osteoarthritis. So the combination of the use of massage with the use of red ginger essential oil is expected to give a positive impact on the reduction of stiffness and functional disability clients with osteoarthritis. However, the effect of red ginger massage on stiffness and functional disability in elderly with osteoarthritis has not been proven. Respondents' satisfaction and side effects from giving this massage will be noted.

Based on these findings, the authors considered that it is necessary to identify the effects of aromatic massage of pure red ginger of signs and symptoms of osteoarthritis. Therefore, the purpose of this study was to identify the effect of red ginger massage on joint stiffness and functional disability in elderly with osteoarthritis.

MATERIALS AND METHODS

Study Design and Participants

This study was a randomized control group with pre-test and post-test experimental design. Single blinding was applied in this study. The research was carried out on a voluntary basis among members of the three public health centers (PHC) in Surabaya, Indonesia. The participants were recruited via a list of elderly with osteoarthritis from each PHC.

Sample size calculation performed based on different proportion of independent sample formula at $\alpha = 0.05$. It was found that the expected total number of participants was 64 with 32 respondents in intervention and control group However, only 62 respondents can be involved in this study based on inclusion criteria for 4,419 population. The inclusion criteria were those who had knee joint pain over the past month, aged 60 - 85 years (based on elderly criteria in Indonesia), used piroxicam and had good cognitive ability (MMSE score 24-30). The participants were excluded if they were those who underwent physiotherapy for knee joint pain, did routine exercise more than once a week, had operated wound in joint and leg area over the past six months, were sufferred from cancer, rheumatoid arthritis, gout or any serious illness and were suffering from contagious skin illness.

Participants who were eligible and willing to participate in the study were requested to sign a consent form before undergoing treatment. Participants were assigned to one of two groups based on their living area.

Red Ginger Massage Treatment Protocols

Participants in the intervention group received a session of 20 minutes of red ginger massage on both lower limbs sixteen times within eight weeks. The intervention group received massage with red ginger oil (3.33% red ginger oil in virgin coconut oil). The red ginger essential oil obtained from laboratorium in Yogyakarta, Indonesia. Virgin Coconut oil was selected as the base because it was relatively less costly, safe for dry and delicate skins, easy to make and obtain compared to other carrier oils. The control group received no massage but conventional treatment during the study (piroxicam). However, the same massage session was given to the control group after study as a service. The same supply of oils and dilutions were used throughout the study. Effleurage and petrissage were applied over the front and side of both legs of the participants. Various muscles on the thigh were massaged: quadriceps femoris, gracillis, and biceps femoris. Recommended pressure massage between 100-118.7 mmHg. The massage treatment was given by a nurse with training in leg aroma-massage. Their skill were assessed and evaluated by an experienced masseur. Participants in the control group received same massage treatment after eight weeks.

Outcome Measures

Demographic information of the respondents included age, sex, body mass index, herbal consumption, medicine consumption, long time of osteoarthritis diagnosed, exercise frequency per week, massage habit per 12 month.

The primary outcome were knee joint stiffness intensity and physical functioning. They were measured by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). It consisted of 19 questions assessed on likert scale, analyzed as 2 subscale with average score 2 questions on stiffness and 17 questions on physical function. Some countries that have tested the validity and reliability of these instruments stated that the WOMAC index is a very reliable and valid instrument for evaluating the signs and symptoms of osteoarthritis. WOMAC already translated by The Indonesian Rheumatology Association (IRA) into Indonesian language. By the every end of treatment completion, the participant were asked about their feedback about the intervention.

Data Collection Procedures

WOMAC questionnaires and cognitive assessments (Mini Mental State Examination or MMSE) were performed by third-year nursing students by face to face interviews. Before doing interviews, the nursing students got an explanation and training for massage inform consent, WOMAC and cognitive assessment. In this study, the data collector and all participants were blinded to the group allocation. Besides, the nurse who gave the red ginger massage was not involved in the data collection of outcome measurements except the general feedback toward the massage process. Data were collected at three time points namely before intervention (baseline assessment), one hour after the completion of treatment at week 8th and one hour after completion of every treatment schedule.

Data Analysis

Normality checking of the outcome data was examined by the Kolmogorov-Smirnov test with $p > 0.05$ indicating that the data were normally distributed and that parametric statistic should be performed. Subsequently, we compared the baseline characteristics of participants from the control and intervention group using paired t test and MANCOVA to describe difference between the control and intervention group after 8 weeks intervention. The level of significance was 0.05 (one-tailed) for all test. All of the analyses were completed using SPSS.

Ethical Clearance

This research has been approved by the Commission of Health Research Ethics Faculty of Nursing Universitas Airlangga no. 685-KEPK by date 7th March 2018.

RESULTS

Participants socio-demographic and knee pain related characteristic

Of the 62 participants recruited in this study, 60 (96.7%) participants completed eight weeks intervention consisted of 16 session of red ginger massage. There were 2 drop-outs participant with private reasoned without any concerned with the study. The majority of the 60 participants were women (97.1%), the majority of the age category was 60-74 years (88.3%) and the majority category of BMI was normal. The rate of herb consumption were the same between the treatment and control group at 50%. The majority of the respondents took standard osteoarthritis therapy (piroxicam) once a day (60%). The majority of long time diagnosed of osteoarthritis are less than 1 year (38.3%), the majority of knee pain is left knee (40%), the frequency distribution of exercise per week was the same in the category never and once per week, and the majority of habitual massage in 12 months is 2-4 times (50%) (Table 1).

Table 2 Comparison of the mean change in the WOMAC subscale among intervention and control groups from baseline to post an eight weeks.

Effect on knee stiffness relief and functional disability

Table 1. Demographic Characteristics of Intervention and Control Groups at Baseline

Sociodemographic data		Group	
		Intervention (n = 30) frequency (%)	Control (n = 30) frequency (%)
Age			
Elderly	60 - 74 y.o	25 (83.33)	28 (93.33)
Older Elderly	75 - 90 y.o	5 (16.67)	2 (6.67)
Sex			
Female		27 (90)	28 (93.33)
Male		3 (10)	2 (6.67)
Body Mass Index (BMI)			
Normal	BMI ≥ 18.50 - 24.99	13 (43.33)	16 (53.33)
Overweight	BMI ≥ 25.00 - 27.00	10 (33.33)	7 (23.33)
Obesity	BMI ≥ 27.00	7 (23.33)	7 (23.33)
Herb consumption			
Yes		15 (50)	15 (50)
No		15 (50)	15 (50)
Drug consumption			
Once a day		23 (76.67)	13 (43.33)
Twice a day		7 (23.33)	17 (56.67)
Long-time diagnosed with osteoarthritis			
≤ One year		11 (36.67)	12 (40)
1 - 3 years		12 (40)	9 (30)
4 - 9 years		4 (13.33)	7 (23.33)
≥ Ten years		3 (10)	2 (6.67)
Knee pain site			
Unilateral knee		15 (50)	24 (30)
Bilateral knee		15 (50)	6 (20)
Exercise frequency per week			
Never		15 (50)	15 (50)
Once		15 (50)	15 (50)
Massage habit per 12 months			
Never		9 (30)	6 (20)
Once		5 (10)	9 (30)
2-4 times		15 (50)	15 (50)
Routine		3 (10)	0

Table 2. Comparison of the Mean Change in the WOMAC Subscale Among Intervention and Control Groups from Baseline to Post an Eight Weeks

WOMAC	Baseline (Mean ± S.D.)	Post 8 week (Mean ± S.D.)	Within group p-value[a]
Stiffness (0-8, ↑ worse)			
IG	4.47 ± 1.717	2.40 ± 1.380	0.000
CG	4.70 ± 1.601	4.63 ± 1.542	0.161
Between-groups p-value[b]		0.000	
Function disability (0-68, ↑ worse)			
IG	35.93 ± 12.806	19.50 ± 9.420	0.000
CG	43.03 ± 10.975	28.33 ± 11.583	0.000
Between-groups p-value[b]		0.004	

CG = Control Group; IG = Intervention Group; S.D. = Standard Deviation; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; a = p-value calculated by paired t test for within group comparison; b = p-value calculated by MANCOVA for between group comparison.

The decrease of knee joint stiffness in treatment group had p=0.000 while control had p=0.161 after eight weeks. In addition, the difference between the control group and the treatment time over eight weeks was p=0.000. Furthermore, the reduction of functional disability in the treatment group had p=0.000 while the control group had p=0.000 over eight weeks. The difference between control group and treatment after eight weeks was p=0.004 (Table 2).

DISCUSSION

The analysis in each group found significant decreased in stiffness and functional disability at the post eight weeks after intervention for the intervention group, but not for the control group. These results are consistent with the results of the intervention study of ginger extract and aroma of ginger massage to decrease stiffness and functional disability in participants with osteoarthritis (Bing,

Chung, & Tam, 2008; Masoud, Ali, Tayebeh, & Shohreh, 2005; Zakeri, Izadi, Bari, Soltani, & Narouie, 2011). It suggests that ginger may be used as an anti-inflammatory and analgesic to relieve stiffness in the elderly with osteoarthritis. Essential oils contain sesquiterpenoids (such as zingiberene, α-curcumene, β-bisabolene, α-farnesene), monoterpenoids (such as β-sesquiphellandrene and camphene), the phenolic concepts of sharp red ginger (gingerol and shogaol 5-8%) , lechitin, protein, starch (60%), vitamins, minerals and others (B. H. Ali et al., 2008; Ali Hasan, 2012; Young et al., 2006). The combination of massage movements was effleurage (circular motion carried out with the palm of the hand), tapotement (hands hit soft tissue with rhythmic rhythms) and friction. Based on previous research, these massage movements able to improve physical function of participants with osteoarthritis (Atkins & Eichler, 2013; Bing et al., 2008; Juberg et al., 2015). Combination of massage and essential oil works synergistically can affects the decrease in stiffness resulting in decreased functional disability.

Stiffness in osteoarthritis caused by osteophyte formation in the result of an inflammatory process involving leukotrin activation (Sowers, Karvonen-gutierrez, Jacobson, Jiang, & Yosef, 2011). Therefore using red ginger massage reduces inflammation in the area around the knee joint due to the massage process. In addition it will help reduce symptoms of joint stiffness in osteoarthritis. There were two participants who got the highest stiffness score in the treatment group and did not change after being given a mixture of red ginger for eight weeks. The initial situation in the respondent's joints is definitely not always the same. However, this study did not use radiological criteria in responding to osteoarthritis screening, so the researcher could not ensure whether the osteophytes in the respondent had occurred.

Based on the analysis result, differences in the functional disability in the control and treatment groups seen in several point of the WOMAC subscale fuctional disability. On point such as the difficulty of participants in doing activities up and down stairs, standing, walking in a flat surface, and shopping. There are quite a number of changes in participant score. That question majority asking about respondent's knee function. In the treatment group that received red ginger massage in this study experienced a decrease in stiffness therefore the function of the quadriceps muscle knee joint to support body weight was better than before receiving the red ginger massage. Furthermore on certain questions about the difficulty of respondents to stand up from sitting, bending the floor, getting out of bed, lie down in bed, sit down, heavy household chores and light household chores there are not many changes in value. The majority of the questions asked about whole joint function and were not specific to the knee function of the respondents.

Participants of red ginger massage intervention did not report any adverse event or allergies regarding the use of red ginger essential oil. Therefore, we used the highest concentration of red ginger essential oil of 3%. According to previous study no adverse event reported of using ginger massage (Bing et al., 2008; Ding, Leach, Hons, & Bradley, 2013).

Massage belongs to complementary and alternative treatments within the category of manipulative and body based (Moquin, Blackman, Mitty, & Flores, 2009). A massage is a form of cutaneous stimulation while the use of red ginger essential oil as anti-inflammatory and enhanced blood circulation in osteoarthritis and as an aromatic that provides a relaxing effect. Massages have been shown to reduce pain and improve the health and wellbeing of the elderly as a professionally managed complementary therapy (McFeeters, Pront, Cuthbertson, & King, 2016). According to Louisiana in Sparber (2011), complementary therapies describe the integrative nature of nursing practice and is a vast domain of healing sources that enable nurses to increase supportive or restorative care for life and well-being.

CONCLUSION

In conclusion, the results of our study showed sixteen red ginger massage sessions using a mixture of red ginger essential oil and virgin coconut oil were able to reduce joint stiffness and functional disability in the elderly with osteoarthritis. No adverse event was reported during the study. Therefore, red ginger massage can be recommended as one of the complementary methods for osteoarthritis treatment management.

Our findings on stiffness found that the initial state of joint stiffness in participants was not the same. Several factors such as the inflammatory process and the formation of bone osteophytes also aggravate joint stiffness. However, this study did not use radiological criteria in osteoarthritis screening. Thus, we recommend that future study including radiologic criteria in osteoarthritis screening. High concentration of red ginger oil usage, which is 3%, has not been evaluated for the duration of the effect for stiffness relief, expected that further studies needed to find the right dose for stiffness relief.

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