

**ETHANOMEDICINAL USES AND PHARMACOLOGICAL
EVALUATION OF AVERRHOA BILIMBI LINN.**

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ABSTRACT

Averrhoa bilimbi Linn. is a tropical medicinal plant widely cultivated in many tropical and subtropical regions due to its therapeutic potential. Traditionally, different parts of the plant have been used in the management of diabetes mellitus, hypertension, microbial infections, and several other health conditions. The present review aims to provide a comprehensive overview of the ethnomedicinal uses, phytochemical constituents, and pharmacological properties of A. bilimbi by correlating traditional knowledge with available scientific evidence. Information was compiled from peer-reviewed publications indexed in scientific databases such as PubMed, Medline, EMBASE, and ScienceDirect, with emphasis on studies published between 1995 and 2015. Experimental investigations have demonstrated that A. bilimbi possesses a broad spectrum of biological activities, including antidiabetic, antihypertensive, antimicrobial, antioxidant, hepatoprotective, hypolipidemic, and thrombolytic effects. These findings support its traditional use and highlight its significance as a promising source of bioactive phytochemicals for complementary and alternative medicine. Despite extensive pharmacological research, the specific compounds responsible for many of these therapeutic effects have not yet been fully isolated or characterized. Further studies employing advanced phytochemical and molecular techniques are therefore warranted to identify the active constituents, elucidate their mechanisms of action, and establish their

clinical efficacy and safety. This study highlights the promise of *A. bilimbi* for future drug discovery and development while consolidating the present understanding of the organism.

KEYWORDS: *Averrhoa bilimbi* Linn.; Ethnomedicinal uses; Phytochemical constituents; Pharmacological activities; Bioactive compounds; Therapeutic potential.

INTRODUCTION

Plants have been utilized as medicine for thousands of years (Samuelsson, 2004). These medicines initially took the form of crude drugs such as tinctures, teas, poultices, powders and other herbal formulations (Balick and Cox 1997; Samuelsson 2004). Oral tradition was utilized to transmit the specific plants to be used and the application techniques for specific illnesses.. Eventually information regarding medicinal plants was recorded in herbal pharmacopoeias. Modern allopathic medicines has its roots in ancient medicine, and it is likely that many important new remedies will be discovered and commercialized in the future, as it has till now, by following the leads provided by traditional knowledge and experiences . There are many reports on various aspects of fruits of *Averrhoa bilimbi* such as pharmacognostic studies, antimicrobial activity, antipuritic, antipyretic, antihelminthic properties etc.



Figure 1: Averrhoa bilimbi leaves.

Plant Profile of *Averrhoa bilimbi*.

Scientific name	<i>Averrhoa bilimbi</i> L.
Common name	Bilimbi
Family	Oxalidaceae
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Oxalidales
Genus	<i>Averrhoa</i>
Species	<i>Averrhoa bilimbi</i> L.

ETHNOMEDICINAL USES

Averrhoa bilimbi has been widely utilized in traditional medicine for the management of various ailments. Leaf infusions and decoctions are traditionally used for their antibacterial, antiscorbutic, and astringent properties, as well as for postpartum care and the treatment of fever, rectal inflammation, and diabetes. Leaf paste is applied topically to relieve itching, boils, skin eruptions, bites from poisonous creatures, rheumatism, cough, cold, mumps, and syphilis. The grated fruit, mixed with a small amount of salt, is commonly used as a facial application for acne. Additionally, the fruit juice has been traditionally employed to treat scurvy, bilious colic, whooping cough, hypertension, obesity, and diabetes.

Pharmacological Activities of *Averrhoa bilimbi* L.

- **Antimicrobial Properties:** Leaf, fruit, and root extracts of *Averrhoa bilimbi* L. exhibit broad-spectrum antimicrobial activity against Gram-positive bacteria, Gram-negative bacteria, fungi, and *Mycobacterium tuberculosis*. Ethanolic leaf extract has demonstrated significant activity against *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus cereus*, *Staphylococcus aureus*, and *Candida albicans*. The plant also possesses potential as a natural food decontaminant by reducing microbial contamination.
- **Antidiabetic Activity:** Leaf extracts of *Averrhoa bilimbi* L. have been reported to significantly reduce blood glucose levels in streptozotocin-induced diabetic rats by improving glucose tolerance and insulin secretion. The extracts also inhibit α -glucosidase activity, reduce oxidative stress, and exhibit hypolipidemic effects comparable to metformin in experimental studies.
- **Anti-inflammatory Properties:** Methanolic leaf extract of *Averrhoa bilimbi* L. demonstrates significant anti-inflammatory and analgesic effects in animal models. The

observed activity has been reported to be comparable to standard drugs such as ibuprofen and diclofenac.

- **Antihypertensive Properties:** *Averrhoa bilimbi* L. has traditionally been used for the management of hypertension. Experimental studies have demonstrated that its leaf extract possesses blood pressure-lowering activity, which may be associated with a reduction in cardiac contractility.
- **Hepatoprotective Properties:** Leaf and fruit extracts of *Averrhoa bilimbi* L. exhibit hepatoprotective activity against chemically induced liver damage. The extracts reduce elevated serum liver enzyme levels and help prevent oxidative stress in experimental animals.
- **Antiulcer Properties:** Fruit extract of *Averrhoa bilimbi* L. has demonstrated protective effects in experimental models of ulcerative colitis. The activity is associated with a reduction in inflammatory mediators and enhancement of antioxidant defenses, thereby reducing inflammation and tissue damage.
- **Anticancer Properties:** Leaf and fruit extracts of *Averrhoa bilimbi* L. exhibit cytotoxic and antiproliferative activities against various cancer cell lines, including breast cancer cells. These findings indicate the potential of the plant as a source of bioactive compounds with anticancer properties.
- **Wound Healing Properties:** Topical application of 10% ethanolic leaf extract of *Averrhoa bilimbi* L. has been reported to accelerate gingival wound healing. The activity is associated with increased fibroblast proliferation and enhanced tissue regeneration.
- **Other Pharmacological Properties:** In addition to the above-mentioned activities, *Averrhoa bilimbi* L. has been reported to possess antioxidant, anticoagulant, thrombolytic, hypolipidemic, cholesterol-lowering, and antifertility activities, demonstrating its broad therapeutic potential.

CONCLUSION

A. bilimbi is an important medicinal plant used in traditional medicine for the treatment of various ailments and in maintaining good health and well-being. Extensive pharmacological research conducted over the years have proven the scientific bases for the therapeutic uses of *A. bilimbi*'s leaves and fruits in the treatment of several diseases including DM, hypertension, and microbial infections. In contrast to several pharmacological investigations, few preliminary phytochemical studies have been reported on this plant and the compounds identified so far are mainly volatile oils, fatty acids, and long-chain hydrocarbons with weak medicinal value. Despite the beneficial use of *A. bilimbi* in complimentary medicine and its

scientifically proven pharmacological activities, there is a paucity of information on the bioactive compounds present in this plant. Given its interesting pharmacological profile, there is an urgent need to identify and isolate the bioactive constituents of this plant responsible for various biological activities. Isolation and characterization of bioactive compounds of different parts of *A. bilimbi* will provide an insight into the biochemical mechanism of action of this plant. Knowledge of bioactive constituents will provide the bases for developing a new drug from the plant either as a pure compound or standardized extracts using advanced and sophisticated technology. The pure compounds exhibiting different pharmacological effects may also serve as lead for future drug development.

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