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Effect of *Moringa Oleifera* Leaf Decoction on Uric Acid in Gout Older Adults

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Abstract
Gout is a chronic inflammatory joint disorder characterized by uric acid crystal deposition, which frequently affects elderly individuals due to age-related decline in kidney function and purine metabolism. Non-pharmacological interventions such as herbal therapy: Moringa oleifera leaves contain flavonoids, saponins, and antioxidants that are believed to reduce uric acid levels. This study aimed to examine the effect of Moringa oleifera leaf decoction consumption on uric acid levels in older adults with gout arthritis. A quasi-experimental design with a pretest-posttest control group was conducted involving 58 older adult's participants with hyperuricemia (>7 mg/dL), selected through purposive sampling. Participants were allocated to the intervention or control group based on the order of enrolment, with 29 participants in each group. The intervention group consumed Moringa oleifera leaf decoction daily for four weeks, whereas the control group received standard care. Uric acid levels were measured at baseline before the intervention and after four weeks of intervention using the EasyTouch GCU Meter. Capillary blood samples were obtained by fingertip puncture, and the measurement was performed once at each assessment time point. The single reading displayed by the device was recorded as the participant's uric acid value. The same measurement procedure was applied at baseline and post-intervention. Data were analyzed using Wilcoxon and Mann-Whitney tests. The intervention group showed a significant reduction in mean uric acid levels, from 7.96 ± 0.42 mg/dL to 6.84 ± 0.48 mg/dL ($p < 0.001$), whereas no significant change was observed in the control group (7.92 ± 0.43 mg/dL to 7.98 ± 0.45 mg/dL, $p = 0.270$). Between-group comparison demonstrated no significant difference at baseline ($p = 0.579$) but a significant difference after the intervention ($p < 0.001$), with a large effect size ($r = 0.81$). Regular consumption of Moringa oleifera leaf decoction plays a beneficial role in controlling uric acid levels among older adults with gout arthritis. This intervention is recommended as a safe, accessible, and cost-effective complementary therapy in community health practice.

Keywords: Aged, Gout Arthritis, Gout Therapy, Moringa Oleifera Leaf Therapy, Uric Acid.

INTRODUCTION

Gout arthritis, is a common inflammatory joint disease caused by the deposition of monosodium urate crystals resulting from hyperuricemia (Dalbeth et al., 2021; Sueni et al., 2021 ; Global Clinical Trila Landscape, 2024). The condition is particularly prevalent among older adults because aging is associated with reduced renal uric acid execration and impaired purine metabolism (Lee et al., 2017; Lin et al., 2016; J et al., 2023). Gout can cause recurrent severe pain, functional limitations, reduced quality of life, and long-term complications such as tophi, kidney stones, and chronic kidney disease

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if left untreated (Li et al., 2024; Sueni et al., 2021. In Indonesia, data from the Indonesian Basic Health Research (*Riskesdas)* in 2018, the prevalence of gout arthritis diagnosed by healthcare professionals was 11.9% and based on diagnosis or symptoms was 24.7%, with the highest prevalence observed among individuals aged 75 years and above (Indonesian Basic Health Research (Riskesdas), 2018).

Pharmacological treatment, including urate-lowering therapy, is effective in controlling gout but may be associated with adverse effects and poor long-term adherence in some patients (Tumwikirize et al., 2011; Indonesian Rheumatology Association, 2024). Consequently, complementary therapies derived from medicinal plants have attracted increasing attention because they are relatively affordable, accessible, and generally well tolerated (Majnik et al., 2022). One of the natural remedies that has recently gained attention is Moringa oleifera leaves (Pareek et al., 2023).

Moringa oleifera leaves has long been recognized in traditional medicine due to its rich nutritional content and diverse pharmacological properties (Pareek et al., 2023; Gopalakrishnan et al., 2016). *Moringa oleifera* leaves contain abundant flavonoids (particularly quercetin and kaempferol), phenolic compounds, vitamin C, and other antioxidants with anti-inflammatory and antioxidant properties (Pareek et al., 2023; Gopalakrishnan et al., 2016). Experimental studies suggest that these bioactive compounds may reduce uric acid levels by inhibiting xanthine oxidase, the key enzyme responsible for uric acid production, while simultaneously reducing oxidative stress and inflammatory responses associated with hyperuricemia (Pareek et al., 2023; Gopalakrishnan et al., 2016). These mechanisms indicate that *Moringa oleifera* may have therapeutic potential as a complementary intervention for gout management.

Several studies have shown that Moringa leaves contain bioactive compounds that can increase hemoglobin levels in adolescents (Mauliku et al., 2019)(Mauliku et al., 2019), enhance total serum antioxidant levels (Mauliku et al., 2019), and exert neuroprotective effects (Worku & Tolossa, 2024). Additionally, Moringa leaves have been reported to lower blood pressure in hypertensive patients (Etri & Nofia, 2023), increase breast milk production (Sulthoh & Rohmah, 2023) , and reduce blood glucose levels in diabetic patients (Age, 2021 ; Saputra et al., 2023).

Despite these promising mechanisms, evidence regarding the effect of *Moringa oleifera* leaf decoction on uric acid levels in older adults with gout arthritis remains limited. Previous studies have mainly reported its effects on pain reduction using warm Moringa leaf compresses (Widiyanto et al., (2020) or demonstrated uric acid-lowering effects in animal models (Rahmawati & Candra K, 2015). Clinical evidence evaluating oral *Moringa oleifera* leaf decoction in older adults with gout arthritis is still scarce.

Teluk Dalam Community Health Center, Nias, reports an increasing number of older adults with gout arthritis from 2022 to 2024, there were 607 visits by elderly patients with gout, with cases steadily increasing during the past three years while management is currently limited to health education, lifestyle advice, and pharmacological therapy. To our knowledge, no previous study has evaluated the effect of *Moringa oleifera* leaf decoction on uric acid levels among older adults with gout arthritis in this setting.

Therefore, this study aimed to examine the effect of *Moringa oleifera* leaf decoction on uric acid levels among older adults with gout arthritis at Teluk Dalam Community Health Center, Nias.

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METHODS

A quasi-experimental study with a two-group pre-test and post-test design was employed. Potential participants were identified from the gout arthritis registry and medical records at Teluk Dalam Public Health Centre, Nias, North Sumatra. Participants were selected using a purposive sampling technique based on the following inclusion criteria: (1) physician-diagnosed gout arthritis at Teluk Dalam Public Health Centre, Nias, North Sumatra; (2) hyperuricemia, defined as a serum uric acid level >7.0 mg/dL at baseline; (3) aged ≥60 years; (4) not taking uric acid-lowering medications during the study period; and (5) willing to participate.

Potential participants were identified from the gout arthritis registry and medical records at Teluk Dalam Public Health Center, Nias, North Sumatra. Individuals who appeared to meet the eligibility criteria were personally invited by the research team and received information about the study. Eligibility was then assessed according to the predefined inclusion and exclusion criteria. Individuals who met the eligibility criteria and agreed to participate provided written informed consent.

A total of 58 individuals were identified purposively, invited, assessed for eligibility, and found eligible for participation. No eligible individual declined participation, and no participant was excluded after eligibility assessment. The 58 participants were subsequently enrolled and allocated to the intervention group (n = 29) or control group (n = 29) according to their order of enrolment. During follow-up, three participants in the control group were lost to follow-up, leaving 55 participants with complete post-intervention outcome data for the final analysis **(Figure 1).**

The sample size was calculated using G*Power software for an independent samples *t*-test, assuming a medium effect size (Cohen's *d* = 0.50), a significance level (α) of 0.05, and a statistical power of 0.80 (Cohen, 1988). Based on these parameters, the minimum required sample size was 26 participants per group. To account for a potential 10% dropout rate, the sample size was increased to 29 participants per group. Participants were recruited until the target sample size was achieved**.**

The intervention consisted of a *Moringa oleifera* leaf decoction. Fresh *Moringa oleifera* leaves (10–15 g), collected from the same local source throughout the study, were washed thoroughly and boiled in 500 mL of clean water for approximately 15–20 minutes until the volume was reduced to 200 mL (Gopalakrishnan et al., 2016). The decoction was filtered, allowed to cool to a safe drinking temperature, and prepared daily by the research team to ensure consistency. Participants consumed 200 mL once daily for four weeks. Throughout the study, participants continued to receive routine care from the Public Health Center, including standard medical treatment and health education as needed. Uric acid levels were measured using the EasyTouch GCU Meter (Bioptik Technology Inc., Taiwan), a point-of-care testing device that utilizes a biosensor method with specific uric acid test strips. Capillary blood samples were obtained via fingertip puncture, and results were displayed digitally in mg/dL within 60 seconds. Previous studies have demonstrated that the EasyTouch GCU Meter has good correlation with standard laboratory methods and is considered valid and reliable for community-based research (Dai et al., 2005).

The study was conducted from July to September 2025 at Teluk Dalam Public Health Center, Nias, North Sumatra. Eligible participants were invited personally and received a formal invitation to join a WhatsApp group created for study communication. After recruitment, participants were allocated to the intervention or control group based on their order of enrolment (non-random assignment). The intervention group received one cup (200 mL) of *Moringa oleifera* leaf decoction once daily for four weeks in addition to routine care, whereas the control group received routine care only. Routine care consisted of regular medical consultations, dietary counseling on a low-purine diet, advice to maintain adequate fluid intake and physical activity, routine monitoring of uric acid levels, and pharmacological treatment prescribed by the attending physician when clinically indicated**.** Baseline

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fasting uric acid levels were measured before the intervention and repeated after four weeks. Adherence to the intervention was monitored through a WhatsApp group and a daily log in which participants recorded their consumption of the *Moringa oleifera* leaf decoction. Participants who missed consumption or experienced difficulties were followed up by telephone or home visits to encourage adherence.

Ethical approval was obtained from the Ethics Committee of Universitas Sari Mutiara Indonesia (Approval Number of Certificate: 3800/F/KEP/USM/VII/2025). All participants provided written informed consent prior to participation, and confidentiality of participant information was strictly maintained throughout the study. Data were analyzed using IBM SPSS Statistics version 25.0. Descriptive statistics (Mean ± SD and frequency) were used to summarize participant characteristics. As the data were not normally distributed, within-group comparisons were performed using the Wilcoxon signed-rank test, and between-group comparisons used the Mann–Whitney U test. All tests were two-tailed with a significant level of $\alpha = 0.05$. Effect sizes and 95% confidence intervals were reported when applicable.

RESULTS

A total of 58 participants were enrolled in the study and allocated to the intervention (n = 29) or control group (n = 29) according to the order of enrolment. During follow-up, three participants in the control group were lost to follow-up, resulting in a final analytical sample of 55 participants (29 intervention and 26 control) (Figure 1). The specific reasons for loss to follow-up were not systematically documented. The mean age of participants was 65.10 years (SD = 2.74) in the intervention group and 69.53 years (SD = 4.68) in the control group. More than half of the participants were female in both groups (58.6% and 57.7%, respectively). The majority of participants were Christian in both groups (82.8% and 80.0%, respectively). Most participants were farmers (75.9% and 62.1%, respectively). Nearly half of the participants had no formal education in both groups (44.8% and 42.3%, respectively). There were no statistically significant differences in characteristic between the intervention and control groups (Table 1).

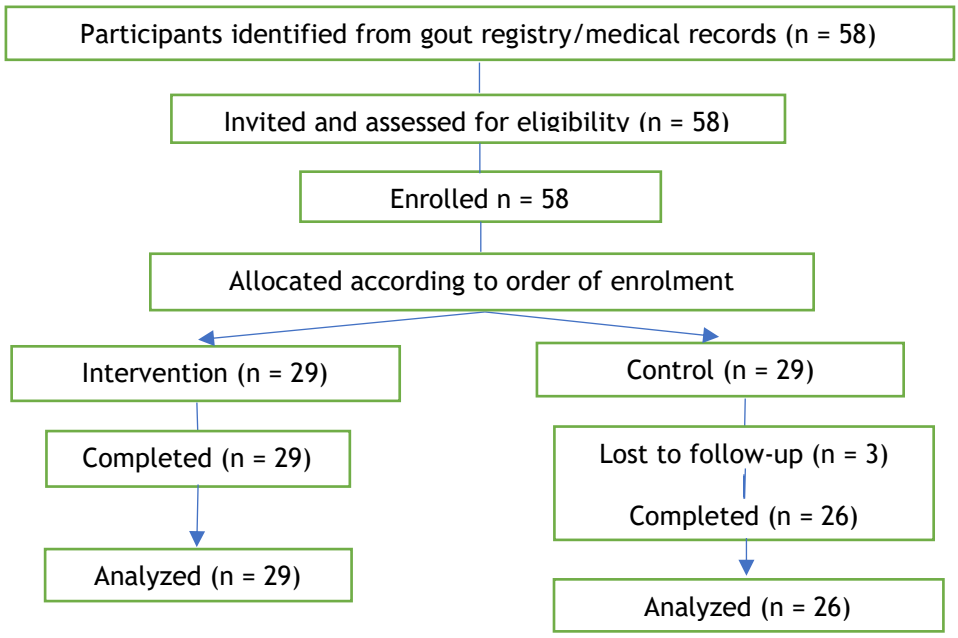


Figure 1. Flow Diagram of Participant Recruitment, Allocation, Follow-up, and Analysis

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Table 1. Demographic Characteristics of Participants (N=55)

Variables	Intervention group (n=29)		Control group (n=26)		Statistic	P-*value*
	n	%	n	%		
Age (years) M ± SD	65.10 ± 2.74		69.53 ±4.68		275.500[b]	0.084
Gender						
Male	12	41.3	11	42.3	0.394[a]	0.689
Female	17	58.6	15	57.7		
Religion						
Islam	2	6.9	1	3.8	1.130[a]	0.889
Christian	24	82.8	21	80.8		
Catholic	3	10.3	4	15.4		
Employed						
Farmers	22	75.9	18	62.1	9.264[a]	0.159
Self-employed	3	10.3	5	17.2		
Retired	4	13.8	3	10.3		
Education						
No formal education	15	51.7	11	42.3	5.913[a]	0.206
Primary School	10	34.5	10	38.5		
Junior High School	4	13.3	5	19.2		

M=Mean, SD=Standard Deviation

Table 2. Pre and Post Intervention Uric Acid Levels in Both Groups (Wilcoxon Test) (N = 55)

Group	n	Pretest		Post test		Mean Change (Δ)	*P*-value
		Min-Max	M±SD	Min-Max	M±SD		
Intervention	29	7.50-9.00	7.96 ± 0.42	6.10-8.00	6.84 ± 0.48	+1.12	<0.001
Control	26	7.30-9.00	7.92 ± 0.43	7.30-9.00	7.98 ± 0.45	-0.06	0.270

Min=Minimum, Max=Maximum, M=Mean, SD=Standard Deviation. Δ = Pretest-Posttest. Positive Δ values indicate a reduction in uric acid levels, whereas negative Δ values indicate an increase.

The intervention group showed a reduction in uric acid levels from baseline (7.96 ± 0.42 mg/dL) to post-intervention (6.84 ± 0.48 mg/dL), with a mean change (Δ = Pretest − Posttest) of +1.12 mg/dL ($p < 0.001$). In contrast, the control group showed a slight increase in uric acid levels from 7.92 ± 0.43 mg/dL to 7.98 ± 0.45 mg/dL, with a mean change of −0.06 mg/dL ($p = 0.270$). The difference in change scores between the two groups was 1.18 mg/dL, indicating a greater reduction in uric acid levels in the intervention group compared with the control group (Table 2).

Tabel 3. Between-Group Comparison of Uric Acid Levels at Baseline and Post-Intervention Using the Mann–Whitney U Test (N = 55)

Time Point	Group	n	Mean Rank	Sum of Ranks	Z	*P*-value
Pretest	Intervention	29	29.12	844.50	-0.556	0.579
	Control	26	26.75	695.50		
Posttest	Intervention	29	15.81	458.50	-5.975	<0.001
	Control	26	41.60	1081.50		

Table 3 shows that there was no significant difference in uric acid levels between the intervention and control groups at baseline ($p = 0.579$). However, a significant difference was found at post-

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intervention, with lower uric acid levels in the intervention group compared to the control group ($p < 0.001$).

Table 4. Comparison of Changes in Uric Acid Levels Between Intervention and Control Groups (Δ Pretest-Posttest) (N = 55)

Variable	Group	n	Mean Rank	Sum of Ranks	Z	*P*-value	Effect size (r)
Change in uric acid level (Δ)	Intervention	29	40.83	1184.00	-6.293	<0.001	0.85
	Control	26	13.69	356.00			

Effect size (r) calculated as Z / √N

The Mann–Whitney U test revealed a significant difference in changes in uric acid levels between the intervention and control groups (U = 5.00, Z = -6.293, $p < 0.001$) (Table 4). The intervention group showed a higher mean rank (40.83) compared with the control group (13.69), indicating a greater reduction in uric acid levels following the intervention. The effect size was large (r = 0.85), demonstrating a strong effect of the intervention on reducing uric acid levels.

DISCUSSION

This study provides evidence that *Moringa oleifera* leaf decoction was associated with a reduction in uric acid levels measured using capillary fingertip blood with a point-of-care meter among older adults with gout. The consistency between the within-group and between-group analyses strengthens the interpretation of the findings, particularly given the absence of significant baseline differences between the groups. The large effect size (r = 0.85) indicates a substantial difference in uric acid changes between the intervention and control groups. However, because this study used a non-randomized quasi-experimental design, the findings should be interpreted as an association rather than definitive evidence of a causal effect of the intervention.

The intervention was associated with a mean reduction in uric acid levels of 1.12 mg/dL, which may represent a clinically relevant improvement in older adults. Current gout management guidelines recommend maintaining serum urate levels below 6.0 mg/dL (360 µmol/L) for most patients and below 5.0 mg/dL in those with severe or tophaceous gout to reduce crystal deposition and prevent recurrent gout flares (Fitzgerald et al., 2020). In the present study, although uric acid levels decreased significantly following the intervention, the mean post-intervention level remained above the recommended therapeutic target. Therefore, the findings suggest that *Moringa oleifera* leaf decoction may have potential as a complementary non-pharmacological intervention rather than as a replacement for standard urate-lowering therapy. Nevertheless, the observed reduction of approximately 1 mg/dL may be clinically meaningful and warrants further investigation regarding its potential contribution to gout management and functional outcomes in older adults.

This is particularly relevant in geriatric populations, where management of chronic conditions may be complicated by comorbidities and polypharmacy (Adonteng-Kissi et al., 2020). The potential antihyperuricemic properties of *Moringa oleifera* have been investigated in relation to its bioactive compounds, particularly flavonoids and phenolic constituents (Tian et al., 2021; Pareek et al., 2023). Experimental studies have suggested that these compounds may inhibit xanthine oxidase (XO), an enzyme involved in uric acid production (Jami et al., 2022; Gopalakrishnan et al., 2016).

Experimental studies have reported that *Moringa oleifera* leaf extracts may suppress XO activity and influence uric acid metabolism and renal urate transport (Tian et al., 2021). Similarly, in vivo studies have suggested that flavonoids and phenolic compounds derived from *Moringa oleifera* may exert antihyperuricemic effects through modulation of purine metabolism and oxidative stress pathways

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(Luo et al., 2022). In addition, the phytochemical profile of *Moringa oleifera*, including quercetin and kaempferol, has been associated with antioxidant and anti-inflammatory properties (Worku & Tolossa, 2024). These biological properties provide a plausible basis for the observed reduction in uric acid levels; however, the underlying mechanisms were not directly assessed in the present study. Therefore, the findings should be interpreted as clinical observations rather than direct evidence of the proposed biological mechanisms.

The present findings are consistent with previous research suggesting the potential of plant-based interventions as complementary approaches to conventional urate-lowering therapy. *Moringa oleifera* leaf decoction may represent an accessible complementary intervention, particularly in community and primary care settings. However, this study did not formally assess adverse events, long-term safety, adherence, or cost-effectiveness. Therefore, conclusions regarding the safety, economic benefits, or superiority of *Moringa oleifera* compared with pharmacological treatment cannot be drawn from the present findings. Further randomized controlled trials with longer follow-up and formal assessment of safety, adherence, and economic outcomes are warranted.

From a clinical and nursing perspective, these findings suggest that *Moringa oleifera* leaf decoction may have potential as a complementary approach to gout management in older adults. Nurses in community and geriatric care settings may provide appropriate education regarding complementary approaches alongside standard gout management, while emphasizing adherence to prescribed urate-lowering therapy and monitoring of patients' health status. Further evidence is needed before this intervention can be routinely recommended as part of clinical practice.

The findings of this study have implications for nursing practice, particularly in patient education and self-management support for older adults with hyperuricemia and gout. Nurses play an important role in providing education on dietary regulation, physical activity, hydration, medication adherence, and appropriate monitoring of uric acid levels. Structured education and follow-up may support patients in managing hyperuricemia as part of a comprehensive care plan that includes standard medical treatment. Complementary interventions such as *Moringa oleifera* leaf decoction should be discussed cautiously and should not replace prescribed urate-lowering therapy.

Despite these promising findings, several limitations should be acknowledged. The quasi-experimental design limits causal inference compared to randomized controlled trials. The relatively small sample size and single-setting design also restrict generalizability. In addition, dietary intake, physical activity, and hydration status were not strictly controlled, potentially introducing confounding effects. Participant adherence was not objectively measured, which may have affected intervention fidelity. Furthermore, the short follow-up period of four weeks limits the ability to assess long-term sustainability of the observed effects. Although attrition occurred in the control group, the final sample size remained adequate based on the initial power calculation.

Future research is recommended to employ randomized controlled trial designs with larger, multi-center samples and extended follow-up periods. The inclusion of objective biomarkers such as xanthine oxidase activity, inflammatory cytokines, and oxidative stress markers would provide deeper insight into the underlying mechanisms of *Moringa oleifera*. Comparative studies evaluating different formulations, such as decoction versus standardized extract, are also warranted to determine the most effective and practical mode of administration.

CONCLUSION

Moringa oleifera leaf decoction was associated with a reduction in uric acid levels among older adults with gout. The findings suggest that Moringa oleifera leaf decoction may have potential as a

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complementary non-pharmacological approach to support gout management in nursing and community care settings. However, it should not be considered a replacement for standard urate-lowering therapy. Further randomized controlled trials with larger samples and longer follow-up are needed to confirm its potential benefits and establish its safety and long-term effectiveness

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