# Review on Ayurvedic, Pharmacognostical, Phytochemical and Pharmacological insights of Brahmadandi (*Tricholepis glaberrima DC*).

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**ABSTRACT** *In the primary health care the plants are of great importance. Ayurveda describes about the medicinal values and uses of plants for healthcare since first time. By the course of time various new plants got added in Ayurvedic materia medica i.e. Dravyaguna vigyan. Brahmadandi (Tricholepis glaberrima DC) is such a plant which got added to it after 10th century, hence less explored.Nowadays its phytochemical analysis and pharmacological activities are being studied. It is mostly used for its aphrodisiac property but there are several activities which need to be taken into account. This review paper encompasses the Ayurvedic aspects as well as the woks done in the title of pharmacognosy, Phytochemistry and pharmacology regarding Tricholepis glaberrima DC.*

***Keywords:*** *Brahmadandi, Ayurvedic,Pharmacognosy,Phytochemical,pharmacological activity, Tricholepis glaberrima.*

## Introduction

Plants have the ability to synthesize secondary metabolites known as phytochemical compounds. In order to treat various acute and chronic inflammatory disorders Plant have a great potential for producing new drugs used in traditional medicine. Due to fewer side effects, the uses of herbal medications are increased now a day.

*Tricholepis glaberrima* commonly known as "Brahmadandi" belongs to family Asteraceae. It is prominently used by traditional healers as an aphrodisiac. It is somewhat termed with a phrase "poor man's sex tonic" by many traditional healers.[1]The plant contains several phytochemical constituents.

## Botanical description

It is a stout annual erect herb[2]quite smooth, grayish,with, , purple, bracts erect, motabor [3]*Leaves* sessile, 2.5-6.3 cm by 3-6 mm, linear oblong or lanceolate, acute entire, spinous, bristle [3] toothed or spinous serrate, punctate, base of cauline leaves not or rarely uricled; midrib and nerves very prominent beneath. *Heads* 6.8 mm long, ovoid, glabrous. *flowers* small and slender, more or less penciled, florets few [3] purple in terminal head [2] *Corollas* 1.25-1.4 cm long purple. Style-arms slender, with a ring of hairs at the base of the lobes. *Pappus* shorter than the achenes, copious, yellowish brown, rigid, subpaleaceous. Achenes oblong , faintly ribbed[4, 2]

**DISTRIBUTION**-.

It is found around West Rajputana, mount abu, Central india Konkan, Deccan, western ghat in Bombay presidency, Hills of Mysore.[4]mahabaleshwar. It often grows on cultivated fields[3]rocky soil of grasslands[5]

**VERNACULAR NAME**- Synonyms-**Guj**- fusiyaroon, Talakanto[4] . tilkatta[6] **Farasi**- baadaavarda. **Marathi**-Bothamore, Dahan **Bangla**- Chhaagaldandi, Vamanadandi [2, 4] **Kannada**-Brahmadandi [7] **English**-Thistle, Smooth Tricholepis.

**Botanical name –***Tricholepis glaberrima* DC

*Tricholepis* is a Greek word meaning *thrix*, *trichos* =hair. and *lepis*, *lepidos* =scale. ( Archives de Botanique2:515.1833) [6]

This genus was established by de Candolle (1838) with five species [8]

The name *glaberrima* is derived from a latin origin *glaber* which means bald, without hairs: (superlative) very smooth, completely smooth, completely glabrous.

Hence the complete name *Tricholepis glaberrima* get established

**Parts used**-The aerial part, whole plant and sometimes bark of roots

**Characters of market sample**-Drug of a pale brown color consisting of pieces of stem and flower heads. Stems slender, round, furrowed, slightly hairy, soft and containing awhile pith: flower heads conical and surrounded by numerous bristly bracts. Within these or in the middle of the flower heads are numerous down like serrated poppus white in color and surrounded on seeds which are erect , wrinkled, furrowed and of a darkish brown color; taste bitterish. The flowers smell like chamomile. [9]

**Material and Methods-**Ancient Ayurvedic texts were studied regarding review of Brahmadandi from different libraries of IMS, BHU.

The online research journals were made available with the help of pubmed and google scholar. Keyword searching done and the papers were read thoroughly in order to know the methodology of work done as well as the outcomes of study.

**Brahmadandi in Ayurveda**

The description about *Brahmadandi* is not found in the Brihattrayi (charak, sushrut and vagbhat). Its description is found in very few Nighantus which means that this plant would have not been included in ayurvedic text before 14th century. Probably it was *Pandit Narhari* who included this medicinal plant in his book '*Rajnighantu*'; a well known materia medica of ayurveda. Later on this got included in *Vaidyamanorama*, *Nighantu ratnakar*, *Shaligram nighantu* , *Nighantu adarsh* like texts.

The botanical identification of brahmadandi is *Tricholepis glaberrima* DC. Brahmadandi has got sanskrit names like *ajalaadandi*, *kantakapatrafalaa* [10], *ajadandi* [11] in ayurvedic texts. It is *Ushna veerya* (Hot in nature) dravya with *Tikta* (bitter) [12] , *Katu* [10] *rasa* (taste) in nature. It has been said to possess *katu vipaka* which diminishes the *kapha* and *vata dosha* predominated diseases like *shopha* (inflammations) [12,10].

In the *Guhyarogadhikar* chapter of Ayurvedic treatment book *Vaidyamanorama* the *Brahmadandi* has been used in different way. The juice of brahmadandi leaves mixed with honey is advised to apply locally in vagina. It produces great pleasure to male partner while intercourse.[12]

Jayakrishnaji bhayi quoted uses- The whole plant of *Brahmadandi* is dried and burned completely. The ash is mixed with oil and applied to the chronic as well as non healing wound. The seeds are grinded and applied over the oedema[12]

**Why it is called Brahmadandi**

Jayakrishnaji bhayi has discussed it in Vaidyakalpataru (Pu 23., vol 2, pp 49).

Bhramavaat (a type of unmaada) is treated with this plant effectively. Whole plant is grinded with 7 seeds of black peeper and given to patient orally in liquid form. It has been seen that within ten days it showed very positive effect, whereas after 20 days of use, the patient started to recognize the persons properly with normal behavior. Hence it can be said that this plant treats the disease *Bhramavaata* effectively so got justification about namimg it as *Brahmadandi*.[12]

**Uses in Ayurveda**

Brahmadandi has been attributed to overcome daurbalya (generalized weakness) kaasa (cough) shvitra (leucoderma), charmaroga(skin diseases) and shopha (swellings) and act as vrishya (as aphrodisiac) [13]

It is believed that this plant is aphrodisiac which provide strength to sexual organs and is used for ailments related to sperm also.

**In Yunani system** of medicine it is believed as a hot and rough plant. It is blood purifier which ultimately nourishes the skin, heals wounds, act as face glow promoting drug. It is useful in leprosy when taken with black peeper for a term of 40 days along with the bread of gram flour as a regular diet. It promotes the intellect and speech when taken with cow milk.It increases libido as well as delays ejaculation also. It is also claimed to be beneficial in hematurea like condition, burning micturition, maintaining the natural color of urine. Post labour pain in uterus is treated with this plant[14]

**PROPERTIES & USES**- -.It is believed to be a nervine tonic and an aphrodisiac and it is used in seminal debility (S Arjun).[4, 2, 7 ,15]The herb is believed to possess antiseptic properties and is employed in the disease of skin.[16] The root bark is stated to be employed in urinary trouble and cough. [2 ,7 , 17]It is an aromatic bitter plant which cures Hysteria [9]

For sore throat, inflammation, contact therapy, stem pieces with phyllocephalum phyllolaneum stem pieces tied around the neck. Root paste used as antidote against snakebite, powdered plant for the treatment of leprosy. As a Veterinary medicine, whole plant is crushed to treat abdominal distention and diarrhea [6]**.** Also used as an antipyretic [18, 19]for regularizing the malfunction of pancreas, malaria, , skin grains, aphrodisiac, stomach pain, blood purification and dysentery [19] **.** Twice a day leaf paste is used for leucoderma and eczema[20,16] it is used as folk medicine for , treatment of cancer, skin diseases and it acts as best tonic for internal use to get rid from exhaustion [21]

**Phytochemical constituents**

The aerial part contain sesquiterpene , lactones, cyneropicrin and 11,13 dihydrodesacylcynaropicrin [22]

Cycloartenol derivatives- sterols isolated from the plant sources that contain conjugated ketone or allylic alcohol features in the sterol side chain. Only the $\Delta^{23}$ -3β,25-diol was found in Tricolepis glaberrima**.**[23] The plant is rich in many pharmaceutical active ingredients like flavonoids, triterpenoids, saponin glycosides and sterols [24, 25]

**PHARMACOGNOSTICAL STUDY**

Padashetty et al (2008) performed a pharmacognostical study of this plant.

**Microscopic studies**-revealed that Periderm was clearly differentiated into phellogen and cortex in the roots of T. *glaberrima.* Transverse section (T.S) of stems was having ridges and furrows. Presence of a clear chlorenchyma layer is the distinct feature of the T.S of *T. glaberrima.* T.S of the leaves shows-a single centrally located vascular bundle.

**Powder microscopy of** T. *glaberrima* showed presence of cortical parenchyma, vessel elements, parenchyma cells showing plasmodesmata and non lignified fibers in bundle.[26]

**Karyomorphological study**

Despande et al (2014) communicated firstly about the karyotypic analysis of T.glaberrima. The somatic chromosomal count was found to be (2n) =32 with a chromosomal length ranging from 0.52-1.19 $\mu$m and arm ratio 1.38-1.17. It possessed only m-type of chromosomes. With a karyotypic formula (2n) =32=2Am +8Bm+ 18Cm+ 2Dm+ 2Em it has been categorized under 1A as per Stebbins (1971) classification. It has also been cleared that though T. glaberrima and T, amplexicaulis belong to same genus are quite distinct in their external morphology but as far the chromosome number and chromosome morphology concerned , they are cytologically similar.[8]

**PHYTOCHEMICAL STUDIES**

**Padashetty Somashekar A**2007 In crude dug market different plants are available under the trade name Brahmadandi i.e. aerial parts of *Tricholepis glaberrima* DC and roots of *Echinops echinatus* Roxb. In order to overcome the problem of substitution and adulteration in the name of Brahmadandi a simple, precise and accurate HPTLC method has been developed which may play an important role for routine quality control of its commercial samples. This simple HPTLC method deals with the quantification of lupeol content in the aforementioned plant species. It has been found convenient. (Padashetty et al 2007)[27]

Singhal et al (1982)reported about the isolation of 11,13-dihydrodesacylcynaropicrin and Cynaropicrin from Tricholepis glaberrima DC.[28]Later on the cynaropicrin [28] was found to be a potent feeding deterrent . This was proved against *Diacrisia oblique* Walker and *Philosamia ricini* Hutton species of pests. This component retained feeding(40%) upto two days from treatment which was considered as an appreciable outcome (Bhattacharyya et al ,1995)[29].

The petroleum ether extractive of T. glaberrima on chromatography over alumina yielded a sterol fraction and a triterpenoid identified as betulin. The sterol fraction on GLC resolution was found to be a mixture of spinasterol , stigmasterol and stigmast-7-enol.(chawla et al ,1976)[24]

Presence of betulin, spinasterol, stigmasterol and stigma-7-en-3-ol has been reported in T glaberrima. For the first time chawla et al (1978) reported about the presence and isolation of Cycloart 23-ene-3β-25 diol, an uncommon triterpenoid from T. glaberrima. This formed the first report of its occurrence in the genus Tricholepis. The Cyclortendiol was found in petroleum ether extract of this plant. (chawla et al ,1978)[30]

**Padashetty et al(**2008 )carried the preliminary phytochemical studies which showed the lower yield of petroleum ether extract indicating the low content of non polar constituents. Whereas chemical tests on T. *glaberrima* showed the presence alkaloids as the chief constituents.Determination of physicochemical constants indicated a higher ash value in T. *glaberrima* (10% W/w). A higher alcohol and water soluble extractive values in case of T. *glaberrima* (9.6 and 13.2% w/w respectively) Preliminary phytochemical screening showed the presence of alkaloids, terpenoids and phenolic compounds in T. *glaberrima,* all of these can be extracted using methanol as solvent.

Determination of inorganic elements, including the trace elements and heavy metals has gained outstanding importance in the life sciences. The recent reports on the potential deleterious effects of some Ayurvedic medicines, due to presence of unacceptable levels of metals and metalloids such as Lead, Arsenic, Mercuiy etc, and their possible chronic toxicological effects, have caused much concern not only among the herbal practitioners,

but also among large population who still depend on the medicinal plants for their healthcare needs.

Aerial parts of T. *glaberrima* were found to be devoid of arsenic and cadmium but were found to contain traces of lead (21.6 ppm) which is within the limits of WHO specifications for heavy metal content[26].

**Yadava et al (2009).** Air-dried powdered flowers (4 kg) of the plant were extracted with 95 % methanol in Soxhlet apparatus for 1 week. The total methanolic extract was successively partitioned with petroleum ether. The acetone soluble fraction of the plant gave two spots on TLC examination, indicating it to be mixture of two compounds. These were separated by column chromatography over silica gel column and purified by preparative TLC yielded compound 1 and 1a. Compound 1 and 1a were studied separately.

Its IR spectrum, 1H NMR spectrum of compound, Acid hydrolysis of compound was performed.The position of sugar moieties in compound 1 were established by its permethylation followed by acid hydrolysis. Enzymatic hydrolysis of compound was also done. Keeping all basis of above studies as evidences, the structure of compound 1 was confirmed as 5,2'-dihydroxy-3,6,7-trimethoxy flavone-5-O-α-L-rhamnopyranosyl-(1→4)-O-β- D-xylopyranosyl-(1→4)-O-β-D-galactopyranoside.[31]

**Shivraj H. Nile** 2009

In order to evaluate the nutritive value and mineral content of plants used for diabetes like diseases a study carried by shivraj et al under which the aforesaid values of T. glaberrima was assessed along with three other plants. By using flame photometry and various titration methods the mineral elements were analysed whereas the nutrients were analysed by using different biological methods.

The sufficient amount of mineral elements like P(0.175), K(0.76%), Na(0.42%), Ca(0.145%) , Fe(0.36%), Zn(0.09%), N(0.42%), Mg(12.34%) are found but a low Cu(0.042%) and Cr(0.003%) content was noticed in *T. glaberrima* (Brahmdandi). A low fat content but rich carbohydrate and enough protein with good nutritive value has been found in it.

The percentage of magnesium higher( **Mg** 12.34%)in *T. glaberrima*, Mg plays important role in the formation and biological functions of muscles , bones, enzymatic activities and preventing the depression ,high blood pressure and heart diseases like life threatening conditions.[30] Irritability and nervousness are caused due to its deficiency which also interferes with the transmission of nerve and muscle impulses.

**The potassium content( K=**0.76%)was found higher but the level of sodium **(Na=**0.42%) was low. K and Na play the role of the ionic balance of the human body. In the maintenances of nerve impulses and heart rhythms the potassium plays an active role ; due to deficiency of which nervous irritability, mental disorientation , low blood sugar , insomnia and coma like conditions develop rapidly.The availability of Mg and K may establish a scientific explanation for traditional uses of Tricholepis glaberrima in nervous diseases.

*T. glaberrima* contain a high level of Calcium which is attributed to playing important role in building and maintaining strong bones and teeth also a large part of human blood and extra cellular fluids. Normal functioning of cardiac muscles, blood coagulation, milk clotting and regulation of cell permeability requires the adequate amount of calcium. Its deficiency causes rickets, backache, osteoporosis, irritability, cramping of the uterus and premenstrual tension. **Here an attention is required that in Ayurvedic practice the decoction of *T. glaberrima* is used in the condition of painful menstruation, amenorrhea and hypomenorrhea . I personally experienced it on several patients under supervision of my guru and got excellent results.**

A low amount of Zinc and copper is noticed in *T. glaberrima* .Cu is an important component of an iron oxidizing enzyme in blood

Zinc help to construct and maintain DNA, required for growth and repair of ligaments, tendons and other body tissues. Its deficiency results in clinical consequences, including growth delay, diarrhea and disturbed neuropsychological status.

*T. glaberrima* contain very low amount of potassium; an element necessary for normal heart contraction and playing important role in maintaining bodys acid alkaline balance also.

*With a* **Percentage Ash Content (**8.1%) and **Moisture Content (**20.05%) *T. glaberrima* shoot has **Crude Fat content (**5.5%) **Crude Protein** (6.4%) **Crude Fibre (**13.1%) **Crude Carbohydrate(**59.5%)in sufficient amount. on a dry matter (DM basis) it has a good nutritive value (313.1 calorie/100gm), which supports its use as food, fodder and good source of various important nutrients for live stock[32]

**PHARMACOLOGICAL STUDIES**

**Antifungal activity of the compound 1**: In a study **(Yadava et al, 2009).**the antifungal activity of the acetone soluble fraction of compound1 from extract of Tricholepis glaberrima was observed. It was tested against various fungi at various concentrations. For observation of this activity the Petri dishes were placed on "Saboraud's broth media" with (4 %) agar. The zone of inhibition was recorded in terms of diameter at 27 ± 1 ºC after 48 h. it was found that the antifungal activity of compound 1 was good against Trichoderma viride followed by Aspergillus niger. As a standard antifungal agent the Griseofulvin was used. The compound 1 was further identified as 7, 3'-dihydroxy-6, 4'-dimethoxy flavones. [31]

**Hepatoprotective activity**

In order to assess the role of Tricholepis glaberrima in hepatotoxicity induced by rifampicin and Bacillus Calmette-Guerin/lipopolysaccharides (BCG/LPS) in rats a study was performed by Gound et al (2015).it was also attempted to understand its probable mechanism of actions.

For inducing hepatotoxicity in rats the rifampicin was administered for 30 days and in another experiment BCG on day 1 and LPS on day 11. The parameters for assessment of hepatotoxicity were alteration in level of total proteins, serum marker enzymes, , MDA and NO formation, cytokines mainly IL-6 and TNF-α and histoarchitecture alterations in both the experiments. ELISA method.was applied for determination of IL-6 and TNF-α level in liver homogenates.

It was found that Administration of both rifampicin and BCG-LPS elicited hepatic damage which reflected in significantly ($p<0.01$) increased MDA, serum marker enzymes AST, ALT, ALP, GGT, LDH, depleted total proteins, and formationof NO in liver homogenate. In both the experimental conditions IL-6 and TNF-α found increased significantly. The Pretreatment with Methanolic Extract of Tricholepis glaberrima (METg)and silymarin attenuated significantly ($p<0.01$) marker enzymes, TP, MDA and NO formation as well as IL-6 and TNF-α production in liver homogenates. Whereas Prophylactic treatment with METg exhibited significant improvement in liver damage as compared to therapeutic treatment.

It has been concluded that the METg exhibit the hepatoprotective activity by ameliorating the immunological insult And oxidative stress through improving antioxidant defense ability of hepatocytes as well as by reducing the cytokines (TNF-α, IL-6 and NO) [33]

**Antioxidant activity**

There is an inverse relationship between dietary intake of antioxidant rich foods and the incidence of human disease. And the antioxidant from natural source is immensely appreciable.

In order to determine a potential natural antioxidant source the antioxidant activities of *Tricholepis glaberrima DC*.was subjected for evaluation by **Naphade et al 2009** .

The FTC (ferric thiocyanate )and TBA(thiobarbituric acid) methods were applied for evaluation of antioxidant activity of three different extracts of aerial parts of Tricholepis glaberrima DC . The study was carried out on aqueous, chloroform and methanol extracts of the aerial parts of plant.

Free radicals hamper healthy cells, causing genetic damage and mutations as well as tearing the cell membranes. They give rise to atheromatous plaques while react with serum lipoprotein (LDL). Also cause peroxidation of polyunsaturated fatty acids and generating further free radicals when react with the cell membranes lipid . So, there is need of antioxidants in the different body compartments such central nervous system and across the bloodbrain- barrier as well as in the circulating system inside the cells .

At the primary stage of linoleic acid peroxidation the FTC method was implied to measure the amount of peroxide formed. In this method the concentration of peroxide remains inversely proportion to the antioxidant activity.

when compared with the standard vit C the aqueous extract possessed significant antioxidant activity.whereas in comparision to chloroform and aqueous extract the methanolic one was found to have high antioxidant activity as suggested by analysis of outcomes of FTC and TBA method. The study indicate about natural antioxidant potentiality of the plant*Tricholepis glaberrima DC*[39,40] .

**Aphrodisiac property**

Because infusion of its aerial parts are prescribed traditionally in seminal debility and impotence So, in order to investigate this claim a study was performed to document the effect of methanolic extract of the aerial parts in sexually active male rats by **Padashetty** et al( 2007)

In addition, the effect of the extract on the activity of two antioxidant enzymes, viz. catalase and superoxide dismutase in testicular homogenate as well as on the testicular histology were also assessed. The methanolic extract of aerial partss of *Tricholepis glaberrima DC* was administered at the dose of 200mg/kg b.w for 28 days which altered the various components of the sexual behavior study significantly. It increased the intromission latency (IL) and mounting latency (ML) significantly and with a significant reduction in intromission frequency (IF), post-ejaculatory interval (PEI) and mounting frequency (MF).The testicular histology suggested that the extract enhances proliferation of seminiferous epithelium which in turn favors spermatogenesis. Therefore, findings provide experimental evidence that the extract of T. glaberrima possesses aphrodisiac properties.

The data obtained reveal that methanol extract of T. glaberrima effectively facilitates several components of the copulatory behavior. The observed activity could be due to either drug-induced changes in neurotransmitter levels or their action in the cells. The increase in the body weight of T. glaberrima–treated rats could be due to the androgenic properties of this plant as androgens possess anabolic activity (Johnson & Everitt, 1988). Increase in testicular phospholipids and cholesterol may be due to decrease in testes function or viceversa. In the current findings,decreased level of cholesterol was observed which suggest its increased utilization for steroidogenesis. A significant increase in alkaline phosphatase in the treated group was observed which reveal to increase the prostatic secretions and helping for maintenance of proper pH of seminal fluid which is thought to be necessary for retaining the sperm motility .

Hence in the condition when there is case of diminished prostatic secereton associated with male infertility the *Tricholepis glaberrima* may serve as an effective tool.

The health of sperm depends upon the status of antioxidants present in body. From the results, it was observed that in the testicular homogenate of the rats had significant increase in the activity of two powerful antioxidant enzymes i.e. catalase and superoxide dismutase when compared to the control rats.. These enzymes may help in order to retain the motility and viability of the sperm by effectively neutralizing the deleterious effects of the ROS(reactive oxygen species). these enzymes play an important role. This may help in improving the success rate of treating male infertility.

Testicular histomorphology of animals treated with T. glaberrima showed that mean STD and GECT were significantly higher when compared with control group. Increment in these values are indication of better proliferation of the testicular tissues and thereby representing better spermatozoal maturation within the seminiferous tubules leading to healthier spermatogenesis.

The flavonoid content of the plant may also contribute to its sex-stimulating activity as flavonoids were shown to alter the androgen levels (Ageel et al., 1994), which play an important role in sexual stimulation, and also it is well-known that these compounds increase significantly SOD and catalase activities (Toyokuni et al., 2003) thereby imparting an indirect potentiating effect on the observed activity.

Conclusively the results presented in this article indicate the potential value of T. glaberrima as a therapeutic agent in treating male infertility seems high. it can enhance the sexual activity in normal rats and favors spermatogenesis by enhancing the proliferation of seminiferous epithelium.

The plant T. glaberrima was credited to fall under the domain of aphrodisiacs which increase the sexual desire and those that improve the quality and stimulate the production of semen.[1]

**Neuropharmacological potential**

For investigating the neuropharmacological potential of Tricholepis glaberrima, a study has been done by **Naphade et al (2009).**this study was carried out at different doses (100, 300 mg/kg) of methanol, chloroform and aqueous extracts in mice. For the study the oral toxicity was also tested after which no any toxicity was found upto the dose of 2gm /kg but tendency of sedation was noticed above the dose of 1gm/kg. for assessment of activity the effect of motor coordination, object recognition test, Haloperidol induced catalepsy, sodium nitrite induced respiratory arrest, maximum electroshock induced seizures (MES) were observed.

Increase in muscle relaxation, discrimination index as well as potentiation in haloperidol induced catalepsy and increament in reaction time in analgesic activity was exhibited by CHE, MHE and AQE. at two dose levels (100 and 300 mg/kg) of extract . The improvement in discrimination index as well as improvement in memory in absence cognitive deficit stands a major criteria of nootropic activity. Between time intervals of 15-60 min a significantly potantiation in haloperidol- induced catalepsy observed at the dose level of 100 and 300 mg/kg. It did not produce any significant anxiolytic activity when tested on EPM and double unit mirror chamber too. CHE extract shows better analgesic activity than other extract. The anticonvulsant effect in MES model couldnot be found. Also the extracts failed to decrease the effect of sodium nitrite which indicates that extracts did not increase the cholinergic transmission in the CNS.

It is thus apparent that different extract of *Tricholepis glaberrima* plant exhibited
improvement in the discrimination index, potentiation of haloperidol induced catalepsy, and increase in reaction time in analgesic activity and muscle relaxant activity.as a conclusive remark it can be suggested that due to presence of terpenoids and phenolic like phytoconstituents the aforesaid dopaminergic transmission is facilitated by the different extracts of Tricholepis glaberrima.[34]

**Anti inflammatory activity**

In order to assess the anti-inflammatory activity of the Methanolic and aqueous extract of aerial part of *Tricholepis glaberrima* extracts **Veena et al (2017)** administered them at the dose of 100mg/kg, 200mg/kg and 400mg/kg, per orally in carrageenan induced right hind rat paw odema method in albino rats.

At different time intervals the difference in paw oedema thickness were calculated in each control, test, standard and toxic groups. It was found that the animals treated with toxicant carageenan (0.1ml of 1%)were getting a significant increase in paw thickness at the end of 24$^{th}$ hr than the initial paw thickness. Whereas Significant reduction in the thickness of paw was observed when the animals were treated with different doses of methanolic and aqueous extract of *Tricholepis glaberrima.* It reversed the carrageenan induced toxicity in the terms of paw thickness drastically and was less than that of control animals at different hours.

Elevation in paw thickness observed at 1st hr and 2nd hour as compared to 6th and 24th hour followed by the values lowered in 3rd, 4th, and 24th hr respectively, and comparable to that of standard diclofenac

sodium(10mg/kg) and control groups. Both extracts had showed same anti-inflammatory activity in carrageenan induced animals at different doses and time intervals.

Carrageenan-induced paw edema which is a biphasic response in vivo model is frequently employed to assess the anti-edematous effects .

The effectiveness of plant extracts to suppress inflammatory responses may be due to the presence of secondary metabolites and their inhibitory action on COX enzymes.

This study revealed that the extract of *Tricholepis glaberrima* showed possible significant inhibitory action on paw edema, due to presence of tannins, glycosides, saponins, alkaloids, and flavanoids like phytochemical constituents by inhibiting the action of cox-2. It thereby inhibits the synthesis of prostaglandins, an inflammatory mediator.

This study concludes with a remark that the extracts of *Tricholepis glaberrima* possess significant anti-inflammatory activity which supports the claim in its use in traditional medicines for the treatment of inflammatory diseases.[35]

**Antibacterial activities**

In order to assess the antibacterial activity of several plant extractswhich were being utilized for cure of different diseases the methanolic and acetone extracts of Tricholepis glaberrima was also taken into account against seven different bacterial strains by **Noreen et al (2012).** It was done through diffusion method and microdilution method.plant extract (20 mg/mL) was used to evaluate antibacterial activities.

The methanolic extract showed more activity than the acetone extract against tested organisms. Using atomic absorption spectrophotometer the elemental composition of plant was also explored in order to know natural sources of essential element that can be utilized for medicinal purposes.

The results of antimicrobial activity of crude extracts (methanol and acetone) of the plant *T. glaberimma* showed good antimicrobial activity against almost all the strains of selected bacteria as judged by zones of inhibition as compared favorably with the standard antibiotic ciprofloxacin and methicillin . plant extract exhibited a broad spectrum of activity.

The methanolic extract of T glaberrima exhibited best inhibition against *S.aureus* (30mm) which was more than even possessed by controls i.e methicillin (24 mm)and ciprofloxacin (26mm). whereas this extract exhibited good inhibition against *B. subtilis* (25 mm)which was about same as exhibited by controls i.e methicillin (27 mm)and ciprofloxacin (28mm).

As far as acetone extract concerned , it exhibited its best inhibition against S. aureus (23 mm) which was almost same as the controls exhibited.

The E. coli exhibited resistance against methanolic extract whereas the *M. luteus*;and *B. subtilis were foun resistant against acetone extract.*

These plants extracts were bacterostatic at lower concentrations and bacteriocidal at higher concentrations as revealed by MIC and MBC values shown.The phytochemical analysis of the plant extract revealed the presence of tannins, alkaloids, saponins and flavonoids.

Herbs that have tannins as their main components are astringent in nature and are used for treating intestinal disorders such as diarrhea and dysentery thus exhibiting antimicrobial activity.

One of the largest groups of chemicals produced by plants is the alkaloids and their amazing effects on humans have lead to the development of powerful pain killer medications . The metallic analysis revealed the presence of maximum concentration of sodium and magnesium Hence this study establishes the antibacterial activity of extracts of *T. glaberrima*.[36]

**Antidepressant activity**

Kiranmai et al 2017

The main objective of this research work was to evaluate the antidepressant activity of Tricholepis glaberrima in rats. The study was undertaken to evaluate the possible antidepressant effect of *Tricholepis glaberrima* aerial parts using forced swimming test and tail suspension test models of depression. Imipramine was taken as a standard drug with a dose of 10mg/kg, Group 3, 4 and 5 received METG at the doses of 200, 400 and 600mg/kg respectively. Methanolic extract of aerial parts of *Tricholepis glaberrima* produced significant antidepressant like effect at the dose of 600mg/kg in both models of FST and TST which indicated reduction in immobility time. The efficacy of METG at 600mg/kg found to be comparable to that of standard drug Imipramine at 10mg/kg. The results of study indicated that methanolic extract of aerial parts of *Tricholepis glaberrima* possesses significant antidepressant activity compared to that of standard drug imipramine.

Depression is a heterogeneous, life threatening illness which is characterized by negative mood, decreased physical activity and feelings of helplessness and is caused by decreased levels of Monoamines like noradrenaline, dopamine and serotonin in brain.

Therefore, the drugs which have the potential to enhance the reduced levels of Monoamines , first by inhibiting Monoamine oxidase enzyme and the second way is through inhibiting reuptake of those neurotransmitters which are necessary for normal brain function, may be effective in the treatment and management of depression.

Those drugs which can reduce the immobility period in rodent models of depression are therapeutically effective in human depression. Thus for this study both forced swim test (FST) and tail suspension test (TST) were used to screen antidepressant potential of *Tricholepis glaberrima.* methanolic extract of *Tricholepis glaberrima* the antidepressant like potential might be due to the presence of phytochemical constituents such as alkaloids, flavonoids and glycosides. Thus these phytoconstituents might be responsible for the treatment of depression.

It is believed that the pathophysiology of depression is due to the decrease levels of monoamines such as serotonin, dopamine and noradrenaline in the brain. Inhibition of this enzyme monoamine oxidase (MAO) causes a reduction in metabolism and subsequent increase in the concentration of biogenic amines

The methanolic extract of *Tricholepis glaberrima* contains chemical constituents like alkaloids (ephedrine), flavonoids which may act as reversible monoamine oxidase inhibitors and improves the activities of dopamine and serotonin in the brain by blocking the enzymatic breakdown of the brain chemicals by monoamine oxidase inhibition and possesses antidepressant like activity. And they promotes the transport of both dopamine and serotonin precursors into the brain by increasing the permeability of the blood brain barrier to the precursors and eliciting the antidepressant potential.The reduction of immobility period in animal models of depression is due to the enhancement of monoamine neurotransmitters.

The results concluded that the shortening of immobility time in the (FST) and (TST) mainly depends on the enhancement of central 5HT and catecholamine neurotransmitters, these effects are thought to be due to the presence of chemical constituents like, alkaloids, flavonoids and glycosides. Hence *Tricholepis glaberrima* aerial parts extract possesses antidepressant effect in animal models of depression.[37]

**ALPHA AMYLASE INHIBITORY ACTIVITY**

**(Qureshi et al** 2017)

In the study, 70% Hydroethanolic extract of polyherbal formulation AET, containing leaves of *Argemone mexicana*, roots of *Echinops echinatus*, and aerial parts of *Tricholepis glaberrima* was investigated for its potential to inhibit α-amylase enzyme. For the evaluation of α-amylase enzyme inhibiting potential of a polyherbal formulation AET, its 70% hydroethanolic extract was subjected under study. Along with other two components the aerial part of Tricholepis glaberrima was a part of AET. The % yield of 70% Hydroethanolic extract of Polyherbal formulation AET was found to be 4.61%. For Invitro α – amylase inhibition assay, the formulation was tested for its activity in four concentrations. Highest amylase inhibition of 74.67% was observed at 25 mg/ml concentration of the extract.

It has been concluded from the results that use of this formulation AET will be beneficial in reducing digestion rate and absorption of carbohydrates. This can be effective in treatment of diabetes. This study indicates the antidiabetic potential in *Tricholepis glaberrima*.[38]

**Conclusion:** on dry matter basis these medicinal plants shows high nutritive value with maximum percentage of important minerals, which can be used for health care during
anaemic condition and as food and fodder for livestock.

The strong antioxidant activity of extracts of *Tricholepis glaberrima DC* may be useful in the treatment of arteriosclerosis, cancer, diabetes, malaria, heart disease, stroke and acquired immunodeficiency syndrome.

This study would lead to the establishment of some compounds that could be used to formulate new and more potent antimicrobial drugs of natural origin. Herbal products are preferred as a symbol of safeguard in comparison to synthetic one which shows various untoward effects on health. The present literature review supports the broadness of activity present in the various parts of *Tricholepis glaberrima* DC. The advanced phytochemical analysis entails us the presence of a variety of active molecules which may be responsible for its various biological activities. From Ayurvedic review it seems that there are several pharmacological activities attributed to it but their scientific validation and documentation is awaited till now. More research can be done to explore the unexplored potential of *Tricholepis glaberrima* DC.

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