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A Review on Medicinal Plant Haritaki and It's Pharmacology

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Abstract: *Haritaki, an esteemed Indian herbal species, is known for its widespread recognition as a deciduous tree type.A crucial part in shaping many Ayurvedic remedies. Originating material for botany purposes.Terminalia chebula, also known by its common name of Chebulic Myrobalan, is haritaki. The haritaki fruit comes in quantities of five units. Except for salt, rasna's post-digestive taste turns out sweet. Upharayam (powerfulness) corresponds to Ushaanam (heat). Thanks to possessing such qualities, this species exhibits diverse functions.Pharmaceutical effects including rejuvenation techniques like rasayana, cognitive enhancement through medhya therapies, and digestive stimulants known as deepana. Aamapanchan aids in detoxifying ama or metabolic waste through srotashuddhi - cleansing of bodily channels.Through eliminating bodily toxins. The tree thrives in areas below the Himalayas.Running eastward from Ravi through western regions like West Bengal, Assam, extending into the vast deciduous forest areas across India.In particular, these states include Madhya Pradesh, Bihar, Assam, and Maharashtra. The species Terminalia chebula refers to. A unique plant renowned for its array of medicinal qualities, such as reducing inflammation. antiviral, antimicrobial, cardioprotective, antiprotozoal, antioxidant, anticancer, and digestive Advantages. Furthermore, this plant offers benefits beyond its practical uses; it also boasts skincare properties like those promoting youthful appearance on the skin.Brightening, minimization of under-eye discoloration, suppression of hyperpigmentation, skincare enhancement, and protection against aging.The issue of baldness. The t. chebulia plant and its bioactive compounds show medicinal properties without side effects.Linked adverse effects. Additionally, t. chebula plays an important role as a crucial component of this highly esteemed medicinal herb mixture.Triphala formulation, used in managing enlarged livers and digestive issues, serves as an effective remedy and ocular pain.*

Keywords: Haritaki(Terminalia chebula), Phytochemistry, Pharmacological Activity, Clinical studies, Safety Evaluation

I. INTRODUCTION

The WHO reports that roughly two-thirds of people living in underdeveloped regions depend on herbal remedies for basic medical care.Ancient healing practices like Ayurvedic medicine, Sidahe therapy, and Unani system focus on using herbal remedies for health care [1]. The use of herbs is on the rise globally, especially among nations at various stages of. development, thanks to their broad range of health benefits, improved safety profiles, and lower costs. The terminalia chebula belongs to the genus Terminalia within the combretaceae family, also referred to by its common name of black myrobalan in English. Other common terms for this plant include Haritaki in Sanskrit and Bengali, Harad in Hindi, Karkchettu in Telugu, Kadukkaya in Tamil, Harada in Marathi, and Gujarati. This particular group originates in the southern regions of India and its neighboring territories such as Pakistan, Nepal, and southwestern portions of China, reaching down into southeastern India up to states like Kerala and occasionally touching on Sri Lanka, commonly referred to there as Aralu. [2]. More recent research indicates that components within haritaki include both medicinal substances and chemicals. Haritaki contains key compounds such as chebulic acid, gallic acid, corilagin, ellagic acid, chebulagic acid, chebulinic acid, tetraterpene derivatives, and anthrones. The research examines T. chebula across ancient and modern texts, concentrating on its medicinal properties. [3].

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Geographic Distribution and Habitat -

T. Chebula is an evergreen tree shedding its foliage annually; it typically attains moderate to substantial dimensions, growing as high as three dozen feet while boasting trunks ranging between one foot wide at their base to about half this measurement towards the top. Five metres. Leaves take on an oval form, measuring between ten and thirty centimeters in length, featuring a pointed end and a rounded bottom shape. Leaves possess six to eight distinct vein configurations. Flowers possess slender stalks; they exhibit both masculine and feminine characteristics within the same specimen; their hue ranges between pale whites and yellows, accompanied by an overpowering odor. Often located as isolated pairs near tree ends or grouped together briefly. The fruit is oblong in shape and resembles a stone pit; it measures approximately three to six centimeters in length and about an inch across. A ratio of three to one is being referred to here. A five-centimeter-wide object featuring a yellow-green hue contains a solitary elliptical kernel within it. The species T. chebula thrives across various soils, encompassing both loamy and shady environments. Several species thrive up to an elevation range of approximately 2 kilometers over sea level, where yearly precipitation falls within the span of about 1 meter to 1. 5 meters per year, along with average air temperature fluctuating between roughly -3 degrees Fahrenheit and +6 degrees Celsius. Its presence extends across numerous regions within India, starting at the eastern end near the Ravi River all the way southward into West Bengal and Assam; it also reaches heights exceeding 1500 meters in the Himalayan mountains. Additionally, its distribution includes areas such as Bihar, Odisha, Madhya Pradesh, Maharashtra, the Deccan Plateau, and southern India [1].

Taxonomy of Haritaki [5] -

Botanical Classification:

Botanical Name: Terminalia chebula Retz.
Family: Combretaceae
Kingdom: Plantae
Division: Phanerogams
Subkingdom: Angiosperms
Class: Monocotyledons
Subclass: Epigynae
Order: Scytaminialea
Genus: Terminalia
Species: T. chebula Retz.

Morphology of Haritaki

that is a reasonably sized deciduous tree that reaches a top of 25 to 30 meters.

Leaf:

The leaf buds, branchlets, and the youngest leaves are gentle, smooth, and generally included with rust-colored hairs[6].

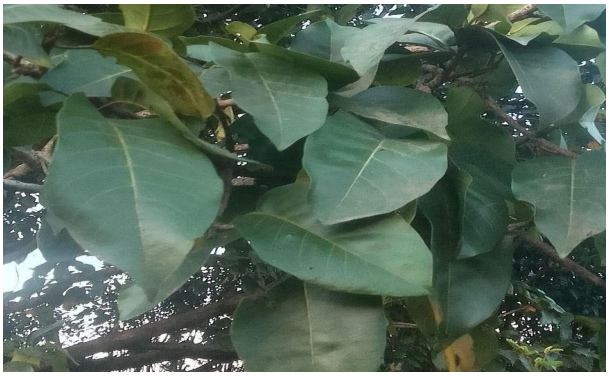

Figure 1 :-Haritaki Leaf

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Flowers

characterized by short stalks and being dioecious in nature. Displaying hues transitioning from dark ivory through mustard yellow. Their strong, disagreeable aroma is characterized by dense spike formations resembling genuine terminal spines or short clusters of flowers [7].

Figure 2 :- Haritaki flowers.

Bark

The bark measures six millimeters in thickness; it is predominantly dark brown in coloration, characterized by several relatively shallow vertical cracks Certainly. Wood exhibits exceptional hardness; it displays an olive-brown tint encircled by either a bluish-green or yellow border.Marked by its distinctive feature of unevenly distributed, diminutive purplish-brown heartwood which exhibits pronounced grain patterns [8].

Figure 3 :- Haritaki Bark

Fruits

The fruit exhibits an appearance marked by its golden hue, elongated form, and distinctively arranged five segments along each axis.Ridges measure roughly between two and four centimeters in length and about one and a half inches wide. A measurement of five centimeters wide. Large fruits are considered precious commodities. As fruits reach maturity, they develop into ellipsoidal forms typically measuring between 25 and 38 millimeters in size. However, undeveloped fruit appears dehydrated, dark in color, egg-shaped, and has an abrasive feel [9].

Figure 4 :- Haritaki dried fruits

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Seeds

The seeds possess a protective, smooth exterior of yellowish-brown coloration; they exhibit a spherical form ranging between approximately two and six centimeters in diameter, often tapering towards their bases while maintaining a vague five-to-six sided outline, accompanied by a coarse, bumpy surface characteristic of their nature [3].

Propagation, Planting and Harvesting -

Frequently, plants propagate through seedling cultivation rather than being directly sourced from existing trees. Initially, all the decaying produce undergoes thorough dehydration. Next, the resilient skin layer is eliminated. The optimal outcome is achieved through fermentation of the rocks; nonetheless, successfully removing the wider part while preserving the seed's core, then immersing it in chilled water for thirty-six hours yields satisfactory results as well. Seeds frequently find their way into containers or nurseries during early springs or right as monsoons approach, then buried under earth and kept well hydrated. [10]. After approximately 15 days, germination begins, lasting between three and four weeks. One method for planting trees involves direct seeding of seeds into soil; another entails growing sapling plants in nurseries before transplantation outdoors; still others propagate through cutting branches as new shoots. Transplanting first-year saplings yields superior growth compared to cutting techniques or direct seeding methods. Offering accommodation proves beneficial for young plants in their infancy and when being transplanted later on. In summary, the plant exhibits relatively sluggish growth. [5].

Chemical Composition

The components consist of a coumarin associated with gallic acids, referred to as chebulin, in addition to a variety of other phenolic substances such as ellagic acid, 2,4-chebulyl-β-D-glucopyranose, chebulinic acid, Chebulic acid, gallic acid, Gallic Acid, ethyl gallate, punicalagin, terflavi A, terchebin, luteolin, and tannic acid [10]. Research results have shown the existence of phytochemicals, which include anthraquinones, sennoside, terpinenes, and terpinenols [1].

Components	Content (µg/g)
Chebulic acid	34582.7 ± 1,656.2
Gallic acid	23144.9 ± 183.6
Protocatechuic acid	268.5 ± 28.1
Chebulinic acid	62357.3 ± 1,483.1
Corilagin	13784.9 ± 264.2
Chebulagic acid	47033.7 ± 2,859.2
1,2,3,4,6-O-pentagalloylglucose	2,233.6 ± 231.2
Ellagic acid	14195.2 ± 726.3
Ethyl gallate	481.6 ± 13.3

Table 1. Content Present into Haritaki fruits in µg/g

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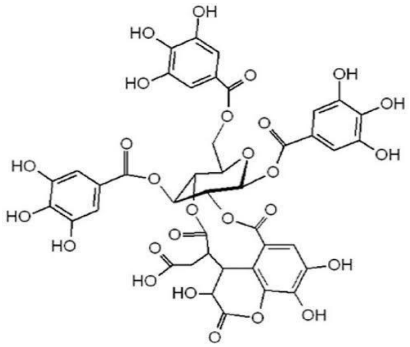
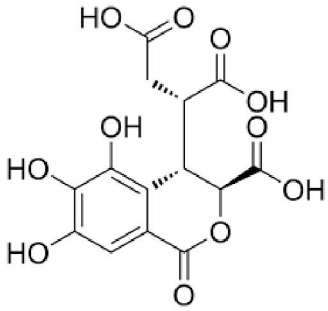
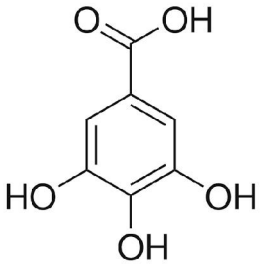


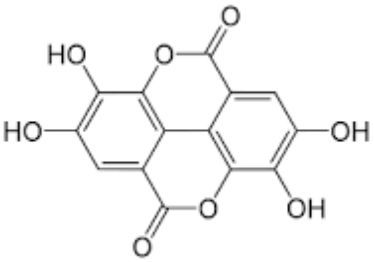
Chebulinic Acid



Chebulic Acid



Gallic Acid



Ellagic Acid

Traditional Uses

1)In Thai traditional medicine, Haritaki fruit is extensively used for its laxative, carminative,astringent, and general tonic effects.

2) Among the tribal communities of Tamil Nadu, it is a common therapeutic agent for managing a range of conditions, including fever, cough, diarrhea, gastroenteritis, skin disorders, candidiasis, urinary tract infections, and wound-related infections.

3) Haritaki is also a key component in numerous Ayurvedic formulations, where it functions as a diuretic and a cardiotonic.

4).Additionally, it is valued for its role in slowing the aging process and supporting overall immune function.

5) Reports indicate its potential to treat blindness, and it is also believed to promote the growth of malignant tumors [11].

6) This herb improves memory and is helpful for dysuria and urinary stones.

7) Haritaki promotes appetite and aids in digestion.

8) Haritaki functions as an effective nervine tonic, supporting the management of nervous debility and irritability, while also enhancing the sensory functions of all five senses.

9) Due to its notable anti-inflammatory and astringent properties, it is useful in the treatment of urethral discharges, including spermatorrhea, as well as vaginal discharges such as leucorrhea [5].

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Pharmacological Activity Of Terminalia chebula

1) Antimicrobial Activity

Bacterial infections are among the most pressing global health issues of the 21st century . The increasing resistance of bacteria to antibiotics presents a significant health risk, necessitating the development of new antibiotics that utilize innovative mechanisms of action to combat these challenges [12]. Bacterial strains such as Escherichia coli, Salmonella spp., Shigella spp., and Vibrio cholerae were procured from a local diagnostic laboratory and employed astest microorganisms, along with Saccharomyces cerevisiae. The inocula were prepared by transferring overnight cultures into Mueller–Hinton (MH) broth and adjusting the suspension to an OD_{600} of 0.1. The cultures were then incubated until they attained the 0.5 McFarland turbidity standard. For S. cerevisiae, Sabouraud Dextrose Broth (SDB) was used as the growth medium [13].

2)Antibacterial Activity

Terminalia chebula demonstrates broad-spectrum antibacterial activity, showing effectiveness against both gram-positive and gram-negative human pathogens [8]. Notably, it exhibits strong inhibitory action against Helicobacter pylori, a key organism implicated in gastritis, peptic ulcer disease, and gastric cancer [14]. Ethanol extracts of T. chebula fruits have also been reported to significantly suppress the growth of multidrug-resistant uropathogenic Escherichia coli, with phenolic constituents identified as the major contributors to this activity [10]. Additionally, the extract has shown marked antibacterial effects against methicillin-resistant Staphylococcus aureus (MRSA), resulting in reduced bacterial growth and metabolic activity. Mature seeds of the plant likewise display potent activity against S. aureus. Aqueous extracts have been found to effectively inhibit salivary bacteria, particularly Streptococcus mutans, suggesting potential oral health applications [15]. Among individual phytochemicals, ellagic acid exhibited strong inhibitory effects on Clostridium perfringens and E. coli, whereas compounds such as behenic acid, β-caryophyllene, eugenol,isoquercitrin, oleic acid, α-phellandrene, β-sitosterol, stearic acid, α-terpinene, terpinen-4-ol, terpinolene, and triacontanoic acid showed minimal or no antibacterial activity [4].

3)Antiviral Activity

The fruits of Terminalia chebula yield four compounds that act as inhibitors of HIV-1 integrase, including gallic acid (I) and three galloyl glucose derivatives (II–IV). Notably, the galloyl group plays a vital role in suppressing the 3′-processing function of the HIV-1 integrase enzyme, indicating its importance in antiviral activity [10]. In another study, Ledretan-96 and each of its 23 constituent compounds were tested on an epithelial tissue culture cell line to evaluate their ability to protect against influenza A virus induced cytotoxicity. Of all the components examined, only a single compound exhibited marked protective activity when applied individually to the epithelial cells [4].

4)Antifungal Activity

An aqueous extract of Terminalia chebula exhibits notable antifungal potential against a range of dermatophytes and yeasts. It effectively inhibits the growth of Candida albicans and dermatophytic species such as Epidermophyton floccosum, Microsporum gypseum, and Trichophyton rubrum [2]. Additionally, aqueous, alcoholic, and ethyl acetate leaf extracts of T. chebula have been evaluated against five pathogenic fungi Aspergillus flavus, A. niger, Alternaria brassicicola, A. alternata, and Helminthosporium tetramera. Using the paper disc assay, these extracts showed significant antifungal activity, comparable to the standard fungicide Carbendazim [4].

5)Antioxidant Activity

The activities of antioxidants increase in direct correlation with the levels of polyphenols, primarily due to their redox properties [16]. Compounds such as casuarinin, chebulanin, chebulinic acid, and 1,6-di-O-galloyl-b-d-glucose, which have been extracted from T. chebula, exhibit notable antioxidant activity[17]. In murine macrophages stimulated by lipopolysaccharide, the aqueous extract of T. chebula effectively inhibits haemolysis induced by free radicals and the production of nitric oxide. This extract exhibits a significant antioxidant effect, as demonstrated by its capacity to prevent radiation-induced lipid peroxidation in rat liver microsomes across various dosages [18]. The protective properties of an aqueous extract derived from the fruit of Terminalia chebula against oxidative damage caused by tert-butyl hydroperoxide (t-BHP) have been observed in both cultured primary rathepatocytes and rat liver. This extract

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reveals a more potent antioxidant activity in comparison to alpha-tocopherol [2]. High-Performance Liquid Chromatography (HPLC) analysis utilizing diode array detection has identified hydroxybenzoic acid derivatives hydroxycinnamic acid derivatives, flavonol aglycones, and their corresponding glycosides.[19].

6) Anti-inflammatory Activity

The dried fruit extract of T. chebula demonstrates notable anti-inflammatory activity, primarily through the suppression of inducible nitric oxide production [20]. Gallic acid (3,4,5-trihydroxybenzoic acid), one of the major phenolic constituents of T. chebula, is also recognized for its strong anti-inflammatory potential [9]. In vitro findings further reveal that the plant's proteinase exhibits anti-hyaluronidase action, while its tannins contribute to anti-inflammatory effects by lowering inflammatory mediators such as TNF-α, reducing beta-glucuronidase and lactate dehydrogenase levels, and preventing protein denaturation. Due to the potential adverse effects, including drowsiness, impaired respiratory function, and various skin reactions, commonly prescribed analgesics for pain management have encountered restrictions. To substantiate their effectiveness, the current study examined the anti-inflammatory properties of T. chebula fruit extracts [21].

7) Antidiabetic Activity

chebula (100 mg/kg body weight) was shown by Murali et al. to produce a significant reduction in blood glucose levels in both normal and alloxan-induced diabetic rats within 4 hours of oral administration [14]. Additionally, the fruit extract of Terminalia chebula demonstrated a dose-dependent antihyperglycemic effect in streptozotocin-induced diabetic rats, as confirmed through both short-term and long-term studies [22]. The same dosage also resulted in a notable improvement in managing elevated blood lipid levels, along with a decrease in serum insulin concentrations. In vitro studies using pancreatic islets revealed almost a twofold increase in insulin release compared to untreated diabetic controls. Furthermore, no harmful effects were observed in the liver or kidney function assessments following the treatment [4]. Chebulic acid has been reported to modulate elevated metabolic.markers and oxidative stress by restoring the normal activity of G6PDH, GSH, MDA, and SOD, in addition to supporting NADPH catalysis and regeneration. Furthermore, it played a role in alleviating cachexia, polydipsia, polyuria, and polyphagia, which are commonly observed in diabetic nephropathy cases [7].

8)Anti-protozoal Activity

The acetone extract obtained from Haritaki seeds exhibited anti-plasmodium properties against Plasmodium falciparum [23]. A formulation containing T. chebula along with Boerhavia diffusa, Berberis aristata, Tinospora cordifolia, and Zingiber officinale produced a maximum cure rate of 73% in hamster models of amoebic liver disease [24]. In rat studies, the same combination achieved an 89% recovery rate in experimental cecal amoebiasis, demonstrating strong antiamoebic activity against Entamoeba histolytica [3].

9) Cardioprotective Activity

Haritaki, also known as Hridya in classical texts, is valued for its supportive role in cardiovascular wellness and its therapeutic relevance in heart-related disorders. Research by Suchalatha et al. demonstrated that administering an ethanolic extract of Terminalia chebula fruits (500 mg/kg body weight) offered significant protection to the heart in a rat model [6]. Pre-treatment with the extract was shown to counteract isoproterenol-induced increases in lipid peroxidation and maintain key cardiac enzyme activities during myocardial injury [25]. Additionally, studies on isolated frog heart preparations have reported cardioprotective actions of the fruit pericarp [11]. Evidence also suggests that the extract helps safeguard cardiac tissue by stabilizing lysosomal membranes and preventing both myocardial cell damage and structural disruptions in mitochondria in experimental rats [4].

10) Cyto-protective Activity.

Manosroi et al. evaluated different concentrations of gallic acid and chebulagic acid isolated from Terminalia chebula fruits. Their results showed that both compounds significantly suppressed cytotoxic T lymphocyte (CTL) activity and reduced anti-CD3–induced granule exocytosis at comparable doses [14]. UV exposure is known to generate reactive oxygen species (ROS), leading to DNA strand breaks, DNA–protein crosslinks, and various base alterations that

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contribute to skin cancer, inflammation, and photoaging. In HEK-N/F cells, the ethanolic extract of T. chebula markedly lowered oxidative stress and offered notable protection against UVB-mediated cellular damage [7].

11) Anti-allergic Activity

Aller-7, a polyherbal preparation containing seven medicinal plants such as Haritaki, showed notable anti-allergic effects in vitro, as evidenced by tests conducted on isolated guinea pig ileum tissue [23].

12) Anti Spasmodic Activity

Research on Terminalia chebula consistently highlights its anti-vata or antispasmodic properties, demonstrated by its ability to reduce irregular blood pressure and alleviate intestinal spasms. These findings align with its traditional application in managing conditions like spastic colon and other gastrointestinal disorders [2]. Additionally, studies show that the aqueous seed extract of T. chebula helps counteract morphine-induced constipation and enhances gastrointestinal transit, further validating its long-standing use as a natural remedy for constipation [26].

13) Wound Healing Activity

Topical application of an alcoholic extract from Terminalia chebula leaves has been shown to accelerate skin wound repair in rats by promoting faster wound contraction and shortening the epithelialization period [27]. According to Nasiri et al., herbal formulations incorporating T. chebula also enhance tissue recovery in burn injuries. These healing effects are largely attributed to the plant's strong antioxidant capacity, which helps prevent lipid peroxidation and supports tissue regeneration [15].

14) Immuno Modulatory Activity

A water-soluble extract of T. chebula was shown to enhance humoral antibody production and extend the period of delayed-type hypersensitivity in mouse studies. Additionally, the crude extract activated cell-mediated immunity in golden hamsters affected by amoebic liver abscesses [18].

15) Gastro Protective Activity

The gastroprotective effects of T. chebula have been confirmed, as chebulinic acid (CA), a principal component derived from its extraction, significantly enhanced mucus production and inhibited H+-K+ ATPase activity [7]. T. chebula has a long-standing historical significance in improving gastrointestinal motility, alleviating constipation, and promoting overall comfort. Studies suggest that T. chebula markedly reduces gastric juice production and the incidence of gastric lesions, while simultaneously increasing stomach pH and mucus secretion in various ulcer models induced by both physical and chemical stress [15]. Chebulinic acid (CA), a key bioactive compound obtained from T. chebula, has been shown to offer strong gastroprotective benefits by boosting gastric mucus secretion and suppressing H^+/K^+-ATPase activity [7]. T. chebula has a long-standing historical significance in improving gastrointestinal motility, alleviating constipation, and promoting overall comfort. Studies suggest that T. chebula markedly reduces gastric juice production and the incidence of gastriclesions, while simultaneously increasing stomach pH and mucus secretion in various ulcer models induced by both physical and chemical stress [15].

16) Carcinogenic Activity

A crude extract from the fruit of T. chebula contains chebulinic acid, tannic acid, and ellagic acid, which are acknowledged as the most effective phenolic compounds for growth inhibition found in T. chebula [18]. The ethanol extract of T. chebula fruit exhibited biological activity in multiple cell models, including human (MCF-7) and mouse (S115) breast cancer cells, the human osteosarcoma line (HOS-1), the human prostate cancer line (PC-3), and an immortalized, non-cancerous human prostate cell line [20].

17) Skin Disorder:-

This extract is beneficial for skin conditions characterized by discharges, such as allergies, urticaria, and a variety of erythematous disorders [11].

18) Radioprotective Activity

Pre-treatment with Terminalia chebula extract in mice exposed to whole-body irradiation was found to lower hepatic membrane lipid peroxidation and lessen the extent of DNA damage caused by radiation. Additionally, it offered protection to human lymphocytes against DNA damage induced by gamma radiation during in vitro exposure [2].

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Studies investigating the radioprotective properties of T. chebula extract showed that it helped maintain the native supercoiled form of the bacterial plasmid DNA pBR322, thereby reducing radiation-induced strand breaks and preventing the formation of nicked DNA structures [7].

19) Anti-amoebic activity

A polyherbal mixture containing Terminalia chebula, along with Boerhavia diffusa, Berberis aristata, Tinospora cordifolia, and Zingiber officinale, demonstrated strong biological activity. It achieved 73% efficacy in hamsters with experimentally induced amoebic liver abscess and produced an 89% enhancement in humoral antibody levels and delayed-type hypersensitivity responses in a cecal model using mice [3].

Marketed Product Of Haritaki:-

Haritaki powder:-

Uses:-

1)relieves constipation.

2)relieve various diabetic symptoms . like frequent urination.

3) excessive thirst.

4)weight loss .

5)used for treating various stomach disorders [28].

Figure 5 :- Haritaki Powder .

Haritaki Tablets:-

Uses:-

1) Antidiabetic

2) Laxative

3)Used as lubricant

4)Hypolipidemic

5) Lubricant [8].

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Figure 6 :- Haritaki Tablet .

Haritaki Creams

Uses:-

1)used as a popular medicine for astringement, denrifrice, purgative, stomachic, tonic, cardiotonic purposes[29].

2)Helps the skin glow.

3) Reduces skin damage

4) dryness of skin.

5)Cures the skin irritation.

6) Provides nourishment to all type of skins[30].

Figure 7 :- Haritaki Cream .

Haritaki Hair oil

Uses:-

1)Keep scalp skin

2)May prevent premature hair graying and hair loss.

3) Control excess oil [8].

4)Ultimately leading to dandruff and hair fall [31].

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Figure 8 :- Haritaki Hair Oil.

Clinical investigations and safety assessments of T. chebula:-

T. chebula is widely regarded as a highly versatile medicinal plant, with research highlighting its broad spectrum of therapeutic and pharmacological actions. Multiple studies suggest thatit holds strong potential for the development of safe medicinal agents, owing to its notable cardioprotective, antioxidant, cytoprotective, chemoprotective, and hepatoprotective effects. Since no significant toxic or harmful impacts have been reported, T. chebula appears to be a promising candidate for future nutraceutical products or herbal functional supplements [7]. T. chebula has shown a protective effect by inhibiting dental cavities for up to three hours post-rinsing. A clinical investigation reported that patients with hemorrhoids experienced notable improvements after receiving Terminalia chebula supplements, including a substantial decrease in hemorrhoidal mass and relief from constipation compared with the control group [15]. Safety evaluations also indicate that both TCF and TAB possess low toxicity when administered orally. The aqueous, ethanol, and ethyl acetate extracts of TCF showed no harmful effects on sheep erythrocytes, and acute toxicity tests in rats demonstrated that dried TCF extracts did not cause acute or long-term adverse effects in either males or females [32]. Moreover, the fruit of T. chebula may help mitigate genotoxic damage triggered by lead and aluminum exposure. Its hydrolysable tannins have also exhibited antimutagenic activity against direct-acting mutagens such as sodium azide and 4-nitro-O-phenylene diamine. These outcomes indicate that T. chebula is a safe botanical with promising potential for pharmaceutical use [27]

II. CONCLUSION

Survey results suggest that Terminalia chebula plays a meaningful role in accelerating wound repair, shows clear antibacterial activity, and offers strong protective benefits for the heart. Furthermore, Terminalia Chebula is rich in antioxidant compounds, which implies its potential to extend tissue longevity. In addition, multiple studies have reported the anti-tumor effects of Terminalia Chebula, Another study highlights its strong potential to suppress HIV activity, suggesting a possible role in preventing the progression of the virus to AIDS. Terminalia Chebula is available in various commercial products aimed at alleviating disorders. There is considerable evidence endorsing its application as a gastrointestinal motility enhancer and an anti-aging agent. Moreover, it showcases a range of properties, including antilithiatic effects, hypolipidemic activity, radioprotective capabilities, antifungal properties, and more. This review seeks to guide future researchers in developing and implementing innovative ideas related to T. Chebula. Further investigation is required to fully elucidate the plant's mechanistic pathways and to define the safety and toxicity profiles, metabolic fate, and bioavailability of its bioactive constituents before clinical application.

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