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A BRIEF REVIEW OF THE PHYTOCHEMICAL CONSTITUENTS AND ANTIBACTERIAL POTENTIAL OF *TRIBULUS TERRESTRIS*

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Abstract

Tribulus terrestris (Puncture vine) is a medicinal herb found worldwide. Its therapeutic efficacy as Eastern medicine has been known since ancient times. For thousands of years, TT's fruits and roots have been utilized as traditional medicine in India, Pakistan, and China. Several bioactive phytochemicals, including flavonoids and saponins, have been discovered from *Tribulus terrestris* and are responsible for a variety of pharmacological actions, either alone or in combination. This plant is known to have antioxidants, antibacterial, antidiabetic, antihelmintic, larvicidal, anti-inflammatory, cardiotonic, antispasmodic, diuretic, analgesic, immunomodulatory, hepatoprotective, and anticancer activities. Phytochemical investigations have revealed significant differences in the number of active compounds present in this plant, particularly the concentration of spirostanol and furostanol saponoside, which are thought to be the primary active elements involved in the therapeutic activity of *Tribulus terrestris*. Several in vitro investigations have shown that *Tribulus terrestris* extracts in both whole and fractionated forms exhibit antibacterial potential against Gram-positive and Gram-negative bacterial pathogens. *Tribulus terrestris* aqueous extract exhibited greater antibacterial properties than methanol extract and inhibited selective bacterial growth, proposing the existence of bioactive compounds throughout a vast range in *Tribulus terrestris*. The current study clearly showed that *Tribulus terrestris* is an abundant source of phytochemicals and has excellent pharmacological properties. Therefore, it is concluded that this plant is very therapeutic and may be utilized to make powerful pharmaceuticals that are beneficial to people.

Keywords: *Tribulus terrestris*, Phytochemical screening, Antibacterial activities.

Introduction

People have used medicinal plants to treat and avoid many health problems since ancient times. Plants continue to serve as a self-sufficient source of medication even in today's healthcare system (Addis *et al*., 2001; Taddese *et al*., 2003). Plant-based traditional medicine is becoming increasingly popular. Screening these plants is necessary to encourage their use in folk medicine and identify novel active components that can combat multi-resistant bacteria and reducing the toxicity of conventional antibiotics (Mothana and Lindequist, 2005; Jigna and Chanda, 2006). There are so many plant-derived phytochemicals that can work independently help to promote well-being or can combine to produce a greater impact (Srinivasahan and Durairaj, 2014).

Certain extracts provide a variety of ways to treat different illnesses, with some being much more powerful than others. That has many beneficial uses, such as prolonging shelf life, preventing the growth of mold, or increasing food freshness (Bernhoft *et al*., 2010). It is observed that *Tribulus terrestris* aqueous extract exhibited greater antibacterial properties in comparison to methanol extract and inhibited the

selective bacterial growth and fungi, proposing the existence of bioactive compounds throughout a vast range in *Tribulus terrestris* (Kalaiselvi *et al*., 2012). Not only does the existence of the Gram-negative and Gram-positive bacteria suggested the presence of bioactive metabolites such as furostanol and spi-rostanol saponins, flavonoids, and phytosterols present in the fruit, but there are also numerous non-active metabolic toxins including phytosterols and amides (Wu *et al*., 1999). The word tribulus is derived from the Latin ``terris'' (earth) because of the main ingredient: (steroid) saponins that are found in the plant and contain a whole range of steroidal saponins that aids in the growth of muscles, as well as cure of specific diseases (Huang *et al*., 2003; Conrad *et al*., 2004; Dinchev *et al*., 2008). People have demonstrated that it is an antihypertensive and vasodilatory, used to treat different ailments, like edema, asthma, ophthalmia, and as well as urinary disorders and cystic ovaries (Phillips *et al*., 2006; Sarwat *et al*., 2008; Qureshi *et al*., 2010).

Additionally, it decreases oxidative stress, functions as cytotoxin, an opponent of fungi, and tends to have anticancer, antioxidative, cytotoxic, and anti-fungus aspects (Deepak *et al*., 2002; Neychev and Mitev, 2005; Pandey *et al*., 2007). It was known further that the gist of *Tribulus terrestris* had low carbohydrate and low fatty acidic properties found through rodents that received saponin treatment (El-Tantawy and Hassanin, 2007). It has been shown that saponins aid in the resistance of cardiac cells to programmed cell death during experimentation (Sun *et al*., 2008).

Although modern medicine has made incredible strides, most people throughout the world are still accustomed to using conventional methods of therapy. Many people in rural regions take these medications to treat a variety of illnesses since they are inexpensive and convenient. The growing demand for traditional remedies is driving the publication of research on medicinal plants (Mir *et al.,* 2022). Immunomodulatory, antimicrobial, antibacterial, antidiabetic, antihelmintic, larvicidal, anti-inflammatory, diuretic, analgesic, hepatoprotective, and anticancer are some of its pharmacological properties (Khoja *et al.,* 2022). Additionally, the herb strengthens vitality and stabilizes the digestive system by acting as a tonic (Abdullah and Andrabi, 2021). Athletes who are always looking for natural ways to improve their performance have also been seen to use more *T. terrestris* supplements (Stefănescu *et al.,* 2020).

In the current review, we analyze the phytochemical constituents present in *Tribulus terrestris* and highlight its pharmacological and antibacterial activities to support traditional medicinal claims and offer baseline information for future research. These current research findings will be useful in comprehending the traits and advantages of this traditional medicine that will be useful in the future development of new goods and herbal medicines.

Botanical description

The small prostrate plant *Tribulus terrestris* has smooth hairs. After sprouting two cotyledons, the plant grows two normal leaves (Shaheen *et al*., 2012). Spear-shaped four to eight pairs of little, opposing leaves make up pinnate leaves and measuring around 1.25 cm in length. *Tribulus terrestris* is characterized by having thorny fruits and little yellow color petals. The fruits of *T. terrestris* contain a woody prickle with pointed spines having a diameter of 1 cm. The fruit is triangular-shaped and has spines on each of its corners. Its leaves are green in color and fruit is greenish- yellow. The seeds, or carpels, are contained in a rigid star-like structure having length around five to seven millimeters. Each carpel has five seeds, each measuring 1.5–3 mm in length and having a golden

hue.

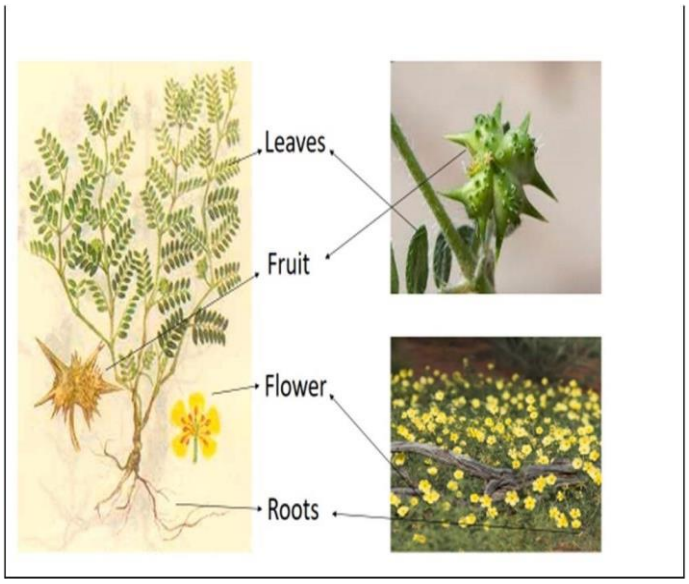

Fig. 1. *Tribulus terrestris* and its different parts.

It was determined through examination that each plant had about 2000 seeds. When its root is young, it is light brown in color, cylinder- like, thin, and fibrous. The leaves are opposite and short, while the stem reaches around 2 m in length. The taste of *Tribulus terrestris* is bitter (Hashim *et al.,* 2014; Ibrahim and Kadhim, 2015). *Tribulus terrestris* is an annual plant and sometimes becomes perennial. Although *Tribulus terrestris* may grow in a variety of soils, it is most successful in sandy, dry soils that are close to sandbanks, rich soils that are found on the edges of fields. It also grows well in compacted soils along highways and in thick soils, especially when they are moist or nutrient-rich (Deepak *et al.,* 2002).

Traditional medicinal plant

Different countries have long used this plant as a folk medicine for a variety of uses and treatments. *T. terrestris* is utilized as a herb or as a primary ingredient in many drugs and dietary supplements for liver and kidney issues, cardiovascular health, immunological functions, and physical rejuvenation (Tilwari *et al.,* 2011). *T. terrestris* has been utilized in conventional medicines of numerous cultures in these regions of the world as ages, including Indian traditional medicine commonly called Ayurveda, Chinese medicine, and conventional medicine of south-east Europe, defining its ethnomedicine significance as a herbal remedy (Neychev and Mitev, 2016).

T. terrestris fruits have been used in Chinese pharmaceutical manual to tone the kidneys, as urinary stimulant and respiratory expectorant, to enhance vision, and to treat skin itching, mammary gland obstruction, headache, and dizziness (CPC, 2015). In Ayurvedic medicine, the fruits have been utilized to treat low sexual desire, fertility problems, and erectile dysfunction (ED). Additionally, cardiotonic qualities were said to be present in both roots and fruits. *T. terrestris* has been

used as a demulcent in Sudan, as well as to treat inflammatory illnesses and a condition called nephritis (Mohammed *et al.,* 2016). It was also utilized for diuretic and uricosuric activity in Pakistan (Akram *et al.,* 2011). Recent studies have revealed that *T. terrestris* chemical components, especially flavonoids and steroidal saponins, which have strong rejuvenating and anti- inflammatory properties, and they were the primary drivers to its conventional medicinal activity. Phytochemical constituents

T. terrestris has a variety of phytochemicals with diverse biological activities and chemical compositions, including flavonoids, saponins, tannins, glycosides, terpenoids, amino acids, and proteins. Flavonoids and Saponins are regarded to be the most significant metabolites with varied bioactivities (Zhu *et al.,* 2017).

Flavonoids

Flavonoids, a kind of polyphenol which is found in most plants. Based on existing research, phenolic secondary metabolites, flavonoids are accountable for a range of therapeutic actions (Mahomoodally *et al.,* 2005; Pandey, 2007). Flavonoids were found in *Echinops amplexicaulis* root, *Ruta chalepensis* fruit, *Persea Americana* fruits, and *Tribulus terrestris* leaves and fruit extracts (Agidew, 2022). Flavonoids are phenolic hydroxylated compounds that plants synthesize in consequence of infections by microbes (Dixon *et al.,* 1983).

Alkaloids

According to some publications, alkaloids were obtained from various portions of plants (root, bark, stem, leaves, and fruits) via various solvents comprising methanol, petroleum ether, ethanol, chloroform, acetone, and water (Agidew, 2022). Alkaloids are the most important and abundant components generated by plants (Naseem *et al.,* 2014).

Tannins

Tannin, a large polyphenol biological molecule with enough hydroxyls and carboxyl, in order to form powerful structures with diverse macromolecules (Navarrete *et al.,* 2013). Methanol and acetone extract of *Tribulus terrestris* were examined and tannins were found in both leaves and fruit extracts of solvents. Tannins also existed in most plant species, including the *Ruta chalepensis* fruit, *Echinops amplexicaulis* root, and Rhizome extract (Agidew, 2022). Tannins are commonly employed as therapeutic agents for gonorrhea, inflammation, and burns (Boroushaki *et al*., 2016).

Saponins

Saponins are a significant category of secondary plant compounds found across the plant kingdom. Saponins exist in numerous vegetables, legumes, and medicinal plants (Francis *et al.,* 2002). Saponins were found in *Tribulus terrestris* leaves and fruit extracts as well in most medicinal plants such as *Salix subserrata* Leaf, *Echinops amplexicaulis* Root and *Vernonia amygdalina* leaf and stem (Agidew, 2022).

Terpenoids

Terpenoids are tiny molecular compounds produced by plants and have massive pharmacological actions, including antibacterial, anti-inflammatory, antiviral, antimalarial, anti-cancer, and cholesterol synthesis inhibition properties (Boroushaki *et al.,* 2016). As previously stated, terpenoids were found in *Tribulus terrestris* and its pharmacological actions was also analyzed in majority of other plant species, including citrus fruit, leaves of *Hagenia abyssinica*, and root of *Syzygium guineans* however, the results in certain plants vary

depending on the solvent used.

Phenolic

Phenolic are secondary metabolites generated by pentose phosphate and shikimic acid in plants (Derong *et al.,* 2016). Phenolic was found in *Tribulus terrestris* leave and fruit extract and in most therapeutic plants, and its therapeutic effects was also studied in other plants including *Ruta chalepensis* fruit, *Salix subserrata* Leaf, and *Citrus medica* peel (Agidew, 2022).

Table 1. Different components of *T. terrestris* used to treat a variety of illnesses

Parts of TT	Activity
Leaves	Lravicidal, antidiabetic, and anticarcinogenic
Fruits	Antiurolethic, analgesic, antioxidant, improve learning and memory
Leaves and Fruits	Anti-inflammatory and Antifungal
Root	Antibiotic
Stem	Anti-cancerous
Seed	Diuretic and to treat other urinary infections
Fruits and roots	Antimicrobial
Fruits and stems	Cytotoxic
Aerial parts	Erectile dysfunction and used against acute kidney damage
Whole plant	Immune-modulating, neuropathic, anthelmintic, and estrogenic

Variation in Phytochemical Content

According to studies, the phytochemical composition is closely related to the plant's place of origin and, consequently, to the climate. Moreover, the harvesting season and growing factors, such as quality of soil, affect the biological activity and composition of *Tribulus terrestris* (Neychev and Mitev, 2016). The flowering and pre-flowering phases had the greatest concentration of saponins in the aerial portions of plant. The composition of herbal medicines is greatly influenced by other factors such as geographic locations. Only samples from Greece, Turkey, and Iran had prototribestin and samples from India and Vietnam did not contain any protodioscin. This chemical seems to have the potential to serve as a marker for the European form of *Tribulus terrestris* (Dinchev *et al.,* 2008). However, notable differences in chemical content and the lack of some compounds were seen across samples taken from the same country. Some samples taken from Bulgaria did not contain dioscin, and the chemicals' quantities also differed greatly (Lazarova *et al.,* 2011).

Antibacterial Potential

The wide spectrum of antibiotic compounds present in the plant might explain its potency against bacteria (Mitra *et al.,* 2012). The bactericidal activity of *Tribulus terrestris* had been extensively investigated. It was found that 50% strains of *Helicobacter pylori* were susceptible to a level of 1000 mg mL^{-1} of *Tribulus terrestris* extract (Zhu *et al.,* 2017). *T. terrestris* was extracted using several solvents (methanol, chloroform, and ethanol). Methanol extract had the largest inhibitor y range for *B. cereus, E. coli,* and *S. aureus* (Kiran *et al.,* 2011). *Tribulus terrestris* ethanol extract had antibacterial action against *E. coli, S. mutans, E. faecalis, S. aureus,* and *A. viscosus. T. terrestris, Glycyrrhiza glabra*, and *Capsella bursa-pastoris,* complexes demonstrated synergistic benefits when compared to the individual herbs effect (Soleimanpour *et al.,* 2015).

T. terrestris roots extract has lower antibacterial activity than stems, fruits, and leaves extracts (Kianbakht and Jahaniani, 2003). Spirostanol and furostanol saponins were found and measured primarily in the aerial sections of *T. terrestris* compared to roots. Although, alkaloids were found in all of the plant parts. These findings indicate that TT antibacterial action is mostly connected with its saponin concentration. Fractions of flavonoid from *T. terrestris* fruits and leaves have been demonstrated to be antibacterial toward *S. aureus, E. coli, Streptococcus,* and *Salmonella* (Tian *et al.,* 2019). A recent study demonstrated that *T. terrestris* (origin India) root extracts have quorum quenching ability against *Serratia marcescens, Chromobacterium violaceum,* and *P. aeruginosa* bacteria (Vadakkan *et al.,* 2019).

Several *in-vitro* investigations have shown that *T. terrestris* whole or fractionated extracts possess antibacterial actions toward both Gram-positive and Gram-negative bacterial pathogens. Among the Gram-negative bacteria, *P. aeruginosa, K. pneumoniae, S. typhi, P. vulgaris,* and *E.coli* were susceptible, while within Gram-positive bacteria, strains of facultative anaerobe such as *S. sanguinis, S. aureus, Bacillus subtilis, S. mutans, E. faecalis, and Actinomyces viscosus* (Jindal *et al.,* 2013; Soleimanpour *et al.,* 2015).

Mechanism of antibacterial action

It is yet uncertain which bioactive components of *T. terrestris* play a part for antibacterial action, however alkaloids participate to the overall antibacterial impact of the extract (Jindal *et al.,* 2013). Saponins antibacterial activities are widely known, and their mode of action mainly centered on the breakdown of cell membrane, which results in cell death, most likely due to their amphiphilic origin and wetting agent abilities. Additionally, it was observed that saponins might modify channels of ion, affecting the potential of cell membrane (Böttger *et al.,* 2012).

Table 2. Phytochemical compounds identified in *Tribulus terrestris*

Phytochemical Compounds	Plant parts
Frustanol saponins	
Protodioscin, Neoprotodioscin, Prototribestin, Neoprototribestin	Aerial parts
Terestrinin B, Terrestrinin D, Tribufuroside D, Tribufuroside E	Fruits
Terestrinin A, Polianthoside D	Fruits and root
Terestrinin J-T, Terrestrosin K	Whole plant
Spirostanol saponins	
Dioscin, Tribestin, Diosgenin, Prosapogenin B	Aerial parts
Tigogenin, Hecogenin, Agovoside A	Fruits
Terestrinin U, Tribulosin	Whole plant
Flavonoids	
Kaempferol, Astragalin, Tribuloside, Kaempferol 3-rutinoside	Leaves
Quercetin, Rutin, Isoquercitrin, Isorhamnetin-3-glucoside	Fruits
Apiotribosides A-D	Root
Alkaloids	
β-carboline Alkaloid, Harmine, Harmane, N-transcoumaroyltyramine	Leaves
Tribulusterine, Harmine, Harmalol, n-Caffeoyltyramine	Fruits
Harmaline	Stem and roots
Harmane, Norharmane	Aerial parts
Phenolic	
2,6-dimthyl pyrazinyl	Root
Amides	
Terrestribisamide, Tribulusamide A, Tribulusamide B, Tribulusamide C	Fruits
Other Compounds	
Tannins, Stigmasterol, Carbohydrates, 1,3-Benzenedicarboxylic acid	Stem

Due to the growing issue of multidrug resistance, scientists are working to provide a workable substitute for standard antibiotics that have become resistant. *Tribulus terrestris* biosynthesized nanoparticles are now thought to be a suitable and effective substitute for conventional antibiotics, with a good probability of resolving this problem (Mishra *et al.,* 2021). According to some recent research, silver nanoparticles from TT exhibit antibacterial efficacy against *P. aeruginosa*. This hypothesis has been put out to explain how direct interaction with nanoparticles might cause disruptions to intracellular structures and cell membranes. Furthermore, this model takes into consideration the release of silver ion's positive charge from nanoparticles both outside and inside of cells, which starts a series of intracellular reactions that inhibit DNA replication and protein synthesis, produce ROS, and deactivate enzymes (Ali *et al.,* 2023).

In general, it is still unknown which primary ingredients provide the TT extract its antibacterial and antibiofilm properties. Saponins have been identified as the primary constituent in certain investigations, whereas alkaloids have been cited in others. It has also been demonstrated that the flavonoids in the TT extract have antibacterial action against a variety of species, including Streptococci (Azarm *et al.,* 2024). Furthermore, additional investigation is required to determine the antibacterial mode of action.

Other Pharmacological activities

Tribulus terrestris has been widely utilized in Chinese and Indian conventional medicine for the prevention and cure of several ailments, involving diabetes and cardiovascular disease. *T. terrestris* has antioxidant, immune- modulating, antibacterial, liver-protective, anti-inflammatory, and anticancer abilities (Shahid *et al.,* 2016).

Antioxidant activity

The buildup ROS, within the body, as well as their relationship to the occurrence of persistent illnesses, have been extensively explained in the literature of science and is now accepted as fact. Flavonoids and phenolic carboxylic acids are present in TT extracts and the capacity of these chemicals to donate hydrogen has been used to conclusively prove their antioxidant action. Polyphenols have the capacity to eliminate radicals such as peroxide, hydroxyl, and superoxide (Bors *et al.,* 1990). *T. terrestris* fruits aqueous extract reduced ROS produced by gamma radiation in spleen cells. It induced mitosis in spleen cells (Pandey *et al.,* 2007). It has been demonstrated that TT extracts have antioxidant properties in vitro utilizing ABTS, DPPH, and FRAP techniques (Durgawale and Datkhile., 2017).

Antidiabetic activity

Saponins in *T. terrestris* has been linked to hypoglycemic action (Li *et al.,* 2002). It lowers cholesterol, blood glucose, and triglyceride levels, while serum SOD action elevates in alloxan- induced diabetic experimented in mice. In mice, an extract of TT inhibited gluconeogenesis. In an animal performed experiment, it was established that inclusive saponins from plants decrease the post-meal spike in blood sugar levels and alleviate diabetic symptoms. Plant saponins can reduce α-glucosidase activity (Ercan and El, 2016).

Larvicidal and anti-helminthic activity

Leaf extract of *Tribulus terrestris* in Petroleum ether has been shown to have outstanding repellent properties towards *Aedes aegypti* mosquito larvae that spread dengue fever (Singh *et al.,* 2008). Several plant

extracts were evaluated for larvicidal efficacy by measuring infectious vector fatality rates. Leaves have lower larvicidal potential in comparison to fruit (Zhu *et al.,* 2017). Sitosterol and tribulosin glycosides found in *T. terrestris* methanolic extracts have been claimed to have anti-helminthic effects. *T. terrestris* extracts have been shown to have anti-helminthic actions towards a transparent nematode *Caenorhabditis elegans* under *in vitro* investigations (Kiran *et al.,* 2011).

Anti-inflammatory activity

N-trans-ρ-caffeoyl tyramine was stated to exist within the plant extract, which has significant anti-inflammatory characteristics (Ko *et al.,* 2015). Furthermore, it was discovered to inhibit the generation of cytokines that promote inflammation such as TNF-α and IL-4 in macrophage cells. In consequence, plant ethanolic extract decreases inflammatory mediators and cytokines, which in result improves a range of inflammatory illnesses (Lee *et al.,* 2017). *T. terrestris* methanolic extract was found to inhibit volume of paw in rats which was caused by carrageenan-induced inflammation (Baburao *et al.,* 2009).

Immunomodulatory activity

When tested on rats, saponins isolated from the fruit of this plant showed a dose-dependent rise in the phagocytic indices. The plant's alcoholic extract significantly increases immune response and postpones allergic-type symptoms. Plants have immune-modulating properties (Tilwari *et al.,* 2011). When plant alcoholic extract was employed, the humoral immunity increased which resulted in delayed hypersensitive reaction, indicating a particular immune response (Chhatre *et al.,* 2014).

Hepatoprotective activity

A hydrolytic protease, Caspase-3 that plays a crucial part in hepatic cell apoptosis. *T. terrestris* hepatoprotective action might be attributed to its antioxidant activity, impact on metabolic control, and inhibition of liver cell death, which significantly decreases caspase-3 levels in tissue of liver (Hu„ 2009). *T. terrestris* has beneficial effects against hepatocellular carcinoma. The aqueous extract of *Tribulus terrestris* inhibits the NF-kB signaling pathway, preventing HepG2 cell growth and inducing cell death (Chhatre *et al.,* 2014).

Anticancer activity

Plant anticancer capabilities have been characterized by many cell lines, including murine sarcoma 180 (ASC), breast cancer cell line Bcap-37, and hepatoma cell line BEL-7402 (Sun *et al.,* 2004). Swiss albino rats were used to assess the chemo preventive potential of *T. terrestris* towards DMBA-induced skin cancer. Their examination revealed that the oral organization of the *Tribulus terrestris* removal at the post and pre commencement stages resulted in a significant reduction in tumor development and the total amount of papillomas. Nevertheless, it has been demonstrated that the plant's fruit extract had less chemoprevention than the root in dermal papillomagenes is when experimented in Swiss albino rats (Kumar *et al.* 2006).

Agricultural application

As by recent studies, it was evidenced that both broiler and layer performance, nutritional ability to digest and overall health can be improved by supplementing them feed with natural products and medicinal herbs. Additionally, these changes strengthen body defense against illnesses and toxic chemicals (Untari *et al.,* 2022). According to reports, *Tribulus terrestris* has phyto- therapeutic action in its

different parts like leaves, fruit, and root. Glycosides, alkaloids, flavonoids, and protodioscin are abundant molecules in *T. terrestris* with possible biological activity (Chhatre *et al.,* 2014). Particularly in arid areas, it may be fed to farm animals, however some animals might become poisoned as a result (Halvorson and Guertin, 2003). *Tribulus terrestris L.* grows extensively in Korea, China, Turkey, Africa, the southern part of Europe, and the western part of Asia (Abarikwu *et al.,* 2020).

Research was conducted to ascertain the effects of *T. terrestris L.* on the growth efficacy and immune response of broiler chickens as a potential substitute for antibiotic growth boosters (Yazdi *et al.,* 2014). The saponins present in *Tribulus terrestris* were useful in managing diseases in chickens. Research demonstrated that the growth performance of the broiler chickens was not significantly affected by feeding them 1 g quantity of *Tribulus terrestris* powder/kg of feed and 0.06 and 0.12 g quantity of *Tribulus terrestris* crude extract. Conversely, I found that growth performance of broiler was improved when fed a diet that included 0.8 g of *Tribulus terrestris* powder/kg feed (Sahin, 2009). Tests of liver function were found elevated in broiler birds that received an overdose of *Tribulus terrestris* due to higher liver cell membrane viscosity, resulting in cell damage and detrimental abnormalities (Pattar *et al.,* 2020). In an investigation chickens were kept at a low ambient temperature of about 6.83 ◦C, to check the effects of supplementing *Tribulus terrestris* aqueous extract on hen laying performance, quality of egg, and biochemical indicators of blood. Comparing *T. terrestris* treated groups to the control group, the findings showed that egg weight and mass, and the thickness of shell increased while blood cholesterol and fractional catabolism rate considerably decreased (Akbari and Torki, 2016). In guinea fowls, *Tribulus terrestris* extract has also been shown to boost egg and yolk weight, eggoutput, and fertility (Nikolova *et al.,* 2010).

CONCLUSION

This comprehensive analysis offers a thorough overview of *T. terrestris,* covering its pharmacology, phytochemistry, beneficial effects, and medicinal uses. This plant has a significant diversity of chemical composites which can be used to cure bacterial and viral infections. Since this plant contains such a diverse range of chemical substances, research on it is a new way to explore new information and medicines. Furthermore, it may assist to identify new chemical families of antibiotics that can act as selective agents for the preservation of animal or human health and give biochemical instrument for the research of infectious illnesses. It further indicates a goal for the formation of many more unique chemotherapeutic drugs from these plants that in future could contribute for the synthesis of synthetically enhanced therapeutic agents. *T. terrestris* is regarded as a major plant having a wide range of pharmacological properties for which substantial scientific data and publications are accessible. Steroidal flavonoids and saponins with strong anti-aging and anti-inflammatory properties were shown to be the primary contributors to conventional pharmacological actions, according to recent research. Randomized placebo-controlled clinical studies should be conducted in the future, as there are currently few clinical trials with *T. terrestris*. Additionally, much study is needed to uncover the hidden advantages of plant extracts, particularly root extracts.

CONFLICTS OF INTEREST

There is no conflict of interest related to this article.

AUTHOR'S CONTRIBUTION

All authors have contributed equally

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