



Original Research Article

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## Extracts of the *Cissus quadrangularis* Linn. against the oral pathogens

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### Article Info

### Abstract

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*Cissus* belongs to Vitaceae family and it was classified into 13 distinct genera. Among these species, *Cissus quadrangularis* Linn commonly known as Asthisamharaka found in hottest region of India, it has more potential applications in various fields, including medicine, agriculture, and industry. *Cissus quadrangularis* is a perennial plant native to Asia and Africa, known for its medicinal properties. It's often used in traditional medicine to treat various ailments such as bone fractures, joint pain, and digestive issues. Research suggests it may have anti-inflammatory and bone-healing properties, making it popular in supplements for athletes and those with bone-related conditions. However, more studies are needed to fully understand its effectiveness and safety. Oral pathogens are microorganisms that can cause diseases in the oral cavity. Common examples include *Streptococcus mutans*, which contributes to tooth decay, and *Porphyromonas gingivalis*, associated with periodontal disease. Proper oral hygiene and regular dental check-ups are crucial for preventing these pathogens from causing harm. Phytochemical analysis has unveiled a plethora of bioactive compounds within *Cissus quadrangularis*, including flavonoids, triterpenoids, phyosterols, and various minerals. *Cissus* have diverse pharmacological activities, which encompass anti-inflammatory, analgesic, antioxidant, anti-osteoporotic, anti-diabetic, and anti-obesity effects. Qualitative analysis is done to identify the phytochemicals present in the different extract of source and quantitative analysis has done for the estimation. Then the extract was screened for its anti-inflammatory activity by the method of inhibition of denaturation. The results show increase in the concentration of extract increases the inhibition percentage. Chromatographic techniques are done to find which ratio of concentration of solvents elutes efficiently. By the results, 7:3 ratio of benzene extract of *Cissus quadrangularis* elutes efficiently at Rf value of 0.86 respectively. The benzene extract of *Cissus quadrangularis* shows best result in FT-IR analysis. The peak value of the FT-IR 3400 shows possible compounds are alkene and alcohol.

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### Introduction

The extensive research conducted on plants, including the genus *Cissus* within the Vitaceae family, has contributed significantly to our understanding of their properties and potential applications. These studies have

utilized various methodologies and approaches to explore the diverse aspects of plants, providing valuable insights for future researchers (Bafna et al., 2021). The genus *Cissus* is particularly noteworthy within the Vitaceae family, as it encompasses over 800 species. These species have been further classified into 13

distinct genera, taking into account regional variations and specific characteristics. Among these species, *Cissus quadrangularis* Linn., commonly known as Asthisamharaka, stands out as a visually captivating plant that is predominantly found in the hottest regions of India (Siddiqua and Mittapally, 2017). One remarkable feature of *Cissus quadrangularis* is its adaptability and resilience. It is capable of thriving in diverse environments, ranging from elevations of 500 meters to low lying coastal areas. This adaptability showcases the plant's ability to withstand different climatic conditions and highlights its potential for cultivation in various regions. The comprehensive understanding gained from multiple studies on *Cissus quadrangularis* and other plants within the Vitaceae family has significant implications for future researchers. These studies have provided essential principles encompassing safety, efficacy, and specific functionalities of these plants (Siddiqua and Mittapally, 2017). Such knowledge is crucial for guiding further research and exploration of their potential applications in various fields, including medicine, agriculture, and industry. In conclusion, the extensive research conducted on plants, particularly within the Vitaceae family and the genus *Cissus*, has greatly contributed to our understanding of their properties and potential uses. Traditional practitioners have long revered.

## Materials and methods

### Collection of plant source

The plant source *Cissus quadrangularis* was collected around Chengalpattu region respectively during February 2024.

### Extraction process

The internodes from *Cissus quadrangularis* were harvested and then shade dried until the amount of moisture was no longer present. With the use of a stainless- steel grinder, the plant's dried source was ground into powder (Ghouse, 2015). Thermal agitation was the method used for the extraction. In a 1:10 ratio, the plant extract was combined with low, mid, and high polar solvents. Acetone, a mid-polar solvent, and water, a high-polar solvent, were combined and incubated for 24 hours in an incubator shaker for *Cissus quadrangularis*. The mixes were filtered and kept in an airtight container after a 24-hour period.

## Qualitative analysis of plant extract

Phytochemicals are naturally occurring compounds found in plants. The identification of different biochemical substances generated by plants is mostly dependent on qualitative phytochemical screening. Natural substances derived from prebiotic, microbial, plant, and animal origins have long captivated humanity. Bioactive substances that combat illness include alkaloids, steroids, tannins, glycosides, volatile oils, fixed oils, resins, phenols, terpenoids, and flavonoids, which are found in extracts of various plant sections. Plant-derived phenolic phytochemicals are important antibacterial agents. Antimicrobial drugs cause the protein components of the cell wall to break down, which interferes with enzyme activity and the replication of DNA and RNA (Anuj et al., 2011). There are several extraction techniques, including pressing, sublimation, distillation, and solvent extraction. The most popular technique is called solvent extraction, in which natural materials go through a process in which a solvent enters the plant cell wall and dissolves the solute, collecting the extract as a result. The size of the plant matter, the solvent's solid-to-solvent ratio, the temperature during extraction, and the length of the extraction process have all been found to have an impact on the extraction efficiency (Bafna et al., 2021). They are identified with series of tests listed below (Siddiqua and Mittapally, 2017).

- *Test for flavonoids:* Alkaline reagent test: Add two to three drops of sodium hydroxide to two milliliters of plant extract, followed by the addition of diluted HCL.
- *Test for steroids:* One milliliter of extract was mixed with two milliliters of chloroform, a few drops of acetic acid, and concentrated H<sub>2</sub>SO<sub>4</sub> was added. The presence of steroids was shown by the emergence of blue and green colour.
- *Test for saponins:* After shaking 0.2g of the extract with 5ml of distilled water, it was brought to a boil. The presence of saponins was indicated by the creamy appearance of tiny bubbles.
- *Test for phenol:* 2 millilitres of distilled water were mixed with 1 milliliter of extract. Ferric chloride drops were added sparingly. Synthetic resin compound is indicated by a dark, unexperienced colour.
- *Test for terpenoids:* Salkowski's test: A few

drops of concentrated sulphur acid were added to two milliliters of the extract along with one milliliter of chloroform. Terpenoids are present because a reddish-brown precipitate has formed.

- *Test for carbohydrate:* In a test tube, 2 milliliters of the extract, 2 drops of iodine, and 1 milliliter of water were added. The presence of starches is indicated by the emergence of a dark blue tint.
- *Test for alkaloids:* Mayer's test: Mayer's reagent was added in little drops to the filtrates. When alkaloids are present, a yellow cream precipitate form.

## Quantitative analysis

### Estimation of alkaloids

A beaker containing 5 g of the plant sample is filled with 200 ml of 10%  $\text{CH}_3\text{CO}_2\text{H}$  in  $\text{C}_2\text{H}_5\text{OH}$ . After covering, the mixture is let to stand for four hours. The extract is then allowed to concentrate in a water bath until it reaches 1/4 of its initial volume after the combination has been filtered.  $\text{NH}_4\text{OH}$  concentrate is added up until the point of full precipitation. After allowing the entire mixture to settle, the precipitate is collected, cleaned with diluted  $\text{NH}_4\text{OH}$ , and filtered. Alkaloid residue is weighed and dried after that (Siddiqua and Mittapally, 2017).

### Estimation of flavonoids

About 100 ml of 80% aqueous methanol are used to repeatedly extract 10 grams of plant material at room temperature. After passing the entire mixture through filter paper, the filtrate is moved into a water bath and allowed to evaporate until the solution is completely dry. Next, the sample is weighed until it reaches a steady weight (Siddiqua and Mittapally, 2017).

### Estimation of saponins

The plant samples were pulverized, and 20 g of each sample was added to a conical flask along with 100 ml of 20%  $\text{C}_2\text{H}_5\text{OH}$ . Using constant stirring, the sample is heated to about  $55^\circ\text{C}$  over a 4-hour period in a hot water bath. After filtering the mixture, 200 ml more of 20% ethyl alcohol are used to extract the residue once again. Over a water bath at around 90 degrees Celsius, both

extracts are reduced to 40 milliliters. After that, the concentration is put into a 250 ml separating funnel, and the extract is given a good shake after 20 ml of  $(\text{CH}_3\text{CH}_2)_2\text{O}$  is added (Siddiqua and Mittapally, 2017).

### Estimation of tannins

Tannin quantity is measured by use of the spectrophotometer technique. A 50 ml plastic container is filled with 0.5 g of plant sample. After adding 50ml of distilled, stir for one hour. After filtering, the sample is made up to mark in a 50ml volumetric flask. A test tube is filled with 5 milliliters of the filtered sample, 2 milliliters of 0.1 M  $\text{FeCl}_3$ , 0.1 M  $\text{HCl}$ , and 0.008 M  $\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$ . In ten minutes, the sample's absorbance is determined at a wavelength of 395 nm using a spectrophotometer (Siddiqua and Mittapally, 2017).

## Chromatography

### Column chromatography

Column chromatography is a laboratory technique used to separate and purify mixtures of compounds. A glass or plastic column is packed with a material like silica gel as a stationary phase. The mixture is dissolved in a suitable solvent and applied to the top of the column. By adding an elution solvent, the compounds in the mixture move down the column at different rates, separating based on their solubility. Fractions are collected as the compounds elute from the column, and the separated components are isolated and analysed. This method is commonly used in chemistry for purification and analysis purposes. Proteins differ in their size, shape, net charge, stationary phase utilized, and binding capability. Chromatographic techniques may be used to purify each of these distinguishing elements. Among these techniques, column chromatography is used the most often. Biomolecules can be purified using this approach. The sample to be separated is put to a column (stationary phase) initially, followed by the application of wash buffer (mobile phase). It is assured that they pass through the inside column material that is supported by fiberglass. The samples are gathered at the device's bottom in a volume- and time-dependent way (Ghouse, 2015).

### Thin layer chromatography

Thin-layer chromatography (TLC) is a simple and rapid

analytical technique used to separate and identify compounds in a mixture. In TLC, a small amount of the mixture is spotted onto a thin layer of stationary phase (typically silica gel or alumina) on a plate. The plate is then placed in a chamber with a solvent (the mobile phase), which travels up the plate via capillary action. As the solvent moves, it carries the compounds with it, and they separate based on their affinity for the stationary phase. After development, the plate is dried and visualized, often using UV light or a staining agent. The relative distance traveled by each compound (measured as the R<sub>f</sub> value) can be used to identify and quantify the compounds. TLC is a valuable tool in fields like chemistry, biochemistry, and pharmacology for qualitative and semi-quantitative analysis of mixtures (Ghouse, 2015).

"Solid-liquid adsorption" chromatography is what thin-layer chromatography is. Chromatography phase in this technique station 159 Coskun is a solid adsorbent material placed on glass plates. All solid materials used in column chromatography, such as cellulose, silica gel, and alumina, can be employed as adsorbent materials. Using this technique, the mobile phase passes through the stationary phase and ascends. Through the process of capillary action, the solvent rises up the thin plate that has been soaked with it. In the process, a pipette is used to push the mixture that was previously dropped at various flow rates onto the bottom portions of the plate. Analyte separation is thus accomplished. This upward traveling rate is dependent upon the solvent's, solid phase's, and material's polarity. When the sample's molecules are colourless, their locations on the chromatogram can be determined by using fluorescence, radioactivity, or a particular chemical to create a visible, coloured reactive result. Visible colour formation may be seen in both UV and room light. By determining the ratio between the lengths travelled by the molecules and the solvent, the positions of each molecule in the mixture may be determined. Relative mobility is the measurement value that is represented by the sign R<sub>f</sub>. The compounds' qualitative description is based on their R<sub>f</sub> value (Anuj et al., 2011).

In thin layer chromatography, the solid phase is a thin glass plate covered with either silica gel or aluminium oxide. The mobile Phase is a solvent that is selected according on the characteristics of the mixture's constituent parts. The distribution of a component between a liquid mobile phase (eluting solvent) that is traveling across the solid phase and a solid stationary

phase (the thin layer) placed to a glass and plastic plate is the basis of TLC. A starting point slightly above the bottom of the TLC plate is covered with a little amount of a compound or combination. In the developing chamber, which has a small pool of solvent immediately underneath the position at which the specimen was applied, the plate is next developed. By capillary action, the solvent is pulled up through the plate's particles; as it passes over the mixture, each component either stays in the stationary surface or dissolves in the solvents and moves up the plate. Whether a compound climbs the plate or lags behind depends on its physical characteristics and, consequently, on its chemical composition, particularly its functional groups. The "Like Dissolves Like" solubility rule is adhered to. The longer a chemical stay in the solvent system, the more physically similar its properties are to those of the mobile phase. The most soluble substances will be carried up the TLC plate the farthest by the mobile phase. The substances that have a stronger affinity for the granules on the TLC plate and are less soluble in the mobile phase will remain (Anuj et al., 2011).

#### Anti-inflammatory assay

Inhibition of protein denaturation: Plant extract made it into different concentration (200,400,600,800,1000µL) with distilled water homogenized with 1ml of aqueous bovine serum albumin and incubated for 10 minutes at 70 degrees Celsius in water bath. Only bovine serum albumin is kept as standard. After incubation period the optical density of the mixtures was 17 measured using UV- spectroscopy (Anuj et al., 2011). Then the inhibition percentage is calculated using the following formula:

$$\% \text{inhibition} = \frac{\text{Absorbance of control} - \text{absorbance of sample}}{\text{Absorbance of control}}$$

#### Determination of minimum inhibitory concentration (MIC)

Using the two fold serial micro dilution technique in a 96-well microtiter plate, the minimum inhibitory concentration (MIC) value of each extract was found for each strain of bacteria. The sterile broth medium (50 µL), which was identical to the media used in the screening test, was first mixed with the tested extract (20mg/mL). The microtiter plate was then filled with a 50µL diluted bacterial slurry that contained a

final inoculum of 105 bacteria/mL. The final concentration of the microdilution was between 0.01 and 5 mg/mL. Every extract underwent three assays. The bacterial suspensions functioned as a positive control to monitor if the broth was sufficiently sterile for bacterial development, while the extracts in the broth were used as a negative control to guarantee medium sterility. 20µL of 3- [4,5- dimethylthiazol-2-yl]-2,5-diphenyltetrazoliumbromide (MTT, 1mg/mL) for Gram- positive bacteria and 40 L of 2,3,5-triphenyltetrazolium chloride (TTC, 2 mg/mL) for Gram-negative bacteria were added to the plate after it had been incubated under anaerobic conditions. After that, the plate was incubated for a further two hours in the dark. The lowest extract concentration at which the indicator's color did not change upon addition was determined to be the MIC value (Rex and Ravi, 2020).

### FT-IR analysis of the compound

The vibrational characteristics of amino acids and cofactors are investigated using Fourier transform infrared (FTIR) spectroscopy, which is sensitive to even the smallest structural alterations. On the one hand, this technique's lack of specificity allows us to directly examine the vibrational characteristics of practically all cofactors, side chains of amino acids, and water molecules. On the other hand, vibrations corresponding to individual chemical groups engaged in a particular reaction can be chosen using reaction-induced FTIR difference spectroscopy (Singh et al., 2007).

The resultant reaction-induced FTIR difference spectra are analysed using several techniques to determine the IR fingerprints of each residue of interest. (Distinct)To identify the chemical groups, methods including isotope labelling, site-directed mutagenesis, and hydrogen/deuterium exchange are frequently employed. We are able to interpret the infrared frequencies in terms of particular structural properties of the chemical group or molecule of interest thanks to studies on model compounds and the growing use of theoretical chemistry for normal modes calculations. The fundamentals of FTIR spectroscopy are covered in this paper, along with particular, significant structural and functional data that was discovered through this method's examination of photosystem data (Thalkari et al., 2019).

*Cissus quadrangularis* for its versatile therapeutic properties, employing it to alleviate various maladies

ranging from bone fractures and joint disorders to gastrointestinal ailments and metabolic disorders. Such widespread usage has prompted scientific inquiry into the herb's pharmacological constituents and mechanisms of action, leading to a burgeoning body of research aimed at unlocking its therapeutic secrets. Phytochemical analyses have unveiled a plethora of bioactive compounds within *Cissus quadrangularis*, including flavonoids, triterpenoids, phytosterols, and various minerals. These constituents are thought to underpin the plant's diverse pharmacological activities, which encompass anti-inflammatory, analgesic, antioxidant, anti-osteoporotic, anti-diabetic, and anti-obesity effects, among others. Such multifaceted pharmacological properties have positioned *Cissus quadrangularis* as a promising candidate for addressing contemporary health challenges. In recent years, scientific investigations have sought to elucidate the underlying mechanisms through which *Cissus quadrangularis* exerts its therapeutic effects.

Experimental studies have revealed its ability to modulate key signaling pathways involved in inflammation, oxidative stress, bone metabolism, glucose homeostasis, and lipid metabolism. Furthermore, preclinical and clinical studies have provided compelling evidence of its efficacy in ameliorating various pathological conditions, ranging from musculoskeletal disorders to metabolic syndrome. Despite the growing body of research supporting the therapeutic potential of *Cissus quadrangularis*, several avenues remain ripe for exploration (Tharshanodayan and Rohini, 2019). Further elucidation of its pharmacological mechanisms, validation of its efficacy through rigorous clinical trials, exploration of potential synergistic effects with conventional therapies, and elucidation of optimal dosage regimens are among the pressing questions that warrant attention. In light of the increasing prevalence of chronic diseases and the escalating demand for natural alternatives, *Cissus quadrangularis* stands poised as a botanical treasure trove with immense therapeutic promise.

## Results and discussion

### Extraction process

For *Cissus quadrangularis* extract:10g of shade dried internode powder was dissolved in100ml of Ethanol (Polar), Acetone (Mid-polar) and benzene (non-polar) separately.

## Qualitative analysis of plant extract

The extracts were tested to series of tests to identify the presence of phytochemicals. The results of qualitative analysis of plant extracts were shown in the below table (Raj and Joseph, 2011). The result confirms that the presence of important phytochemicals. Such as flavonoids, steroids, and alkaloids in both benzene extract of *Cissus quadrangularis*

**Table 1.** Qualitative analysis of extracts of *Cissus quadrangularis*.

Phytochemicals	Ethanol extract	Acetone extract	Benzene extract
Flavonoids	+	+	+
Steroids	+	-	-
Tannins	-	-	+
Saponins	-	+	-
Alkaloids	+	+	+
Terpenoids	-	-	+
Carbohydrates	+	-	-
Phenol	-	+	-

## Quantitative analysis

### Estimation of alkaloids

Presence of alkaloids in the benzene extract of *Cissus quadrangularis* and acetone extract of *Cissus quadrangularis* and ethanol extract of *Cissus quadrangularis*. The quantitative test is to done to estimate the total amount alkaloid content (Gabriel Fernandes, 2012).

- Alkaloid content in Benzene extract of *Cissus quadrangularis*:0.18%
- Alkaloid content in acetone extract of *Cissus quadrangularis*:0.07%
- Alkaloid content in ethanol extract of *Cissus quadrangularis*:0.16%

### Estimation of flavonoids

Presence of flavonoids in the benzene extract of *Cissus quadrangularis* and acetone extract of *Cissus quadrangularis* and ethanol extract of *Cissus quadrangularis*. The quantitative test is to done to estimate the total amount alkaloid content (Jayanthi and Ibrahim., 2014).

- Flavonoid content in Benzene extract of *Cissus*

*quadrangularis*:0.25%

- Flavonoid content in acetone extract of *Cissus quadrangularis*:0.34%
- Flavonoid content in ethanol extract of *Cissus quadrangularis*: 0.21%

## Chromatography

### Column chromatography

The 5 ml of plant extract is loaded to the silica column. Elutes of various concentrations based on polarity dissolve the sample and transport it through the column. A total of 11 concentrations were eluted (Thakur et al., 2009). The concentrations were prepared in the ratio of Toluene: acetic acid ranging 10:0 to 0:10.

### Thin layer chromatography

Collected purified fractions were run on the TLC plates. The concentrations 5:5, 6:4 and 7:3 gave the satisfactory result for benzene extract of *Cissus quadrangularis*. The Rf value of 0.80, 0.84 and 0.88 was attained for each concentration respectively (Meyer and Fives-Taylor, 1998). The ratio of 7:3 gave the higher Rf value. The concentrations 4:6, 6:4 and 7:3 gave the satisfactory Rf value of 0.79, 0.82 and 0.86 was attained for each concentration respectively. The ratio of 7:3 gave the higher Rf value providing to be the best. The Rf value of extracts were shown in the below table

**Table 2.** TLC analysis findings.

Various conc. of toluene: acetic acid	Rf value of benzene extract
10:0	0.69
9:1	0.71
8:2	0.73
7:3	0.87
6:4	0.91
5:5	0.77
4:6	0.89
3:7	0.75
2:8	0.73
1:9	0.67
0:10	0.68

### Anti-inflammatory assay

The anti-inflammatory property of the benzene extract of *Cissus quadrangularis* was examined using Inhibition of protein denaturation. The plant extracts were made into different concentration and homogenized with bovine serum albumin (Jainu et al., 2006). The mixtures were incubated in water bath and optical density is taken using UV spectroscopy. The percentage of inhibition is tabulated below. The results show increase in the concentration gradually increases the percentage of inhibition.

**Table 3.** Anti-inflammatory activity of benzene extract of *Cissus quadrangularis*

Concentration in $\mu\text{L}$	Inhibition percentage of Benzene extract
200 $\mu\text{L}$	65%
400 $\mu\text{L}$	69%
600 $\mu\text{L}$	71%
800 $\mu\text{L}$	84%
1000 $\mu\text{L}$	93%

### Anti-bacterial activity

The anti-bacterial activity has been carried out by the oral pathogens *Streptococcus mutans* and *Enterococcus faecalis* (Jainu et al., 2006). Among these two pathogens the isolated extract shows a great result in the *Streptococcus mutans*.

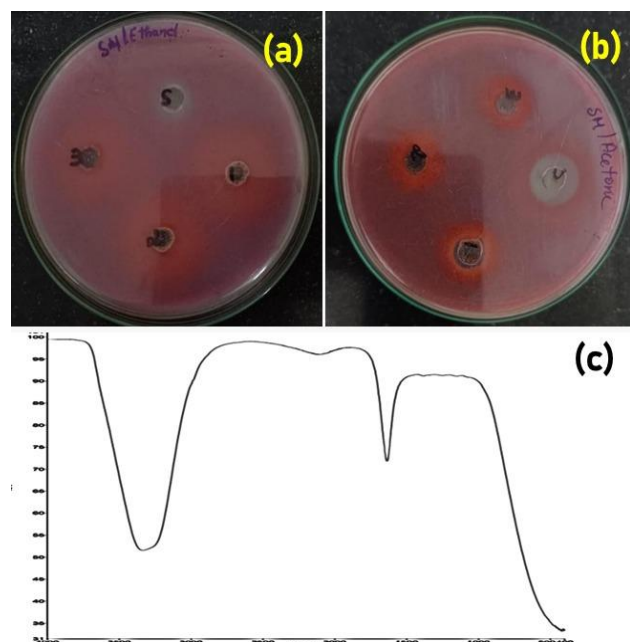
**Table 4.** Antibacterial activity of ethanol and acetone extract of *Cissus quadrangularis* against *Streptococcus mutans*

Concentration ( $\mu\text{l}$ )	Ethanol extract (mm)	Acetone extract (mm)
150	21	17
100	17	14
50	11	8

### FT-IR analysis

Among these three extract benzene extracts of *Cissus quadrangularis* shown a better result than the other two

extracts which have further studied by FT- IR analysis which results are given in the below picture.



**Fig. 1:** (a) Ethanol extract of *Cissus quadrangularis* against *Streptococcus mutans* (b) Acetone extract of *Cissus quadrangularis* against *Streptococcus mutans* (c) FT-IR of benzene extract

### Conclusions

*Cissus quadrangularis* is commonly grown in many parts of the Tamil Nadu and it is consumed as food. In the traditional medicine system, it is used to cure the ortho related disease. They are known for their availability and the medicinal value. The extracts of *Cissus quadrangularis* have been widely studied for the anti- cancerous activity but its efficacy against the oral pathogens remains unknown. This study primarily focuses on the extraction of *Cissus quadrangularis* and its efficacy against the oral pathogens. There are into three solvents have been used among which benzene extracts shown a better result. The FT-IR analysis of benzene extract indicates the presence of alkane, alcohol, aldehydes, conjugated acid and alkenes. This study have been completed till the activity against the oral pathogens and the determination of the minimum inhibitory concentration and minimum bactericidal concentration have been remaining part of the study.

### Conflict of interest statement

Authors declare that they have no conflict of interest.

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## References

- Anuj, S., Srivastava, P., Tiwari, B., Mishra, J., Behera, B., Shrivastava, A., 2011. Plant (*Cissus quadrangularis*) with various ethnopharmacological action: A review. J. Pharm. Res. 4, 1887–1890.
- Bafna, P.S., Patil, P.H., Maru, S.K., Mutha, R.E., 2021. *Cissus quadrangularis* L: A comprehensive multidisciplinary review. J. Ethnopharmacol. 279, 114355. <https://doi.org/10.1016/j.jep.2021.114355>
- Gabriel Fernandes, 2012. Medicinal properties of plants from the genus *Cissus*: A review. J. Med. Plants Res. 6. <https://doi.org/10.5897/JMPR11.1637>
- Ghouse, M., 2015. A pharmacognostical review on *Cissus quadrangularis* Linn. Int J Res Pharm Biosci. 7, 28–35.
- Jainu, M., Vijai Mohan, K., Shyamala Devi, C.S., 2006. Gastroprotective effect of *Cissus quadrangularis* extract in rats with experimentally induced ulcer. Indian J. Med. Res. 123, 799–806.
- Jayanthi, A., Ibrahim., S., 2014. Effect and properties of *Cissus Quadrangularis* in fracture repair. Int. J. Res. Appl. Sci. Biotechnol. 1, 1–6.
- Meyer, D.H., Fives-Taylor, P.M., 1998. Oral pathogens: from dental plaque to cardiac disease. Curr. Opin. Microbiol. 1, 88–95. [https://doi.org/10.1016/S1369-5274\(98\)80147-1](https://doi.org/10.1016/S1369-5274(98)80147-1)
- Raj, S., Joseph, B., 2011. Pharmacognostic and traditional properties of *Cissus quadrangularis* Linn-An overview. Int. J. Pharma Bio Sci. 2, 131–139.
- Rex, M.C., Ravi, L., 2020. A review on *Cissus quadrangularis* L. as herbal medicine. Indian J. Nat. Prod. Resour. 11, 155–164.
- Siddiqua, A., Mittapally, S., 2017. A review on *Cissus quadrangularis*. Pharma Innov. 1, 329.
- Singh, G., Rawat, P., Maurya, R., 2007. Constituents of *Cissus quadrangularis*. Nat. Prod. Res. 21, 522–528. <https://doi.org/10.1080/14786410601130471>
- Thakur, A., Jain, V., Hingorani, L., Laddha, K., 2009. Phytochemical studies on *Cissus quadrangularis* Linn. Pharmacognosy Res. 1.
- Thalkari, A.B., Karwa, P.N., Sagde, R.M., Chopane, P.S., Zhambare, K.K., 2019. *Cissus quadrangularis*: A natural booster. Res. J. Pharmacogn. Phytochem. 11, 129. <https://doi.org/10.5958/0975-4385.2019.00022.0>
- Tharshanodayan, N.J.Q., Rohini, P., 2019. A review on medicinal properties and nutraceutical importance of *Cissus quadrangularis*. Int. J. Life Sci. 7, 368–374.

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