

A CLINICAL APPROACH OF THE AERIAL PARTS OF *TINOSPORA CORDIFOLIA* AS ANTI-INFLAMMATORY DRUG

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Abstract: This review article basically focuses on the anti-inflammatory properties of the *Tinospora cordifolia* in colitis and inflammatory bowel disease. *Tinospora cordifolia* belongs to the family Menispermaceae, generally known as Giloy. The treatment of the colitis based on the pathogenesis of the disease. Now days, herbal based treatments are popular because of its improved drug delivery and potential efficacy. *Tinospora cordifolia* possess various properties such as anti-inflammatory, anti-spasmodic and anti-viral because of the certain phytochemicals i.e. alkaloids, terpenoids, lignans to be precisely. This study will encompass the clinical advantages of the *Tinospora cordifolia* as anti-inflammatory drug in mainly colitis. The future scopes in the continuation of the research on this topic may cover the signaling involves in the colitis and IBD.

Keywords: *Colitis, Tinospora cordifolia, inflammatory bowel diseases*

Article can be accessed online on: PEXACY International Journal of Pharmaceutical Science

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Update: Received on 09/02/2023; Accepted; 14/02/2023, Published on; 16/02/2023

Introduction

Tinospora cordifolia popularly known as Giloy belongs to the family Menispermaceae is a plant or shrub used to climb on the other shaded trees [1]. *Tinospora cordifolia* is broadleaved plant with the diverse potential characteristics,

blossom yellow flowers, and usually grow at the typical higher altitude. The flowers used to be cultivated both the seasons winter and summer. The variety of the active phytochemical used to found in the various parts (roots, stem, leaves, and shoot) of the

plants such as steroids, alkaloids, terpenoids, and aliphatic compounds [2].

Natural resources such as plant are considered as the medicinal treasure for the Ayurveda. These plants are gaining attention towards the importance of their own medicinal properties [3]. These herbal plants are the most desirable topic for the researcher as they do not have the side effects and clinical bioavailability is also remarkable. As per literature, *Tinospora cordifolia* possess the various features for example anti-inflammatory, anti-spasmodic, anti-oxidants [4].

The plant is widely available in India and is cultivated as temple garden plant. The fruit of the tree has certain medicinal uses and also been used for eating. The leaves are believed to have anti-inflammatory, anti-spasmodic, anti-allergic, anti-oxidant and anti-pyretic activity.

Botanical Name: Tinospora cordifolia

English Name: Guduchi/Giloy

Family: Menispermaceae

Parts of Plant used: Leaf, Fruit, Root, Bark

Cultivation: All over India [5]

Tinospora species are known for its tender woody texture generally used climb over the shaded tree with the help of the tendrils. Leaves are oval in shape, broad leaved, margin dentate, basal and lateral veins and usually elongated at size of three to six and 1-3 respectively. Male flower and female flower consist of six sepals, in two series, outer series smallest. Flower use to blossom in the winter and summer [6].

Phytochemical Profile

A wide variety of the phytochemicals are available in this plant and parts of the plant. These plant extract used to analyses by the different methods to identify the phytochemicals. The phyto-chemical constituents are belong to different categories of the chemicals classes such as alkaloids, glycosides, steroids, phenolic, aliphatic compounds, polysaccharides, leaves are rich in protein (11.2%), calcium and phosphorus. The basic structures and fundamental procedure of finding the chemical structures are mentioned by the Verma, D. K. et al., 2021 [7]. These phytochemicals have series of positive effects of the certain kind of diseases. However, clinical studies have been identified the course of action and pathways

to treat the disease by these phytochemicals [8].

Tests for Carbohydrates using Benedict's test

The extract of the seeds were dried and stored at room temperature. The extract was taken in the test tube and added 2ml of Benedict's reagent. The test tube was then boiled on the flame for few minutes. Upon boiling the solution turned in to reddish brown color sediment. This is the indication of carbohydrate [9].

Test for reducing sugar

The extract was shifted in the closed tube and mixed with the water. After filtration with the whatman paper, the filtrate was again shifted in the test tube. On the filtrate Fehling's solution A and B was added drop by drop. When the reaction stops an orange to yellow color appear which identify the presence of reducing sugar [9].

Tests for Amino Acids using Ninhydrin test

Formulated extract was added in the closed test tube and then 3 mL water added. 5% Ninhydrin solution was prepared in the separate tube. On the solution reactor solution was added drops by drops after few minutes the reaction stops and produces the

blue color, which confirm the amino acid [10].

Tests for Proteins using Biuret test

In the test tube, the crude drug was added along with the 3 mL of 4% NaOH and 1% CuSO₄. When color changes to pink, it indicates the presence of the protein[11].

Tests for Vitamin C

To perform the presence of Vitamin C, the crude drug was mixed with the 5 mL of water in the test tube. Sodium nitroprusside was added to the tube drop by drop along with it sodium hydroxide solution was added. After those 600 microliters of HCl was added to the solution in the test tube. The solution color turns yellow once reaction is completed, indicates the presence of Vitamin C [12].

Tests for Chloride

The crude drug extract were prepared using nitric acid (3mL). To the solution silver nitrate added drop by drop. After reaction stops it give color less precipitate which identifies the silver chloride [12].

Tests for Tannins

Crude drug solution was taken in the test tube on to the solution 5% FeCl₃ was added

slowly. The color changes to black indicate the presence of tannins [12].

Tests for Alkaloids using Wagner's test

The crude drug filtrate was taken in to the test tube. On to the solution, Wagner's reagent was added drop by drop. The solution color changes to reddish brown indicate the presence of the alkaloids [13].

Tests for Steroids

Crude drug sample was taken in the test tube, to the sample 2 ml chloroform and 2 ml concentrated H₂ SO₄ was mixed drop by drop. After the reactions completed the ring observes, indicates the presence of Steroid [13].

Table- 1: Phytochemical Present in Tinospora Cordifolia

SN.	Phytochemical Extract	Results
1	Carbohydrates	++
2	Proteins	--
3	Amino acids	++
4	Steroids	++
5	Glycosides	++
6	Saponins	- +
7	Flavonoids	++
8	Alkaloids	++
9	Tannin	--
10	Phenolic	++

Table- 2: Chemical Constituents of *Tinospora Cordifolia*

Sn.	Chemical Name	Active Principles	Part in which present
1	Alkaloids	Berberine, Palmatine,	Stem
		Tembetarine, Magnofl orine, Choline, Tinosporin, Isocolumbin, Palmatine, Tetrahydropalmatine, Magnofl orine	Root
2	Glycosides	18-norclerodane glucoside, Furanoid diterpene glucoside, Tinocordiside, Tinocordifolioside, Cordioside, Cordifolioside A, Cordifolioside B, Syringin, Syringin-apiosylglycoside, Palmatosides C, Palmatosides F, Cordifolioside A, Cordiofolioside B, Cordifolioside C, Cordifolioside D, Cordifolioside E	Stem
3	Diterpenoid lactones	Furanolactone, Clerodane derivatives and [(5R,10R)-4R-8R-dihydroxy-2S-3R:15,16-diepoxy-cleroda-13 (16), 14-dieno-17,12S:18,1S-dilactone] and Tinosporon, Tinosporides, and, Jateorine, Columbin	Whole plant
4	Steroids	β -sitosterol, δ -sitosterol, 20 β -Hydroxy ecdysone. Ecdysterone, Makisterone A, Giloinsterol.	Aerial part & Stem
5	Sesquiterpenoid	Tinocordifolin.	Stem

6	Aliphatic compound	Octacosanol, Heptacosanol,	Whole Plant
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Pharmacological Profile

Anti-inflammatory

Vineetha, V. P., et al, 2021, identified that the extract of the *T. Cordifolia* and introduced in the animals which were having the paw edema. This study was performed in the rats and edema was induced with the help of the carrageenan. The carrageenan experiment was done along with the important parameters i.e. rota rod and Cold hyperalgesia. This models is based on the fluid accumulation, when cells are injured, the area of the injury gets accumulated by the blood and other vital fluids. The inflammation and redness can be seen at site of the injury because of the fluids only. The methonlic extract were prepared and administered in the animals at three different doses (low, mid and high) along with the reference control and negative control.

The recovery period was identified as the increase in the locomotors activity and reduces the inflammation. The paw edema score was significantly reduced in the *T. Cordifolia* group, although, other groups of the *T. Cordifolia* was less significant than

the high dose but comparable to the controls animals.

Antioxidant activity

Arunachalam, K., et al., 2021, has formulated a formulation of *T. Cordifolia* which was the basically to reduce the superoxide ions from the cells and to probe the activity of the formulation free scavenging method was followed. They have identified that DPPH (1-diphenyl-2-picrylhydrazyl) activity was higher along with the inhibitory concentration was identified at maximum 5µg/ml which was comparable to control values.

The identification of the total flavonol and phenolic content concentration was identified as maximum which possess anti-oxidant property. Also reported that hydro-alcoholic extract of the *T. cordifolia* possess the anti-oxidant activity which can reduce the superoxide dismutase to minimum concentration [15].

Antimicrobial activity

Prajwala, B., et al., 2021 have identified that *T. Cordifolia* has the antimicrobial activity by following its methanolic extract. They

have done this experiment in in vitro to see gram positive bacteria activity in the presence of the of the proper nutrition. The gram positive bacteria was grown in the nutrient broth and plated on to the agar plate. After the exposure of the test item, the result has been analyzed. In this experiment the plant extract showed the excellent results which support the antimicrobial activity [16]. Mittal, J., Pal, et al., 2021, has identified the antimicrobial potential on the different anaerobic bacteria [17].

These bacteria were grown in the sterile environment and exposed to the plant extract, which followed by the different concentrations of the plant extract. The results were enough convincing to identify this plant as the antimicrobial. Duhan, P., et al., 2021 have reported the enormous potential to kill the bacteria in the agar plate.

This experiment was conduct with *s. typhi* strains. The strains of the *s.typhi* were grown to the late exponential stage and plated on the agar plates. The colonies were counted against the background lawns. The colonies were counted and compare with the negative controls and reference controls for the analysis purpose. The result showed that the *T. Cordifolia* inhibit the growth of the bacteria [18].

Anti-diabetic activity

Kumar, V., et al, 2021 explained that the anti-diabetic activity of the plants could be due to the phytochemicals such as alkaloids, tannins, cardiac glycosides, flavonoids and, saponins, etc. They have identified that the plant possess the anti-diabetic activities because of its ability to bind and reduce the activity of the alpha-glucosidase enzyme in the pancreas.

Tinospora cordifolia extract prepared in the water and this study was performed in the Wistar rat. The water extract was able to bind and reduce the activity of the glucose, insulin, and triglycerides.

The same experiment was performed without water, et al, prepared the extract in the alcohol and found that the level of glucose was coming down. They have identified the pre and post glucose levels were low to normal [19].

Another study was performed by the Mandar, B. K., et al, 2021, in the diabetic rats. They have identified the *Tinospora cordifolia* extract could easily bind the insulin and reduce the glucose level in just 30 days. The obtained results identified the efficacy was almost 50-60%. No mortality

and morbidity was recorded during the experimental period [20].

Anticancer activity

Patil, S., et al., 2021 have performed the experiments with the *Tinospora cordifolia* extract in methanol. The model was performed with the help of the 7, 12-dimethyl-benz (a)anthracene DMBA. The extract was given them by oral route at the different concentrations. Low, mid and high dose performed well in the experimental period. The skin cancer was reduced to 40% when compare to the other control groups of the animals. At the high dose 600mg/kg have worked well as compare to other concentrations of the drug [21].

Another study was performed by the Pant, C., et al., 2021 in the athymic mice. The animals were introduced the cancer by MG 87 cells in the mid brain. The cells were grown in the DMEM medium and at the density of the 10^6 were introduced in the brain. The ethanolic extract of the *Tinospora cordifolia* were able to control and decrease the size of the brain tumor and increase the quantity of the glial cells in the brain [22].

Anti-HIV activity

Kumar, P., et al, 2020 confirmed that in his research that clinical evidence prove that the

T. Cordifolia root extract has potential to retain the level of the lymphocytes and macrophages in the blood. *T. Cordifolia* has the potential to increase the level of the hemoglobin, and poly morphonuclear leucocytes [23].

Wound healing

Singh, A. K., et al, 2017 proved in his research that the potential of the wound healing is enormous in the extract of the *T. Cordifolia* as it has given to the animals in wound healing model. The result were convincing as compare to the other groups. It increases the healing process and collagen strength. The collagen fibers were started to regenerate and also increased the tensile strength of the tendon and other joints. From this study, it may alter the decorin and fibrin protein bonding [24].

Anti-osteoporotic effects

Munshi, R., et al, 2019 has identified that the *T. Cordifolia* extract to enhance the role of the minerals and other proliferative bone matrix like structures. It may also introduce the matrix regeneration by helping to stimulate the growth of the osteoblasts. Additionally, the cartilage strength of the joints was increased [25].

Conclusion

T. cordifolia is an herbal plant which possesses all the required characteristics to fall in the medicinal plant family. With the help of the phytochemical properties it has been identified and proved that *T. cordifolia* can treat various diseases. As per literature review it has been identified that *T. cordifolia* can act as anti-inflammatory, antioxidant activity, antimicrobial activity, antibacterial activity, hypolipidaemic effect, hepatic disorder, anticancer.

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