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Effectiveness of Warm Moringa Leaf Compress in Reducing Knee Pain in Elderly Individuals with Gout Arthritis: A Quasi-Experimental Study

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Abstract

Introduction: Gout arthritis is one of the leading causes of knee pain in the elderly, resulting from increased uric acid levels that trigger joint inflammation. One potential non-pharmacological therapy is a warm compress using Moringa leaves containing flavonoids with analgesic properties.

Methods: This quasi-experimental study employed a pre-test and post-test design involving treatment and control groups. A total of 22 participants were selected through purposive sampling and divided into two groups: 11 individuals in the intervention group and 11 in the control group. The intervention group received a warm compress using Moringa leaves, while the control group received a standard warm compress. Data were analyzed using paired t-tests and independent t-tests.

Results: The intervention group experienced a significantly more significant pain reduction than the control group ($p = 0.027$). Paired t-test analysis indicated a significant decrease in pain within both groups (intervention: $p < 0.001$; control: $p = 0.001$). The mean pain reduction in the intervention group was more significant than in the control group, suggesting that the warm Moringa leaf compress is more effective in alleviating knee pain due to gout arthritis.

Conclusion: The warm Moringa leaf compress effectively reduces knee pain in elderly individuals with gout arthritis and may serve as a complementary non-pharmacological therapy.

Keywords: gout arthritis, knee pain, elderly, warm compress, *Moringa oleifera*, pain management.

Introduction

Aging leads to a decline in cellular function, resulting in various degenerative diseases. Epidemiologically, degenerative diseases are non-communicable diseases such as obesity, cardiovascular diseases, osteoporosis, diabetes mellitus, stroke, gout arthritis, and approximately 50 other degenerative conditions. One of the most prevalent degenerative diseases in Indonesia is gout arthritis, which affects the musculoskeletal system due to excessive uric acid levels in the blood.[1] Normally, uric acid levels are 7 mg/dL in men and 6 mg/dL in women. Gout arthritis is most commonly found in individuals aged 45 years and older, frequently affecting small joints such as the big toe, wrist, foot, knee, hand, and elbow.[2]

According to the World Health Organization (WHO), gout arthritis ranks second in prevalence in Indonesia after osteoarthritis, with an estimated 100,000 cases per year.[3] This prevalence increases with age, reaching 18.9% in individuals over 75 years old, with a higher incidence in women (8.5%) than men (6.1%).[3]

In Bali, gout arthritis ranks third among the ten most common diseases reported at community health centers (Puskesmas), with 115,157 documented cases.[4] The high consumption of purine-rich foods, which is deeply embedded in Balinese culinary and social traditions, contributes to elevated uric acid levels in the blood, ultimately increasing the incidence of gout arthritis.[5] Various high-purine and high-fat foods are often served during traditional ceremonies.

Additionally, the Balinese cultural tradition of *menyama-braya*, which involves social gatherings during religious and customary ceremonies, is often associated with the consumption of alcoholic beverages such as *teak*, beer, *arak*, and other types of alcohol.[6] Consequently, uric acid levels in Balinese communities tend to be high, increasing the risk of gout arthritis.

The management of gout arthritis can be pharmacological, medication, or non-pharmacological, through physical therapy. While pharmacological treatments are effective in relieving gout arthritis pain, long-term use may lead to significant side effects. Therefore, safer, more affordable, and self-administered non-pharmacological therapies, such as warm compress therapy using natural ingredients like Moringa leaves, are needed.

One plant frequently used in phytopharmaceuticals is the Moringa leaf (*Moringa oleifera*), which contains flavonoids with anti-inflammatory and analgesic properties.[7] These compounds help reduce inflammation and pain caused by the accumulation of uric acid crystals in the joints, making Moringa a potential alternative for gout arthritis

management. Additionally, warm compress therapy is another effective non-pharmacological method for relieving joint pain.[8]

Warm compress therapy can be performed independently by patients as part of self-care. This method helps dilate blood vessels around the joints, facilitating the removal of uric acid crystals from the joints into the bloodstream.[9] Warm compresses provide a soothing effect, relieve pain, prevent muscle spasms, and offer a comforting sensation.[10] While warm compress therapy has been proven effective in reducing pain, the effectiveness of combining warm compresses with Moringa leaves in alleviating joint pain due to gout arthritis remains largely unexplored.[2] Some studies have demonstrated the benefits of warm compress therapy in reducing joint pain caused by gout, and others have investigated the anti-inflammatory effects of Moringa leaves. However, research on the combination of both therapies is still minimal.[2]

This study aims to evaluate the effectiveness of a warm Moringa leaf compress in reducing knee pain in elderly individuals with gout arthritis compared to a standard warm compress. The research hypothesis is that the warm Moringa leaf compress is more effective in reducing pain than a warm compress without Moringa leaves.

Previous research has shown that applying a warm compress three times on patients with gout-related joint pain can reduce pain levels to a mild scale (score 2) and improve patient comfort.[11] The compounds in Moringa leaves may help alleviate joint pain in elderly individuals through warm compress therapy. The primary objectives of warm compress therapy are to soften fibrous tissue, relax muscles, reduce pain, improve blood circulation, and provide a comforting effect for patients.[12]

Methods

This study employed a quasi-experimental design with a non-randomized controlled trial approach, utilizing a pre-test and post-test framework. Ethical approval for this study was obtained from the Research Ethics Committee of the Faculty of Medicine, Udayana University, under approval number 1562/UN14.2.2.VII.14LT/2024, dated June 14, 2024. All research variables were measured twice: on the day of implementation and the following day to ensure data reliability. This study aimed to evaluate the effectiveness of warm Moringa leaf compresses in reducing knee joint pain, considering control variables such as medical history, age, and body mass index (BMI). Data was collected using the Numeric Rating Scale (NRS), measured during the pre-test and post-test phases. Additional factors, such as physical activity patterns and dietary habits that could influence joint pain levels were recorded to enhance the validity of the results. The study was conducted on June 29 and 30, 2024, in Banjar Ulapan, Bukian Village, Payangan, Gianyar.

Sampling was conducted using purposive sampling, targeting elderly individuals aged 55–65 with a history of gout arthritis and obesity. Participants were selected based on secondary data from the UPTD Kesmas Payangan, and prior permission was obtained from the village head to research eligible subjects. After screening, 22 participants met the inclusion criteria and signed an informed consent form as an agreement to participate. They were then proportionally divided into two groups, with 11 participants in the experimental group and 11 in the control group. A single-blinded method was applied to minimize bias, ensuring participants were unaware of their assigned group.

The research process began with an initial assessment of participants' conditions, conducted by the research team in collaboration with a physiotherapist and a physician. Baseline measurements were taken using the Numeric Rating Scale (NRS) before intervention (pre-test). The control group received a standard warm water compress, while the experimental group was given a warm Moringa leaf compress. The Moringa leaf compress was prepared by boiling fresh Moringa leaves in water at 45–50°C for 10 minutes, then cooling to a comfortable temperature before application. The intervention was administered for 20 minutes once per day over two consecutive days. Following the intervention, knee joint pain levels were re-measured using the NRS as a post-test, conducted within the same 24-hour timeframe after the final intervention to prevent temporal bias.

Participants were educated on dietary recommendations to control confounding variables, particularly avoiding purine-rich foods such as legumes, red meat, and high-fat foods, which could exacerbate joint pain. Additionally, they were instructed to maintain consistent physical activity levels throughout the study to ensure the validity of the results. Data analysis was performed using SPSS software. Normality testing was conducted using the Shapiro-Wilk test. The Paired Sample T-Test assessed pre- and post-intervention differences within each group.

Meanwhile, the Independent Samples T-Test was applied to compare differences between the experimental and control groups. Statistical significance was determined at a p-value < 0.05. Additionally, effect size analysis was considered to evaluate the clinical impact of the intervention.

As this study employed a non-randomized controlled trial design, randomization was not performed to allocate experimental and control groups. However, a single-blinded method was implemented to reduce bias, ensuring participants were unaware of their intervention group. Furthermore, blinding of assessors was conducted by assigning two researchers to perform pre-test and post-test measurements, enhancing objectivity. If complete blinding was not feasible, alternative methods such as standardized questionnaires or video recordings were considered to ensure measurement accuracy.

The sample size was determined based on power analysis using G*Power software, with an effect size of 0.8 (large), an alpha (α) level of 0.05, and a power (1-β) of 0.80. The calculation indicated a minimum required sample size of 10 participants per group. However, the final sample size included 11 participants per group to account for potential dropout. In this study, no missing data were found. However, if missing data had occurred, an intention-to-treat (ITT) analysis or per-protocol analysis would have been applied to maintain the validity of the study results.

Results

Characteristics of Study Subjects

The study subjects were elderly individuals aged 55–65 years with a history of gout arthritis and obesity. The subjects' data were registered and recorded by UPTD Kesmas Payangan. The recruitment period spanned from January to February 2025, with a follow-up period of four weeks after the intervention. Based on the inclusion and exclusion criteria, 22 elderly individuals were recruited for this study. All recruited participants were analyzed without any exclusions. Subsequently, the 22 subjects were divided into the control group (n=11) and the experimental group (n=11). The Flow Diagram (Figure 1) presents the recruitment process and research flow, which follows the CONSORT standard.

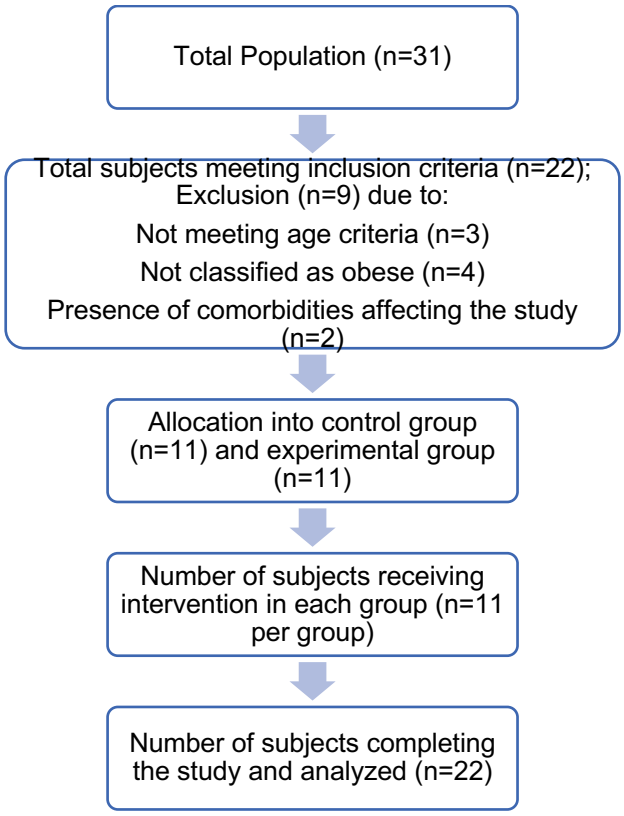

Figure 1. Flow Diagram

Table 1. Frequency Distribution of Subject Characteristics

Variable	Frequency (n)	Percentage (%)
Age		
55-57	6	27.27
58-60	8	36.36
61-62	3	13.64
63-65	5	22.73
Gender		
Male	6	27.27
Female	16	72.73
Body Mass Index (BMI)		
23-25	12	54.55
26-28	10	45.45
Uric Acid Levels (mg/dL)	Male	Female
6.0-7.0	0	15 (68.18%)
7.1-8.0	6	1 (31.82%)
Total	22	100.00

Table 2. Subject Characteristics by Group

Variable	Experimental (n=11)	Control (n=11)
Age (Mean ± SD)	60.00 ± 2.99	59.09 ± 2.95
Male (%)	27.27	27.27
Female (%)	72.73	72.73
BMI (Mean ± SD)	26.76 ± 1.44	25.72 ± 0.65
Uric Acid Levels (Mean ± SD)	6.81 ± 0.53	6.74 ± 0.56

Effectiveness Analysis of Warm Moringa Leaf Compress in Reducing Knee Joint Pain in Elderly Individuals with Gout Arthritis

Bivariate analysis using the Paired Sample T-test was conducted to determine the effectiveness of the warm Moringa leaf compress in this study. The variables analyzed were the pre-test and post-test results from the control and experimental groups, measured using the Numerical Rating Scale (NRS) questionnaire.

Table 3. Paired T-test Results

Comparison	p-Value
Control Pre-test vs. Control Post-test	0.001
Experiment Pre-test vs. Experiment Post-test	0.000

The analysis results indicate that Pair 1 (Control Pre-test vs. Control Post-test) had a p-value of 0.001 ($p < 0.05$), suggesting a significant difference between pre-test and post-test results in the control group. Meanwhile, Pair 2 (Experimental Pre-test vs. Experimental Post-test) had a p-value of 0.000 ($p < 0.05$), indicating a highly significant difference between pre-test and post-test results in the experimental group.

Furthermore, an Independent Sample T-test was conducted to compare the effectiveness between the control and experimental groups. The test results are presented in the following table.

Table 4. Independent T-Test Results

Comparison	p-Value
Pre-test between both groups	0.251
Post-test between both groups	0.027

Based on the Independent Sample T-test results, the pre-test comparison yielded a p-value of 0.251 ($p > 0.05$), indicating that both groups originated from the same baseline condition. In contrast, the post-test comparison produced a p-value of 0.027 ($p < 0.05$), signifying a significant difference in effectiveness between the two groups after administering the intervention.

Discussion

Characteristics of Research Subjects

Most subjects in this study were aged 58-60 years, with eight individuals (36.36%) falling within this age range. This age group is classified as elderly, at a higher risk for gout arthritis.[13] Knee pain due to gout can affect the quality of life through daily activities. The largest age group was 58 years (4 individuals or 18.2% of the total subjects), followed by ages 56, 60, and 64 years, with three individuals each (13.6% of the total subjects). Other age groups, such as 55, 57, 59, 61, 62, and 63 years, had between 1 to 2 participants.

These findings align with the study by Rani Eka Sapitri (2021), which stated that joint pain due to uric acid is more prevalent in older people. This is due to the aging process, which inhibits the formation of the uricase enzyme, which oxidizes uric acid into allantoin to facilitate excretion from the body. When this enzyme function is impaired, blood uric acid levels can increase, leading to a higher incidence of gout arthritis among older individuals.

Regarding gender characteristics, most subjects in this study were female, accounting for 16 individuals (72.7%), while males comprised six individuals (27.3%). This finding is supported by the study of Zuhdita Aulia Sulthon et al. (2024), which found that lower limb joint diseases are more prevalent in older women. The main contributing factor is the anatomical structure of females, with a smaller femur bone and a thinner patella than males.[14] Additionally, postmenopausal women experience a decline in estrogen levels, which triggers increased bone resorption and raises the risk of joint diseases.[15] Estrogen plays a role in stimulating osteoblast activity responsible for bone matrix synthesis. After menopause, the ovaries nearly cease estrogen production, leading to a decline in bone matrix and calcium and phosphate reserves in the bones.[16]

Based on body mass index (BMI), the frequency distribution ranged from 25.10 to 28.88, with each BMI value found in 1 individual (4.5% of the total subjects). This study's results indicate that BMI affects uric acid levels, as all subjects had a BMI >25, indicating obesity. This is supported by research stating that obese individuals have a higher risk of gout due to excessive protein consumption.[17] However, in this study, participants' dietary consumption patterns were not fully controlled, suggesting that nutritional factors may influence uric acid levels and joint pain. Additionally, participants' use of other medications was not evaluated, which could be a limitation in interpreting the results.

Sari et al. (2019) also stated that being overweight is associated with an increased risk of gout arthritis, likely due to elevated leptin levels in obese individuals. Leptin plays a role in regulating uric acid concentration in the blood, and high leptin levels can trigger hyperuricemia.[18] Additional evidence was found in the study by Welmy Indaputri Leokuna (2020), which demonstrated a significant relationship between BMI and blood uric acid levels, where higher BMI correlated with higher uric acid levels.[19]

Although this study indicates a relationship between subject characteristics and uric acid levels and joint pain, limitations in sample selection must be considered. The study sample included only 22 participants from a single village, limiting the generalizability of these findings to a broader population.[20] Potential selection bias should also be considered, as the subject selection method was not randomized. Information bias may also occur when measuring uric acid levels and pain, mainly due to participants' subjective nature of pain assessment.[4]

Analysis of the Effectiveness of Warm Moringa Leaf Compress in Reducing Knee Joint Pain in Elderly Individuals with Gout Arthritis

The effectiveness of warm moringa leaf compress in reducing knee joint pain in elderly individuals with gout arthritis in Banjar Ulapan, Bukian Village, was analyzed using the Paired Sample T-Test. The results for Pair 1 (Control Pre-test - Control Post-test) showed a p-value of 0.001 (p-value 0.001 < 0.05), indicating a significant difference between pre-test and post-test results in the control group. However, it should be noted that even though the control group did not receive the moringa leaf compress intervention, pain reduction still occurred.[21] This may be due to the natural improvement of subjects' conditions over time, psychological effects of study participation (placebo effect), or uncontrolled changes in daily activities.[22]

Meanwhile, the same test for Pair 2 (Experiment Pre-test - Experiment Post-test) yielded a p-value of 0.00 (p-value 0.00 < 0.05), also indicating a highly significant difference between pre-test and post-test results in the experimental group. However, an effect size analysis between the two groups is necessary to determine the clinical significance of the intervention.[23] The results can demonstrate whether the observed differences have meaningful clinical implications by incorporating effect size.[24]

Additionally, this study conducted an Independent Samples Test. Based on the obtained data, the pre-test results showed a p-value of 0.251 (p-value 0.251 > 0.05), indicating no significant difference between the pre-test results of the two groups. However, in the post-test results, both groups showed a p-value of 0.027 (p-value 0.027 < 0.05), indicating a significant mean difference between the two groups (p-value < 0.05).[25]

To further support the effectiveness of moringa leaves in reducing joint pain, future studies should incorporate an analysis of the bioactive compounds in moringa leaves, such as flavonoids, alkaloids, and saponins, which are known to have anti-inflammatory effects. Other studies demonstrating the pharmacological effectiveness of moringa leaves in the context of joint pain due to gout arthritis should also be included to provide a more substantial explanation of the mechanism of action.

This study suggests that warm moringa leaf compress may serve as a non-pharmacological alternative therapy for relieving joint pain due to gout arthritis. However, future studies should employ a randomized controlled trial (RCT) design with blinding methods to reduce selection bias and subjectivity in pain assessment. Further research with a more substantial methodology and a larger population must confirm these findings.

Conclusion

Warm compresses with Moringa leaves have been proven effective in reducing knee joint pain in elderly individuals with gout arthritis in Banjar Ulapan, Bukian Village, Payangan, and Gianyar. Statistical analysis showed that the experimental group experienced a significantly more significant pain reduction than the control group (p-value < 0.05), indicating that the effect of the Moringa leaf warm compress was more substantial than that of a regular warm compress.

Despite the promising findings, several limitations should be considered. The small sample size (22 participants) may restrict the generalizability of the results to a broader population. Additionally, the pain assessment method was subjective, potentially introducing bias in the evaluation. The relatively short study duration also limits the ability to assess the long-term effects of this therapy. External factors such as dietary habits and physical activity were not strictly controlled, which could have influenced pain levels and intervention effectiveness. Moreover, potential side effects, such as skin irritation or allergic reactions to Moringa leaves, have not been thoroughly explored.

Therefore, further research with a larger sample size, more objective pain assessment methods—such as pain threshold measurement tools or inflammatory biomarker analysis—and long-term follow-up are needed to confirm these findings. Additionally, the combination of Moringa leaf warm compresses with other physiotherapy modalities, such as therapeutic exercises or electrotherapy, should be explored to assess their potential for enhanced effectiveness in managing pain in elderly individuals with gout arthritis

Author Contribution

Dewa Gde Rismanandha Adiwira: Conceptualization, methodology, data collection, data analysis, and manuscript drafting.
I Made Niko Winaya: Supervision, guidance on research design, and critical review of the manuscript.
Ni Luh Nopi Andayani: Supervision, validation, and manuscript editing.
Ni Wayan Tianing: Supervision, methodological consultation, and final manuscript review.

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

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Ethics Statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Universitas Udayana (Approval No. 1562/UN14.2.2.VII.14LT/2024). All participants provided informed consent prior to data collection.

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