

***Terminalia Chebula* - Review on Pharmacological and Biochemical Studies**

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Abstract: *Terminalia chebula* Retz (combretaceae) is a medicinal plant widely distributed throughout India, Burma, and Srilanka. Many Indian plants have been used from time immemorial to treat various diseases and infections in traditional medicinal systems. *Terminalia chebula* is one of the most commonly used plants in traditional systems of medicine in Indian sub-continent. *Terminalia chebula* is called the 'King of Medicine' in Tibet and is always listed at the top of the list in Ayurvedic Materia Medica due to its extraordinary power of healing. This review attempts to summarize the various pharmacological and biochemical studies on *Terminalia chebula*, this gives a wide knowledge about the herb and their importance in personal healthcare and hygiene.

Keywords: *Terminalia chebula* Retz, king of medicine, Classification, Applications.

1. INTRODUCTION

Recently there are lot of attraction towards natural based herbs as an antimicrobial agent because of its eco friendly and health hazardless nature¹⁻⁸. The traditional Indian systems of Ayurveda and Siddha medicines support the importance of medicinal plants to treat diseases⁹.

At the turn of the century, approximately 170 herbal drugs were officially recognized in the U.S.P and N.F.¹⁰ The Director of WHO Traditional Medicine reported in 1993 that 80% of the world population rely chiefly on traditional medicine, mainly plant based, specially for their primary health care needs.¹¹ In India 70% of populations are reported using traditional medicine for primary health care.¹² The present annual turnover of herbal medicinal products manufactured by large companies is estimated to be approximately US \$ 300 million, compared to a turnover of approximately US \$ 2.5 billion for modern drugs.¹³

Terminalia chebula is an important medicinal plant in Indian traditional medicine and it is most frequently used herb in Ayurveda. *Terminalia chebula* is a medium- to large-sized tree distributed throughout tropical and sub-tropical Asia, including China and Tibet. This tree is found in the forests of northern India, Uttar Pradesh and Bengal, and is common in Tamil Nadu, Karnataka and southern Maharastra. *Terminalia chebula* is commonly known as black myroblans in English and harad in Hindi. The *Terminalia* consists of 250 species and widely

distributed in tropical areas of the world¹⁴. The fruit of *Terminalia chebula* is consider as the "king of medicines" by Tibetans and second-to- none by ayurvedic apothecaries, and also held in high regard by other folk medicinal practitioners¹⁵.

Terminalia chebula is routinely used as traditional medicine in the name of 'Kadukkaai' by tribal of Tamil Nadu in India to cure several ailments such as fever, cough, diarrhea, gastroenteritis, skin diseases, candidiasis, urinary tract infection and wound infections¹⁶. Antibacterial activity of *Terminalia chebula* extracts against several bacterial strains have been reported¹⁷. Extracts from different parts of diverse species of plants like root, flower, leaves, seeds, etc. exhibit antibacterial properties were applied on cotton material for wound, healthcare care application¹⁸. It is a well known fact that the demand for the herbal drug treatment of various ailments is increasing and plant drugs from the ayurvedic system are being explored more, not only in India but also globally. As a result, many research studies are being undertaken and there is a need for an update and to put them together. In this article an attempt has taken to recapitulate available pharmacological studies for *Terminalia chebula*. The first part of the article explains the natural species identity, habitat, botanical description, chemical constituents. The second part abridges the various pharmacological studies so far done with the different extracts of *Terminalia chebula* fruits, leaf and bark extracts.



Figure 1 *Terminalia chebula* fruit, leaf and tree

2. Species Identity^{19,20, 21,22}.

Taxonomy

Current name: *Terminalia chebula*,

Botanical description

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Myrtales

Family: Combretaceae

Genus: *Terminalia*

Species: *chebula*

Common names

(Cambodia) : sa mao tchet

(Filipino) : chebolic myrabolan

(French) : myrobolan noir

(Lao (Sino-Tibetan)) : somz moox kh'ook

(Malay) : manja puteri (unripe fruits)

(Thai) : samo thai (central)

(Vietnamese) : chieu lieu xanh

India : haritaki (Sanskrit and Bengali), harad

(Hindi), harada (Marathi and Gujrati) Karkchettu

(Telgu) and Kadukkaya (Tamil).

2.1 Botanic Description

A medium-sized, up to 25 m tall, deciduous tree of variable appearance, with a usually short cylindrical bole of 5-10 m length, 60-80 cm in diameter at breast height; crown rounded, with spreading branches; bark dark brown, usually longitudinally cracked with woody scales; branchlets rusty-villous or glabrescent. Leaves alternate or opposite, thin-coriaceous, ovate or elliptic-obovate, 7-12 cm x 4-6.5 cm, rounded at base, obtuse to subacute at apex, entire, pubescent beneath; petiole up to 2 cm long, provided with 2 glands at the base of the leaf blade. Flowers in axillary 5-7 cm long spikes, simple or sometime branched, about 4 mm across, yellowish-white and unpleasantly scented; calyx 5-lobed, corolla absent; stamens 10, exserted; ovary inferior, 1-celled. Fruit an obovoid or oblong-ellipsoid drupe, 2.5-5 cm long, faintly 5-angular, yellow to orange-brown when ripe, glabrous.^{19,20,21,22}

2.1.1 Classification according to the size of the fruit¹⁹

- (i) **Survari harade** - which are large, dense and heavy about 2 inches long, yellowish-brown: when cut it contains yellowish or darkish brown, pulp and stone.
- (ii) **Rangari harade** - these are smaller, less wrinkled and less furrowed than the above variety; in length about an inch; the epidermis is yellow; when cut it presents a yellow dried pulp and a stone. The pulp is less astringent than that of survari harade.
- (iii) **Bala harade** - are smaller than the above two varieties. Their color is deep brown or black; highly wrinkled, dark or brown epidermis. Their pulp is dark and homogenous; there is no stone.
- (iv) **Java harade** - these are the smallest of all. Other characters are similar to those of Bala harade.

2.1.2 Classification according to shape¹⁹

- (i) **Vijaya** - having alabu shape used in all diseases, habitat in vindahya mountains
- (ii) **Rohini** - Round in shape- used in vrana, habitat in zansi and other states of india
- (iii) **Pootana** - Size is small, mesocarp is less, seed is bigger, externally used, habitate Sind.
- (iv) **Amirtha** - Mesocarp is more used for shodhanakarma habituate
- (v) **Abhya** - Fruit having five ribbed used in eye diseases, habitate champaranya, himalaya
- (vi) **Jeevantee** - fruit is golden yellow, used in all diseases, habitate himalaya.
- (vii) **Chetaki** - Fruit having three ribs, used as purgative.

2.1.3 Classification according to the growth of the fruit

Halileh - Zira. When the size is that of a cumin seed.

Halileh - Javi, when the size is that of a barely corn.

Halileh - Zangi when the size is of a raisin

Halileh - Chini when fruit is greenish yellow and somewhat hard.

Halileh - Asfer when it is very nearly mature

Halileh - Kabul or fully matured fruit

Chattopadhyay and Bhattacharyya,²² classified the *T. chebula* of three types - actually these are the different stages of maturity of fruits (a) small Myrobalan- the immature fruit; (b) yellow Myrobalan- after development of seed, the mature stage of the fruit; (c) large Myrobalan- the fully matured fruit.

2.2 Ecology and distribution

2.2.1 Natural Habitat

Terminalia chebula occurs scattered in teak forest, mixed deciduous forest, extending into forests of comparatively dry types. In Thailand and Burma, it is found together with teak. The tree is a light-demander, but withstands some shade in youth, and may benefit then from protection from the sun. It is fairly tolerant to frost and drought, and withstands fire, recovering well from burning and also from coppicing. Regeneration is usually poor, maybe because people harvest the fruit but also because of predation by animals. *Terminalia chebula* is known to withstand fire well.

Chebolic myrobalan occurs naturally from the sub-Himalayan region of Nepal and northern India, through India to Sri Lanka, Burma, Thailand, Indo-China and southern China. It has been introduced to Singapore, where it failed, but it was planted successfully in the botanical garden in Bogor, Java. It was also introduced to Peninsular Malaysia.²¹

2.2.3 Biophysical limits

Altitude: Up to 1500(-2000) m. Soil types: The species is found on a variety of soils, clayey as well as shady.

2.3 Chemical Constituents

In *Terminalia chebula*, 33% of the total phytoconstituents are hydrolysable tannins (which may vary from 20-50%) and are responsible for pharmacological activity. These tannins contain phenolic carboxylic acid like gallic acid, ellagic acid, chebulic acid and gallotannins such as 1,6 di-*O*-galloyl- β -D-glucose, 3,4,6 tri-*O*-galloyl- β -D-glucose, 2,3,4,6 tetra-*O*-galloyl- β -D-glucose, 1,2,3,4,6 penta-*O*galloyl- β -D-glucose. Ellagitannin such as punacalagin, casuarinin, corilagin and terchebulin and others such as chebulanin, neochebulinic acid, chebulagic acid and chebulinic acid reported in literature^{23,24}. The tannin content varies with the geological variation. Flavonol glycosides, triterpenoids, coumarin conjugated with gallic acid called chebulin, as well as phenolic compounds were also isolated²⁵.

Various methods have been reported for extraction of phytoconstituents from *Terminalia chebula* for studying their pharmacological activities. total eight compounds viz. gallic acid, methyl gallate, ethyl gallate, chebulagic acid, tetra-*O*-galloyl- β -D-glucose, ellagic acid, chebulinic acid and penta-*O* galloyl- β -D-glucose from *Terminalia chebula* were isolated on reverse phase chromatography²⁶ There are seven varieties of *Terminalia chebula* all of which are more or less used in similar fashion but vary in specific usages and quality²⁷.

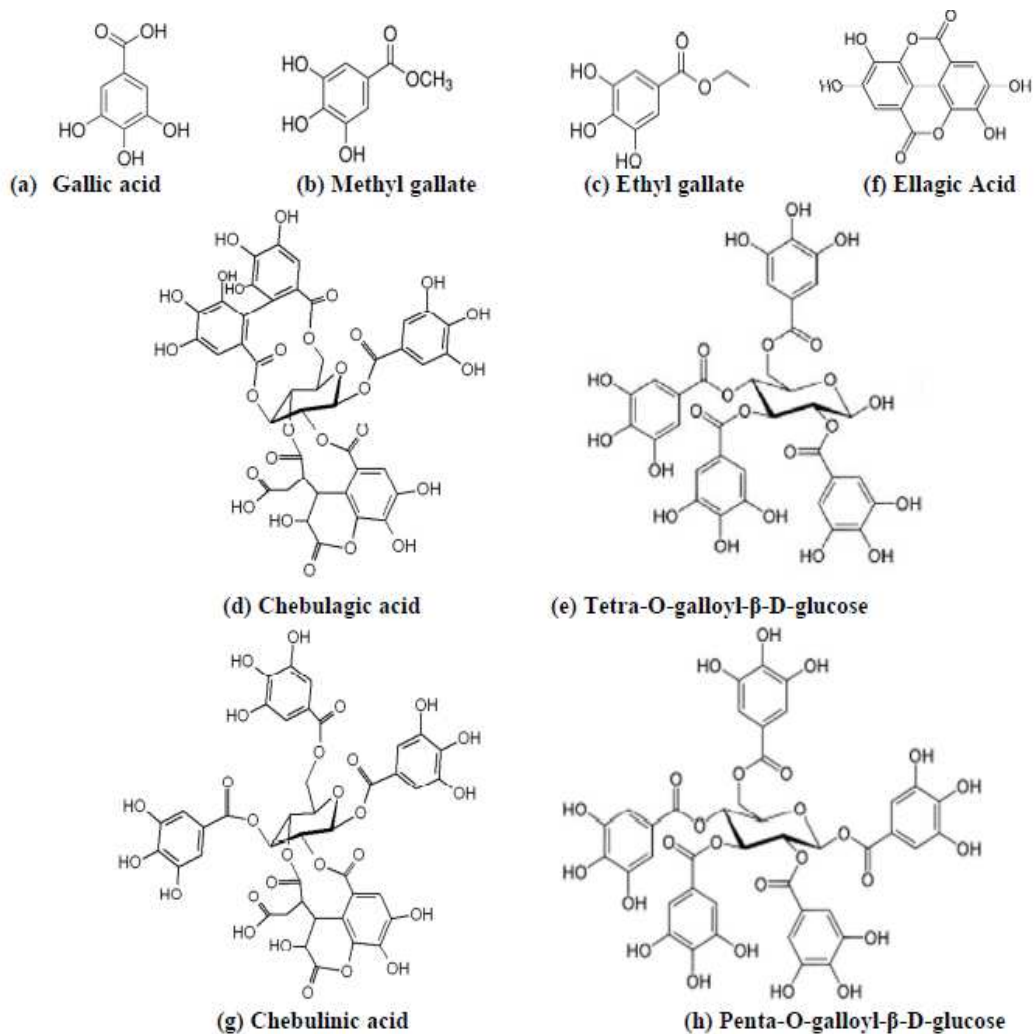


Figure 2 various acids presents in *Terminalia chebula* and their structures

Several pharmacological investigations for different biological activities of *Terminalia chebula* in various in vivo and in vitro test models have been carried out based on the presence of chemical ingredients. A summary of the findings of some of these pharmacological studies is presented below in Table 1.

Table 1 Various pharmacological in-vitro and in-vivo studies on *Terminalia chebula*

S.N	Pharmacological properties	Mode of Extraction	Research finding	Ref
1	Wound healing	Ethanollic extract	Evaluated on excision and incision model, in albino rats, in the form of an ointment with two Concentrations. Both concentrations of the ethanollic extract showed significant response in wound types	28
2		Dry powder mixed with water	Studied on 30 rabbits in wound model. Herbal paste application showed significant improvement on Maturation, wound contraction and epithelialization on rabbits	21
3		Extracted with warm water	The wound healing experiment suggests that tannin extracts from dried immature fruits of <i>terminalia chebula</i> fructus retz. Can promote cutaneous wound healing in rats, probably resulting from a powerful anti-bacterial and angiogenic Activity of the extracts.	30
4		alcoholic extract of the leaves	Biochemical studies revealed increase in total protein, DNA and collagen contents in the granulation tissues of treated wounds. The levels of hexosamine and uronic acid also increased up to day 8 post-wounding. The tensile strength of tissues in extract-treated incision wounds increased by about 40%. These results shows beneficial effects of <i>T. chebula</i> in the acceleration of the healing process	31
5	Dermal wounds	Dry powder mixed with water	Equi – dimensional full thickness excision wound model on rabbit were studied. Herbal paste application showed significant (p<0.05) improvement on Maturation, wound contraction	32
6	Antimicrobial activity	Aqueous extract	Anti-microbial activity of <i>terminalia chebula</i> retz fruit extract against Microgrnism. <i>Bacillus substils</i> , <i>staphylococcus aureus</i> , <i>staphylococcus epidermis</i> , <i>escherichia coli</i> , <i>Staphylococcus flexineria</i> and <i>pseudomonas aeruginosa</i> were studied by disc diffusion method.	33
7		Acetone, ethanol, methanol, cold and hot aqueous extracts	All the tested extracts of <i>T. Chebula</i> Were highly effective against two of the Tested dental caries causing bacteria. They suggest as an Alternative antimicrobial agent against dental caries causing microorganisms.	34

8	Crude ethyl acetate and ether extract	The activity was performed against common pathogenic bacterial (<i>staphylococcus aureus</i> , <i>proteus vulgaris</i> and <i>escherichia coli</i>) and fungal strains (<i>aspergillus niger</i> and <i>candida Albicans</i>). The extracts of <i>T. Chebula</i> were found to be more or less active against almost all tested pathogenic strains	35
9	Water and methanol extracts	<i>Terminalia chebula</i> inhibited the growth of both strains <i>E. Coli</i> and <i>S. Aereus</i> with Highest ZOI 12mm and 13mm respectively with 15% methanolic and aqueous extracts. <i>Terminalia chebula</i> was also found active with all concentrations for aqueous and methanolic Preparations.	36
10	Water and ethanol extracts	The antibacterial activity of <i>T. Chebula</i> (leaf gall) was evaluated against ten bacterial strains including gram-positive and gram-negative bacteria using the agar-well diffusion method	37
11	Cold aqueous, hot aqueous and ethanol extracts	Antibacterial potency of the extracts was tested by standard growth inhibitory Assay methods. All the tested extracts showed to varying degrees of strain specific antibacterial Potential against tested strains of which ethanol extract showed superior activity against <i>e. Coli</i> and hot Aqueous extract against <i>s. Aureus</i> . Cold aqueous extract exhibited the least antibacterial activity Against all the tested strains.	38
12	Ether, alcoholic and water extracts	<i>Teminalia chebula retz</i> on <i>helicobactor pylori</i> were examined using an agar diffusion method on columbia agar. Water extracts of black myrobalan showed significant antibacterial activity and had a minimum inhibitory concentration (MIC) and minimum bacteriocidal concentration (MBC) of 125 and 150 mg/l, respectively.	39
13	methanol, ethanol, acetone and aqueous (hot and cold) extracts	Of the four solvents evaluated, acetonic fruit extract of <i>T. chebula</i> was found to be best. The MIC values ranged between 0.78 mg/mL and 50 mg/mL for the different bacterial ear pathogens and MBC values ranged between 1.56 mg/mL and 50 mg/mL.	40
14	Methanol extract	Anti-microbial activity of <i>terminalia chebula retz</i> fruit extract against Microgrnism. The extract wile material for health applied on the textile material as health care product.	41
15	Methanol and aqueous extracts	Methanol extract as a potential bactericidal and potent Antioxidant while aqueous extract showed the least potential as an antimicrobial agent, though a moderate antioxidant.	42

	Alkaloids		
16	extracted from different parts (leaf, stem, stem bark, and fruits)	Alkaloids from all plant Parts showed good antimicrobial activity against almost all the test microorganisms except Niger, against which, none of the tested Extracts showed activity. The largest zone of inhibition (iz 20.75 mm) was observed against p. Aeruginosa.	43
17	Water and Methanolic extracts	The water and methanolic extracts were applied on a cotton fabric and the anti bacterial activity of the fabric was analysed for mosr common human pathogenic bacterial stains like <i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Klebsiella pneumoniae</i> , <i>Proteus vulgaris</i> , and <i>Salmonella typhi</i> .	44,45
18	Ethanol extract	The antibacterial activity studied against Salmonella typhi, Staphylococcus aureus, Bacillus subtilis etc.	46
19	Methanol, Ethanol, ethyl acetate water and chloroform extract of leaf	While all the organisms were resistant to chloroform extract and some of them to that of ethyl acetate, the Methanol as well as the aqueous extracts of the plant showed the potential bactericidal activity.	47
20	Aqueous extracts	It was tested against six medically important bacterial strains, namely gram-positive bacteria (<i>bacillus subtilis</i> , <i>bacillus aureus</i> and <i>staphylococcus aureus</i>) and gram-negative bacteria (<i>escherichia coli</i> , <i>k pneumoniae</i> , and <i>pseudomonas aeruginosa</i>). The susceptibility of the microorganisms to the aqueous extracts of <i>terminalia chebula</i> was compared with standards drug i.e. Gentamycin, tetracycline. The aqueous extract was more significant against gram-positive bacteria than against gram-negative bacteria.	48
21	Methanol, isopropanol, chloroform, diethyl ether and hexane	Against multi drug resistant diabetic foot ulcer isolates.	49

22	Antibacterial and antifungal activities	Ethyl acetate, chloroform, n-butanol and aqueous fractions	<i>T. Chebula</i> was Studied for the possible presence of anti microbial activities and antifungal activities	50
23		Water extract	Aqueous extract of <i>T. chebula</i> has been reported to show antifungal activity against a number of dermatophytes (<i>e.g. Epidermophyton, Floccosum, Microsporium gypseum and Tricophyton rubrum</i>) and yeasts (<i>e.g. Candida albicans</i>)	51,52
24	Anti hyperglycemic effect	Water extract of dry fruits	Water extract of <i>Terminalia Chebula</i> improves glucose tolerance and brings down Fasting blood glucose in diabetic rats.	53
25	Antioxidant activity	Methanol Extract, water extract, 95 % ethanol extracts were used	Comparisons of antioxidant Activities between unfermented extracts and Fermented products are demonstrated for the first Time. The antioxidative Pattern plots revealed valuable information and showed good correlation between scavenging effect on DPPH radical assay and hrp-luminol-H ₂ O ₂ assay	54
26		Warm water extract	6 extracts and 4 compounds were investigated for anti-lipid peroxidation, anti-superoxide radical formation and free radical scavenging activities. The results showed that the all tested extracts of <i>terminalia chebula</i> exhibited antioxidant activity at different magnitude of potency	55
27		Hexane extracts	The extracts were tested for their relative levels of antioxidant activity and the Total phenolic content using dpph, deoxyribose, reducing power, chelating power, lipid peroxidation And folin-ciocalteu method.	56
28		Aqueous extract	The antioxidant role of <i>Terminalia Chebula</i> aqueous extract was evaluated against age-related oxidative stress in heart tissues of young and aged rats. The results Show that <i>T. Chebula</i> aqueous extract modulates the activities of antioxidants and lipid peroxidation Through the management of oxidant/antioxidant imbalance in rat heart tissues.	57
29			The <i>T. Chebula</i> fruit meat extracts showed highest total phenolic content and antioxidant activity.	

		Methanolic extracts	Most fruits, that more than one type of crude fruit of each fruit (eg. Meat, peel, raw fruit and ripe fruit) was extracted, indicated their antioxidant activities direct proportion to their amount of total phenols.	58
30		Petrol. Ether, benzene, chloroform, ethyl Acetate, 70% ethanol and water	<i>In-vitro</i> antioxidant activity. The herbal combined with other two herbal material for the test and found to be having high antioxidant activity and radical scavenging activity against various antioxidant systems in vitro	59
31		Methanol extract	Researchers concluded from the study of the 70% methanol extract of the fruits of <i>Terminalia chebula</i> , <i>terminalia belerica</i> and <i>emblica officinalis</i> , imposes the fact that they might be useful as potent Sources of natural antioxidant.	60
32		Aqueous extracts	Different medicinal plants, viz., <i>momardica charantia</i> linn (e1), <i>Glycyrrhiza glabra</i> (e2), <i>acacia catechu</i> (e3), <i>terminalia bellerica</i> (e4), <i>terminalia chebula</i> (e5) And <i>emblica officinalis</i> (e6), and a combination drug, triphala (e7), containing equal amounts of e4, E5 and e6, has been evaluated for the antioxidant activity. E1 and e2 did not show any antioxidant activity and have very low ascorbate Equivalent. E3 acts as a moderate antioxidant, while e4, e5, e6 and e7 are very good antioxidants And are rich in phytochemicals which have high antiradical activity properties	61
33		Ethanol extract	Antioxidant activity of ethanolic extract of fruits of terminalia Chebula (500 mg/kg body wt, orally for 30 days) against Isoproterenol-induced oxidative stress was investigated in rats.	62
34		Ethanol extract	Oral administration of ethanol extract of <i>terminalia chebula</i> Fruit at a concentration of 200 mg/kg body weight for 30 days significantly controlled the alteration in the levels of thiobarbituric acid reactive substances, hydroperoxides, and both enzymatic and nonenzymatic antioxidants.	63
35	Anti	Methanolic extracts	The protective effect of <i>terminalia chebula</i> extract is reported against cyclophosphamide (cp)-induced micronuclei formation and chromosomal aberration in mouse bone marrow cells. In	64

	clastogenic Effect		Mutagenicity assay, <i>terminalia chebula</i> extract protective potential against cyclophosphamide induced Micronuclei formation and chromosomal aberration in mouse bone marrow cells	
36	Immuno modulatory activity	Ethanollic extracts	Study confirms the immunomodulatory activity of ripe <i>T. Chebula</i> fruits as evidenced By increase in the concentration of antioxidant enzymes, GSH, T and B cells, the proliferation of which play important roles in immunity. This phenomenon also enhances the concentration of melatonin in Pineal gland as well as the levels of cytokines.	65
37			Gallic acid and chebulagic acid were isolated from the extract of a herbal medicine, kashi (myrobalans: the fruit of <i>terminalia chebula</i>) as active principles that blocked the cytotoxic t lymphocyte (ctl)-mediated cytotoxicity.	66
38	Radiation protection	Alcohol extract of leaf	The administration of <i>terminalia chebula</i> Prior to whole body irradiation of mice resulted in a reduction of peroxidation of membrane lipids in the mice liver as well as a decrease in radiation-induced damage to DNA, as assayed by single-cell gel electrophoresis (comet assay). These results suggest the radioprotective ability of <i>terminalia chebula</i> .	67
39	Anti caries agent	Aqueous extract	Mouth rinsing with a 10% solution of the extract inhibited the salivary bacterial count and salivary glycolysis. Mouth rinsing with the extract significantly reduced total bacterial counts and the total streptococcal counts in the saliva samples obtained up to and including 3 h after rinsing, compared with the counts obtained prerinsing or after placebo rinsing	68
39	Gastrointestinal motility	Aqueous extract	<i>Terminalia chebula</i> can serve as an useful alternative to pro kinetic drugs available today	69
40	Typhoid fever	Aqueous extract	Aqueous extract of the fruit of <i>terminalia chebula</i> was evaluated for its anti salmonellae activities invitro and invivo.	70
41	Cardio protective	Ethanollic extract	<i>T. Chebula</i> extract pretreatment was found to ameliorate the effect of iso proterenol on lipid peroxide formation and retained the activities of the diagnostic marker enzymes	71,72 ,73

	effect			
42	Anti-aging activities	Hot and cold aqueous processes and hot and cold methanol	This study has confirmed the traditional use of <i>T. Chebula</i> gall in many thai medicinal plant recipes for longevity which will be beneficial for further development of anti-aging products.	74
43	Cyto protective and anti aging activities	Ethanol extract of the fruits	The ethanol extract of the fruits of <i>T. chebula</i> inhibited oxidative stress and the age-dependent shortening of the telomeric DNA length. In the peroxidation model using <i>t</i> -butanol, <i>T. chebula</i> extract showed a notable cytoprotective effect on HEK-N/F cells.	75
44	Anti lithiatic activity	Aqueous extract	Plant extract Inhibited calcium oxalate crystal growth in a dose dependent pattern. When MDCK and NRK-52E cells were injured by exposure to oxalate for 48 hours, the aqueous Extract prevented the injury in a dose-dependent manner. On treatment with The different concentrations of the plant extract, the cell viability increased and Lactate dehydrogenase release decreased in a concentration dependent manner	76
45	Hepatocellular carcinoma (highly aggressive form of solid tumor)	Aqueous extract	Study evaluates the chemo preventive potential of <i>T.chebula</i> aqueous extract by estimating the levels of lipid peroxidation and Assaying activities of various marker enzymes in diethylnitrosamine induced liver cancer bearing rats.	77

46	Inhibition of cancer cell growth	Methanol extract	In all cell lines studied, the extract decreased cell viability, inhibited cell proliferation, and induced cell death in a dose dependent Manner. Flow cytometry and other analyses showed that some apoptosis was induced by the extract at lower concentrations, but at Higher concentrations, necrosis was the major mechanism of cell death	78
47	Hypo lipidemic activity	Dry powder	In atherogenic diet induced hyperlipidemic model, the rats receiving Treatment with <i>terminalia chebula</i> showed significant reduction in total cholesterol, triglycerides, Total protein and elevation of high density lipoprotein cholesterol. Haritaki was found to Possess significant hypolipidemic activity.	79
48	Bactericidal activity	Aqueous extract	Bactericidal Activity of <i>terminalia chebula</i> against <i>salmonella</i> sp., <i>shigella</i> sp., <i>vibrio cholerae</i> and <i>escherichia coli</i> was demonstrated	80
49	Biochemical studies	Ethanol extracted dry powder	Blood glucose, glycosylated hemoglobin, urea, and creatinine as well as fucose, Hexose, hexosamine and sialic acid in the diabetic rats were reduced the levels and treated with the fruit extract. The efficacy of The fruit extract was comparable with glibenclamide, a known hypoglycaemic drug	81
50	Antidiabetic and renoprotective	Chloroform extract	<i>T. Chebula</i> seeds produced dose-dependent reduction in blood glucose Of diabetic rats and comparable with that of standard drug, glibenclamide in short term study. It also Produced significant reduction in blood glucose in long term study.	82
51	Antiviral		Ledretan-96 and each of its 23 individual components were tested on an epithelial tissue culture cell line for their protective activity against cytotoxic effects caused by influenza A virus	83
52		acetone extract	Acetone extract of <i>T. chebula</i> has emerged as a new alternative to treat pandemic swine influenza A infection due to its low cost, easy preparation and potential effect	84

53	Inhibition of HIV 1 integrase	Hot water extract	<i>T. chebula</i> fruits contain four human HIV-type 1 integrase inhibitors such as gallic acid and three galloyl glucoses, and suggested that galloyl moiety had a major role for inhibition of the 3'-processing of HIV-1 integrase by these compounds	85
54	Hepato-protective activity	Leaf powder mixed with 1% gum accai suapension	1% gum acacia suspension of <i>Terminalia Chebula</i> Leaves possess hepatoprotective property due to the Decrease in the serum levels of these enzymes and Recovery of hepatocyte shapes	86
55	Spasmogenic activity	Aqueous extract	Aqueous extract of <i>T. Chebula</i> seed improves constipation induced by morphine and increases the gastrointestinal transit ratio, which supports its traditional use in constipation.	87
56	Radio protecting Ability and PhytochemicalAnalysis	Aqueous extract	The extract inhibits xanthine oxidase enzyme activity and is also an excellent scavenger of DPPH radicals. The rate at which the extract and its constituents scavenge the DPPH radical was studied by using stopped-flow kinetic spectrometer. Based on all these results it is concluded that the aqueous extract of <i>Terminalia chebula</i> acts as a potent antioxidant and since it is able to protect cellular organelles from the radiation induced damage, it may be considered as a probable radioprotector.	88
57		Ethanollic extracts	The results of the study revealed that the Aquous extracts of both plants i.e. <i>T.belerica</i> and <i>T.chebula</i> have antioxidant properties since these contains enzymatic and non – enzymatic antioxidants, these can be very effective against microbes causing various diseases	89
58	The molluscicidal activity	Ethanollic extract	The molluscicidal activity of ethanollic extract of <i>T. chebula</i> fruit powder was studied against the vector snail <i>Lymnaea acuminata</i> and was found time and concentration dependent.	90
59	Anti	Hydro	The <i>T. chebula</i> extract increased mucus production in aspirin and ethanol-induced ulcer	91

ulcerogenic activity	alcoholic extract	models and showed antisecretory activity in pylorus ligated model leading to a reduction in the gastric juice volume, free acidity, total acidity, and significantly increased gastric pH
60	Antinociceptive activity	petroleum ether (PE), chloroform (CH), ethanol (ETH) and water extracts
		Antinociceptive effect exhibited by the ethanolic extracts of both the plants (<i>T. bellerica</i> and <i>T. chebula</i>) may be due to the triterpenoids present in them and can be partially related to the cholecystokinin receptor pathways. It could be the reason for its wide use in treatment of chronic pain.

3. Conclusion

From the survey it was found that, *Terminalia Chebula* has a strong effect against the wound healing, has antibacterial activity, and exhibits strong cardio protective. *Terminalia Chebula* also has antioxidant components, which indicates it can increase the life of tissues. Further few studies shows the anti-tumor activity of *Terminalia Chebula* and another study shows that it has considerable effect in inhibiting the HIV virus which ultimately results in AIDS. There is a substantial evidences found that, it can be used as Gastrointestinal motility agent, Anti-aging substance. It also posses properties like Antilithiatic activity, Hypolipidemic activity, Radio protecting Ability, Antifungal activity and etc.

The chemical constituents of *Terminalia Chebula* like chebulinic acid, Tannin, Galic acid and ascorbic acids are the key factor for the efficient action of the species. However, there are some problems apparently associated with the uncontrolled use of "natural" products and traditional herbal medicines¹³. It needs to be mentioned here that most serious side effects originates from overuse or misuse of such medicines. To know further about a biological and pharmacological action of different part of *Terminalia Chebula*, it is advised to refer the individual research article. We hope the article will be of immense use to the researchers and students who working on medicinal properties of *Terminalia Chebula* and result in increased interest in this medicinal herb.

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