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The effect of moringa oleifera leaf as an anti-inflammatory: a literature review

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ABSTRACT

Background: Inflammation is a local protective response caused by tissue damage, which functions to reduce injurious agents and injured tissue. Moringa oleifera leaves contain 1.4% tannins, 5% triterpenoids, 5% saponins, and secondary metabolites of flavonoids, alkaloids, and phenols. The content of flavonoids in Moringa leaves provides an anti-inflammatory activity that could reduce pain, joint stiffness, and swelling. This research study aimed to determine the benefits of Moringa leaves against the acceleration of inflammation in oedema disease.

Methods: The study used a literature review design using secondary data from published literature. The literature search was conducted online through PubMed and Google Scholar, using the keywords "anti-inflames", "moringa leaves", and "traditional medicine", and selected based on inclusion and exclusion criteria.

Results: The literature search found four articles related to the study topic. These discussed that moringa leaves were helpful as an anti-inflammatory herbal medicine that did not have significant side effects.

Results: Moringa leaves contain flavonoids, saponins, and tannins, which have benefits in accelerating inflammation or as an anti-inflammatory drug. With these ingredients, moringa leaves can help the healing process of oedema.

Keywords: anti-inflammatory, conventional medicine, inflammation modulation, moringa leaves.

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Introduction

Inflammation is a local protective response caused by tissue damage. The emergence of heat, pain, redness, swelling, and decreased function characterises inflammatory reactions.[1] The wound healing process consists of three overlapping phases: inflammatory, proliferation, and maturation.[2] In the inflammatory phase, there are two stages, namely the vascular phase, which is characterised by vasoconstriction in the blood vessels to slow down blood flow so that it does not reach the injured part so that blood clots occur, resulting in the inflammatory phase. Then, there is the cellular phase, where leukocytes, neutrophils, and monocytes will go to the wound, which has been frozen by fibrin. After this phase, it continues with the proliferation phase. Granulation tissue will form in this phase, and the fibroblast cells on the wound surface will slowly produce new collagen fibres. Exposure of fibrillar collagen to the blood will immediately release it, causing aggregation and activation of platelets, thereby releasing chemotactic factors that initiate the wound healing process. The final phase is the remodelling phase. The granulation tissue will turn into scar tissue and mature simultaneously; the damaged epithelial cells will return to normal, and the wound will heal.[3]

Generally, the treatments used to treat inflammation are drugs from the steroid group and non-steroidal anti-inflammatory drugs.[3] Drugs that are included in the steroid group are salicylic acid, indomethacin, mefenamic acid, phenylbutazone, and diclofenac. The mechanism of action of this drug is to restrain the migration of anti-inflammatory mediators, inhibit the formation of inflammatory mediators, and reduce the activity of inflammatory proteases. Drugs classified as anti-inflammatory steroids, such as hydrocortisone and cortisone, are widely used to treat inflammation because they inhibit the inflammatory process phase. The action of steroidal anti-inflammatory drugs is to inhibit the release of prostaglandins from cell membranes by limiting the availability of arachidonic acid substrates.[4]

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These drugs are known to have side effects that can harm the body. An example is steroid anti-inflammatory drugs, which can increase the risk of diabetes and osteoporosis and reduce the body's immunity. And non-steroidal drugs can also cause liver damage and kidney problems.[5] Apart from that, there are also corticosteroid drugs in topical preparations, which are some of the drugs frequently prescribed and used for dermatology patients since they were first introduced in the early 1950s.[6] Topical corticosteroids are derivatives of the corticosteroid hormone produced by the adrenal glands. This hormone plays a vital role in controlling the inflammatory response, so topical corticosteroids can help the inflammatory process and cause vasoconstriction, aligning with its anti-inflammatory power.[6] But again, the side effects caused by topical corticosteroids are also not minor. Topical corticosteroids have two side effects, namely local and systemic. Long-term use of topical corticosteroids or strong potential to induce skin atrophy, striae, telangiectasia, purpura, hypopigmentation, acneiform, perioral dermatitis, hypertrichosis, and moon face. And for systemic side effects, topical corticosteroids have the potential to be strong and very strong. They can be absorbed and cause systemic effects, including Cushing's syndrome, hypothalamic-pituitary-adrenal gland suppression, metabolic disorders, for example, hyperglycemia, kidney/electrolyte disorders, for example, hypertension, and hypokalemic oedema.[7] So, other alternatives are needed that can overcome inflammation with minimal side effects and more affordable access for the wider community.[4,5]

Additional medicine has recently been widely used as alternative medicine in developing countries. The World Health Organisation (WHO) estimates that 75-80% of the world's population uses herbal medicines for health. Traditional medicine is an ingredient or concoction that can come from plants and is used for treatment or health care. Conventional medicine can be extracted in liquid, thick, or dry form.[8] In Indonesia, many medicinal plants are circulating, including moringa oleifera. Moringa leaves are a plant that contains herbal medicine, which has 1.4% tannin, 5% triterpenoid, and 5% saponin and contains secondary metabolite compounds of flavonoids, alkaloids, and phenols. The flavonoid content in Moringa leaves provides anti-inflammatory activity, which prevents stiffness and pain and reduces pain when bleeding and wound swelling occur. Moringa leaves also contain tannins, where tannins are useful as antimicrobials and antioxidants and are responsible for the remodelling process. There are phytochemical compounds that play a role in the wound healing process.[9]

With the widespread use of steroid, non-steroid, and corticosteroid drugs, which have harmful side effects on the body, traditional or herbal medicine can be an alternative so that people can carry out treatment independently. Additionally, conventional medicine can also be a place for travel medicine for Indonesian tourism, especially in Bali, because it can introduce Indonesian herbal medicine to tourists. In this case, the physiotherapy profession also plays a role in promoting health. One of the interventions from the physiotherapy profession is effective communication. In its use, physiotherapists can recommend applying Moringa leaves as home care to support the success of the physiotherapist's primary intervention.

Methods

The method used for the study was a literature review employing secondary data from published literature. An online literature search was conducted through PubMed and Google Scholar, using the keywords "anti-inflammatory," "moringa leaves," and "traditional medicine." The literature selection was based on inclusion and exclusion criteria. The inclusion criteria for this literature review were as follows: publications from reputable organisations, literature reviews of printed books from the last five years, content addressing two or more variables such as moringa oleifera, moringa oleifera leaf as an anti-inflammatory, and traditional medicine, and inclusion of pain measurement in the literature. The exclusion criteria for this literature review were publications from outside credible institutions, published more than five years ago, focusing on only one variable, and needing more appropriate measurements. The literature included in the review met the criteria established by the author.

Results

Based on a study by Maulana et al. (2023), descriptive research procedures with a case study approach were used on Mrs N, who had pain due to gouty arthritis as measured by the NPRS (numeric rating scale). The intervention given to the patient was a warm compress with moringa leaves once daily for 20 minutes for three consecutive days. The results showed a decrease in the pain scale from before the action was taken with a scale of 5 (moderate pain) and after the action became a scale of 2 (mild pain). The implementation of giving warm compresses of moringa leaves will effectively reduce the pain felt by patients with gouty arthritis.[10]

The same research was also conducted by Saputro et al. (2023) case study method with data collection using Gordon's pattern assessment and conducting observations and physical examinations on Mrs S with pain due to gouty arthritis as measured by the NPRS. The intervention given to the patient is a warm compress of moringa leaf extract, shown every morning for 20 minutes for five days at 37^{o}C-34^{o}C. Five days with a temperature of 37^{o}C-39^{o}C on the painful area. Researchers measured pain levels before and after the intervention. Obtained the provision of warm compresses of moringa leaves. Moringa leaf warm compress on Mrs S reduces the pain scale by marking the decrease in the pain scale measured using the NPRS on the first day with a scale of 5 (moderate) to a scale of 2 (Mild) on the last day. This is due to vasodilation of blood vessels, which causes blood vessels to become smooth, and moringa leaves contain analgesic and anti-inflammatory flavonoids.[11]

Moringa leaf extract has better analgesic content with flavonoid content. Research conducted by Widiyanto et

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al. (2020) with a total of 40 respondents found that there was a decrease in the pain scale after being given an intervention for the elderly in the form of Warm compresses of moringa leaves given once a day in the morning for 20 minutes allocated for three consecutive days. Before getting the minimum value, the pain scale is 4, the maximum is 6, and the average is 5.[12.] This flavonoid functions as an analgesic that inhibits the work of cyclooxygenase and lipoxygenase enzymes so that it can interfere with prostaglandin synthesis and reduce pain.[13]

In addition to gouty arthritis, moringa compress is also effective for reducing pain scale pain in older people with osteoarthritis. This is supported by research conducted by Pamungkas et al. (2021) using 20 respondents. Joint pain was measured by calculating the numerical pain scale before and after treatment for seven days. There is a significant difference in results between the variables before and after treatment, meaning that moringa leaf baths reduce the pain scale in older people with osteoarthritis.[14]

Discussion

Inflammation is the production of organism and tissue defences against damage, the aim of which is to repair the damage or at least limit it and eliminate the cause of the damage, such as bacteria or foreign objects. Symptoms of inflammation include redness (rubor), heat (calor), swelling or oedema (tumour), pain (dolour), and loss of function.[1] One of the visible symptoms of inflammation is swelling or oedema.[15] Oedema can occur when the veins become blocked due to increased intravascular hydrostatic pressure (the pressure that forces blood to flow in the vasculature by the action of the heart pump), thereby causing enlargement or accumulation of plasma fluid into the interstitial space. Oedema can present in various forms, including unilateral, bilateral, localised, or generalised oedema. Therefore, assessing oedema's unique presentation and mechanisms is critical to understanding its relationship to disease pathophysiology, clinical presentation, and treatment. In oedema, the patient cannot carry out daily activities, which can cause complications.[3,16]

In Indonesia, currently, the management of oedema still uses non-steroidal anti-inflammatory drugs (NSAIDs) and anti-inflammatory steroids (AIS). Every day, NSAIDs are used by more than 30 million people worldwide. However, it has been reported that NSAIDs cause surface injury by affecting the integrity of the gastrointestinal mucous membrane. In Indonesia, the prevalence of diseases related to damage to the gastric mucosa due to side effects of using NSAIDs is relatively high, around 15% - 30%.[17] Apart from these drugs, corticosteroids in topical preparations are still often used. This also has side effects that are not simple for the body. With these side effects, non-steroidal and steroidal anti-inflammatory drug preparations can be alternatively used with natural or traditional preparations. Traditional medicine in Indonesia is a cultural heritage that has become an integral part of the life of the Indonesian people[5], especially older people who are ageing. Ageing is a process of slowly losing the ability of tissues to repair themselves or replace and maintain their normal function so that they cannot survive infections and repair the damage suffered. This certainly requires a solution that has minimal side effects.[18]

Traditional herbal medicines are currently starting to be intensified for several reasons. Conventional medicine has proven effective in treating various complaints and diseases. Not only that, traditional medicine is also predicted to have no or very few side effects on its users. This is, of course, inversely proportional to chemical drugs, which have side effects that can sometimes be very disturbing. One of the other advantages of traditional medicines is their very affordable prices. The ingredients for this conventional medicine are straightforward to find in almost all corners of the country, so it is not surprising that its popularity is increasing.[19] One type of herbal medicine used as an anti-inflammatory is herbal pain medicine, which has anti-inflammatory properties and contains droghrapisherba, euphorbia herba, and Curcuma rhizome.[9]

Research conducted by Lia Hikmatul Maula and Maria Ulfah in 2023 showed the results that there was a decrease in the pain scale from before the action of giving warm Moringa leaf compresses to a scale of 5 (moderate pain) and after the action to a scale of 2 (mild pain) for pain in elderly with gouty arthritis. In this study, the patient's pain level decreased from moderate to mild pain after treating pain by administering warm compresses of moringa leaves. The warm compress used in this study was via a cloth or towel soaked in hot water in a particular place or a bottle filled with water. A warm water compress plays a role in widening blood vessels, relieving stiffness, stimulating blood flow, and reducing pain. Warm compresses can be combined with herbs for other benefits, including Moringa leaves. The phytochemical content in Moringa leaves, such as steroids, tannins, triterpenoids, saponins, flavonoids, alkaloids, and interquinones, acts as an antibiotic, anti-inflammatory, antibacterial, and detoxification drug. Flavonoid compounds, in particular, can inhibit xanthine oxidase. Xanthine oxidase is an enzyme that oxidises hypoxanthine to xanthine and then forms uric acid in the body.[10]

Research conducted by Faisal Hidayatullah also stated that warm Moringa leaf compresses affect joint pain in older people with gout. According to researchers, warm Moringa leaf compresses contain flavonoids that have a small molecular weight and moderate solubility in warm water, which allows for good potential for skin penetration due to absorption, which enters through the pores and is then absorbed by the epithelial tissue, resulting in vasodilation of blood vessels. Which causes increased blood flow to painful parts of the body.[20,21] Apart from that, the flavonoid content in the bloodstream will inhibit the work of the cyclo-oxygenase enzyme so that the formation of prostaglandins is inhibited, thereby reducing pain.[12]

States that warm compresses from Moringa leaves effectively reduce gout pain in the elderly. This research showed that Moringa leaves can treat rheumatism because

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they contain flavonoids, alkaloids, steroids, tannins, saponins, and terpenoids.[12] Flavonoids inhibit neutrophil degranulation to inhibit the release of cytokines, free radicals, and enzymes that play a role in inflammation.[22] This flavonoid functions as an analgesic, inhibiting the action of the cyclooxygenase enzymes and lipoxygenase to interfere with prostaglandin synthesis and reduce pain. Moringa leaf water extract can also be used as an analgesic.[23]

Research from Putri Pamungkas and Dwi Olinda stated that 13 older people (65%) who previously had moderate pain before being given treatment became nine older people (45%) with mild pain after being given treatment, namely by applying Moringa leaf decoction for joint pain. According to this research, Moringa leaves function as a laxative, applied as a poultice for wounds, rubbed on the forehead for headaches, used as a compress for fever and joint pain, a heart-strengthening tonic, preventing the formation of tumours and cancer, leaf juice is believed to control blood glucose levels and is used to reduce swollen glands. Apart from that, it is also said that the benefits of Moringa leaves include increasing the body's natural resistance, increasing the body's metabolism, and having anti-inflammatory properties. According to researchers, moringa leaves are helpful for the body to treat various problems, including joint pain. Joint pain that occurs before soaking with Moringa leaves will improve after washing because the muscles will be more relaxed with warm water and nourished by the contents of Moringa leaves.[14]

This study has several limitations. Firstly, the limited number of studies identified in the literature review suggests a need for more research in this area, potentially limiting the breadth and depth of the analysis. In addition, heterogeneity among the included studies in terms of methodology, population studied, and outcome measures may impact the comparability and generalizability of the findings.

Conclusion

Moringa leaves contain flavonoids, saponins, and tannins, which have benefits in accelerating inflammation or as an anti-inflammatory drug. With these contents, Moringa leaves can help the healing process of oedema. Oedema is a sign of inflammation and can occur due to increased intravascular hydrostatic pressure, causing enlargement or accumulation of plasma fluid in the interstitial space.

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Conflict of interest

The author states there is no potential conflict of interest with this article's research, authorship and publication.

Author contributions

DGRA conceived the study design and data collection and drafted the manuscript; IMNW and NLNA collected the data and revised the manuscript.

Ethical consideration

This review study used published articles that are accessible. Thus, this study did not require any informed consent or ethical consideration.

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