

A Comprehensive Review Of Traditional Uses, Phytochemical Profile And Pharmacological Activities Of Terminalia Bellirica Extract

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Abstract

The medicinal plant, Terminalia bellirica (Gaertn) Roxb and commonly known as Belleric Myrobalan is a significant medicinal tree native to India and other parts of Southeast Asia. It is widely used in the traditional Indian system of medicine like Ayurveda for centuries in the treatment of various ailments owing to its rejuvenating as well as health promoting effects. The fruit has various medicinal properties such as laxative, astringent, anthelmintic, and antipyretic properties. Hepatitis, bronchitis, asthma, dyspepsia, piles, diarrhoea, coughs, hoarse of the voice, eye disease, Scorpio-sting, and hair tonic are all treated with its fruits. The fruit's pulp can help with dysentery, diarrhoea, dropsy, piles, leprosy. Purgative are made from half-ripe fruit. It also treats disorders such as obesity, diarrhoea, digestive system weakness, greying of hair, kidney stone, memory loss, ageing, eyesight strengthening, immunity building, and many other diseases. The tree is rich in bioactive compounds including tannins, flavonoids, phenolic acids, saponins, and triterpenoids. The present study highlights the importance of T. bellirica in traditional medicine and modern therapeutic applications.

Keywords: Terminalia, bellirica myrobalan, bioactive compound, pharmacological uses, Traditional uses

Introduction

Terminalia bellirica is recognized as one of the ancient medicinal plants (Nayak and Kumar, 2023) found in India, Pakistan, Bangladesh, Sri Lanka, and Southeast Asia. It has had many therapeutic applications and various traditional medicinal practices, including Ayurveda, Unani, Siddha, and traditional Chinese Medicine. Herbal medicines are derived from various plant components including leaves, stem, root, and bark. These preparations predominately consist of biologically active compounds and are primarily

utilized for the treatment of mild to chronic health conditions. A diverse array of phytochemicals has been extracted from different parts of the plant, including alkaloids, coumarins, flavonoids, steroids, lignans, tannins, glycosides, terpenoids, and saponins which are responsible for various pharmacological activities like anti-diabetic, anti-microbial, anti-salmonella, anticancer, anti-pyretic etc. This study focuses on the investigation of this medicinal tree.



Vernacular Names:

TAMIL	TANDRIKAI
HINDI	BAHERA, BHERA,BUHURA
ENGLISH	BELLIRIC MYROBALAN
SANSKRIT	AKSA, AKSHKA, VIBHITAK
KANNAD	TANREKAI
KASHMIRI	BABELO, BALALI
GUJARATI	BAHEDAN, BAAHEDA, MUNJHAD, BAHEDO,BAHEDA
MARATHI	BAHERA, BHIRA
TELEGU	TANI, TANDI
MALAYALAM	TANNIKKA, THANI

SCIENTIFIC CLASSIFICATION:

KINGDOM	PLANTAE
DIVISION	ANGIOSPERM
CLASS	MAGNOLIOPSIDA
ORDER	MYRTALES
FAMILY	COMBRETACEAE
GENUS	TERMINALIA
SPECIES	TERMINALIA BELLIRICA

CHEMICAL CONSTITUENTS

Flavones	7-hydroxy 3',4'(methylenedioxy)flavone, luteoline
Steroids	Beta-sitosterol
Lignans	Termilignan,thannilignin,anolignan
Tannins	Gallic acid,ellagic acid,methyl gallate,ethyl gallate (phenyllemblin),chebulagininc acid,chebulagic acid,hexahydroxydiphenic acid ester
Glycosides	Fructose,sucrose ,galactose,D-glucose , mannose,rhamnose
Terpenoids	Belleric acid,chebulagic acid ,arjungenin
Saponin	Bellericoside and belllericanin
Cardenolide	Cannogenol 3-O-β-gallactopyrenosyl-(1→4)-O-α-L-rhamopyranoside
Flavonol aglycones	Quercetine and kampferol
Flavonol glycosides	Quercetin-3-O-[6"-α-L-rhamnopyranosyl]-(1 →6)- β-D-glucopyranoside (rutin),quercetin-3-O-α-L-rhamnopyranoside,quercetin-3-O-β-D-glucopyranoside and kaempferol-3-O-β-D-glucopyranoside
Fatty acid present in oil	Palmitic acid ,linoleic acid , stearic acid ,oleic acid , myristic acid
Glycerides of fatty acid	Palmitooleolinolein ,stearo-oleolinolein,palmitodiolein,stearodiolein,dioleolinolein and triolein

PLANT DESCRIPTION:

It is a large deciduous tree with the height of 50m and diameter of 30m with a rounded crown. It is branchless up to 20m. it is perennial and requires cold climate.

PART OF THE PLANT

BARK

The outer bark is bluish or ashy-grey whereas inner-bark is yellow in colour. The bark contains number of longitudinal cracks

LEAVES

Young leaves are copper red in colour which turn into parrot green and later they become dark green leaves are large, alternate, glabrous mostly clustered at the twig ends. Leaf tip is narrowly pointed. Base of the leaf is rounded to cunate, rufous-serious which turn to glabrescent, having 6-9 pairs of secondary veins. Secondary and tertiary venation are prominent on the surfaces generally clustered towards the end of branchlets. Petiole is 2.5-9cm long, flat above with pair of sessile glands just above the middle, sometimes indistinct. Lamina is broad elliptical or broad. Apex is rounded to abruptly short acuminate. Margin is entire.

FLOWERS

They are greenish white in colour usually appear along with new leaves having an offensive odour or strong honey like smell. Flowers are simple, solitary and sessile. Inflorescence is axillary spikes generally 3-15cm long. Upper flowers of the spikes are male. Lower flowers are bisexual. Calyx tube is sericeous or tomentulose.

FRUIT

It is light yellow in colour. It is drupe, globose or ovoid, densely velutinous or sericeous. It is slightly 5 ridged, 3cm across. It is one seeded and covered with minute pale pubescence.

Medicinal Uses:

FRUITS:The fruits are used to treat respiratory conditions such as asthma and bronchitis, helping to clear the airways and reduce inflammation. They may have hepatoprotective properties. The fruit is known for its astringent properties. They may have also anti-inflammatory and antioxidant properties. The pulp is used to treat diarrhoea and leprosy due to its antimicrobial and astringent properties. It may have

sedative properties, providing relief from pain and inducing sleep. The fruit is believed to promote hair growth and improve hair health. It can soothe the throat and restore normal voice in cases of hoarseness. The ripen fruit acts as a strong laxative, helping in clearing the bowels.

BARK:The gum and kernel oil are used as a laxative.

Leaves:The leaves can help improve appetite. They are used to treat haemorrhoids by reducing

inflammation and discomfort. The leaves have properties that help in lowering cholesterol levels and blood pressure, contributing to overall heart health. The leaves have antioxidant properties, which help in slowing down the aging process. They help to strengthen the immune system.

Therapeutic Uses:

Wound Healing Activity:

Wound healing is a complex phenomenon which includes a number of processes such as migration and proliferation of both epithelial and connective tissue, parenchymal components, collagen synthesis and acquisition of wound strength. T.bellirica enhanced fibroblast function, improved production of glycosaminoglycan and deposition of collagen which is required for wound healing and may be useful as an adjuvant in wound healing process.

Antithrombotic And Thrombolytic Process:

Atherothrombotic diseases such as myocardial or cerebral infarctions are serious consequences of the thrombus formed in blood vessels. A blood clot (thrombus) formed in the circulatory system due to failure of haemostasis causes vascular blockage. Thrombolytic agent are used to dissolve the previously formed clots in the blood vessels. T.bellirica it contain thrombolytic and anti-thrombolytic activity. However in vivo clot dissolving properties and active component of T.bellirica for clot lysis are yet to be discovered.

Angiogenic Activity:

Angiogenesis is the formation of new blood vessels and play a role in cardiovascular diseases. It is a potent physiological process that underlies the natural manner in which our bodies respond to a decrease of blood supply to vital organ namely the production of new collateral vessels to overcome the ischemic state. T.bellirica leaf contain angiogenic activity.

Antihypertensive Activity:

Lowering a blood pressure by acting as a Ca^{++} antagonist T.bellirica lowers blood pressure giving a sound mechanism underpinning its use as a hypertension medication.

Antioxidant:

The fruit of T.bellirica contain large number of naturally occurring antioxidant, including ellagic acid

and gallic acid which give them antioxidant characteristics.

Antidiabetic Activity:

Diabetes refers to a group of metabolic disorders that result in increased blood glucose level, either pancreas does not produce enough functional insulin (type1 diabetes) or cell do not respond to the insulin which is produced (type2 diabetes). Excessive amount of glucose reaching mitochondria lead to an overdrive of the electron transport chain, resulting in overproduction of superoxide anions normally scavenged by mitochondrial SOD enzyme. When later fails oxidative stress develop and it was proposed that this mechanism is responsible for the activation of all major diabetic complication involving glycation and sorbitol pathway etc. T.bellirica fruit stimulated insulin secretion from a pancreas so it contain antidiabetic activity.

Hepatoprotective activity:

Protective effect of TB fruit extract and its active principle, gallic acid against CC14 intoxication. Treatment with extract (200,400 and 800 mg/kg, p.o.) and gallic acid (50,100 and 200 mg/kg, p.o.) showed dose dependent recovery in biochemical parameters such as SGOT, SGPT and lipid peroxidase, glutathione but the effect was more pronounced with gallic acid.

Haemostatic:

Its antisecretory properties aid to stop blood flow in a burst blood vessel.

Antimicrobial:

Tannins in T.bellirica fruit extract may hinder the development of germs by precipitating microbial protein and rendering nutritious proteins inaccessible to them.

Circulatory system:

Because of its astringent proper. It is employed as a blood coagulant. An astringent is a substance that causes the body tissues to contract or shrink.

Anti-diarrheal activity:

Ethanolic extract of T. bellirica fruit in castor oil induced diarrhea, PGE2 induced enter pooling and gastrointestinal motility test. The percentage protection in castor oil induced diarrhea was found to

be 73.37 and 63.58 by aqueous and ethanol extract respectively. Both the extracts showed significant anti-enter pooling effect in PGE2 induced pooling effect as in gastrointestinal motility test, percentage protection of aqueous and ethanolic extract was found to be 67.20 and 68.27 respectively. The result indicates that extracts exhibit prominent anti-secretory effect as compared to reduction in gastrointestinal motility. Presence of tannins, flavonoids, and alkaloids could be responsible for anti-diarrheal effect, either by stimulating the reabsorption or anti-secretory effect in the intestinal lumen as well as significantly enhancing intestinal transit time and intestinal motility decreased.

Acute and subacute toxicities:

Acute and subacute toxicities of ethanol extract of *T. bellirica* were studied and it was found a single oral dose of ethanol extract did not produce signs of toxicity, behavioural changes mortality and differences in gross appearance of internal organs. In sub-acute toxicity, all rats were administered with a repeated oral dose of ethanol extract for 14 days whereas the satellite group also administered with ethanol extract for same period but kept further 14 days to check the delayed effects or reversibility of toxic effects. The result indicated that the ethanol extract did not show any change in general behaviours, mortality, weight gain, haematological or clinical blood chemistry parameters as well as gross and histological examination showed normal appearance of the internal organs as compared to control group.

Antibiofilm activity:

The ethanolic extract of a plant *Terminalia bellirica* was tested for its antimicrobial activity against the oral plaque forming *Streptococcus mutans*. It was found to significantly inhibit biofilm formation. It was found that the extract from *Terminalia bellirica* showed strong activity against *Streptococcus mutans*. The extract also prevents the formation of biofilm by the bacteria. The study suggests possible benefits of this herbal preparation which inhibits biofilm formation by streptococci, an oral pathogen.

Immunological activity:

T. bellirica extract affected T cell proliferation mainly through the same mechanism as PHA. The extract with LPS and PWM also affected B cell proliferation through T cell- independent and T cell- dependent mechanisms respectively. The result indicated the

extract affected cellular mediated immunity (CMI) rather than humoral mediated immunity (HMI).

Antimutagenic activity:

Water, acetone and chloroform extract of TB were examined for their antimutagenic potency using the Ames Salmonella/microsome assay. Acetone extract exhibited variable inhibitory activity of 65.6%, and 69.7% with 4-O-nitrophenylenediamine (NPD) and sodium azide, respectively (as direct – acting mutagens), and 81.4% with 2-aminofluorene (2AF) (an S9- dependent mutagen), in the preincubation mode of experimentation. Inhibition of chloroform and water extracts was rather insignificant.

Contraindication:

It should be avoided during pregnancy as it is unsafe during pregnancy and breast feeding.

It has blood sugar lowering activity; hence, diabetes medications need to be adjusted for diabetic patients.

Due to its blood sugar lowering activity, it may interfere with blood sugar control surgery, hence it should not be taken at least 2 weeks before surgery.

Conclusion:

Terminalia bellirica has been extensively used as traditional medicine. It is native to the Indian sub-continent and Southeast Asia not mostly Sri Lanka. It offers medicinal qualities. Laxative, astringent, anthelmintic, and antipyretic effects are all present its fruits are used to cure, bronchitis, asthma, indigestion, piles diarrhea, cough, Half-ripe fruit is used to make purgatives. Phytochemical studies revealed the presence of various phytoconstituents such as tannins, flavonoids, steroids, lignin, glycosides, terpenoids, saponins, cardenolides flavanol glycosides and fatty acid. It possesses various pharmacological activities such as wound healing, antithrombotic and thrombolytic, angiogenic activity, antihypertensive activity, antioxidant, anti-diabetic, hepatoprotective, haemostatic, antimicrobial, circulatory system, anti-diarrheal activity, acute and sub-acute toxicity, antibiofilm activity, immunological activity, and antimutagenic activity. TB fruits are used natural remedies and promote its use in contemporary healthcare systems.

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