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A comprehensive overview of *Gokshura* (*Tribulus terrestris* Linn.)

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ABSTRACT

Gokshura (Tribulus terrestris Linn.*)* is very revered herb of the Indian Ayurvedic system of medicine for treatment of various kinds of diseases. Its various parts conatain variety of chemical constituents which are found medicinally important. Although the review articles on this plant are already published, this review article is presented to compile the complete literature review of *Gokshura* from *Brihatrayi* and updated information on its pharmacological activities, which are performed by widely different experiments. Various studies which are done on *Gokshura* revealed the result that the plant possesses Antiurolithiatic, Antimicrobial, Antihelminthic, Cardiotonic, Anti- inflammatory, Hypolipidemic, Immunomodulatory, Antispasmodic, Analgesic, Aphrodisiac, Antidiabetic, Anti-tumour, Hepato-protective, Anticarious, Anti-oxidant, CNS modulator properties. Considering its therapeutic values, a review has been done to gather complete information on different aspects of *Gokshura*.

Key words: *Gokshura, Tribulus terrestris Linn, Brihatrayi, Phytopharmacological properties.*

INTRODUCTION

Tribulus terrestris is a well-known reputed Ayurvedic drug. In Ayurveda, it is popular by the name *Gokshura*. *Gokshura Moola* (root of *Tribulus terrestris* Linn.) is a component of *Dashmoola* (group of ten medicinal plants principally comprising of roots as the useful part) which is used in the managment of various diseases. The drug is well described in *Brahatrayi* (*Charaka Samhita*, *Sushrut Samhita*, *Astanga Hridaya*) and *Ayurvedic Nighantus* with its synonyms and therapeutic potential.[6] In the commentary of *Madanapala Nighantu*, it is mentioned that the root is used in *Dashmoola* while the fruit is *Vrushya* (aphrodisiac). Mainly two varieties of *Gokshura* are found in *Samhitas* and *Nighantus* – *Brihat Gokshura* (*Pedalium murex* linn.) and *Laghu Gokshura* (*Tribulus Terrestris* linn.).[7]

Tribuus terrestris is also called as a punctue vine is an annual flowering (yellow colour) plant which belongs to Zygophyllaeceae family found in hot places. It is found in various countries of subtropical part of world such as India, Pakistan, China, Africa, Australia, southern and western Europe, North Africa. *Tribulus terrestris* is a common weed plant with divaricate spines found in sandy soil and waste lands.[8] It is anannual herb which is rarely Perennial having yellow flowers and woody fruits with spines.[9] It has been reported that *Tribulus terrestris* possess antimicrobial, antihypertensive, diuretic, anti-acetylcholine, haemolytic activity, stimulate spermatogenesis and shows anti tumour activity. Many articles are already published on *Gokshura* regarding its pharmacological, anatomical, phytochemical properties. In this paper review all possible update regarding its chemical,

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pharmacological, ethnomedicinal properties has been done with its potential in Ayurveda.

GOKSHURA (*TRIBULUS TERRESTRIS* LINN.)

- **Family:** Zygophyllaceae
- **Classification:**
  - *Charaka: Krimighna, Anuvasanopaga, Mootravirechaneeya, Shothahara mahakashaya.*[1]
  - *Sushruta: Vidarigandhadi, Veeratarvadi, Laghupanchamoola, Panchkantaka Gana*[2] *Bhavaprakasha: Guduchyadi Varga*[3]
- **Synonyms:**
  - Sanskrit Names: *Goksuraka, Trikanta, Svadamstra, Traikantaka.*[4]
  - English Name: Small Caltrops, Land caltrops, Puncture vine.[5]

Gokshura in *Brahatrayi*

Charaka Samhita

SN	Name of formulation/*Yoga*	Uses	Reference
1.	*Sothhara Mahakashaya*	*Shool* (Pain), *Sotha* (Inflammation)	C.Su. 4/38
2.	*Gokshura*	*Mutrakrichara* (Difficulty in micturation), *Vatahara*	C.Su.25/39
3.	*Branhani Gutika*	*Vrishya*, *Brnhana*, *Balavardhaka*	C.Ci. 2(1)/25
4.	*Agruvadi Taila*	*Sheetjwara*	C.Ci.3/266
5.	*Gokshura Ksheera*	*VatanubandhitaRakta pitta*	C.Ci.4/84
6.	*Gokshura Ksheera*	*MutramarggataRakta pitta*	C.Ci. 4/85
7.	*Duralabhadhya Ghrita*	*Jwara, Daha, Bhrama, Kasa, Ansshoola, Parshvashoola, Shiroruja, Trishana, Chardi, Atisara*	C.Ci.8/107-110
8.	*Rasanadi Ghrita*	*Yakshma (Shosa)*	C.Ci.8/170
9.	*Kantkari Ghrita*	*Hikka, Swasa, Kasa, Kaphavyadhi*	C.Ci.18/127-128
10.	*Punarnavadi Yoga*	*Ashmari, Sharkara*	C.Ci.26/63
11.	*Tryushandi Ghrita*	*Swasa, Kasa, Pandu, Halimaka, Hridyaroga, Grahni*	C.Ci.26/87-89
12.	*Piluparnyadi Taila*	*Urustambha*	C.Ci.27/41-42
13.	*Amritadhya Ghrita*	*Ksheenaveerya, KsheenJadaragani, Alpabala, Mansaroga, Unmada, Apasmara, Vatavayadhi*	C.Ci.28/159-164
14.	*Basti Yoga (Niruha Basti, Uttara Basti)*	*Mutrashyashoola, Mutaravikara*	C.Si. 9/8
15.	*Yapana Basti (Niruha Basti)*	*Lalita, Sukumara, Mathunarata, Yakshama, Kshata, Vridha, Jiranarsha, Santanichuka*	C.Si. 12/15(2)
16.	*Shaliparnyadi Basti*	*Ksheenindarya, Ksheen* due to *Jwara*	C.Si.9/15(11)

C.Su.-Charaka Samhita Sutarasthana, C.Ci.- Charaka Samhita Chikitsasthana, C.Si.-Charaka Samhita Siddhi Sthana.

Sushruta Samhita

SN	Name of formulation/*Yoga*	Uses	Reference
1.	*Gokshura Ksheera*	*Vrishya*	Su.Ci.26/35
2.	*Mustadi Basti (Yapana Basti)*	*Vatarakta, Prameha, Sopha, Arsha, Gulma, Mutravikara, Vibandha, Visharpa, Jwara, Atisara, Raktapitta, Balya, Jeevaniya, Vrishya, Chakshusya, Shoolnasaka*	Su.Ci.38/106-111

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3.	*Samangadi Lepa*	*Keetdansha*	Su.Ka. 8/132-133
4.	*Prishanparnyadi Ghrita*	*Jirnajwara, Shiroshoola, Parshvaruja, Kasa, Kshaya*	Su.Ut.39/223
5.	*Erandamooladi Kashyam*	*Vataja, Pittaja, Kaphaja* and *Sannipataja Shoola*	Su.Ut.42/112-115
6.	*Gokshuradi Ksheera*	*Mutraghata*	Su.Ut.58/33

Su.Ci.- Sushruta Samhita Chikitsasthana, Su.Ka.- Sushruta Samhita Kalpasthana, Su.Ut. -Sushruta Samhita Utartantara

Ashtanga Hridaya

SN	Name of formulation/*Yoga*	Uses	Reference
1.	*Laghupancha Moola*	*Sarvadoshjita, Hikka, Swasa, Kasa, Shoola*	As.H.Su. 6/168, As.H.Ci. 1/29
2.	*Patoladiksheera Basti*	*Jwara*	As.H.Ci. 1/119-120
3.	*Laghupanchmoola Ksheera*	*Raktapitta*	As.H.Ci.2/37-38
4.	*Kantkari Ghrita*	*Kasa, Swasa, Hikka, Kaphajavyadhi*	As.H.Ci. 3/61-62
5.	*Jivantyadi Ghrita*	*Yakshama*	As.H.Ci. 5/16-17
6.	*Rasanadi Ksheera*	*Shosa (Yakshama)*	As.H.Ci. 5/24
7.	*Hingvadi Lavana*	*Vatasaleshmvikara, Garvisha*	As.H.Ci. 10/53-55
8.	*Satavaryadi Kashaya*	*Mutraghata*	As.H.Ci. 11/6
9.	*Gandharvahastadi Yoga*	*Ashmari*	As.H.Ci. 11/21
10.	*Brahtayadigana Ksheera/Ghrita*	*Sarvamutaravikara*	As.H.Ci. 11/35
11.	*Vyagharigokshura Yavagu*	*Mutaraghata*	As.H.Ci. 11/38
12.	*Erandadi Ksheera*	*Medovartinirgamana*	As.H.Us. 26/53
13.	*Gokshuraka Rasayana*	*Kama (Vrishya)*	As.H.Us. 39/56
14.	*Gokshura*	*Mutrakrichara*	As.H.Us. 40/55

As.H.Su.-Astanga Hridaya Sutarsthana, As.H.Ci.- Astanga Hridaya Chikitsasthana, As.H.Us.-Astanga Hridaya Utarasthana.

Chemical constituents

Chlorogenin, Diosgenin and its acetate, Gitogenin, Astragalin, Dioscin, Gracillin, Hecogenin, Ruscogenin, Trillin, Spirosterol, Saponin, Kaempferol, Glucose, Rutin, Harmine, Quercetin, Amino acids.[4]

Phytochemistry

Gokshura as a whole plant contains a number of chemical constituents.

Group of Phytochemical	Chief phytochemicals	Reference
Alkaloids	Tribulusin A, tribulusamide C, tribulusterine, terrestriamide, harman, harmine , harmmol, N-trans-caffeoylyramine, N-transcoumaroyltyramine	A review on advancements in ethnomedicine and phytochemistry of *Tribulus terrestris* - a plant with multiple health benefits, International Journal of Biosciences, Vol. 14, No. 1, p. 21-37, 2019
Flavonoids	Kaempferol, isorhamnetin and quercetin	A review on advancements in ethnomedicine and phytochemistry of *Tribulus terrestris* - a plant with multiple health benefits, International Journal of Biosciences, Vol.

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		14, No. 1, p. 21-37, 2019
Amino acids	Alanine and threonine	A review on advancements in ethnomedicine and phytochemistry of *Tribulus terrestris* - a plant with multiple health benefits, International Journal of Biosciences, Vol. 14, No. 1, p. 21-37, 2019
Saponins	108 types of steroidal saponins, 58 types of Spirostanoland 50 types of furostanol	A review of traditional pharmacological uses, phytochemistry, and pharmacological activities of *Tribulus terrestris*, Zhu et al. Chemistry Central Journal (2017) 1-16
Organic acids	Benzoic acid, vanillic acid, 2-methyl benzoic acid, ferulic acid, succinic acid, palmitic acid	A review on advancements in ethnomedicine and phytochemistry of *Tribulus terrestris* - a plant with multiple health benefits, International Journal of Biosciences, Vol. 14, No. 1, p. 21-37, 2019

Pharmacological Properties

- *Rasa: Madhura, Tikta*
- *Guna: Guru, Snigdha*
- *Virya: Sheeta*
- *Vipaka: Madhura*
- *Doshaghnata: Vatahara, Kaphahara, Pittahara*
- *Karma: Vrishya, Brimhana, Mutrala, Balya, Dipana, Kesya, Shothahara, Vedanasthapana*
- *Rogaghnata: Amavata, Amlapitta, Antravriddhi, Ashmari, Arsha, Hridroga, Raktapitta, Shoola, Shotha, Vatarakta*[10]

Pharmacological Activities

Antiurolithiatic activity

Tribulus terrestris has been successfully used for the treatment of urinary tract disease. Ethanolic extract of the fruit of *tribulus terrestris* showed significant dose dependent protection against uroliths induced by glass bead implantation in albino rats.[11]

Calcium oxalate monohydrate (COM) calcium oxalate dihydrate (COD) containing stones are commonly found as urinary stones. Inhibition of COM crystals growth was observed by *tribulus terrestris* extract.[12]

Antimicrobial activity

The ethanol extract showed antimicrobial activity against both gram positive and gram negative bacteria and antifungal activity. Methanolic extract of *Tribulus terrestris* showed growth inhibitory effects and antimicrobial activity against salmonella and e.coli and no microbial activity was observed for bacillus badius, lactobacillus plantarum and lactococcus lactus.[13]

Antihelminthic activity

Tribulosin and sitosterol glycosides present in 50% methanolic extracts of *tribulus terrestris* reported to possess anti helminthic properties. The extracts of *tribulus terrrestris* show in vitro anti-helminthic activity against caenorhabditis elegans.[14]

Cardiotonic activity

The (tribulosin) saponins in *Tribulus terrestris* is effective at cardiac ischemia/reperfusion injury and the underlying mechanism in rats.[15] The tribulosin reduced the myocardial apoptosis rate and treated rats showed ewduced MDA, AST, CK, CDH contents with elevated activity of SOD. The major phytochemical saponin is positive in response to

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dilate the coronary artery and improves circulation in blood vessels.[16]

Anti-inflammatory activity

The extract (methanolic) of *Tribulus terrestris* showed inhibition of rat paw volume in carrgeena induced inflammation in rats.[17]

Hypolipidemic activity

The extract (aqueous) of the fruits of *Tribulus terrestris* was evaluated for the hypolidemic activity in wistar albino ratswith a decrease in cholesterol, triglycerides, low density lipoprotein (LDL), very low density lipoprotein (VLDL), and atherogenic index (AI), and an increase in high density lipoprotein (HDL) levels in the blood. Hypolipidemic activity may be due to the presence of phenolic compounds.[18]

Immunomodulatory activity

An alcoholic extract of the whole plant of *Tribulus terrestris* exhibited a significant dose dependent increase in humoral antibody titre and delayed type hypersensitivity response, indicating increased specific immune response.[19]

Antispasmodic activity

The lyophilized saponin mixture of the plant exhibited a significant decrease in peristaltic movement of rabbit jejunum preparation in a dose dependent manner.[20]

Analgesic activity

It was found that the extract of *Tribulus terrestris* showed pain reducing activity by studying male mice using formalin and frick test. It was found that the methanolic extract of 100mg/ml is sufficient to produce an analgesic effect.[21]

Aphrodisiac activity

Phytochemical and pharmacological studies in humans and animals revealed an important role for *T. terrestris*in treating erectile dysfunction and sexual desire problems. It was also reported that the drug *Tribulusterrestris*has more potential than *Aswagandha* and *Kappikachu*. All three drugs are good enhancers of sexual function and behaviour by increasing the testosterone levels and regulating the NF-κB and Nrf2/HO–1 pathways in male rats.[22]

Antidiabetic activity

Tribulus terrestris has hypoglycemic activity due to saponins.[23] It reduces the level of serum glucose, serum triglyceride, and serum cholesterol, while serum superoxide dismutase (SOD) activity was found to be increased in alloxan-induced diabetic mice. The decoction of TT showed inhibition of gluconeogenesis in mice.[24]

Anti-tumour activity

The anti-tumours activity of the drug iS well reported with its anti-cancerous effect.[25]

Hepato-protective activity

The hepatoprotective activity may be due to the antioxidant activity, the influence on metabolism regulation and the repression of apoptosis of liver cells, which effectively reduces the level of Caspase-3 in liver tissue.[26]

Anticarious activity

The extract of *Tribulus terrestris* is good *Streptococcusmutans* bacterial inhibitor which is cause of dental caries.[27]

Absorption enhancer

It is necessary to increase the intestinal permeability of drugs to improve their bioavailability. Because some drugs have potent but due to the less absorption they have less effective but the drug the experiment indicated that the drug (*Tribulus terrestris*) can enhance the absorption of Metformin HCl in a goat intestine.[28]

Antioxidant activity

The drug shows anti-oxidant property in DPPH and FRAP methods.[29]

CNS activity

Rasayana Ghana tablet which contains three herbs, viz. *Tinospora cordifolia* (stem), *Emblica officinalis* (fruit), and *Tribulus terrestris* (fruit and root), present in equal quantities in the tablet showed

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antidepressant and anxiolytic activity in Swiss Albino mice due toharmine, a β-carboline alkaloid. Harmine is an inhibitor of monoamine oxidase which helps to increase level of dopamine in the brain.[30]

CONCLUSION

Tribulus terrestris extract are widely used as a traditional curable medicines used by several nations such as china, European nations, and America. Lots of studies on *Tribulus terrestris* have reported that the complete plant has tremendous medicinal and pharmacological activities such as dieresis, aphrodisiac, anti-urolithic, immunomodulatory, anti-hypertensive, anti-diabetic, anti-cancer, anti-bacterial, analgesic, and anti-inflammatory.

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