

Review Article

Tinospora Cordifolia (Gurjo) and Its Potential Role to Combat with COVID-19: A Review

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Article History

Received 22 April 2022

Revised October 2022

Accepted 01 December 2022

ABSTRACT

Plant-based medicines have been used to maintain health and treat disease since the dawn of civilization. The present review focuses on studies that have been done on the characteristics of T. cordifolia to see if they may be used to combat COVID-19 Pandemic. During the review, various methodological activities were involved from developing the review concept, reviewing the articles, analyzing them, and finally writing the paper. The result shows that herbal medicine is used by 80% of the world's population for some aspect of basic health care. T. cordifolia is a medicinal plant which is a useful home remedy for chronic fever, as it calms burning sensations and boosts energy and hunger. Glycosides, alkaloids, steroids, diterpenoid lactones, sesquiterpenoid, and aliphatic chemicals are the most common substances found in this herb. Scientific research on this medicine could lead to a novel method as well as knowledge into COVID-19 prevention, management, and the development of a new therapeutic component.

Keywords: Coronavirus; Medicinal herbs, Pandemic, Phytochemicals, Immune-modulator

INTRODUCTION

The sudden of novel coronavirus (COVID-19) have created unexpected consequences in every aspect around the globe. The globe has been battling to develop an effective drug for the cure of epidemic disease (Gyawali et al., 2020; Keni et al., 2020). The original name

“2019-n Cov” was changed into the new novel corona virus on 11 February, 2020 as SARS-CoV 2 (Gorbalenya et al., 2020). It is an extremely contagious disease that transfers through inhaling droplets and by fomites due to personal contact (Hanaei & Rezaei, 2020; Huang et al., 2020; Rothe et al., 2020). Initially, it was reported on the Wuhan city of China on December 31, 2019, later it spread rapidly to become a global pandemic (Timilsina et al., 2020; Hui et al., 2020). The serious health effect of Covid-19 disease is pneumonia characterized by fever, dry cough, and dyspnea (Yazdanpanah, 2020). Other reported symptoms include respiratory problems, neuralgia, headache, skin rashes, gastrointestinal troubles, and myalgia (Gennaro et al., 2020; Huang et al., 2020; Jahanshahlu, 2020; Netea et al., 2020; Recalcati, 2020).

Several experiments and trials have been carried out, but the exact result has not been productive to fully recover the patients (Rome & Avorn, 2020; Rosa et al., 2020). The recent appearance of a coronavirus has posed a significant threat to human civilization, as no viable medicine or vaccine has not yet been discovered. The demand for new medication options is growing with the increase in morbidity and death rates (Jena et al., 2021). In this sense, the world is looking its way to get rid of this disease and started searching for the available medicine around their surroundings (Rome & Avorn, 2020; Rosa et al., 2020). Given the absence of effective medications for rising viral infections, traditional herbs provide significant potential for developing viable solutions to viral disorders. Medicinal herbs have a wide range of use for prevention as well as treatment of corona virus. Nepal is a hub of medicinal plants where more than 80% of people use their traditional knowledge to meet their needs for basic health care (Khadka et al., 2021). People of Nepal are enriched with traditional folk medicine (ethnomedicinal) knowledge which has been recognized much after 1995. In Nepal, several herbs, and medications such as *Curcuma longa*, *Zingiber officinale*, *Terminalia bellerica*, *C. caesia*, *Allium sativum* etc. have emerged as potential treatments for virus including *T. cordifolia* (Willd.) Miers ex Hook. f. & Thomas, generally known as Gurjo in Nepali.

T. cordifolia is an Ayurvedic immune-modulator medication with antioxidant, immunomodulatory, anti-inflammatory, anti-antiallergic, anti-cancer, anti-viral hyperglycemic, and other effects. In the literature of Sharma et al. (2019) thirty-one distinct chemical compounds of *T. cordifolia* have been reported including glycosides, alkaloids, steroids, diterpenoid lactones, sesquiterpenoid and aliphatic chemicals. Scientific research on this medicine could lead to a novel method as well as knowledge into COVID-19 prevention, management, and the development of a new therapeutic component (Luo et al., 2019).

DATA AND METHODS

During a literature review, the methodological activities included were: (1) evolving the review idea (2) reviewing papers, bulletins, and authorized websites (3) analyzing prior publications (4) completing the review paper. Google Scholar, Research gate, academic papers, journals, health-related websites, newspapers are some of the most well-known bibliometric information sources investigated. Several keywords were chosen to acquire a high number of papers to be analyzed, including plant names, immunomodulatory, *Tinospora cordifolia*, COVID-19, ayurvedic herbs, and traditional medicine. A total of 29 Published articles from the year 2012 to 2021 were taken as a reference for our study. *T. cordifolia* was recognized and various parts of plants were captured using a camera. Finally, information from all the articles was compiled in a Microsoft word file and we used Excel to make tables and other necessary figures. We presented this methodology in detail with the help of Prisma flowchart given in figure 1.

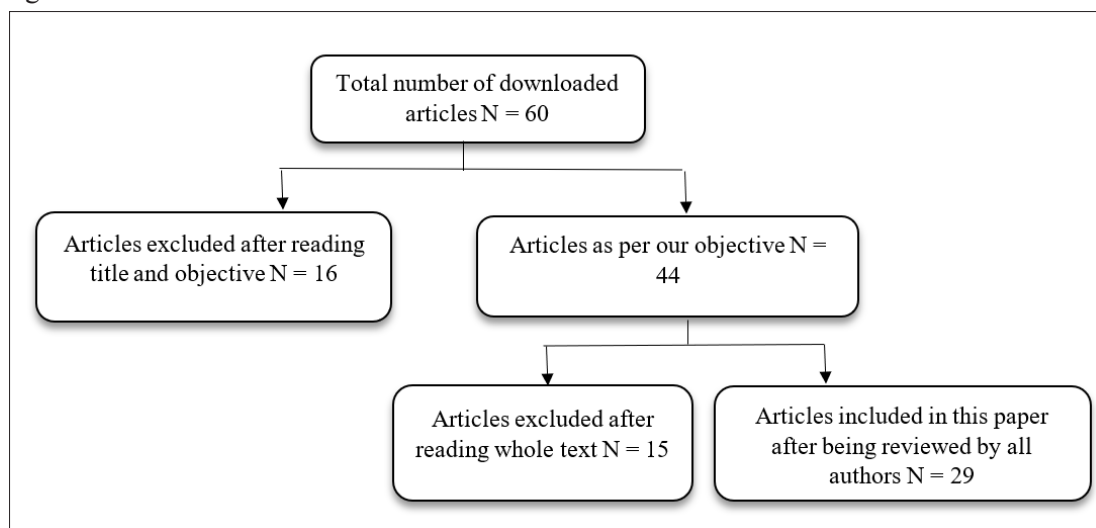


Figure 1: Prisma flowchart to show methodology while preparing this review paper

RESULTS AND DISCUSSION

Taxonomy

Table 1

A Taxonomic Classification of *T. Cordifolia*

Kingdom	Plantae
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Sub kingdom	Phanerogams
Super division	Angiosperms
Division	Magnoliophyta
Class	Magnoliopsida
Sub class	Thalamiflorae
Order	Ranunculales
Family	Menispermaceae
Genus	Tinospora Miers
Species	T. cordifolia
Local names	Gurjo, Giloy

Morphology: *T. cordifolia* is a vast, deciduous, glabrous, perennial, climbing shrub reaching 3-4 feet in height with a network of coiling branches (Modi, 2019). The plant's stem is climbing by nature, filamentous, succulent and the bark has whitish-gray color (Upadhyay et al., 2010). The stem powder is creamy to deep brown, has a distinctive odor and a bitter taste (Tiwari et al., 2018; Dwivedi & Enespa, 2016).

The leaf is usually simple, alternate, ex-stipulate, petiolate, heart-shaped that is curved halfway around. The lamina is oval in shape, seven nerved, cordated and membranous (Dwivedi et al., 2016; Albinjose et al., 2015; Meshram et al., 2013). Flowers are unisexual, axillary, and greenish-yellow in color, with 2-9 cm long branches. A female flower is positioned solitarily while a male flower has clumped inflorescence. Both petal and sepal are six in number. Out of six, every three sepals are arranged in two whorls. The petals are free and smaller than sepals (Arul et al., 2005). It has single-seeded fruits that ripen in the winter and bloom in the summer. The aerial roots have a tetra to penta arch basic structure (Singh et al., 2003) and are filamentous, airy, squairshin, occasionally lengthening and touching the ground (Sinha & Sharma, 2015). Seeds are curved as they belong to the moonseed family. Endocarp is decorated in numerous ways which insights significant taxonomic characters (Shetty et al., 2015; Mishra et al., 2015).

Phytochemical Constituent: *T. cordifolia* is bestowed with diverse phytochemical constituents that play a crucial role to cure diverse types of diseases. A majority of Phyto chemical compounds including alkaloids, terpenes, terpenoids, amino acids, glycosides, and lignin are beneficial from the pharmacological view (Emran et al., 2015; Emran et al., 2018). *T. cordifolia* also consists vivid phytochemical constituents categorized as alkaloids, polysaccharides, diterpenoids, aliphatic compounds, glycosides, etc. which are located in various segments of the plant body (Khan et al., 2016; Reddy & Reddy, 2015). Leaves contain high protein (11.2 %), phosphorus as well as calcium (Chaudhary 2014). Saiko saponins (A,

B2, C, and D) are triterpene glycosides derived from medicinal plants are also operative against corona virus (Hwa-Jung, 2018). Some of the major phytoconstituent found in the stem are berberine, choline, cordifol, diterpinoid furano lactone, hepatacosonal, palmatine, tinosprine, tinosporide, β -sitosterol etc (Singh et.al, 2003). Fiber (15.9%), ample protein (4.5 %-11.2 %), abundant carbohydrates (61.66 %), and little fat (3.1 %) are all common in *T. cordifolia*, with elements like high potassium (0.845 %), calcium (0.28 %) (0.131 %), iron (0.28 %) and chromium (0.006 %) (Khan et al., 2011).

Medicinal Properties: *T. cordifolia* plant is broadly employed in ancient Ayurvedic medicine and has a variety of therapeutic capabilities (Sharma et al., 2012, Meena et al., 2010) including urinary disorders, cough, skin illnesses, diabetes, tonsillitis, rheumatism, inflammation, allergy, gastritis, anti-periodic, radioprotective characteristics, boost the immune system, the body's ability to fight infections and so on (Pariyar et al., 2021; Sonkamble & Kamble, 2015). It can also help with hyperacidity, worm afflictions, anorexia, extreme thirst, colitis, gastrointestinal pain, and vomiting as well as liver problems such as hepatitis (Upreti & Chauhan., 2018; Salkar et al., 2017).

Antioxidant Properties: Phenolic compounds, methanol, ethanol, and water extract of *T. cordifolia* stems show anti-oxidant activity (Praveen et al., 2012; Krishna et al., 2009; Singh et al., 2005; Jagetia et al., 1998). Metal chelation and free radical scavenging are seen in its aqueous extract, indicating that it has radioprotective properties (Gupta & Sharma, 2011).

Antimicrobial Properties: *T. cordifolia* had good antifungal and antibacterial action when tested with different solvents on different microorganisms (Duraipandiyar et al., 2012). Plant extracts have been shown to counteract *Escherichia coli*, *Salmonella typhi*, *S. paratyphi*, *S. typhimurium*, *Enterobacter aerogene*, *Staphylococcus aureus* and *Shigella flexneri*, *Proteus vulgaris* (Narayanan et al., 2011).

Anti-toxin Properties: Choline, isocolumbin, magnoflorine, palmatine, tinosporin and tetrahydropalmatine are present in *T. cordifolia* to protect against aflatoxin-induced nephrotoxicity (Gupta & Sharma, 2011).

Anti-diabetic Properties: Tannins, saponins, flavonoids including alkaloids such as Magnoflorine, Jatrorrhizine, Plametine and several other compounds have anti-diabetic properties. Insulin-mediated effects were observed in alkaloids from this plant due to insulin hormone (Patel et al., 2016). It shows its anti-diabetic property by lowering oxidative stress, secreting insulin, and inhibiting gluconeogenesis and glycogenesis (Sangeetha et al., 2011).

Anti-stress properties: When diazepam, the standard drug of 2.5 mg/kg dose is

compared to the ethanolic extricate of *T. cordifolia* at 100 mg/kg, has remarkable anti-stress activity in all criteria. It functions as a brain tonic by improving mental abilities such as memory and recall. Patients’ I. Q levels improved the clinical investigation (Baghel, 2017).

Anti-HIV properties: The root extricate of *cordifolia* impacts the HIV-positive people’s immune system, its stem extract lowers eosinophil count, B lymphocyte stimulation, macrophage stimulation, hemoglobin level, and polymorphonuclear leucocytes (Akhtar, 2010 & Kalikaer et al., 2008).

Immuno-modulator properties: *Cordifolia* has been studied for its immune-boosting and revitalizer in Ayurveda medicine for a long time. Various compounds are isolated from it, and tests for immunomodulation activities are conducted. Because it contains arabinogalactan, an aqueous extract from the plant’s stem has been demonstrated to have immunological activity (Tiwari et al., 2018)

Anti-Inflammatory Properties: *Cordifolia* alcoholic extract has been demonstrated to show an anti-inflammatory role in both severe and mild inflammation models (Wesley et al., 2008). It exhibits an anti-inflammatory activity against edema and arthritis (Wesley et al., 2008 & Ana et al., 1999).

Antipyretic properties: *Cordifolia* has also been the subject of certain therapeutic trials, which have revealed its Jwaraghna (anti-pyretic) properties (Kumar & Ojha, 2018). The pyrexas test in Yeast also supports antipyretic activity (Hussain et al., 2015).

Either a whole plant or part such as stem, root, leaf, the tuber of *T. cordifolia* is utilized to heal distinct types of human diseases in Nepal.

Table 2

Ethnic Groups, Location, Parts of Tinospora cordifolia, Uses and Mode of an Application

Ethnic Group	Location	Parts used	Health uses	Mode of application	Sources
Tamang	Nuwakot	Tendril	Mensural disorder	Extract	Tamang, 2003
Raji	Surkhet,	Tuber,	Gastrointestinal	Juice	Thapa et al.,
	Kailali	Root	disorder, fever		2013
Tharu	Chitwan	Stem	Jaundice, immune booster, fever, cough & cold, skin disease, gonorrhoea, gout disease,	Juice	Maharjan et al., 2012

Tharu	Parsa	Stem, leaf	Jaundice, stomach disorder, rheumatism, diabetes, urinary problems	Powder, Juice	Singh, 2016; Singh, 2020
NS	Rupendehi	Root		Juice	Singh et al., 2011
		Stem	Gonorrhoea,	Decoction	
		Stem, Leaf	hyperacidity, jaundice, fever, cold cough	Juice Extract	
NS	Siraha	Root Stem, leaf	Diabetes	Juice	Alam & Sharma, 2020
Magar	Tanahun	Stem, Leaf	Sprain, cooling body	Juice, Paste	Uprety et al., 2011
NS	Palpa		Anti-diabetic, malaria, rheumatism, stomach problems, diarrhea, dysentery		Singh & Kumar, 2017

NS-Not Specified

Potential Role of *T. Cordifolia* to Fight Against COVID-19

No specific medicinal treatments have been found for the Corona virus. Research results have not shown their practical effectiveness (Weiss & Murdoch, 2020). According to WHO, (2021) data, the total number of confirmed cases is 245,373,039 and total deaths are 4,971,421 till October 29, 2021, around the globe which is one of the biggest public health challenges in the 21st century. Corona virus damages epithelial cells, induces oxidative stress, and damages the tissue of lungs, heart, and kidney causing respiratory infection, ARDS, and thus death (Wang et al., 2020). ‘Rasayan dravyas’ are detailed in Ayurveda to combat epidemic illnesses as well as other treatments. They are focused on increasing immunity, immune system modulators, and nourishing the body. Ayurveda contains a wide range of therapy options for a wide range of tedious illnesses, but there is not enough scientific evidence to back them up (Chavan et al., 2016). It is evident that those infected with the novel coronavirus have a terrible time fighting back, and many have died already as a result of the illness. In this scenario, utilizing *T.*

cordifolia to enhance their immunity and combat the illness could be beneficial. This plant is high in antioxidants, which help to neutralize free radicals and reduce inflammation according to a study (Mishra et al., 2013). *T. cordifolia* cleanses the blood, eliminates toxins from the body, and successfully fight infections and viruses, in addition to improving immunity. Fever, which is one of the sign of COVID-19, can be lessened by drinking *T. cordifolia* juice. The anti-inflammatory qualities of this plant aid in the treatment of primary symptoms of the Covid-19 infection such as breathing difficulties, cough, and colds.

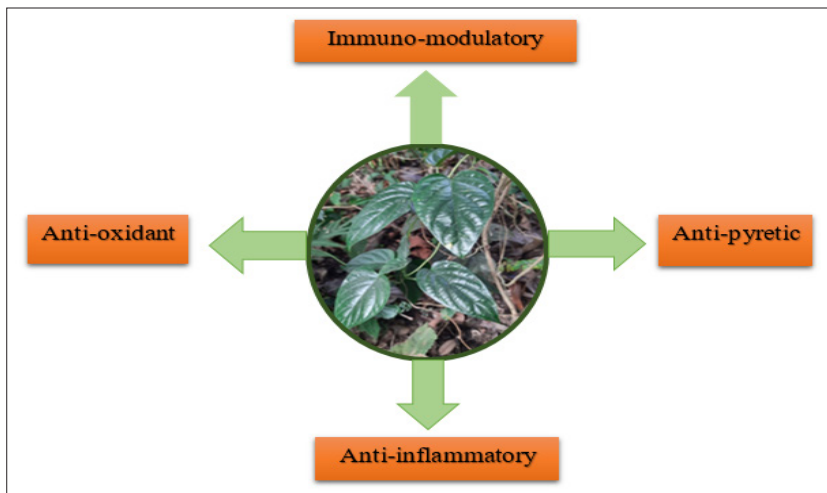


Figure 2: Potential Roles of T. Cordifolia to Fight COVID-19

T. cordifolia is found in tropical regions of Asian countries like China, India, Nepal, Srilanka, Myanmar (Chowdhury, 2020). The plant had been used for a few years to fight against diverse types of human and animal illness due to its wide medicinal properties. A TCM (Traditional Chinese medicine) which also includes *T. cordifolia* reports its success to treat about 60, 107 COVID-19 confirmed cases (Publicity department of the People’s Republic of China, 2020). The Siddha system of medicine in Srilanka suggested the treatment of COVID-19 using Ayurveda which also includes *T. cordifolia* (Rajeev & Soruban, 2020). Several literature shows the role of *T. cordifolia* herbal extract or tablet to treat COVID-19 in India (Kumar et al., 2020; Panda et al, 2020; Rias et al., 2020; Thorat et al., 2020). The US Food and Drug Administration approved *T. cordifolia* for therapeutic use after it was found to be effective against Covid-19 infection. Ministry of AYUSH’s recommended *T. cordifolia* as an alternative medicine to boost the immune system (ABP News Bureau, 2021). Acharya Balkrishna conducted a trial of medicine in India by making juice of *Withania somnifera*, *Tinospora cordifolia*, *Ocimum tenuiflorum* on hundreds of covid patients claimed the cent-

percent favorable result against COVID-19 infection (English Jagran, 2020). Despite the hype, *T. cordifolia* plantation, sale, and consumption are all prospering in Nepal. Nepal Government (GoN) is also prioritizing medicinal plants for their immune increasing act with detailed prescriptions (Pandit et al., 2020). On 26 April 2020, a joint effort of Nepal's government, Department of Ayurveda and Alternative Medicine (DoAaAM), Nepal Ayurveda Medicinal Council (NMAC) and Ayurveda Campus and Teaching Hospital (ACTH) released "Ayurveda & Alternative Medicinal Guideline of Preventive Measures and Management Protocol for CoVID-19" (DoAaAM, 2020; Pandit & Singh, 2020) sets the powerful step as the herbal application of available medicinal plants of Nepal to prevent corona virus. A health status study of home isolated covid patients in Nepal reports that 32.4 % of a participant consumed *T. cordifolia* to cure COVID-19 (Gyanwali & Dhimal, 2020). An article by Khadka et al. (2021) reports when *T. cordifolia* stem is boiled with water or milk shows an immune modulatory effect and therefore it acts as a potential herb to fight against COVID-19 (Khadka et al., 2021). Dr. Kopila Adhikari (an Ayurvedic physician at Chitwan's District Ayurveda Health Centre) stated, "Medicines are prescribed only when certain criteria are observed such as pulse diagnosis, tongue diagnosis, and others when prescribing *T. cordifolia* or any other medicine to the patient, taking into account the nature, age, digestion capability and health conditions" (Budathoki, 2020). Drinking too *T. cordifolia* decoction can cause liver damage, conforming to published research in the Journal of Clinical and Experimental Hepatology. In fact, throughout the pandemic, people forgot to consume the herb mixture in a proportional amount causing the body's immune system to attack its cells and tissues instead of the virus or bacterium that ultimately damages the liver (ABP News Bureau, 2021).

CONCLUSIONS

Traditional herbs are a ray of hope owing to the limitations of modern medicine and therapies. As a result, adequate research, and scientific documentation on herbal medications such as *T. cordifolia* is an urgent requirement for COVID-19 preventive and therapy solutions. *T. cordifolia* contains anti-inflammatory, anti-oxidant, and antipyretic properties and is traditionally used to treat pain, fever, inflammation, and boost the immune system. The usage of *T. cordifolia* has increased during a pandemic period with claims that they might avert COVID-19. Concerned authorities should show critical concern on conducting tests on the efficacy of medicinal plants and regulate the dissemination of incorrect information obtained through research and education initiatives.

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