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A Comprehensive Review on the Therapeutic Potential of Different Leaves

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ABSTRACT

Medicinal plants have been an integral part of traditional medicine systems for centuries, owing to their diverse pharmacological properties. This review aims to provide a comprehensive analysis of the pharmacological properties of various studied medicinal plants, drawing from a wide range of scientific literature. The review encompasses plants studied for their therapeutic potential in treating various ailments, including but not limited to, cardiovascular diseases, gastrointestinal disorders, neurological conditions, and infectious diseases. Through an extensive literature survey, this review synthesizes information on the phytochemical composition and pharmacological activities of selected medicinal plants. Emphasis is placed on elucidating the mechanisms of action underlying the observed therapeutic effects, highlighting both in vitro and in vivo studies. Furthermore, the review discusses the safety profiles and potential toxicological concerns associated with the use of these plants, addressing the need for further research in this area. Key findings from the reviewed literature reveal the remarkable pharmacological diversity exhibited by medicinal plants, including antioxidant, anti-inflammatory, antimicrobial, antidiabetic, analgesic and immunomodulatory activities, among others. Moreover, certain plants demonstrate promising effects in modulating specific molecular targets implicated in disease pathogenesis, thus offering potential avenues for drug discovery and development.

Keywords: Medicinal, Antidiabetic, Antioxidant, Antimicrobial, Anti-cancer, Toxicology

INTRODUCTION

In the realm of traditional medicine and herbal remedies, the utilization of plant leaves for their therapeutic properties has been a practice deeply rooted in various cultures worldwide. Among these leaves, bael leaves (*Aegle marmelos*) hold a significant place due to their extensive use in Ayurveda, traditional Chinese medicine, and other indigenous healing systems.

Bael, often referred to as the "wood apple" tree, is native to the Indian subcontinent and parts of Southeast Asia. Its leaves, along with other parts of the plant, have been valued for centuries for their wide-ranging medicinal benefits. However, in recent times, with an increasing interest in natural remedies and alternative healthcare approaches, there has been a resurgence of scientific inquiry into the therapeutic properties of bael leaves, as well as a comparison with other leaves renowned for their medicinal value.

In this context, this exploration aims to delve deeper into the therapeutic potential of Bael leaves alongside other medicinal leaves, shedding light on their traditional uses, pharmacological properties, and emerging scientific evidence. By elucidating the multifaceted benefits of these leaves, we can further appreciate their contributions to holistic health and well-being, both within traditional healing systems and in contemporary healthcare practices.

Aegle marmelos (Bael) leaves:

Lakht e Zehra *et al.* (2015) observed that the leaves

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of the bael plant are consumed in the human diet and possess a superior amino acid profile compared to the seeds. They found that the major essential amino acids were present at optimal levels according to the ideal amino acid score, including leucine, methionine, tyrosine+ phenylalanine, valine, and isoleucine. However, lysine and threonine were identified as the only limiting amino acids. Among non-essential amino acids, alanine was the most abundant (constituting 14.29% of total amino acids), followed by aspartic acid (9.52%), arginine (9.52%), and glutamic acid (8.57%). Therefore, the amino acid profile of bael plant leaves largely fulfills human dietary requirements.

Islam *et al.* (2014) noted that the decoction of the leaves is employed for the treatment of peptic ulcers, whereas the leaf oil is utilized for respiratory disorders.

As per the review conducted by CHEMEXCIL in 1992, it was suggested that leaves are considered highly beneficial for addressing various ailments such as fever, abdominal pain, intermittent fever, urinary issues, heart palpitations, dysentery, dyspepsia, stomach pain, seminal weakness, vomiting, fever, and swellings.

Baliga *et al.* (2010) asserted that the leaf extract outperforms both the fruit extract and the positive control (2-mercaptopropionylglycine). They emphasized that leaf extracts offer protection against gastrointestinal and hematopoietic damage. Inhibiting lipid peroxidation plays a crucial role in diseases involving free radicals. Studies demonstrated that both leaf and fruit extracts prevented radiation-induced lipid peroxidation in the livers, kidneys, intestines, and spleens of mice.

Prince *et al.* (2005) conducted an assessment of the preventive effects of an aqueous extract derived from Aegle marmelos leaves (AMLEt) in isoprenaline (isoproterenol)-induced myocardial infarction in rats. They observed that pretreatment with AMLEt led to a decrease in the activity of creatine kinase (CK) and lactate dehydrogenase (LDH) in serum, while increasing their levels in the heart. Additionally, AMLEt pretreatment resulted in an increase in the activity of Na+K+ ATPase and a decrease in the activity of Ca^2 + ATPase in both the heart and aorta simultaneously. Furthermore, levels of cholesterol and triglycerides decreased, whereas phospholipids increased in the heart and aorta of AMLEt-pretreated rats. Importantly, administration of 200 mg kg-1 AMLEt restored all the deranged biochemical parameters to normal levels.

In their 2003 study, Lampronti *et al.* conducted preclinical investigations that demonstrated the effectiveness of A. marmelos leaf extracts in inhibiting the growth of diverse cancer cell lines. These included leukemic K562, T-lymphoid Jurkat, B-lymphoid Raji, erythroleukemic HEL, melanoma Colo38, as well as breast cancer cell lines MCF7 and MDA-MB-231.

Costa-Lotufo *et al.* (2005) investigated the anticancer properties of 11 plants commonly employed in Bangladeshi folk medicine. Their findings revealed that among all the extracts tested, only those derived from Oroxylum indicum, *Moringa oleifera*, and Aegle marmelos exhibited significant potential in combating cancer.

Narender *et al.* (2007) elucidated that Aegeline, an alkaloidal-amide compound, was isolated from the leaves of Aegle marmelos. It has been demonstrated to exhibit antihyperglycemic and antidyslipidemic effects in validated animal models of type 2 diabetes mellitus.

Karawya *et al.* (1980) reported that the primary constituents of the leaf extract were identified as tannins, skimmianin, essential oils (predominantly composed of caryophyllene, cineole, citral, citronellal, D-limonene, and eugenol), sterols and/or triterpenoids (comprising lupeol, β- and γ-sitosterol, α- and β-amyrin), flavonoids (particularly rutin), and coumarins (including aegeline, marmesin, and umbelliferone).

Upadhya *et al.* (2004) investigated the utilization of leaf extract in Ayurveda as a treatment for diabetes. Their findings revealed that the extract enhances the body's ability to utilize external glucose by stimulating glucose uptake, akin to the action of insulin.

Kuttan and Sabu (2004) conducted research on the leaf extract of Aegle marmelos in alloxan-induced diabetes. Their study reported that the utilized extract demonstrated significant capability in reducing oxidative stress by scavenging lipid peroxidation and boosting certain antioxidant levels. These effects contributed to the reduction of elevated blood glucose levels.

Arul *et al.* (2005) demonstrated the anti-inflammatory, antipyretic, and analgesic properties of consecutive extracts derived from Aegle marmelos leaves. They found that the majority of the extracts exhibited notable inhibition of carrageenan-induced paw edema and cotton-pellet granuloma in rats. Additionally, the extracts displayed significant analgesic effects by reducing both early and late phases of paw licking in mice. Moreover, most of the extracts also led to a significant decrease in hyperpyrexia in rats.

In 2007, Shankarananth, illustrated that the methanolic extract derived from the leaves of Aegle marmelos exhibited noteworthy analgesic activity at doses of 200 and 300 mg/kg in mice, as evidenced by its effects on acetic acid-induced writhing and the tail flick test.

Veerappan *et al.* (2007) investigated the toxic effects of Aegle marmelos leaves. Their study involved the intraperitoneal administration of extracts of A. marmelos at a dose of 50 mg/kg body weight to rats for 14 consecutive days. Histopathological examinations of the heart, liver, kidney, testis, spleen, and brain revealed no significant changes. Neither gross abnormalities nor histopathological alterations were observed. Additionally, the researchers administered extracts at doses ranging from 50 to 100 mg/kg body weight for 14 days to male and female Wistar rats, without inducing any short-term toxicity.

In a study conducted by Lakshmi (2012), the oral administration of an aqueous extract of Aegle marmelos leaves at a dose of 2000mg/kg body weight in rats did not result in any observable signs of toxicity. There were no recorded mortalities, and animals exhibited no toxic symptoms. Furthermore, neither food nor water intake was reduced throughout the observation period, even at the highest dose administered.

***Mangifera indica* (Mango) leaves:**

Kulkarni and Rathod (2018) conducted a comparative analysis between mangiferin and MLs (Mango leaves) extract to assess the efficacy of each in inhibiting á-glucosidase enzymes. Results showed that MLs extracts at concentrations of 100, 250, and 500 mg/mL led to inhibition of α-glucosidase by up to 77.8%, 83.4%, and 95.7%, respectively. Conversely, mangiferin at concentrations of 10, 25, and 50 demonstrated inhibition percentages of 86.85%, 92.35%, and 99.11%, respectively. These findings suggest that mangiferin exhibits significant activity in inhibiting á-glucosidase enzyme activity, indicating its potential in managing diabetic conditions.

Ramírez (2017) evaluated the effect of MLs (Mango leaves) extracts from the Ubá variety for their anti-obesity activity in male Wistar rats fed with a high-fat diet. Consumption of MLs tea at a concentration of 24.7 mL/day led to increased antioxidant activity and exhibited anti-inflammatory effects. This was evidenced by elevated total antioxidant activity and interleukin-10 concentration, reduced abdominal fat accumulation, enhanced expression of PPAR-γ and lipoprotein lipase, and decreased expression of fatty acid synthase.

De *et al.* (2014) investigated the effects of aqueous extract from young mango leaves on Gram-negative microorganisms associated with gastrointestinal disorders. The authors highlighted the role of phytochemicals present in the crude extract as antidiarrheal agents. The aqueous extract of mango leaves was screened against various pathogens including E. coli, S. typhi, Vibrio cholera, and S. sonnei at dose levels of 300, 200, 100, and 50 mg/mL. It was observed that the antidiarrheal activity increased with higher doses. Therefore, the study concluded that the aqueous extract of young mango leaves could effectively manage diarrhea.

Yakubu *et al.*, in 2015 documented the antidiarrheal effects of the aqueous extract of MLs (Mango leaves) in female albino rats. Their findings revealed that the leaves' sample exhibited a rich composition of phytochemicals, including flavonoids, saponins, phenolics, and alkaloids. Administering doses of 25 and 50 mg/kg body weight resulted in a reduction in the total amount of wet feces and increased reluctance of evacuations. Notably, the MLs extract exhibited prominent antidiarrheal activity at a concentration of 100 mg/kg body weight, effectively preventing the onset of diarrhea. Furthermore, escalating the dose level led to a reduction in both the frequency and volume of intestinal fluid, demonstrating the dose-dependent nature of its antidiarrheal effects.

Zhang *et al.* (2014) conducted a long-term study spanning three consecutive months on Sprague Dawley rats, administering various doses (100, 300, and 900 mg/kg) of MLs (Mango leaves) extract. The study found a slight increase in body weight and higher fat weight, serum thyroglobulin, and cholesterol levels, as well as a slight increase in epididymis weight in male rats compared to the control group. However, no abnormalities were observed in short-term exposure lasting 14 days. The researchers concluded that the MLs extract was safe even at the maximum dose of 18.4 g/kg weight of mice.

Reddemann *et al.* (2019) conducted histopathological examinations which revealed various microscopic lesions in the epididymides, kidneys, livers, skin, or thymus of individual animals. Additionally, several lesions were identified upon examination of mid-dose animals with macroscopic lesions. However, no morphological evidence of degeneration, inflammation, or necrosis was observed in the alimentary system, liver, pancreas, cardiovascular system, immune system,

hematopoietic system, skeleton, muscular system, male and female reproductive system, or the central or peripheral nervous system.

Aderibigbe *et al.*, in 1999 investigated the impact of the aqueous extract of Mangifera indica on glucose-induced hyperglycemia. The study examined the effects when the aqueous extract and glucose were administered simultaneously, as well as when the aqueous extract was administered 60 minutes before the glucose. In both experiments, the aqueous extract significantly reduced the progressively elevated glucose levels, with the effect being statistically significant. The observed time taken for reduction suggests that the absorption of glucose by the intestine may play a significant role.

Islam *et al.* (2010) evaluated analgesic and anti-inflammatory properties, acetic acid induced writhing response model and carrageenan induced paw edema model were used in Swiss albino mice and Wistar albino rats, respectively. In both cases, leaves extract were administered and the obtained effects were compared with commercially available analgesic and anti-inflammatory drug, Diclofenac Sodium. In analgesic bioassay, oral administration of the ethanol leaves extract significantly reduced the writhing response. The degree of inhibition of leaves extract 55.8% compared to the effect of standard analgesic drug ,Diclofenac sodium (75.28%). On the other hand though leaves extract reduce paw edema but they did not show any significant effect.

***Moringa oleifera* (Moringa) leaves:**

Mapiye *et al.* (2010) demonstrated that Moringa leaves contain valuable and nutritious compounds. Of particular interest is the crude protein content, which was measured at 30.3% in this study. While slightly lower than the crude protein content of sunflower seed cake, which stands at 35.88% and is commonly used as a protein concentrate. Moringa leaves still present themselves as a promising source of supplementary protein in animal diets.

Moyo *et al.* (2011) highlighted another intriguing aspect of their results, which was the low percentages of anti-nutritional factors found in the leaves, with their presence being negligible. The study reported a value of 3.12% for condensed tannins, whereas Foidl *et al.* (2001) reported 1.4% of tannins without detecting condensed tannins. Additionally, it was noted that drying can reduce or eliminate extractable condensed tannins by 15 to 30% compared to fresh foliage, as reported by Vitti *et al.* (2005). This reduction in condensed tannins after drying may be attributed to decomplexation between tannins and proteins, as well as depolymerization and oxidation of tannins, as suggested by Makkar (2003).

Brisibe *et al.* (2009) proposed that the dry leaves could function as a supplementary source of protein in both animal and human diets. This protein content holds particular nutritional significance, as it has been suggested that supplementing amino acids is crucial for meeting a significant portion of an animal's protein and energy requirements. Diets abundant in amino acids play a vital role in enhancing the immune system against gastrointestinal parasite infestations, as noted by Kyriazakis and Houdijk (2006). Additionally, proteins are essential for continuously replenishing the endogenous protein lost due to infections with gastrointestinal helminths, as highlighted by Coop and Holmes (1996).

Verma *et al.* (2009) investigated the effects of administering ethyl acetate/polyphenolic extract of *Moringa oleifera* leaves at doses of 50 and 100 mg/kg bw/day for 14 days on markers of oxidative stress in mice treated with CCl4. The study revealed that supplementation with *Moringa oleifera* leaves extract in CCl4-intoxicated rats prevented the increase in lipid peroxide oxidation (LPO) levels, the decrease in glutathione (GSH) concentration, and the reduction in the activities of superoxide dismutase (SOD) and catalase (CAT) antioxidant enzymes in the liver and kidneys compared to the negative control group. Notably, the effects observed in the group treated with 100 mg/kg bw/day of leaves extract were comparable to those obtained in the standard group treated with 50 mg/kg bw/day of vitamin E.

Moringa oleifera stands out as a notable source of vitamin C, with fresh leaves containing approximately 200 mg per 100 g (Ramachandran *et al.*, 1980), a concentration greater than that found in oranges (Salvini *et al.*, 1996). This vitamin C content holds particular significance, as it plays a crucial role in the synthesis and metabolism of various compounds such as tyrosine, folic acid, and tryptophan. Additionally, vitamin C facilitates the hydroxylation of glycine, proline, and lysine, as well as the conversion of cholesterol into bile acids, thereby contributing to lower blood cholesterol levels. Moreover, it aids in the absorption of iron in the gut by converting ferric to ferrous state. Furthermore, vitamin C acts as an antioxidant, shielding the body from the harmful effects

of free radicals, pollutants, and toxins (Chambial *et al.*, 2013).

El Sohaimy (2015) conducted a study to determine the minimum inhibitory concentration (MIC) of *Moringa oleifera* leaf extracts. The results revealed that the MIC for 70% methanol extract was 40 mg/mL, while for 70% ethanol and water extracts, it was 50 mg/mL. These findings indicate that *Moringa oleifera* leaf extracts exhibit a broad spectrum of antimicrobial activity against various bacterial strains and fungi that were examined in the experiment.

Ambi *et al.* (2011) conducted a study to evaluate the safety of *Moringa oleifera* plant in relation to the elements present in its leaves. The elemental analysis of the leaves revealed high levels of calcium (1.29 x 104 ± 500 ppm), potassium (7.2 x 103 ± 600 ppm), sulfur (3.8 x 1014 x 104 ± 500 ppm), iron (4.53 x 102 ± 21 ppm), and chlorine (1.44 x 102 ± ppm). Histopathological examination showed that rats in group III exhibited fatty degenerations in the liver, focal areas of hepatic cell necrosis with mononuclear cellular infiltrations, necrosis of lymphocytes and spleenic blood vessels in the spleen, and neuronal degenerations and necrosis of glial cells in the brain. In contrast, rats in the control group showed no observable microscopic lesions in the mentioned organs.

Sheikh *et al.* (2014) conducted a study to assess the impact of crude leaves from *Moringa oleifera* on arsenic-induced toxicity. The findings of this investigation revealed that treatment with Moringa leaves substantially shielded animals from the harmful effects of arsenic toxicity.

Senna leaves:

Ibrahim and Islam (2014) investigated the antidiabetic potential of *S. singueana* on male Sprague-Dawley mice induced with type 2 diabetes (*in vivo*). The acetone fraction obtained from the alcoholic extract was administered at two different doses (150 and 300 mg/kg body weight). The fraction notably reduced non-fasting blood glucose concentration after 28 days of administration. Moreover, it effectively regulated liver glycogen levels, glucose tolerance, serum insulin concentration, and pancreatic β-cell function in treated mice, with activities more pronounced compared to the control group.

Essien *et al.* (2011) explored the cytotoxic effects of volatile oils derived from Senna alata and Senna occidentalis on Hs 578T and PC-3 human breast tumor cell lines. The oils, along with tingenone (used as a positive control), exhibited dose-dependent cytotoxicity against the cell lines at concentrations of 250 and 100 µg/mL. Notably, at concentrations below 80 µg/mL, there was an increase in the inhibition ratio on cell variability, indicating the cytotoxic nature of the oils.

Gupta *et al.* (2011) reported that the aqueous extract of leaves from *Senna auriculata* (L.) Roxb. reduced blood glucose levels in streptozotocin (STZ) induced diabetic rats. Additionally, Gupta *et al.* (2009c) demonstrated the potential antihyperglycemic effects of the aqueous extract of leaves in mild and severely diabetic rats induced by STZ, administering a dose of 400 mg/kg body weight for 3 weeks. They observed a reduction of 13.9% and 17.4% in fasting blood glucose levels after 5 hours of administration in mild and severely diabetic rats, respectively.

Furthermore, Mohan *et al.* (2011) found that the ethanolic extract of *Senna auriculata* (L.) Roxb. leaves significantly reduced blood glucose levels ($p < 0.05$) at a dose of 150 mg/kg of body weight for 2 weeks in alloxan-induced diabetic rats. These results were compared with those obtained from the standard drug, glibenclamide.

Ahmed *et al.* (2010) investigated the anti-ulcer activity of methanolic extract from *Senna auriculata* (L.) Roxb. leaves at a dose of 300 mg/kg body weight against pylorus ligation-induced gastric ulcers. The results were compared with those obtained from the standard drug famotidine at a dose of 10 mg/kg body weight. The study revealed that the leaf extract of *Senna auriculata* (L.) Roxb. significantly reduced the number of ulcers in pylorus-ligated rats, accompanied by a notable decrease in gastric volume, free and total acidity, and ulcerative index.

Vedavathy and Rao (1991) investigated the antipyretic activity of the fraction of ethanolic extract obtained from *Senna auriculata* (L.) Roxb. leaves and flowers at doses ranging from 250 to 600 mg/kg body weight. The study demonstrated significant antipyretic activity in yeast-induced pyrexia in experimental rats. These effects were found to be comparable to those observed with a standard drug, aspirin.

Chaudhary and Kumar (2014) investigated the anthelmintic activity of methanolic and ethanolic extracts derived from *Senna auriculata* (L.) Roxb. leaves against earthworms at dose levels of 20, 40, and 60 mg/mL. The standard anthelmintic albendazole was used for

comparison. The study revealed that all the extracts exhibited concentration-dependent anthelmintic properties. *Senna auriculata* (L.) Roxb. leaves demonstrated significant effects ($p < 0.05$) at the tested concentrations of 20, 40, and 60 mg/mL, as evidenced by paralysis and death time. Notably, among all the extracts, the methanolic extract at doses of 40 and 60 mg/mL exhibited efficacy comparable to albendazole in inducing paralysis and death of earthworms at all concentrations.

In their study, Gupta *et al.* (2009a) examined the toxicity of the aqueous extract of *Senna auriculata* (L.) Roxb. leaves at doses of 1,000 and 2,000 mg/kg body weight administered orally once daily for a period of 3 weeks. Throughout the entire experimental duration, rats treated with both the 1,000 and 2,000 mg/kg doses of the extract did not exhibit any drug-induced physical signs of toxicity. Additionally, no mortality was observed in any of the treatment groups.

Sabu and Subburaju (2002) conducted an acute toxicity study on the aqueous extract of *Senna auriculata* (L.) Roxb. leaves in normal healthy albino Wistar rats at various doses ranging from 500 to 5,000 mg/kg body weight. Their findings indicated that the extract did not induce any mortality even at the highest dose tested, which was 5,000 mg/kg body weight. Furthermore, the animals did not display any toxic signs such as restlessness, respiratory depression, convulsions, or coma throughout the duration of the study.

Aloe vera leaves:

Okyar *et al.* (2001) demonstrated that Aloe vera leaf pulp extract effectively reduces blood sugar levels in both type I and type II diabetic rats. However, the extract was found to be ineffective in lowering blood sugar levels in non-diabetic rats, unlike glibenclamide. This observation suggests that the mechanisms of action of Aloe vera leaf pulp extract and glibenclamide may differ.

Byeon *et al*. (1988) proposed a hypothesis suggesting that the administration of Aloe vera gel leads to the generation of an antioxidant protein called metallothionein. Metallothionein functions as a scavenger for hydroxy radicals, thereby protecting the skin from oxidative damage. Additionally, Aloe vera gel is believed to release immunosuppressive Interleukin IL-10, which helps prevent UV-induced suppression of delayed-type hypersensitivity. Furthermore, Aloe vera has been reported to possess protective effects on the skin against damage caused by radiation (Roberts and Travis, 1995; Sato *et al.,* 1990).

In a study conducted by Vazquez *et al.* (1996) it was observed that both the aqueous and chloroform extracts of Aloe vera exhibited anti-edema effects. Additionally, these extracts were found to reduce the neutrophil count in the peritoneal cavity. Aloe vera also demonstrated significant anti-inflammatory potential for the treatment of H. pylori infection.

Madan *et al.* (2008) observed a notable increase in the total white blood cell and macrophage count following the administration of Aloe vera extract.

Surjushe *et al*. (2008) conducted studies that revealed the potential benefits of daily ingestion of Aloe vera in preventing and regressing arthritis. Additionally, Aloe gel was found to alleviate pain associated with tendinitis and injuries. When applied topically to the affected area, Aloe vera penetrates the skin to provide pain relief. Furthermore, Aloe vera acts as a biological vehicle, aiding in the penetration and absorption of other bioactive ingredients into deep tissue. Aloe vera contains six antiseptic agents, including lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols, and sulfur, all of which exhibit inhibitory effects on fungi, bacteria, and viruses.

Hamman *et al.* (2008) highlighted that Aloe vera gel possesses the capability to either cure gastric ulcers or prevent their formation in both animals and humans. The anti-ulcer properties of Aloe vera have been associated with various mechanisms, including its anti-inflammatory effects, healing properties, stimulation of mucus production, regulation of gastric secretions, and the presence of lectins. Specifically, lectins inhibit aminopyrine uptake by parietal cells, which may contribute to the inhibition of gastric acid output, possibly through a direct action on acid-producing cells (Bhuvana *et al.,* 2014).

Kaparakou *et al*. (2021) conducted toxicity estimation using the Microtoxanalyzer, which revealed that Aloe vera gel samples exhibited a toxic effect on Aliivibriofischeri. However, the study also discovered that low concentrations of aloin A (1µg/mL and 10µg/mL) provided protection to cells from hydrogen peroxide-induced toxicity.

Nalimu *et al.* (2022) found that the whole leaf and green rind extracts of Aloe vera are generally regarded as practically non-toxic for single doses or short-duration administration, with an estimated LD50 above 5000 mg/

kg. However, their sub-acute oral toxicity study revealed potential kidney toxicity associated with long-term use at high doses. Therefore, individuals consuming Aloe vera drinks daily should exercise caution and undergo regular kidney function tests for monitoring purposes.

In this study, F344/N rats and B6C3F1 mice were exposed to 0, 1%, 2%, or 3% (wt/wt) extract for a period of 13 weeks or 2 years. The 13-week exposure caused increased incidences of goblet cell hyperplasia in the large intestine of both rats and mice when compared to the control. The two-year study demonstrated significant dose-related increases in the incidences of adenomas and/or carcinomas of the ileocecal and cecal-colic junction, cecum, and the ascending and transverse colon in male and female rats in the high dose groups (Reddeman *et al.*, 2019).

Conclusion:

This review underscores the significance of medicinal leaves (Bael leaves, Mango leaves, Moringa leaves, Senna leaves, Aloe vera leaves) as a valuable source of bioactive compounds with therapeutic potential. By shedding light on their pharmacological properties, this synthesis contributes to the growing body of knowledge aimed at harnessing the medicinal value of plants for the treatment and management of various health conditions. However, further research is warranted to fully elucidate their mechanisms of action, optimize therapeutic efficacy, and ensure their safe and effective use in clinical practice.

Overall, the comparative analysis highlights the unique attributes of Aegle marmelos leaves while also recognizing the shared therapeutic potential among various medicinal leaves. A comprehensive conclusion would affirm that the non-toxic effects of Aegle marmelos leaves, as demonstrated through rigorous experimentation, distinguish them favorably from certain other leaves, thereby advocating for their safe usage and further exploration in various domains.

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