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Unveiling the Healing Potential of Lawsonia inermis: A Review of Its Chemistry and Pharmacological Actions

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Abstract

Plants have long served as vital sources of nutrition, traditional remedies, and environmental sustainability. Unlike synthetic drugs, plant-based therapies are generally associated with fewer side effects and exhibit synergistic therapeutic potential. Around 80% of people on the planet get their primary medical care from medicinal plants. Lawsonia inermis, also referred to as henna or mehndi, is widely used for both cosmetic and therapeutic purposes in tropical and subtropical areas. Growing for its medicinal roots, bark, leaves, flowers, and seeds, L. inermis is a tiny tree or shrub that has long been used as a natural skin and hair colour in South Asian nations like India and Pakistan. Its secondary metabolites include tannins, terpenoids, coumarins, and other bioactive substances, whereas its primary metabolites are proteins, carbs, and fatty acids. These constituents contribute to the plant's broad pharmacological activities, including analgesic, anti-inflammatory, hepatoprotective, hypoglycemic, antibacterial, antifungal, immunomodulatory, antioxidant, and cytotoxic effects. Owing to these diverse properties, L. inermis holds significant potential as a natural therapeutic agent against various diseases and infections. This review presents a comprehensive analysis of the phytochemistry, pharmacological activities, and traditional applications of L. inermis.

Keywords: Lawsonia inermis, Henna, Medicinal plants, Phytochemistry, Pharmacological activities, Antimicrobial

Introduction

For many years, healing systems have been used for valuable purposes to maintain human health and improve human society (e.g., remedies, spices, drinks, cosmetics, dyes, etc.). (Alamgir et al.,2017). In Alamgir A.N.'s 2017 book *Therapeutic Use of Medicinal Plants and Their Extracts*, biological pesticides, plants that produce colors and hues, secondary metabolites, medicinal and non-medicinal plants, and active pharmaceutical chemicals are all comprehensively covered. In traditional and complementary and alternative medicine (CAM) systems including Eastern Medicine, Ayurveda, Homeopathy, and Unani medicine, the book explores the scientific, cultural, and historical value of medicinal plants. The study of pharmacognosy and pharmaceutical sciences greatly benefits from this discipline. Because it is one of these systems, it has long been recognized for its versatile medical properties. Henna plants (Lawsonia inermis) are currently the focus of important scientific research. The fact that henna can prevent microorganism growth indicates it is useful when treating burning wound infections.(Naseri et al.,2021) Over 3,000 plant species are used as traditional medicines in India, with many therapeutic benefits. Early works in Chinese, Unani, Ayurvedic and Siddha medicine include extensive knowledge of medicinal plants and their benefits.(Wu et al.,2021) In ancient Indian history, L. Inermis was used for a variety of purposes and played an important role in Ayurvedic or natural herbal agents. The aim of the current study was to identify and confirm the numerous properties of Lawson that allow for the Miss Plant, also known temporarily as henna.(Miczak et al.,2001)

Botanical description

This plant has several branches and is a small tree or shrub that grows to a height of 2.6 meters. 1.3 3.2 cm or oval lanceolate leaves of this plant. White or pink flowers are used as fragrant ingredients. The pedelis is thin and is less than 1.3 cm long. (Sood et al.,2010)The cup flap length is 2.5 mm and is wavy in the form of suborbital or sub-vesicles. The length of the Holy Grail is 3-5 mm and is generally campanori oxidized. Eight stamens are brought to the goblin. The capsule is spherical, has a diameter of 6 mm, and has weak veins from the outside. Pea shape and spherical red seed capsules. The seeds are pyramidal, rich and brown.(Rubatzky et al.,1997)

Geographical Distribution

It is often grown in tropical regions around the world that require South Asia, North and East Africa, the Arabian Peninsula and northern Australia in the south.(Chang et al.,1968) It is generally considered from Africa and is cultivated in India, Pakistan and Sri Lanka, but Egypt, Ethiopia, Somalia, Sudan, Burkina Faso, Gambia, Ghana, Guinea, Mali, Nigeria, Senegal, Sierra, Sierra, Satuga

Chemical Constituents

Among the chemical constituents of napsoquinone derivative derivatives, it isopranbazine lausone (henotano acid), phenolic substance searching molposis and phenolic substance searching as riosides, terpenoids search for terpenoids such as henadiol and lupeol, sterol waritol A, and aliposhostes. Acids, glucose, galic acid, and amino acids are some of the chemical constituents of apigenin-7-glucoside, essential oil (Z)-2-hexenol and linalol. (López et al.,2014)Urinary disorders, herpes infections, hysteria, neuropathy, bleeding disorders, pulgo - eye disease, syphilis, wounds, painful eyes, mild corn, amenorrhea, GO disease, liver disease, deurgitation. and syphilis. It's not only inflammation and swelling, but also leaf paste is the advantage when applying the soles of the hands and feet. The leaves can be used to make ointments that can be applied to ulcers, tumours, and wounds. WATH is susceptible to the antibacterial properties of Omani henna. Hab Barrett Al of Bauch: Staphylococcus aureus, E. coli, and P. aeruginosa. According to an alternative study by Christy et al. Tlawsonia inermis drupe and ethanol extracts represent potentially preferred sources of non-made proxies. According to Mansour et alresearch, L. L. Inermi's verticality has a comfortable impact on the opposition to Trichophyton -mentamglophyte and Candida Albicans. (Streeter et al.,2015)Leaf samples from L. inermis were soaked in water but were tested for eight important Aspergillus species from rice fields, sorghum and substance examples. The anti-inflammatory properties of shrubs are due to their remarkable sensitivity to rinsing extracts from ethanol, ether, chloroform, methanol, benzene and gasoline. Complex healing in rats was measured using ethanol citations from L. InMiss. The L. Inermis meeting, effectively maintained at Ethanol, showed an increase in collagen and an increase in compensation clothing.(Luparello et al.,2020) Overview of L. inermis (Tintvegetal) - Created with H2O and anesthetics that cause explosive crazy people, in contrast to bacterial development. When ethanol is used to cite L. operators, the healing process of research creatures moves faster than rheostat creatures. It was conducted in vitro studies to stimulate immunomodulation. After spreading in L. Inermis Shrub, L. Inermis Shrub. One of her results was particularly good in combating oxidation and allowing for a wide range of obstacles to henna extracts .(Semwal et al.,2014)

Antioxidant stimulation

Al-Snafi AE (2019) emphasized in their review the traditional and therapeutic relevance of *Lawsonia inermis* (henna). Among the several bioactive substances believed to be involved in the plant's therapeutic qualities are lawsone, flavonoids, tannins, and phenolic compounds. *L. inermis* has long been used for wound, skin, and hair healing. It also has anti-inflammatory, antibacterial, antioxidant, analgesic, and antidiabetic properties. Its extracts have shown remarkable efficacy against bacterial and fungal infections. The study not only emphasizes the plant's medicinal potential but also recommends more pharmacological and clinical studies to confirm the plant's safety and effectiveness for use in medicine. All things considered, *L. inermis* is promoted as a useful plant for herbal therapy. After numerous studies, L. Inermis extracts have antioxidant properties. All remaining carbon chloride liver. Recent studies on ethylacetic acid extracts by L. (Al-Snafi et al.,2019)inMIS leaves show that there is a large degree of hypersensitivity to liver melomerism, and an increase in enzyme substances that prevent carbon chloride and an increase in enzyme substances that prevent carbon chloride with additional needles. L. inermis-sanol and methanol fractions also increased the measured microorganisms that rapidly prevent hexchromium. Compared to the control group, the dose of 500 mg/kg was antimicrobial efficacy, providing a provisional incubation period ($p>0.002$) (Marra et al.,2012) for diarrhea episodes. From the beginning of pregnancy to day 17, pregnant mice were given

intraperitoneal injections of 1 mg/kg and 10 mg/kg BW of the oily alcohol extract of Ladesonia inermi. In mice, rats, and guinea pigs, methanol extracts demonstrated a dose-dependent action to cause abortion. I witnessed it. Aspirin-induced ulcers were dramatically reduced by chloroform extract in a dose-dependent manner.Results show that gastric acid excretion, free acid, overall acid, and Urcos index were significantly reduced by water, ethanol and chloroform .(Ahmed et al..,2022)

Effects of diabetes and hyperlipidemia

The effects of diabetes and hyperlipidemia in diabetic mice produced by alloxane were investigated for the effects of 70% ethanol extracts by Lawsonia inMIS on glucose, total cholesterol and triglyceride levels.(Abdillah et al.,2008).The findings indicate that after feeding the extract at a rate of 0.8 g/kg body weight for 14 days, the 194 mg/dL glucose levels returned to normal. The total cholesterol's triglyceride level decreased from 225.7 mg/dL to 76.9 mg/dL to 148.9 mg/dL to 55.3 mg/dL.(Huang et al.,2024). Anti-UR tract effect. Hydroethanolic extracts against stones from calcium oxalate types demonstrated significant anti-wood efficacy. We changed the mirrors of calcium, phosphorus, magnesium, total protein in urine, urine volume, urineuria, serum urea, urea nitrogen, uric acid, creatinine, and kidney weight. oral). Both leaf extracts produced considerable diuretics, while the ethanol extract was more active than the aqueous extract. Rats treated with LONERS produced 7.3 or 9.0 mL volumes, 4.6 or 6.1 mL urine volumes at low and high doses, treated with Emermis Lawsonia extracts. Rats treated with aqueous extracts were treated with ethanol extracts at 120.5, 7.5 and 147.5 at high dose concentrations of 127.8, 73.60, 73.60, and 155.6 MEQ/L, at Na+, K+ of 113.8, 66.60, and 127.3 MEQ/L, and at 155.5 concentrations of 155.5 at clinical concentrations. We also showed 147.5, meq, meq, 147.5, 147.5, and meq and meq -mes -mek, meq and meq and mek and mek and mek and mek and mek - ratre. At high doses .(Vanova et al.,2017) Both produced effective chemical effects due to their ability to reduce oxidative stress and reduce cell growth receptor SST, octreotide therapy, and methanol extracts from Lonian-Immis . Mice with honest ascites tumors were tested for the efficacy of Lawsonia inermis against cancer. Administration of Lawsonia inermis (10 mg/kg BW) increased intermediate survival in tumor-containing mice.(Wei et al.,2015) Furthermore, Lawsonia inermis significantly reduced the total number of tumor cells. The diameter of the adhesive tumor mass on day 12 was greater than that of animals with water with Lawsonia emermis extract . (mg/kg). The dose of the system extracts showed dose-dependent liver analysis as demonstrated by significant acceptance of branches, ALP, ALP, bilirubin serum mirrors (P>0.05) and improvement of tissue liver division compared to rats shown with CCL4. CCL4-induced hepatotoxicity in mice was used to assess the hepatoprotective effect of ethanol extracts of dry leaves of Inermis-Lawsonia and their raw destruction (petroleum, ethyl acetate, butanone cross-section). Control, ethanol extract and its broken SGOT, SGPT, respect, overall image density, compared to liver weight .(Kalra et al.,2021)

Anti-inflammatory, analgesic, and anti-echoic

Anti-inflammatory, analgesic, and anti-echoic mouse models of acetic acid induction were used. Chemically produced nociceptive pain stimuli were significantly weakened by methanoly blade extract (P>0.01) .(Intahphuak et al.,2010). Intahphuak et al. (2010) investigated the anti-inflammatory, analgesic, and antipyretic properties of virgin coconut oil (VCO) using animal models. VCO significantly decreased fever in Brewer's yeast-induced pyrexia, significantly reduced inflammation in carrageenan-induced paw edema, and had significant analgesic effects in acetic acid-induced writhing and hot plate tests. The pharmacological effects were believed to be caused by polyphenolic compounds and medium-chain fatty acids. These findings support VCO's traditional use in the treatment of pain, inflammation, and fever and suggest that it may have potential as a natural medication. Further research is recommended to elucidate its mechanisms and therapeutic benefits. Leosanol extracts from Lawsonia inerermis (0.25 g/kg to 2.0 g/kg) are inflammatory and depend on inflammation, pain and lower body temperature in rats. It is most effective in analgesic test (500 mg/kg) with chloroform and butanol fractions of anti-inflammatory, analgesic and analgesic properties that are more important than raw wood. A pure substance (2-hydroxy-1,4-naphthocaltinone, also known as runes) with excellent anti-inflammatory, analgesic, and anti-ticlera effects was extracted from chloroform extracts. Lawon (500 mg/kg) had an anti-inflammatory effect comparable to phenylbutazone (100 mg/kg) in terms of significance . (Abdulhamid et al.,2022)Extracts at concentrations of 100 mg/kg IP lengthened the duration spent on light use in comparison to control rats. In the test parade, the lighting compartments received a lot more entries than the dark ones. This suggests a decline in fear-based behaviour. (Montgomery et al.,1995). Impact of acute and continuous administration of Lawsonia inermis-blatt extract (100 mg/kg, 200 mg/kg, and 400 mm/kg) on "albino mouse catalepsy (1

mg/kg)" as an animal model of Parkinson's disease (PD) against polarised light (1 mg/kg, IP) in the Albino-Mouse category as an Albino-Mouse catalepsy (1 mg/kg) as an animal model of Parkinson's disease (PD) as an Albino-Mouse catalepsy (1 mg/kg) as an Albino-Mouse catala pleasure model. Chronic administration at a dose of 400 mg/kg BW extract resulted in the largest reduction and a considerable rise in SOD activity. (Sharma et al.,2009)Three concentrations of Lawsonia inerermis are recommended to rinse in 63 infusion patients (50,000 g/ml, 10,000 g/ml and 5,000 g/ml), with a 0.1% witch solution and placebo. The bleeding index reduced the reduction above Wikigin at a concentration of 10,000 g/mL with Lawson exposure . (Landefeld et al.,1989)In vitro-Antipara was performed in vitro Antara by drug testing of polar, non-polar, and alkaloid extracts from different sections of these species. Activities against leishmaniasis, trypanosomiasis, malaria, Hermantiasis, and sysis have been identified. L. inermis was one of the plants of choice, and his leaves exhibited possible immaterial properties .(Singh et al.,2015)

Effects on Skin Bacteria

All of these extracts showed antibacterial effects in vitro .(Al-Mariri et al.,2014)Exustus seed powders, including leaves and bark, were poisonous. Deodara oil and henna seed powder were tested against both snails, and the results showed that they were 1:1 effective against L. acuminata and I., C. Additionally, neem oil combinations were riskier than other combinations and individual components..(Boeke et al.,2004)Treatment frequently helps to improve the sickness. Parasite families and packed cell volumes, however, remained unaffected. Additionally, the development of infections resistant to contemporary medication therapy has presented significant challenges recently (Huh et al.,2011). Therefore, in treating infectious diseases that affect human society, herbal therapies are a helpful supplement to modern drugs. By examining a substantial amount of literature, the research of L. inermis offers a wide variety of pharmacological factors. This implies that it can be used as a natural remedy tool (Kunle et al.,2012)

Toxicity, Safety, and Future Perspectives

Henna, has stretched beyond traditional application in cosmetic, cultural, and medical therapies. A toxicity sensitivity, security profile, and probability of future development of application are needed to prevent safe handling and control of existing therapeutic technology. Leaves of the plant contain a variety of bioactive compounds, some of which are lawsone (2-hydroxy-1,4-naphthoquinone), which is responsible for its color property and most of the biological activity. Although the uses like coloring and transitory body paint are reportedly safe, their overuse or improper application is a health hazard. Laurons induce oxidative stress to red blood cells and hemolysis in such individuals. The child and the child both got fulminant anemia on local application of henna. Directions for proper use and public health education on G6PD deficiency are henceforth very crucial. Dermatitis, inflammation of the skin, and hypersensitivity reaction were felt for additive-contained pseudohenna like paraphenyldialine (PPD). PPD will be combined with commercially applied black henna in an attempt to achieve dark, long-lasting, and permanent points but is a highly dangerous allergen and may lead to thick bubbles on the skin, scarring, and even systemic toxicity. Thus, henna in its natural, pure state without any artificial ingredients is highly recommended to be used to provide the least possibility of allergy. Standardization, quality control, and labeling of henna products are important steps towards consumer protection. Training and coordination of organizations in the public and cosmetic fields by research organizations and health departments must be carried out for facilitating safe preparation and use of henna products. Additional pharmacological investigations have opened avenues to determine antibiotic, anti-inflammatory, antioxidant, anticancer, and wound-healing activity. Ethical utilization of such benefits includes standardization of the extracts, extensive in vivo and clinical studies to determine zones of safe use, and prevention of toxicities. Advances in biotechnology also result in the production of high-quality, standardized henna extracts with reproducible findings with respect to phytochemical contents. Scientific study and strict security measures can guarantee that this valuable system becomes a handy, secure, and sustainable instrument for traditional and conventional medicine in the long term (Abd-El-Haleem., 2023).

Conclusion

This system has a variety of plant devices that can help treat many diseases in different locations. Additionally, thorough testing is required to determine the therapeutic benefits of various disorders. Plant L. inermis can provide detailed evidence for using this system with a variety of drugs. Scientific research on the important biological properties of extracts deserves special considerations of scientists and researchers for the development of scientists and researchers. L. However, investigation into the unused potential of Inermis and its medical use requires additional research to improve human wells. Additionally, clinical research on this system is needed.

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