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Benefits of Moringa Leaves (*Moringa Oleifera*) as A Source of Functional Food And Herbal Medicine

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ABSTRACT
Moringa Oleifera is classified as a nutraceutical plant due to its nutritional value and medicinal properties. However, it lags behind in popularity compared to Zingiberaceae. Therefore, there is a need for a comprehensive study to explore the benefits and potential use of *Moringa Oleifera*. This research aims to extensively discuss the applications of *Moringa Oleifera* as a food and medicine ingredient, based on thorough literature review. The literature was obtained online using Google scholar with relevant keywords such as *Moringa Oleifera*, uses of *Moringa Oleifera*, and bioactivities of *Moringa Oleifera*. The study reveals that *Moringa Oleifera* demonstrates a broad range of therapeutic effects, including antimicrobial, anticancer, hepatoprotective, anti-diabetes mellitus, and antioxidant activities. It contains significant nutrients and compounds, particularly in the leaves, making it a potential solution for addressing malnutrition. Therefore, *Moringa Oleifera* presents itself as a promising food alternative that can effectively combat malnutrition while also providing pharmaceutical benefits.

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INTRODUCTION

Moringa (*Moringa Oleifera ringa oleifera*) or local name Marungga is a plant of the *Moringa* tribe *Oleiferaringaceae*. The leaves are oval-shaped with small sizes neatly arranged in one stalk. Moringa trees can grow tall up to 7-11 meters, decorated with beautiful yellowish-white flowers that emit a fragrant aroma. The Moringa plant originated in sub-Himalayan India and has long been one of the important elements in Ayurvedic medicine as a cure for more than 300 diseases. Moringa plants are one of 13 species in the same genus and have spread in the tropics and subtropics at altitudes of up to 2,000 m (Leone et al.,2019). Based on the results of research reported by Tapriadi and Jupriyono (2018), Moringa leaves can be made into several processed food products that can increase the income of residents. Moringa plants, especially their leaves, are often used as basic ingredients for medicines and vegetables.

Based on the results of research reported by Tapriadi and Jupriyono (2018), Moringa leaves can be processed into several processed food products that can increase residents' income. Remunggai plants, especially their leaves, are often used as basic ingredients for medicines and vegetables. Some processed forms or forms of Moringa consumption are leftover boiled water from Moringa leaves, herbs, tea, vegetable loloh. Moringa leaf boiled water still contains compounds that are active as antioxidants and some water-soluble

vitamins. Moringa leaves contain potassium which is 3 times greater than bananas, vitamin A which is 4 times more abundant than carrots, vitamin C which is 7 times greater than oranges and calcium levels which are 4 times more than milk. In addition, the nutrients contained by Moringa leaves are protein, vitamin A (ß-carotene), and iron (Singhetal.,2013; Madukwe, et al.,2013)

In Moringa leaves according to Kusmardika (2020) has a high content of antioxidants and bioactive compounds so that it has the potential to prevent oxidative stress and cancer. Based on the research of Paramitha (2020) Moringa is rich in antioxy and according to Kasolo et al.(2010) contains tannins, steroids, triterpenoids, flavonoids, saponins, antarquinones, and alkaloids which are all antioxidants . The function of antioxidants is to repair cells from damage. Therefore, it is likely to help the healing process of cells in the lungs due to the virus attack that is now spreading. Moringa can increase the body's immunity because there are also many minerals and vitamins in the remunggai.

It is suspected that *Moringa Oleifera* originated in India (Olson, 2002) but has been found in many tropical and subtropical regions of the world (Gopalakrishnan et al., 2016) including Indonesia. Epitrically, it can be seen that *Moringa Oleifera* is easy to find and is widely cultivated in various yards of local communities in Indonesia. In East Nusa Tenggara Province (NTT), *Moringa Oleifera* leaves have been traded in various markets that are used as vegetables. *Moringa Oleifera* can live in the tropics and subtropics with temperatures around 25–35◦C. *Moringa Oleifera* requires sandy soils with soil PH ranging from acidic to wet with rainfall of 250–3000 mm (Thurber et al., 2010). Almost all parts of *Moringa Oleifera* can be utilized from leaves, roots, bark, seeds, and pods and are grouped as non-tree forest products (HHBK) (Agoyi et al., 2014). Agoyi et al (2014) further state that *Moringa Oleifera* plays an important role in the livelihoods of the local population, particularly in rural Africa

Although *Moringa Oleifera* has many benefits, its popularity in Indonesia is still inferir to Zingiberaceae (empon-emponan). Different things are found in local communities in Africa such as South Benin (Africa) *Moringa Oleifera* is used to treat up to 34 diseases according to the disease and is also used in rituals known by local people (Agoyi et al., 2014). *Moringa Oleifera* can withstand severe droughts and mild snow conditions and is therefore widely cultivated worldwide (Gopalakrishnan et al., 2016). Agoyi et al (2014) stated that for local South Benin communities in Africa the cultivation of *Moringa Oleifera* is carried out with a agroforestry system. In addition to being consumed by humans, it turns out that leaves can also be used as animal feed for pigs, sheep, and rabbits. Gopalakrishnan et al (2016) state that *Moringa Oleifera* has a high nutritional value so it is suitable for commercialization for nutritional purposes and has a healthy effect.

Extract from the leaves of *Moringa Oleifera* is used to treat malnutrition, adding breast milk (breast milk) in nursing mothers (Gopalakrishnan et al., 2016). The phytochemical content contained in *Moringa Oleifera* includes niazirin, niazirinin, flavonoids, anthocyanins, proanthocyanidins, kaempferol-3-O- (6 " - malonyl- glucoside), 4-hydroxymelin, β-sitosterone, β-sitosterone acid, β-sitosterone acid, and β-sitosterol (Kesharwani et al., 2014). Traditional (indegenous) knowledge about the use of *Moringa Oleifera* is one of the first steps for future efforts to design better management for *Moringa Oleifera* (Agoyi et al., 2014). To increase public understanding of the benefits and bioactivity of Moringa Oleifera, it is necessary to conduct a comprehensive study. Literature studies are one of the efficient ways to reveal the benefits.

LITERATURE REVIEW

Moringa Plant Cultivation (*Moringa Oleifera*)

Moringa plant, scientifically known as *Moringa Oleifera*, is a tropical plant that thrives in regions with tropical climates, including Indonesia and various other tropical areas around the world. In Indonesia, Moringa is referred to by different names such as Kelor in Java, Sunda, Bali, and Lampung, Maronggih in Madura, Marungga in Sumba, Moringa Oleiferaltong in Flores, Keloro in Bugis, Ongge in Bima, and Hau fo in East Indonesia. Belonging to the family Moringa Oleiferaringaceae, Moringa plants exhibit ovoid leaves of small sizes arranged in a single stalk (Tilong, 2012). These plants have a mildly bitter taste, are neutral in nature, and are non-toxic (Hariana, 2008).

Moringa leaves have an ovoid shape with flat leaf edges and a small size, arranged in one stalk (Tilong, 2012). The moringa tree is known by several nicknames such as the Miracle Tree, Tree For Life, and Amazing Tree. These names were given due to the extraordinary benefits of various parts of the tree, including leaves, fruits, seeds, flowers, bark, stems, and roots. Moringa plants are adaptable to different soil types, require minimal care, are resistant to dry seasons, and are easily propagated (Simbolon et al 2007). According to Utami (2013), the leaves of Moringa have anti-inflammatory properties, help with hepatitis, aid in urination, and have anti-allergic effects. Moringa leaves (Moringa Oleiferaringa oleifera) are widely used and believed to possess medicinal properties for treating infectious diseases, acting as antibacterial agents, addressing urinary tract infections, healing external wounds, reducing hypersensitivity, treating anemia, diabetes, colitis, diarrhea, dysentery, and rheumatism (Fahey, 2005).

The utilization of Moringa plants in Indonesia is presently limited. Typically, people use Moringa leaves as a supplement in their everyday cooking. Some even use Moringa plants purely for decorative purposes, cultivating them on their home terraces. Additionally, in certain regions of Indonesia, Moringa leaves are primarily used for bathing corpses, producing amulets, and serving as animal feed (Dewi et al., 2016)..

Moringa Plant Classification (*Moringa Oleifera* ringa Oleifera)

Moringa Oleifera is the most extensively grown species of the *Moringa Oleifera* Ringaceae family, and it is indigenous to sub-Himalayan regions including India, Pakistan, Bangladesh, and Afghanistan. This rapidly growing tree has been utilized since ancient times by civilizations such as the Romans, Greeks, and Egyptians. Until recently, *Moringa Oleifera* was cultivated on a large scale and has now become a naturalized plant in tropical areas (Fahey, 2005). According to the Integrated Taxonomic Information System (2017), the classification of Moringa plants is as follows:

Kingdom : Plantae
Sub Kingdom : Tracheobionta (vascular plants)
Division : Spermatophyta (seed plants)
Division : Magnoliophyta (flowering plants)
Class : Magnoliopsida (dicotyledons)
Subclass : Dilleniidae
Order : Capparales
Family : Moringa Oleiferaringaceae
Genus : *Moringa Oleifera* ringa
Species : *Moringa Oleiferaringa oleifera Lam*

Moringa Leaf Flour

Moringa leaf flour is a product derived from Moringa leaves through a process of drying and grinding them into powder (Tanico, 2011). This form of flour enhances the longevity and storage convenience of Moringa leaves. Additionally, Moringa leaf flour serves as a nutritious dietary supplement and can be incorporated into various food preparations. To ensure its cleanliness, Moringa leaves intended for flour production should be thoroughly washed to eliminate any dirt or potential pathogens (Doerr & Cameron 2005).

According to Broin (2010), there are three ways that can be done to dry Moringa leaves, namely drying indoors, drying with sunlight, and using a drying machine. Leaves that have dried and can be made into flour are characterized by their leaves being brittle and easily crushed. Dried leaves are crushed using *Moringa Oleifera* or grinding.

Moringa leaves (Moringa Oleifera) used in the manufacture of Moringa leaf flour according to Zakaria et al., (2012) are green leaves picked from tree branches that are more or less from the first petiole (below the shoot) to the seventh petiole which is still green, although old leaves can be used as long as the Moringa leaves have not turned yellow. Moringa leaves have a characteristic langu aroma.

Moringa leaves contain the enzyme lipoxidase, this enzyme is found in green vegetables by hydrolyzing or decomposing fat into compounds that cause langu which belong to hexaneal group 7 and hexanol. The aroma of langu on Moringa leaves can be reduced by diblanching (Ilona, 2015).

Nutritional Content of **Moringa Leaves (*Moringa Oleifera*)**

One area of the Moringa plant that has received extensive research is the leaf section, which is known for its nutritional content and its potential benefits for food and health. Within this section, there are several nutrients present, such as calcium, iron, protein, vitamin A, vitamin B, and vitamin C, as stated by Misra and Misra (2014) and Oluduro (2012). Comparatively, the nutritional content of Moringa leaves surpasses that of other vegetables, with a range of 17.2 mg/100 g, according to Yameogo et al. (2011). Additionally, Moringa leaves contain a variety of amino acids, including aspartic acid, glutamic acid, alanine, valine, leucine, isoleucine, histidine, lysine, arginine, venylalanine, tryptophan, cysteine, and methionine, as highlighted by Simbolan et al. (2007). The phenol content in fresh Moringa leaves is reported to be 3.4%, while in extracted Moringa leaves it is 1.6%, as mentioned by Foild et al. (2007). Furthermore, further research indicates that Moringa leaves possess high levels of antioxidants and antimicrobial properties, as identified by Das et al. (2012). These desirable qualities are attributed to the presence of ascorbic acid, flavonoids, phenolics, and carotenoids, as discussed by Anwar et al. (2007b).

RESEARCH METHOD

This article review is a review of literature from various sources online and online from various books and research results published on Google Scholar and Scopus. In online searches using the keywords Moringa Oleifera, bioactivities *Moringa Oleifera* and Uses of *Moringa Oleifera*. The search results obtained are synthesized so that they can explain the benefits and bioactivity of *Moringa Oleifera*.

RESULT AND DISCUSSION

Moringa or known as *Moringa Oleifera* is one of the species in the Family Moringa Oleiferaringaceae. *Moringa Oleifera* ringaceae has only one genus, *Moringa Oleifera* and is estimated to have about 33 species. It is estimated that 4 (four) species have accepted status, while 4 (four) species are synonyms and 25 species have not been verified (Mabberley, 1987). *Moringa Oleifera* has 28 chromosome diploids (Saini et al., 2013). *Moringa Oleifera* has 13 species and the most widely cultivated is *Moringa Oleifera* (Padayachee et al., 2012). *Moringa Oleifera* is a plant that is used as food is a plant that is rich in nutrients and is not toxic to the human body. The following will be further discussed the use of *Moringa Oleifera* as a medicinal ingredient, food, and bioactivity.

Moringa Oleifera has been used as a food ingredient and in medicine since antiquity. Communities in South Benin (Africa) *Moringa Oleifera* is used to treat up to 34 diseases according to diseases known to local people (Agoyi *et al*., 2014). Various researchers report that *Moringa Oleifera* has various therapeutic effects as antimicrobial, anticancer, anti-inflammatory, antidiabetic effects, and antioxidants (Jung 2014; Gopalakrishnan *et al.*, 2016). The content of polyphenols and phenolic acids is also flavonoids, glucosinolics, and alkaloids (Stohs et al., 2009), vitamins, phenolic acids, flavonoids, isothiocyanates, tannins and saponins (Vergara-Jimenez *et al*.,2017; Saini *et al.,* 2016). The bioactivity of *Moringa Oleifera* is presented in Table 1.

Table 1. Bioactivity of Moringa leaves (Moringa Oleifera)

Bioactivity	Reference
Anti-microbial	Nkurunziza et al (2009)
Hepatoprotective	Chattopadhyay et al., (2011); Asiedu-Gyekye et al., (2014).
Anti-cancer	
Antioxidant	Berkovich et al., 2013); Tiloke et al (2013).
Inhibits Menopause	Sreelatha and Padma (2010)
Anti-diabetes mellitus	Kushwaha et al., 2014
	Al-Malki and El Rabey (2015)

Anti Microbial

Various types of pathogenic microbes are the cause of various infectious diseases in humans. Although many compounds have been shown to inhibit growth or cause microbial death, various facts show that microbial resistance to drugs is increasing. This has resulted in the exploration of plants as antimicrobials continues to be carried out, especially nutracetic plants including Moringa Oleifera. The use of *Moringa Oleifera* as an antimicrobial has been reported by Nkurunziza et al., (2009). *Moringa Oleifera* has been shown to be able to kill Eschericia coli bacteria up to 96% in turbid water given (25 to 300 mg/L) in natural surface water whose turbidity levels range from 50 to 450 NTU (Nkurunziza et al., 2009). Eschericia coli is one of the microbes that causes digestive tract disorders, therefore it is very supportive in its use as a food ingredient while inhibiting the growth of pathogenic bacteria.

Hepatoprotective

Hepatoprotective is a compound known for its ability to safeguard the liver. To assess its impact on liver toxicity caused by arsenic, female Wistar rats were administered *Moringa Oleifera* seed extract. The rats were subjected to subchronic exposure of sodium arsenite, where they consumed 0.4 ppm/100 g body weight/day of the substance through drinking water for 24 days. This exposure significantly elevated liver activity and lipid function

markers such as alanine transaminases, aspartate transaminases, cholesterol, triglycerides, and LDL, while causing a decline in total protein and HDL levels. (Chattopadhyay et al., 2011).

Joint administration of *Moringa Oleifera* water seed extract (500 mg/100 g body weight/day for 24 days) was found to significantly prevent arsenic changes in the liver. Use in high doses, it is found that it does not cause side effects, even so the consumption of dried leaves should not exceed a maximum of 70 grams per day to prevent the cumulative toxicity of these important elements over a long period of time (Asiedu-Gyekye et al., 2014). Leaf extracts at doses of 5000 mg/kg (acute doses) and doses of 40 mg/kg to 1000 mg/kg (sub-acute doses) tested on rats showed no adverse reactions (Asiedu-Gyekye et al., 2014). Although there were observed improvements in the liver enzymes ALT and ALP ($P < 0.001$) and lower creatinine levels in the extract-given group, there were no adverse histopathological findings.

Anti-Cancer

Cancer is a disease caused by uncontrolled cell growth, therefore plants used as anti-cancer are plants that produce compounds that can inhibit the growth of cancer cells or induce apostosis but do not interfere with normal cells. Until now, cancer is one of the scary diseases because the disease is difficult to cure. Chemical compounds used as cancer drugs are still mostly extracted directly from plants, therefore exploration of plants that have anti-cancer activities is still being carried out. In principle, plants used as cancer drugs are plants that result in cell death or cytotoxic or stimulate apostosis. Chemotherapy is currently the standard treatment, however these tumors serineg experience drug resistance over time (Berkovich et al., 2013). Jun (2014) states that it has enormous potential as a cancer ant. Aqueous extracts with a concentration of 300 mg/mL induce apoptosis, resulting in stunted tumor cell growth , and lowering internal species oxygen reaction (ROS) levels in human lung cancer cells as well as some types of cancer cells. Administration of *Moringa Oleifera* aqueous extract results in dose-dependent rRNA degradation and shows greater cytotoxicity for cells *Moringa Oleifera* than normal cells (Jung 2014).

Antioxidant

Free radicals are believed to exert a direct influence on several ailments, including diabetes mellitus, stroke, cancer, and tumors. Antioxidants play a crucial role in suppressing the activity of free radicals, thereby offering protective benefits against infections and degenerative diseases for individuals. Various plant species are reported to have activity as antiocacidsand include *Moringa Oleifera* (Sreelatha and Padma 2010). In laboratory experiments antioxidant activity was measured by extract scavenging activity at 1,1-diphenyl-2-picrillhydrazyl (DPPH) radicals while anti-hypolipidemic activity was measured by inhibitory effects on Cu2+ induced low-density lipoprotein (LDL) oxidation (Chumark et al 2008). *Moringa Oleifera* leaf water extract has a strong effect on scavenging 2, 2-diphenyl-2- picril hydrazy l (DPPH) free radicals, superoxide, and lipid-inhibition nitric oxide radicals per oxidation. The free radical scavenger effect of *Moringa Oleifera* leaf extract is comparable to that of the reference antioxidants (Sreelatha & Padma 2009). Total phenolics showed a higher correlation with antioxidant activity (Sreelatha and Padma 2010).

Inhibits Menopause

Menopause is the process of the end of the reproductive period and life. Menopause is also affected by a lack of estrogen and an antioxidant enzyme system. Most women go through menopause between the ages of 40 and 58, with a median age of 51. In post-menopause, the ovaries stop producing estrogen. The antioxidant enzyme system seems to be affected in post-menopause due to a lack of estrogen, which has acquired antioxidant properties. The beneficial effects of estrogens may be caused by the scavenging of free radicals. Another benefit of estrogen is the reduction of low-density Lipoprotein (LDL) cholesterol and the increase in high-density lipoprotein (HDL) cholesterol, affecting lipid metabolism (Srivastava et al., 2005). Menopause is associated with a wide variety of physical and psychological symptoms. Typical symptoms during the menopausal transition, which lasts 4-5 years, include hot flushes, night sweats, vaginal dryness, and sleep disturbances (Moringa Oleiferailanen et al., 2010). *Moringa Oleifera* has antioxidant properties and therapeutic potential for the prevention of complications during menopause (Kushwaha et al., 2014).

Anti Diabetes Mellitus

Diabetes mellitus is a metabolic disorder characterized by elevated blood sugar levels, or hyperglycemia. Ongoing research exploring plants such as *Moringa Oleifera* as potential anti-diabetes agents is being conducted, as these natural remedies are deemed safer and suitable for long-term use compared to synthetic medications. Studies have shown that diabetes in rats leads to increased levels of immunoglobulins (IgA, IgG), fasting blood sugar, and glycosylated hemoglobin (HbA1c) (Al-Malki and El Rabey, 2015).

The use of *Moringa Oleifera* as an anti-diabetes mellitus has been reported by Al-Malki and El Rabey (2015). *Moringa Oleifera* seed powder at low doses (50 and 100 mg/kg body weight, in food) in streptozotocin-induced diabetic male rats (STZ) had anti-diabetes mellitus activity. Albumin levels are reduced, potassium and sodium levels in G2 increase as a sign of diabetic nephropathy.

In people with diabetes mellitus urine analysis shows an increase in glucosuria, potassium, sodium, creatinine, gout, and albumin levels. Diabetes mellitus mice given 50 or 100 mg of MO/kg seed powder body weight improved the level of all these parameters close to negative control values and restore normal histology of the kidneys and pancreas compared to the diabetes positive control group (Al-Malki and El Rabey, 2015).

Moringa Oleiferaringa oleifera as an Ingrediant of Food

Moringa Oleifera is a type of nutracetic plant because in addition to having nutritional value, it also has a healthy effect. *Moringa Oleifera* leaves can be consumed either fresh, dried or processed into powder (Agoyi et al., 2014). *Moringa Oleifera* is rich in nutrients containing various important compounds that accumulate in its leaves, pods and seeds (Rockwood et al., 2013) therefore it can be used as an effective remedy for malnutrition. Rockwood et al., (2013) state that the content is as much as 7 times more vitamin C than oranges (Citrus sp.), 10 times more vitamin A than carrots (*Daucus carota*), 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more bananas than bananas and 25 times more iron than spinach (Amaranthus sp.).

For local peoples South Benin (Africa) has with different local names depending on the socio-cultural group. The leaves are the most frequently used part followed by roots, bark, seeds, and pods (Agoyi et al., 2014). The leaves are eaten as vegetables and are also used for medicinal purposes in a fresh, dried or powdered state (Agoyi et al., 2014). *Moringa Oleifera* is a plant that grows in many tropical countries that has nutritional and pharmacological value so that it is classified as nutraceutical. Young leaves, flowers and pods are common vegetables in the diet in Asia.

All components of this plant exhibit renewable qualities as sources of tocopherol (γ and α), phenolic compounds, β-carotene, vitamin C, and total protein, which encompass vital sulfur amino acids methionine and cysteine. The protein and seed fat content surpass the values reported for legumes and soybean grains of significant cultivars, respectively. Reasonable quantities of unsaturated fatty acids, particularly oleic acid, carbohydrates, and minerals can be found in these seeds.

Moringa Oleifera is a high nutritional value plant that is mostly cultivated in the tropics and subtropics (Moringa Oleiferayo et al 2009). *Moringa Oleifera* is used for food, medicinal and industrial purposes. The approximate and Van Soest methods are used to determine the nutritional value of the leaves of Moringa Oleifera. The dried leaves of *Moringa Oleifera* contain a crude protein content of 30.3% and 19 amino acids. Additionally, the dried leaves contain various minerals such as calcium (3.65%), phosphorus (0.3%), magnesium (0.5%), potassium (1.5%), sodium (0.164%), sulfur (0.63%), zinc (13.03 mg/kg), copper (8.25%), manganese (86.8 mg/kg), iron (490 mg/kg), and selenium (363 mg/kg) (Moyo et al., 2009).

Lack of proteins and micronutrients especially iron, zinc and calcium among children and pregnant women has become a major health problem in Sri Lanka (Liyanage et al., 2014). *Moringa Oleifera* collected from eight districts belonging to different agroclimatic sites in Sri Lanka were analyzed for proteins and some micronutrients.

CONCLUSION

Moringa Oleifera possesses a diverse array of therapeutic properties, such as its antimicrobial, hepatoprotective, anti-cancer, anti-diabetes mellitus, and antioxidant abilities. Additionally, this plant shows potential as a viable food substitute that can effectively address malnutrition concerns, while also offering pharmaceutical advantages.

REFERENCES

Al-Malki A.L & El Rabey H.A. (2015). The antidiabetic effect of low doses of *Moringa Oleifera* Lam. seeds on streptozotocin induced diabetes and diabetic nephropathy in male rats. *Hindawi Publishing Corporation BioMed Research International*. Volume 2015, Article ID 381040, 13 pages.

Abdihaz. (2021). Pemanfaatan Moringa Oleiferaringa oleifera sebagai Produk Olahan Sehat dan Bernilai Ekonomis bagi Masyarakat di Kecamatan Ratu Samban Kota Bengkulu di Tengah Pandemi Covid-19. *Jurnal Ilmiah Pengabdian pada Masyarakat*, Juni 2021, 3(1):1-7.

Agoyi E.E, Assogbadjo A.E, Gouwakinnou G, Okou F.A.Y & Sinsin B. (2014). Ethnobotanical assessment of *Moringa Oleifera* Lam. in Southern Benin (West Africa). *Ethnobotany Research & Applications* 12:551-560.

Anwar F, Latif S, Ashraf M & Gilani A.H. (2007). Moringa oleifera: a food plant with multiple medicinal uses. *Phytotherapy Research* 21: 17-25.

Berkovich L, Earon G, Ron I, Rimmon A, Vexler A & Lev-Ari S. (2013). *Moringa Oleifera* aqueous leaf extract down - regulates nuclear factor-kappaB and increases cytotoxic effect of chemotherapy in pancreatic cancer cells. *BMC Complementary and Alternative Medicine 2013*, 13:212.

Chattopadhyay S, Maiti S, Maji G, Deb B, Pan B & Ghosh D. (2011). Protective role of *Moringa Oleifera* (Sajina) seed on arsenic-induced hepatocellular degenerationin female albino rats. *Biol Trace Elem Res*. 142: 200–212.

Das, A. K., Rajkumar, V., Verma, A. K., & Swarup, D. (2012). *Moringa Oleifera* leaves extract: A natural antioxidant for retarding lipid peroxidation in cooked goat meat patties. *International Journal of Food Science and Technology*, 47, 585–591.

Foild N, Makkar HPS & Becker. 2007. The Potential Of *Moringa Oleifera* for Agricultural and Industrial Uses. Mesir: Dar Es Salaam

Jung I.L. (2014). Soluble extract from *Moringa Oleifera* leaves with a new anticancer activity. Plos One 9(4): 95492. doi:10.1371/journal.pone.0095492

Kushwaha S, Chawla P & Kochhar A. (2014). Effect of supplementation of drumstick (Moringa oleifera) and amaranth (Amaranthus tricolor) leaves powder on antioxidant profile and oxidative status among postmenopausal women. *J Food Sci Technol* 51(11): 3464–3469.

Liyanage R, Jayathilaka C, Perera O.S, Kulasooriya S.A, Jayawardana B.C & Wimalasiri S. (2014). Protein and micronutrient contents of *Moringa Oleifera* (Murunga) leaves collected from different localities in Sri Lanka. *Asian Journal of Agriculture and Food Scienc*e 2(4): 264-270.

Marina Silalahi. (2020). Pemanfaatan Daun Kelor (*Moringa Oleifera* Lam) sebagai Bahan Obat Tradisional dan Bahan Pangan. Biology Education Study Program, Faculty of Teacher Training and Education, Christian University of Indonesia, Jakarta

Mabberley D.I. (1987). The Plant Book. New York: Columbia University Press,Cambridge.

Melo, N. V., Vargas, T. Quirino and C. M. C. Calvo. (2013). *Moringa Oleifera* L. Anunderutilized tree with macronutrients for human health Emir. *J. Food Agric*, 25 (10): 785-789

Misra, S., & Misra, M.K. (2014). Nutritional evaluation of some leafy vegetable used by the tribal and rural people of south Odisha, India. Journal of Natural Product and Plant Resources, 4. 23-28.

Nkurunziza T, Nduwayezu J.B, Banadda E.N & Nhapi I. (2009). The effect of turbidity levels and *Moringa Oleifera* concentration on the effectiveness of coagulation in water treatment. Water Science & Technology 59(8): 1551-1558. Simbolan, J.M., M. Simbolan, N. Katharina. 2007. Cegah Malnutrisi dengan Kelor. Yogyakarta: Kanisius.

Oluduro, A. O. (2012). Evaluation of antimicrobial properties and nutritional potentials of *Moringa Oleifera* Lamk. *Leaf in South-Western Nigeria. Malaysian Journal of Microbiology*, 8, 59-67

Sri W, Ade T, Fungky Y. (2022). Pemanfaatan Daun Kelor (Moringa Oleivera) Sebagai Sumber Nutrisi Dan Obat Herbal Di Lingkungan Pabrik Gula Pagotan – Madiun. Vol 1 No. 1

Sreelatha S & Padma P.R. (2009). Antioxidant activity and total phenolic content of *Moringa Oleifera* leaves in two stages of maturity. *Plant Foods Hum Nutr* 64:303–311.

Tapriadi, & Jupriyono. (2018). Pemanfaatan daun kelor sebagai jajanan sehat dalam rangka pemberdayaan masyarakat Kelurahan Bareng di Kota Malang. *Jurnal Idaman*, 2(1), 27-29.

Yuliani N. DD. Uji Aktivitas Antioksidan Ekstrak Etanol Infusa Daun Kelor dengan Metode 1,1- diphenyl-2-picrylhydrazyl (DPPH). *J Info Kesehat*. 2015;14(2):1060–1082.

Yameogo, W. C., Bengaly, D. M., Savadogo, A., Nikièma, P. A., Traoré, S. A. 2011. Determination of Chemical Composition and Nutritional values of *Moringa Oleifera* Leaves. *Pakistan Journal of Nutrition* 10 Vol (3): 264- 268.