The Effect of Alternative Therapy for Moringa Leaf and Date Palm Juice on Gout

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Abstract

Gout is becoming increasingly prevalent among younger individuals and is impacting work productivity due to the pain associated with the condition, both globally and in Indonesia. Treatment for gout includes both medical and non-medical approaches. Non-medical alternatives, such as utilizing Moringa leaves and dates, are relatively unknown among the Indonesian population. Therefore, there is a need for alternative therapies involving Moringa leaves. This study aimed to assess the variation in uric acid levels before and after administering alternative therapy using Moringa leaf and date palm juice in Banyumas Regency. The method used was a quasi-experiment without a control group. The research population was all people from adult age in the Banyumas Regency area, totaling 480 people. The sample selection technique was carried out using random sampling with a sample size of 107 respondents as the intervention group. The research instrument is a questionnaire. Data analysis uses the T-Test. The results of giving moringa and date juice were effective in reducing respondents' uric acid levels with p = 0.000 after giving the juice for 10 days which was drunk at night as much as 180 ml consisting of moringa leaves, dates and honey.

***Keywords**: Moringa Leaf and Date Juice; Decreased Uric Acid Levels.*

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A. INTRODUCTION

Gout is a condition that occurs when monosodium urate crystals accumulate in the body, leading to the disease. Uric acid, which is produced from the breakdown of purines found in nucleic acids within the body's cells, plays a key role in this process. The presence of purines is responsible for the formation of crystals in the joints, which, in turn, can cause an increase in uric acid levels in the bloodstream. The consumption of purine can raise uric acid levels by approximately 0.5 to 0.75 grams per milliliter (Jaliana and Suhadi, 2018).

Between 1990 and 2010, gout or hyperuricemia experienced a global epidemic, resulting in a doubling of the number of affected individuals. According to Jaliani (2018), the World Health Organization (WHO) reported that in 2013, the prevalence of gout in the United States was approximately 13.6 cases per 1,000 men and 6.4% per 1,000 women. In a survey conducted on 1,381 gout patients in Thailand from July 1999 to February 2000, it was found that 18.4% of the patients were men and 7.8% were women. In China, in 2011, the prevalence of elevated uric acid levels was 21.6% among men and 8.6% among women (Fadillah, 2018).

Gout or hyperuricemia is the second most prevalent disease in Indonesia, ranking after osteoarthritis. The estimated incidence rate ranges from 1.6 to 13.6 cases per 100,000 individuals, and the prevalence of gout increases with age (Syarifah, 2018). Among the diagnosed cases, the highest prevalence was found in Bali at 19.3%,

followed by Aceh at 18.3%, West Java at 17.5%, and Papua at 15.4%. Regarding the distribution of gout by age, the prevalence among individuals under 34 years old is 32%, whereas among those aged over 34, it is 68%. In Indonesia, of the 81% of people affected by gout, the majority tend to self-medicate with over-the-counter pain relievers, accounting for 61%, while 20% seek treatment from a doctor (Arjani, et al, 2018) .

A study showed that elevated levels of uric acid, known as hyperuricemia, were identified as a significant predictor of mortality from heart attacks. Various factors that contribute to this disease include diet, body weight, and lifestyle choices. Presently, risk factors for gout encompass age, consuming high-purine foods, excessive alcohol intake, obesity, hypertension, heart disease, kidney disease, and specific medications, notably diuretics (Andry et al., 2009).

Allopurinol is a pharmaceutical drug used to lower uric acid levels in the bloodstream. It functions by inhibiting the activity of the xanthine oxidase enzyme, which is responsible for uric acid production (Junadi, 2012). However, the use of chemical medications should be reevaluated due to potential long-term effects on liver and kidney health. As a result, extensive research has been conducted to discover alternative medications derived from natural food ingredients, particularly herbs, which are currently unidentified.

One plant that is believed to possess therapeutic properties in reducing uric acid levels is Moringa leaves. This plant is widely utilized, particularly in Indonesia, where it is commonly used as traditional medicine for treating various medical and non-medical conditions. Moringa leaves contain several chemical compounds, including tannins, steroids, triterpenoids, flavonoids, saponins, anthraquinones, and alkaloids (Kasolo, Bimenya, Ojok, & Ochieng, 2010). Sashidhara et al (2009) reported that Moringa leaves have anti-inflammatory, antioxidant, anti-tumor, anti-allergic, anti-viral and anti-angiogenic effects. Other research also states that besides Moringa leaves, dates also contain flavonoids, carotene and phenolic acids which can also be used as strong antioxidants (Arindia, 2017). Likewise, honey from several studies also states that it contains flavonoids.

Numerous researchers assert that flavonoid compounds are believed to be effective in hindering the formation of uric acid and possess properties that are both anti-inflammatory and pain-relieving. This efficacy stems from the ability of flavonoids to impede the activity of the xanthine oxidase enzyme through interactions with side groups and competitive inhibition mechanisms. In vitro, various flavonoid compounds, including luteolin, apigenin, quercetin, and myrsetin, have been identified for their capacity to inhibit the xanthine oxidase enzyme (Muthadi, Retnani, and Wahyuningtyas, 2012; Kristinawati and Nurlaela, 2013; Rinahayunti, 2016).

Several investigations have indicated that the consumption of Moringa leaves, dates, and honey can lead to a reduction in uric acid levels. In light of the information provided, researchers are keen to explore the potential impact of administering Moringa leaves, dates, and honey on lowering uric acid levels.

B. LITERATURE REVIEW

The primary source of uric acid is the metabolic breakdown of endogenous purine nucleotides, namely guanylic acid (GMP), inosinic acid (IMP), and adenylic acid (AMP). Facilitating this metabolic process is the enzyme known as xanthine oxidase. This enzyme plays a crucial role in converting hypoxanthine and guanine into xanthine, a process that takes place in both the kidneys and intestines. In instances where kidney complications arise due to an elevated intake of purines from food, the body experiences an accumulation of uric acid, particularly in the bloodstream (Silbernagl and Lang, 2000; Misnadiarly, 2007; Herliana, 2013).

Hyperuricemia is a prevalent condition within Indonesian society, affecting individuals with elevated uric acid levels surpassing the standard thresholds, specifically exceeding 6 mg/dL in women and 7 mg/dL in men (Eso et al., 2014).

The findings from the study indicate that heightened uric acid levels, or hyperuricemia, emerge as a robust predictor for fatalities resulting from cardiovascular impairment. Factors such as diet, body weight, and lifestyle are implicated as potential contributors to this ailment. Additionally, individual risk factors for the onset of gout encompass age, the excessive consumption of purine compounds, increased alcohol intake, obesity, hypertension, heart disease, specific medications (particularly diuretics), and kidney dysfunction (Andry et al., 2009).

A commonly employed chemical medication for lowering blood uric acid levels is allopurinol. This drug functions by inhibiting the activity of the enzyme responsible for uric acid production, known as the xanthine oxidase enzyme (Junadi, 2012). However, it is crucial to exercise caution regarding the use of chemical medications, as they may lead to complications, such as potential long-term effects on liver and kidney health. Consequently, extensive research is currently underway to explore medicines derived from lesser-known natural ingredients, including herbal alternatives like Moringa leaves, dates, and pure honey.

Moringa leaves offer a highly effective natural remedy for gout due to the presence of active compounds, specifically flavonoids and alkaloids. These compounds play a role in preventing the formation of uric acid. Additionally, Moringa leaves exhibit anti-inflammatory properties, serving as a natural pain reliever. Among the alkaloids found in Moringa leaves, colchicine is noteworthy for its ability to impede uric acid formation and alleviate inflammatory reactions, potentially preventing red swelling in the joints (Nijveldt, 2001).

Dates, being a fruit rich in sugar, vitamins, minerals, and fiber, are also explored for their potential benefits. In a study by Samy Selim et al. on twelve date varieties, it was found that dates contain flavonoid compounds. The study identified various classes of flavonoids, including quercetin, luteolin, apigenin, isoquercetin, and rutin. The total flavonoid content in dates ranges from 1.22 to 2.82 mg/100 g. The Ajwa Al Madinah variety, specifically used in this research, possesses the second-highest flavonoid content (2.78 mg/100 g DW), trailing only the Saffawy variety (Hamad, 2015).

Various herbal treatments are available for gout, and one such remedy involves the use of honey. When properly utilized, honey can serve as an alternative herbal

treatment for gout due to its rich content of substances like glucose, sucrose, and maltose. Adequate amounts of maltose, sucrose, and glucose found in honey are beneficial in eliminating excess uric acid from the body. Moreover, honey possesses properties that aid in the elimination of surplus purine in the bloodstream and the disruption of crystals in the joint area (Kilatinur, L (2017) in Ibrahim, (2021)).

The theoretical basis of this study suggests that the three examined ingredients all contain flavonoids, which are polyphenolic compounds categorized as secondary metabolites in plants. These flavonoids play a role in various activities, including exerting anti-diabetic effects. Evaluated for their pharmacological properties such as antioxidative, anti-inflammatory, and anticancer effects, flavonoid compounds are recognized for their ability to lower blood uric acid levels by functioning as antioxidants and scavengers of free radicals. Moreover, flavonoids can hinder the activity of xanthine oxidase and xanthine dehydrogenase, thereby inhibiting the synthesis of uric acid. A sufficient intake of vitamin C is believed to prevent hyperuricemia and its subsequent progression, including the development of conditions like gout and hyperuricemic nephropathy (Prameswari, 2014; Abdulkadir, 2022).

C. METHODS

This study was conducted in the Banyumas Regency area, employing a quasi-experimental research design with a pretest and posttest structure. The intervention in this research consisted of an alternative therapy for gout, administered following a pretest. The intervention involved the provision of Moringa leaf and date juice for 10 consecutive days, administered once a day in the evening. The dosage was 180 ml per person, composed of 150 mg of boiled Moringa leaves blended with 62.5 mg of dates and 1.25 ml of honey. To assess the effectiveness of the intervention, the researchers conducted a blood sampling examination to measure uric acid levels before and after the intervention. The respondents received Moringa leaf and date juice for 10 consecutive days, and another blood sample examination was performed to assess uric acid levels post-intervention, serving as the posttest to evaluate the success of the research intervention.

The research population was all people from adult age in the Banyumas Regency area, totaling 480 people. The sample selection technique was carried out using random sampling with the sample size being the intervention group of 107 respondents. The research instrument was the results of a uric acid examination. Data analysis used the T-Test with a significance value of $p \leq 0.05$

D. RESULTS AND DISCUSSION

1. Respondent characteristics

An overview of the characteristics of respondents in this study can be seen as follows:

Table 1 Frequency Distribution of Respondents' Characteristics

Variables	Respondents	
	f	%
Age		
< 30 year	-	-
30 - 40 year	15	14,0
41 - 50 year	18	16,8
> 50 year	74	69,2
Gender		
Man	24	22,4
Woman	83	77,6
Education		
Base	12	11,2
Intermediate	50	46,7
College	45	42,1
Work		
Work	35	32,7
Doesn't work	72	67,3

Source: Data processed from SPSS 18.0

Based on table 1 of this study, it can be concluded that the most common age found was > 50 years at 69.2%, with female gender at 77.6%, the most education found at secondary education as much as 46.7% and the majority of respondents were none. working, namely 67.3%.

2. Uric acid Levels Before Intervention

Description of the uric acid levels before intervention can be seen in the following table:

Table 2 Frequency Distribution of Uric Acid Levels Before Intervention

Uric Acid (Pre-Test)	Respondents	
	f	%
Uric acid levels are normal	51	47,7
Abnormal uric acid levels	56	52,3
Total	107	100,0

Source: Data Processed from SPSS 18.0

The results of the study are in accordance with table 2 that the majority of respondents in this study had abnormal uric acid before the intervention, namely 52.3%.

3. Uric Acid Levels After Intervention

Description of the uric acid levels after intervention can be seen in the following table:

Table 3 Frequency Distribution of Descriptions of Uric Acid Levels After Intervention

Uric Acid (Post-Test)	Respondents	
	f	%
Uric acid levels are normal	74	69,2
Abnormal uric acid levels	33	30,8
Total	107	100,0

Source: Data processed from SPSS 18.0

Table 3 in the results of this study shows that after the intervention of giving moringa leaf juice, dates and honey for 10 days given at night, the majority experienced normal uric acid levels, namely 69.2%.

4. Relationship Between Characteristics and Respondents' Uric Acid Levels

The relationship between respondent characteristics and uric acid levels can be seen in the following table:

Table 4. Relationship between Characteristics and Uric Acid Levels

Characteristics	Uric acid levels				Total		p value
	Uric Acid Levels Are Normal		Abnormal Uric Acid Levels				
	f	%	f	%	f	%	
Old							
< 30 year	-	-	-	-	-	-	0,238
30 – 40 year	13	86,7	2	13,3	15	100,0	
41 – 50 year	13	72,2	5	27,8	18	100,0	
> 50 year	48	64,9	26	35,1	74	100,0	
Gender							
Man	18	75,0	6	25,0	24	100,0	0,482
Woman	56	67,5	27	32,5	83	100,0	
Education							
Base	11	91,7	1	8,3	12	100,0	0,144
Intermediate	35	70,0	15	30,0	50	100,0	
College	28	62,2	17	37,8	45	100,0	
Work							
Work	23	65,7	12	34,3	35	100,0	0,591
Doesn't work	51	70,8	21	29,2	72	100,0	
Total	**74**	**69,2**	**33**	**30,8**	**107**	**100,0**	

Source: Data Processed from SPSS

The overall results of table 4 are that the relationship between respondent characteristics based on age, gender, education and occupation on uric acid levels is not related, but there is a tendency that those aged > 50 years out of 48 respondents,

26 respondents have abnormal uric acid levels or 35%, type female gender of 56 respondents, 27 respondents had abnormal uric acid levels or 32.5%, higher education of 28 respondents, 17 who had abnormal uric acid levels or 37.85% and unemployed of 51 respondents, 21 respondents himself had abnormal uric acid levels or 29.2%.

5. Effect of Giving Moringa and Date Juice on Uric Acid Levels

The results of research on the effect of giving Moringa juice, dates and honey on uric acid levels can be seen in the following table:

Table 5. Test Results of the Effect of Giving Moringa and Date Juice on Respondents' Uric Acid Levels

Uric Acid Levels	Mean	Average Difference (Pre-Test-Post-Test)	t Calculated	p Value
Pre-Test	6,21	0,90	12,470	0,000
Psot-Test	5,31			

* *Paired sample t test*

Source: Data Processed from SPSS 18.0

The research results based on table 5 from the data analysis carried out show that the effect of giving moringa juice, dates and honey on gout has a significant effect with p = 0.000.

Based on the data contained in table 1. From this research data, the majority of respondents are over 50 years old, reaching 69.2%. According to Riskesdas in 2018, the incidence of joint problems in Indonesia based on doctor's diagnosis reached 7.3%. As a person gets older, doctors find that the prevalence is highest in people over 75 years old (at 18.9%). More women (approximately 8.5%) have a medical diagnosis compared with men (approximately 6.1%). Meanwhile, the percentage of gout arthritis cases in Central Java in 2018 ranged from 2.6 to 47.2%. When someone enters old age, their body can sometimes experience various kinds of changes involving physical, physiological and psychological (Harlina, 2020). According to Arumsari (2019), elderly people experience a decrease in contraction speed and skeletal muscle strength as one of the changes that affects their musculoskeletal system.

The results of this study revealed that the majority of participants, constituting 77.6%, were women based on gender characteristics. These findings align with Aminah et al. (2022) research, which indicated that a significant proportion of individuals experiencing gouty arthritis were women, totaling 28 individuals (63.6%).

Regarding educational backgrounds, the research outcomes indicated that a substantial portion of respondents had secondary education (46.7%), followed closely by those with tertiary education (42.1%). Wati (2022) suggested a notable correlation between educational levels and uric acid levels. Sarafino (2019) defines adequate knowledge as an individual's capability to adhere to treatment instructions and behavioral recommendations provided by a doctor or another authority figure. The level of education attained significantly influences a person's knowledge. Higher education is often associated with more profound knowledge, though it should be acknowledged that having a lower level of education does not necessarily equate to

having lower knowledge. It is important to recognize that knowledge can be acquired not only through formal education but also through informal or experiential learning.

The predominant segment of participants in this study, amounting to 67.3%, were unemployed as per their occupational characteristics. A reduction in body movement balance coupled with an increased calorie intake can lead to obesity, which is associated with elevated levels of free fat in the blood. This condition is commonly observed in individuals experiencing heightened uric acid levels, as denoted by Burns CM and Wortmann RL (2015), Bruno CM, Pricoco G, Cantone D, Marino E, Bruno F (2016), and Horowitz JF, Klein S (2000), referred to as hyperuricemia.

Analyzing the data presented in Table 2, it can be inferred that the majority of individuals exhibited abnormal uric acid levels before undergoing the intervention (52.3%). Uric acid levels are influenced by factors such as a diet rich in purines, the metabolic breakdown of endogenously formed purines, and excretion through the kidneys. Physiologically, the kidneys play a crucial role in maintaining blood balance and eliminating uric acid. Approximately 2/3 to 3/4 of uric acid is excreted by the kidneys, with the remainder expelled through the intestines. Typically, adults have uric acid levels ranging from 3 to 7 mg/dL, with normal values for men being <7 mg/dL and for women 5.7 mg/dL (Burns CM, Wortmann RL, 2015; Meisenberg G, Simmons WH, 2012).

Based on the information presented in Table 3, it can be deduced that following the intervention, the majority of individuals exhibited normal uric acid levels, accounting for 69.2%. Moringa, scientifically known as Moringa oleifera, belongs to the Moringaceae family and is recognized for its health-promoting properties. Moringa leaves contain various phytochemical compounds, including steroids, tannins, triterpenoids, saponins, flavonoids, alkaloids, and interquinones. These compounds endow Moringa with antibiotic, anti-inflammatory, antimicrobial, and detoxification properties. Notably, flavonoids possess the capability to inhibit the activity of xanthine oxidase, an enzyme crucial in the conversion of hypoxanthine into xanthine and the subsequent production of uric acid in the body (Widiyanto et al., 2020).

In contemporary times, there is a growing emphasis on non-pharmacological methods due to their ease of implementation and cost-effectiveness. Non-pharmacological treatments also mitigate the risk of potentially hazardous side effects associated with pharmacological interventions (Monks & Knoers, 2005). Complementary therapy is a category of non-pharmacological treatment that encompasses various natural approaches, including herbal therapy, diet management, acupuncture, acupressure, progressive relaxation, meditation, homeopathy, aromatherapy, Bach flower therapy, and reflexology. Additional methods include ice and heat therapy, relaxation techniques, distraction, biofeedback, and self-hypnosis (Nuraini, 2011). One specific non-pharmacological treatment option for gout is complementary therapy, and the use of Moringa plant is considered as a natural treatment method. According to Wijaya (2017), Moringa leaves contain compounds such as flavonoids, alkaloids, steroids, tannins, saponins, and terpenoids, which can

be employed to alleviate rheumatic symptoms. Flavonoids, in particular, hinder the release of inflammatory chemicals by neutrophils, including cytokines, free radicals, and enzymes (Mohan et al., 2012).

Based on the data presented in Table 4, the research findings indicate that a significant proportion of respondents within the age ranges of 30-40 years (86.7%), 41-50 years (72.2%), and over 50 years (64.9%) exhibit normal uric acid levels. The analysis results further reveal a p-value of 0.238, signifying that the obtained p-value exceeds the significance level α (0.05). Consequently, Ho is rejected, and Ha is accepted. Therefore, it can be concluded that there is no statistically significant relationship between the age of respondents and their uric acid levels in the intervention group. This aligns with the results of a study conducted by Sabilu & Irma (2023), indicating a lack of correlation between age and uric acid levels. Various factors, such as genetic predisposition, excessive alcohol consumption, a protein-rich and purine-compound-rich diet, the use of medications that elevate uric acid levels, and obesity, can contribute to an increase in uric acid levels. However, a decrease in age is not associated with an elevation in uric acid levels in the bloodstream.

However, when compared between the age groups of respondents who had normal and abnormal uric acid levels in this study, it can be seen that the older they were, the more respondents had abnormal uric acid levels. Data in table 4 shows that for respondents aged over 50 years, 35.1% of them had abnormal uric acid levels, while for those aged 30-40 years, only 13.3% had abnormal uric acid levels. According to research conducted by (Ode, 2012 in Widiyanto et al., 2020), age can be a risk factor for gout. This is because with increasing age, the body's metabolism changes and causes disturbances in uric acid metabolism which can ultimately cause gout. According to Asrori (2020), it is important to pay attention to age because it can have an impact on the physical, mental condition, performance and responsibilities of workers. People over 40 years of age have a high risk of developing gout due to abnormalities in the body's metabolism. People without age risk can experience high uric acid levels due to work, bad habits, smoking, and foods high in purine.

According to the data presented in Table 4, there is an association between gender and uric acid levels. The majority of male respondents (75.0%) and female respondents (67.5%) were found to have normal uric acid levels. The analysis revealed a p-value of 0.482, indicating that the obtained p-value surpasses the significance level α (0.05). Consequently, the null hypothesis is rejected, and the alternative hypothesis is accepted. Statistically, it can be concluded that there is no significant relationship between gender and uric acid levels in the intervention group.

Nevertheless, the study results indicated that the percentage of women with abnormal uric acid levels (32.5%) was higher than that of men (25%). Generally, men are at a higher risk of experiencing elevated uric acid levels, especially during puberty when uric acid levels in men tend to increase. However, women also face a substantial risk of developing gouty arthritis, particularly during menopause, where their risk surpasses that of men. This is attributed to a decline in estrogen hormone levels, significantly impacting uric acid production, which is excreted through urine (Zahroh

& Faiza, 2018).

Table 4 shows that there is a relationship between education level and uric acid levels. It turned out that the majority of respondents with primary (91.7%), middle (70.0%), and high (62.2%) education levels had normal uric acid levels. From the analysis carried out, a p-value was obtained of 0.144. This means that the p-value is greater than α (0.05), so the null hypothesis is rejected and the alternative hypothesis is accepted. It can be concluded that statistically there is no relationship between education level and uric acid levels in the intervention group. The research results showed differences between respondents who had high and low levels of education in terms of uric acid levels. It was found that 37.8% of respondents with higher education had abnormal uric acid levels, while only 8.3% of respondents with low education experienced the same thing. Therefore, it can be concluded that people with higher education tend to have abnormal uric acid levels. According to research results from Asrori (2020), people who have completed higher education tend to have a higher risk of suffering from gout compared to people who do not have a college degree.

The association between employment status and uric acid levels is evident from the data presented in Table 4. It appears that the majority of respondents who are employed (65.7%) and those who are not employed (70.8%) exhibit normal uric acid levels. Upon analyzing the results, a p-value of 0.591 was obtained, which can be interpreted as p-value > α (0.05). This implies the rejection of Ho and the acceptance of Ha. Thus, it can be concluded that, statistically, there is no significant correlation between employment status and uric acid levels among respondents in the intervention group.

In the comparison between employed and non-employed respondents in this study, it was observed that 34.3% of working respondents had abnormal uric acid levels, while 29.2% of non-working respondents had abnormal uric acid levels. Intense physical activities, as per Ilyas' theory (2014), can exacerbate and contribute to complications of gout. The theory posits that physical activity can elevate uric acid levels in the bloodstream due to the production of lactic acid during activities, especially during strenuous physical exertion. According to Dayana's research (2015), the results of the Pearson chi-square test with a p-value of ≤0.023 indicate a significant relationship between the intensity of physical activity and serum uric acid levels. The prevalence ratio of 2.56 suggests that moderate to high levels of physical activity are associated with a 2.56-fold risk of experiencing elevated uric acid levels (hyperuricemia).

The average uric acid levels in the intervention group were in accordance with Table 5, showing a pretest value of 6.21 and a post-test value of 5.31. These results indicate a difference of 0.90 between the pretest and post-test uric acid levels among the respondents in the intervention group. Utilizing the paired sample t-test, it was determined that the difference in the average uric acid levels before and after the intervention had a significance value of 0.000. This result indicates that the p-value is smaller than α (0.05), leading to the conclusion that there is a statistically significant

difference between the average uric acid levels before and after the intervention in the group administered Moringa leaf juice, dates, and honey for 10 days. The juice was administered nightly at a dose of 180 ml per person, containing 150 mg of boiled and blended Moringa leaves, 62.5 mg of dates, and 1.25 ml of honey. Moringa oleifera, commonly known as the Moringa plant, is a versatile plant with numerous benefits and applications.

The Moringa plant, being a local food ingredient, holds the potential for use as a natural remedy for treating gout. This is attributed to the active compounds found in Moringa leaves, such as flavonoids and alkaloids, which can prevent the formation of uric acid. Additionally, Moringa leaves exhibit anti-inflammatory and pain-relieving properties. Consequently, the Moringa plant has the potential for development in gout treatment. One specific alkaloid, colchicine, can prevent uric acid production and reduce inflammation, thereby averting red swelling in the joints (Karuniawati, 2019).

The findings of this research align with a study conducted by Rahmawati & Candra (2015), which demonstrated that administering a Moringa leaf infusion at a dosage of 3.75 g/kg could reduce uric acid levels in white rats induced with goat brain (Rahmawati & Kusumastuti, 2015). Moringa leaves are frequently employed in traditional medicine for various ailments like high blood pressure, diabetes, and gout. Boiling Moringa leaves in hot water is a common method of utilizing their properties, as they work similarly to allopurinol in inhibiting xanthine oxidase production, which can elevate uric acid levels (Johnstone, 2005). Numerous studies have suggested that Moringa leaf extract can be effectively employed in treating gout. Research results indicate that a dose of 3.75 g/kg of Moringa leaf extract can efficiently alleviate gout symptoms (Rahmawati, 2015). Therefore, the application of Moringa leaves in gout treatment extends beyond hot water steeping and includes the use of Moringa leaf extract.

Another investigation demonstrates that flavonoids present in Moringa leaves can diminish blood uric acid levels by inhibiting the activity of the xanthine oxidase enzyme. Additionally, Moringa leaves exert an influence on physiological responses within the body by activating the uricase enzyme. The uricase enzyme plays a crucial role in enhancing the elimination of uric acid from the body, converting it into alatonin, which facilitates faster excretion than uric acid. This physiological process represents the body's mechanism for maintaining equilibrium in blood uric acid levels (Manek et al., 2020). Findings from another study indicate that the administration of Moringa leaf powder can lower uric acid levels in male Wistar rats (Oyewo et al., 2013).

Moringa leaves offer numerous benefits as a traditional remedy used to address various medical and non-medical health conditions. These leaves contain a diverse array of chemical compounds, including tannins, steroids, triterpenoids, flavonoids, saponins, anthraquinones, and alkaloids (Putra et al., 2019). As per Sashidhara's research (cited in Putra et al., 2019), Moringa leaves possess anti-inflammatory, antioxidant, antitumor, antiallergic, antiviral, and antiangiogenic properties.

Several approaches can prevent uric acid formation, encompassing adherence to a low-purine and fructose diet, medical treatments, or the utilization of herbal concoctions like Moringa leaves. Moringa leaves house antioxidant compounds such as flavonoids, vitamin C, and vitamin E. These compounds have been demonstrated to diminish blood uric acid levels by functioning as antioxidants that reduce free radicals. Flavonoids like quercetin and kaempferol exhibit the capacity to inhibit xanthine oxidase and xanthine dehydrogenase activities, thereby impeding uric acid production (Nijveldt RJ, Nood E, Hoorn DEC, Boelens PG, Norren K, Leeuwen PAM, 2001). Adequate vitamin C consumption is estimated to lower the risk of hyperuricemia and prevent subsequent conditions such as gout and hyperuricemic nephropathy (Choi HK, Gao X, Curhan G, 2010; Gao 2010). According to research conducted by Rockwood JL, Anderson BG, and Casamatta DA in 2013, Moringa leaves boast a vitamin C concentration seven times higher than that of oranges.

Moringa oleifera Lamk, commonly known as Moringa, is a plant frequently encountered in Indonesia. It exhibits a remarkable ability to grow throughout the year and thrives in diverse climates and regions. In several localities, Moringa is a commonly utilized ingredient for consumption. The plant is believed to possess therapeutic properties, with Moringa leaf extract being specifically recognized for its proven antioxidant attributes (Suphachai C, 2014; Singh D, Arya PV, Aggarwal VP, Gupta RS, 2014; Luqman S, Srivastava S, Kumar R, Maurya AK, Chanda D, 2012, concluded its hepatoprotective effects). Additionally, Singh D, Arya PV, Aggarwal VP, Gupta RS (2014) identified immune-modulating effects in these medicinal plants. Oyewo EB, Adetutu A, Ayoade A, Adesokan, Akanji MA (2013) further demonstrated their anti-inflammatory effects. Conversely, Okwari OO, Alagwu EA, Dasofunjo K, Okwari KO, Obi L (2015) presented contradictory findings.

According to Singh D, Arya PV, Aggarwal VP, Gupta RS (2014), Moringa leaf extract has validated antioxidant and hepatoprotective effects by counteracting liver cell membrane damage in mice exposed to Carbon Tetrachloride (CCl4). Numerous studies have indicated that the utilization of Moringa leaf extract or powder can reduce uric acid levels in male Wistar rats (Oyewo EB, Adetutu A, Ayoade A, Adesokan, Akanji MA, 2013; Okwari OO, Alagwu EA, Dasofunjo K, Okwari KO, Obi L, 2015; Halaby MS, Elmetwaly EM, Omar AAA, 2013). A study by Mcknight M, Allen J, Waterman JT, Hurley S, Idassi J, and Minor RC in 2014 revealed anti-inflammatory effects of Moringa leaf tea after one week of consumption in mice with acute lung inflammation.

An alternative investigation indicated that administering quercetin at a dosage of 5 mg/kg body weight to hyperuricemic Wistar rats for a duration of 14 days resulted in a reduction in uric acid levels (Haidari F, Rashidi MR, Eshraghian MR, Mahboob SA, Shahi MM, Keshavarz SA, 2008). In this particular study, to accentuate the noteworthy impacts of Moringa leaves, the quercetin dosage used as a control was doubled from the prior dose, reaching 10 mg/kg body weight. A quercetin dosage of 10 mg per kilogram of body weight can be obtained from 11.1 grams of fresh Moringa leaves. Quercetin, the most prevalent type of flavonoid found in Moringa leaves, has

a content of 89.9 mg per 100 grams of fresh leaves (Yang RY, Lin S, Kuo G, 2008). This quercetin content in Moringa leaves significantly surpasses that of shallots (Allium cepa L.), which is only approximately 284 - 486 mg/kg (Hertog MGL, Hollman PCH, Katan MB, 1992). Earlier research demonstrates that red onions possess a hypouremic effect capable of diminishing uric acid levels in hyperuricemic mice (Haidari F, Rashidi MR, Eshraghian MR, Mahboob SA, Shahi MM, Keshavarz SA, 2008).

Varieties of Moringa leaf products such as extracts, powders, and tea infusions have been developed to enhance usability and prolong shelf life. However, there is a dearth of scientific research investigating the impact of consuming Moringa leaf concoctions on reducing uric acid levels in experimental animals or humans. Hence, this study commenced with experimental animals, opting for the Wistar strain of mice due to their resilience to the treatment under examination. Preliminary investigations determined that the administered amount was 3.75 grams per kilogram of body weight of Moringa leaf powder, derived from 11.1 grams of fresh Moringa leaves (Haidari F, Rashidi MR, Eshraghian MR, Mahboob SA, Shahi MM, Keshavarz SA, 2008).

E. CONCLUSION

The average reduction in uric acid levels (pretest and posttest) among participants was 0.90, indicating a notable improvement in uric acid levels after the consumption of Moringa leaf juice, dates, and honey for 10 consecutive nights. The independent sample t-test yielded a significance value of 0.000. This outcome suggests that the significance value is less than α (0.05), implying that statistically, the administration of Moringa juice, dates, and honey is more effective in reducing the uric acid levels of the participants.

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