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Qualitative And Quantitative Analysis of Cinnamomum Tamala Leaf Extract

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Abstract

Objective: The purpose of the study is to assess the properties and bioactive components of Cinnamomum tamala leaves. Methods: The leaves of Cinnamomum tamala were extracted. Different experimental methods have been used to study the phytochemicals (qualitative and quantitative). The phytochemical screening was evaluated in different extractions such as aqueous, hexane, ethanol, petroleum ether and hydroethanolic to compare the solubility of various bioactive components. Further, high performance liquid chromatography (HPLC) and gas chromatography mass spectrometry (GC-MS) were also performed to study the presence of flavonoids and secondary metabolites respectively. Results: The Qualitative analysis showed the presence of phytochemical compounds in higher concentration in hydroethanolic extract of the leaves of Cinnamomum tamala. In comparison with other extracts, hydroethanolic extract had larger yields of flavonoids (186.42 ± 13.04 mg/g QE), phenols (226.34 ± 15.84 mg/g GAE), saponins (112.10 ± 7.84 mg/g) and steroids (161.30 ± 11.29 mg/g CL). HPLC analysis revealed the presence of flavonoids in hydroethanolic extracts of the leaves of Cinnamomum tamala. GC-MS analysis proved the presence of various bioactive compounds in the hydroethanolic extract of the leaves of Cinnamomum tamala. Conclusion: The results of this study demonstrated the significance of the leaves of Cinnamomum tamala. We concluded that Cinnamomum tamala leaves have various biological activities which can treat diseases..

Keywords: *Cinnamomum tamala, Phytochemicals, Qualitative, Quantitative, HPLC analysis, GC-MS analysis*

1. Introduction

The majority of Indians currently use medicinal plants extensively in their traditional medical practices including Siddha, Ayurveda and Unani (1). India has about 4.5 million plant species but only around 250,000 and 500,000 of them are subjected to phytochemical analysis (2). In order to maintain the diversity of these natural products and improve livelihoods, medicinal plants are significant (3). The presence of bioactive constituents of the plants exhibit various pharmacological activities and it is essential to investigate for their medicinal properties.

Botanical name: Cinnamomum tamala

Family: Lauraceae

Genus: Cinnamomum

Species: C.tamala

Parts used: Leaves

The Lauraceae-family species Cinnamomum tamala also known as Indian Cassia, and its leaves are frequently referred to as bay leaves. The Lauraceae family, which primarily consists of trees and plants that resemble trees, is significant commercially. There are about 350 species in the genus Cinnamomum worldwide. It is one of the earliest known and used spices in history. It also plays a role in the traditional Indian medical system. Bark and leaves are used to control colic, diarrhea, nausea

and vomiting because of their odorous, astringent, stimulant and carminative properties. According to ancient literature, the plant's dried leaves and bark were recommended for treating fever, anemia and body odor in the first century A.D. Children were given its seeds for dysentery or cough by crushing and combining with honey or sugar (4). Previous research has shown that Cinnamomum tamala leaves contains a variety of phytochemicals, including cinnamaldehyde (5) and eugenol (6). The flavonoids components such as quercetin and kaempferol present in the leaves of Cinnamomum tamala shows anti-inflammatory property (7). Hence, the objectives of this study was to determine the phytochemical screening of the Cinnamomum tamala leaves by qualitative analysis, quantitative analysis, high performance liquid chromatography analysis and gas chromatography-mass spectrometry.

2. Materials And Methods

Plant material collection and preparation

The leaves used for the study was collected from Thrikkakara North, Kerala, India and the plant leaves were identified by a botanist from the Department of Botany, The Rapinat Herbarium and Centre for Molecular Systematics, Tiruchirapalli, Tamilnadu. For extraction, 10 grams of leaf powder were utilized. To get extracts, cold extraction was carried out using the "intermittent shaking" method for 24 hours in a variety of solvents including aqueous, ethanol, hexane, petroleum ether and hydroethanolic (ethanol and water (70:30). Whatman filter No. 1 paper was used to further filter the extracts and the filtrate was then used for phytochemical analysis.

Determination of extraction yield

The extraction yield was calculated by the following equation:

Extraction yield (%) = W1/W2×100; where W1 is the weight of crude extract and W2 is the dry weight of the sample taken.

Qualitative phytochemical screening

Standard procedures were used to carry out the phytochemical screening (8, 9, 10, 11).

Test for tannin

In a different test tube, 1ml of different extracts of Cinnamomum tamala leaves were boiled in 20ml of water and filtered. A few drops 0.1% ferric chloride was added and the coloration was checked for brownish green or a blue-black color.

Test for saponin

2ml of different extracts of Cinnamomum tamala leaves were taken in different test tubes, boiled in 20ml of distilled water in a water bath and then filtered. For a stable, persistent froth, 10ml of the filtrate was combined with 5ml of distilled water and vigorously shaked. 3 drops of olive oil was added to the froth, which was rapidly shaken and the formation of emulsion was observed.

Test for flavonoids

A fraction of the different extracts of Cinnamomum tamala leaves and 5ml of diluted ammonia solution were added to different test tubes, then concentrated H_2SO_4 was added. Each extract had a yellow coloration that showed flavonoids were present. The yellow coloration disappears later.

Test for steroids

1ml of different extracts of Cinnamomum tamala leaves in different test tubes with 2ml of H_2SO_4 were mixed with 2ml of acetic anhydride. In some samples, the color changed from violet to blue or green, indicating the presence of steroids.

Test for terpenoids (Salkowski's test)

A layer is formed by carefully combining concentrated H_2SO_4 (3ml) with 5ml of different extracts of Cinnamomum tamala leaves in 2ml of chloroform. To indicate that terpenoids were present, a reddish brown coloration of the interface noted.

Test for triterpenoids

Following the addition of 2ml of concentrated H_2SO_4, 1ml of acetic anhydride and 1ml of the different extracts of Cinnamomum tamala leaves was added to 1ml of chloroform. Formation of reddish violet color indicates the presence of triterpenoids.

Test for alkaloids

Mayer's test: A drop of Mayer's reagent was added by the side of the test tube to a few (1) ml of the different extracts of Cinnamomum tamala leaves. A creamy or white precipitate formed indicates the presence of alkaloids.

Test for anthraquinones
5ml of the different extracts of leaves was hydrolyzed with diluted conc. H2SO4 extracted with benzene. 1ml of diluted ammonia was added. Rose pink coloration suggested the positive response for anthraquinones.

Test for polyphenols
Each extract (1ml) was mixed with 4ml of ethanol, which was then transferred to a new test tube and heated in a water bath for 15 minutes. 3 drops of freshly prepared ferric cyanide solution was added to the extract solution. Formation of a blue green color indicated the presence of polyphenols.

Test for cardiac glycosides (Keller-Killani test)
2ml of glacial acetic acid containing one drop of ferric chloride solution was added to 5ml of each extract of Cinnamomum tamala leaves. 1ml of conc. H2SO4 was used as the underlayment. An interface brown ring denotes the cardenolide deoxysugar property. Below the brown ring, a violet ring will emerge in the thin acetic acid layer, a greenish ring will grow gradually.

Test for coumarins
The addition of 3ml of 10% NaOH to 2ml of different extracts of Cinnamomum tamala leaves in different test tubes results in the production of yellow colour, which denotes the presence of coumarins.

Test for emodins
2ml of NH4OH and 3ml of benzene were added to the different extracts of Cinnamomum tamala leaves. Appearance of red colour indicated the presence of emodins.

Test for anthocyanins
2ml of different extracts of Cinnamomum tamala leaves was added to 2ml of 2N HCl and ammonia. The appearance of pink-red turns blue-violet indicated the presence of anthocyanins.

Quantitative phytochemical screening
Total phenolic determination
The phenolic contents of Cinnamomum tamala leaves were calculated using a spectrophotometric approach (12). 10ml of ethanol and 1g of leaf powder (dried) were combined for 15 minutes and then filtered. A diluted filtrate leaf extract (1ml) or gallic acid standard phenolic compound were added to a 25ml volumetric flask, containing 9ml of distilled water. After 5 min, 10ml of a 7% Na2CO3 solution was thoroughly included with the test sample solution before being diluted with 25ml of distilled water. At a temperature of 23°C, the mixture was maintained in the dark for 90 minutes before the absorbance was measured at 750nm. Total phenol content was determined from extrapolation of the calibration curve which was made by preparing gallic acid solution (10 to 100 µg/ml). The estimation of the phenolic compounds was carried out in triplicate. The total phenolic content was expressed as milligrams of gallic acid (GAE) equivalents per gram dried sample.

Total flavonoid determination
Total flavonoids content was determined by using aluminium chloride colorimetric method (13). 10ml of water and 1g of leaf powder (dried) boiled for 15 minutes, then filtered. 1.5ml of methanol, 0.1ml of 10% aluminium chloride, 0.1ml of 1M potassium acetate, and 2.8ml of distilled water were combined with 0.5ml of plant extract. It remained for 30 minutes at room temperature. Using a UV-visible spectrophotometer, the absorbance of the reaction mixture at 510nm was determined. Quercetin solutions in methanol were prepared at concentrations ranging from 10 to 100g/ml in order to develop the calibration curve. The amount of total flavonoids in a dried sample, expressed in milligrams of quercetin (QE) equivalents.

Total saponin determination
Colorimetric techniques were used to measure the total saponin contents of leaf extract (14). 2grams of leaf extract should be placed in a 100ml conical flask along with 25ml of 99.9% methanol. The flask was tightly sealed and shaken at 25°C at 120rpm for 24 hours at followed by centrifuging at 3500 rpm for 20 minutes. After centrifugation, Whatman filter paper No. 1 was used to filter the methanol extracts. The resultant methanolic extracts were dried out in a water bath after being evaporated. After evaporation, dried leaf extract was diluted in 10ml of the minimum amount of distilled water, transferred to a separating funnel, and extracted three times with the same volume of n-butanol. After extraction, n-butanol was evaporated in a water bath with a maximum temperature of 45°C. Added 5–10ml of distilled water to the dried saponins to dissolve them and transferred the solution into a separate pre- weighed container and freeze dried.

In 5ml of 80% aqueous methanol, 10mg of saponin extract was dissolved, and 50µl (0.05ml) of plant extract solution was obtained and mixed with 0.25ml of vanillin reagent (8%). 2.5ml of 72% sulphuric acid was slowly put on the inner side of the wall of test tubes while they were placed in an ice-cold water bath. They were left in the tube after mixing the contents for 3 minutes. The test tubes were heated in a water bath at 60°C for 10 minutes and they were subsequently cooled in an ice cold water bath. Plot the absorbance against the amount of saponin consumed (10 to 100g/ml), which was measured at 544nm. The content of total saponins was expressed as saponin equivalents (mg/gm).

Total steroid determination

The steroids were determined by the spectrophotometric method (15). The leaf sample was weighed to 1gm, then 10ml of chloroform was added and the solution was diluted ten times (10,000 ppm). 2ml Liberman-Burchard reagent, 2ml chloroform, and 3ml of diluted sample solution were combined. The tubes were placed in ice bucket in a darkened room and covered with black carbon paper for 15 minutes. When the Liberman-Burchard reagent reacts with the sterol, a green color was formed; their absorbance was measured on a spectrophotometer at 640 nm. On a spectrophotometer, the absorbances of standard cholesterol (20 to 80g/ml) were determined, and a standard graph was drawn. Steroid Content was expressed as milligrams of cholesterol equivalents per gram of dried sample.

HPLC Analysis

HPLC was used to investigate flavonoids fractions (16, 17). The Chromatographic System (Shimadzu Class-VPV6.14SP2, Japan) used for the HPLC analysis of the leaf extract includes an auto sampler with a 20µl fixed loop and a UV-visible detector. Compound resolution was significantly impacted by the gradient elution of solvents A (methanol) and B (water-acetic acid, 25:1 v/v). Consequently, solvent gradients were produced by varying the ratio of solvent A (water-acetic acid, 25:1, v/v) to solvent B (methanol), utilizing a dual pumping system. At a flow rate of 1.0 mL/min, Solvent B was raised from 0% to 50% in 4 minutes and from there to 80% in 10 minutes. For 25 minutes, the samples were run and detection was performed using a UV detector (Lamp-D2) at 280 nm. Using auto chro-software, all chromatographic data were captured and analyzed.

Gas Chromatography-Mass Spectrometry

On a Shimadzu 2010 Plus equipped with an AOC-20i auto sampler, gas chromatograph, and mass spectrometer, GC MS analysis was performed under the following circumstances: Helium gas (99.999%) was used as the carrier gas at a constant flow of 1.73 ml/min and an injection volume of 0.5µI was used (split ratio of 10:1), injector temperature 270℃, and ion-source temperature 200℃. The column RTX 5Ms has dimensions of 0.32mm in diameter, 30m in length, and 0.50m in thickness. The oven temperature was developed to start at 40℃ (isothermal for 2 minutes), then rise by 8℃/min to 150℃, then 8℃/min to 250℃, and finally 8℃/min to 280℃ for 20 minutes. At 70eV, mass spectra were recorded; 0.5 seconds scan interval with fragment sizes ranging from 40 to 450 Da. Total time utilized on the GC is 51.25 minutes. Comparing each component's average peak area to the total areas allowed us to determine the relative percentage quantity of each component. Turbo Mass Ver 5.2.0 software was used to manage mass spectra and chromatograms (18).

Identification of the compounds

The National Institute of Standards and Technology (NIST) database, which contains more than 62,000 patterns, was used for the interpretation of the GC-MS. A comparison was made between the spectra of the unknown component and the spectrum of the known components contained in the NIST collection. The name, molecular weight and structure of the components of the test materials were ascertained (19).

3. Results and Discussion

Determination of extraction yield

Results showed the significance difference in the extraction yield. Hydroethanolic extract showed the greater percentage yield (16.72%) when compared to the other extracts (Table 1).

Table 1: Yield of various extracts

Extracts	Weight of (W1) crude extract (g)	Weight of (W2) Sample taken (g)	Yield of Extract (s) (%)
Ethanol	1.465	10	14.65
Aqueous	1.123	10	11.23

Hydroethanolic	1.672	10	16.72
Petroleum ether	0.765	10	7.65
Hexane	0.611	10	6.11

Qualitative analysis of phytochemicals

The preliminary phytochemical analysis of *Cinnamomum tamala* leaves shows the presence of tannin, saponin, flavonoids, steroid, terpenoids, triterpenoids, alkaloids, anthroquinone, polyphenol, glycoside, coumarins and anthocyanins. Among the five solvent extracts of *Cinnamomum tamala* studied hydroethanolic extracts contains remarkable positive results of phytochemical compared to other solvent extracts (Table 2). The hydroethanolic extract of leaves contains a higher concentration of phytochemicals than other extracts. Therefore, a quantitative assessment of several bioactive components was performed on the hydroethanolic extract of the leaves of *Cinnamomum tamala*.

Table 2: Qualitative analysis of hydroethanolic extract of *Cinnamomum tamala* leaves

S. No	Phytochemicals	Extracts				
		Aqueous	Ethanol	Hexane	Hydro ethanolic	Petroleum ether
1	Tannin	++	++	-	++	-
2	Saponin	++	++	-	++	-
3	Flavonoids	++	++	-	++	-
4	Steroids	+	++	+	++	+
5	Terpenoids	+	++	+	++	+
6	Triterpenoids	+	++	+	++	+
7	Alkaloids	++	+	-	+	-
8	Anthroquinone	++	++	+	++	+
9	Polyphenol	++	++	++	++	++
10	Glycoside	+	++	+	++	+
11	Coumarins	++	++	-	++	-
12	Emodins	-	-	-	-	-
13	Anthocyanins	+	+	-	+	-

(-) Absent, (+) Present and (++) High concentration

Quantitative analysis of phytochemicals

The quantity of phytochemicals present in the hydroethanolic extract of *Cinnamomum tamala* leaves were shown in the table 3 and figures 1-4.

Total phenolic content

In the hydroethanolic leaf extract of *Cinnamomum tamala*, the total amount of phenols was measured. The total phenolic content of the hydroethanolic leaf extract was estimated as 226.34 mg/g GAE (Table 3).

Total flavonoid content

The hydroethanolic leaf extract of *Cinnamomum tamala* was evaluated for total flavonoid content. The total flavonoid content of the hydroethanolic leaf extract was found to be 186.42 mg/g QE (Table 3).

Total saponin content

In the hydroethanolic leaf extract of *Cinnamomum tamala*, the total amount of saponin was evaluated. The total saponin content of the hydroethanolic leaf extract was estimated as 112.10 mg/g (Table 3).

Total steroid content

The hydroethanolic leaf extract of *Cinnamomum tamala* was evaluated for total steroid content. The total steroid content of the hydroethanolic leaf extract was found to be 161.30 mg/g (Table 3).

Table 3: Quantitative estimation of the phytochemicals of *Cinnamomum tamala* leaves in hydroethanolic extract

Phytochemicals	Amount (mg/g)
Phenols	226.34
Flavonoids	186.42
Saponins	112.10
Steroids	161.30

Values are expressed as Mean ± SD for triplicates.

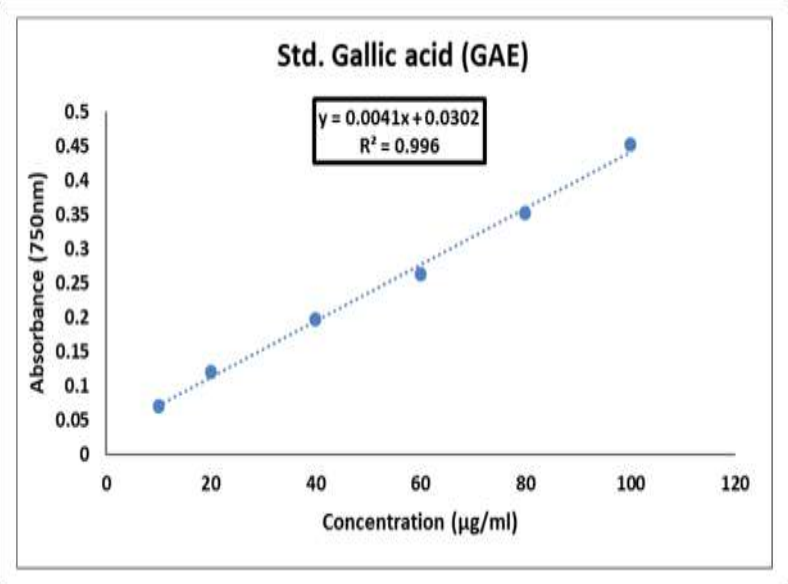

Figure 1: Calibration Curve for Phenol using Gallic acid

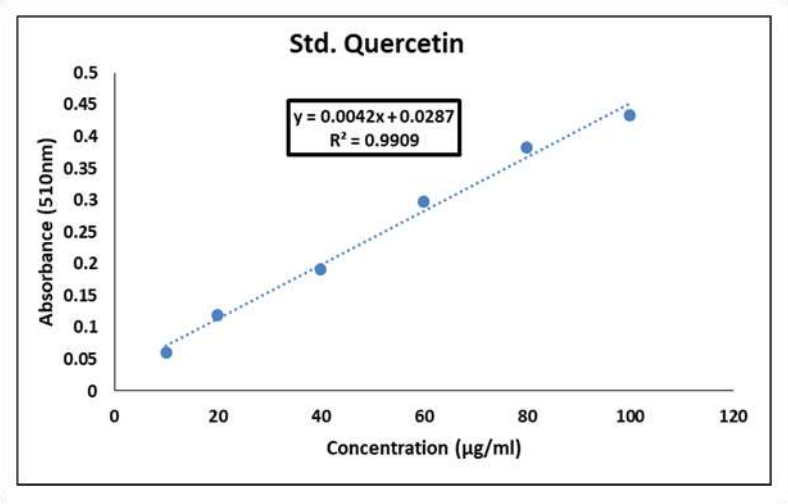

Figure 2: Calibration Curve for flavonoid using Quercetin

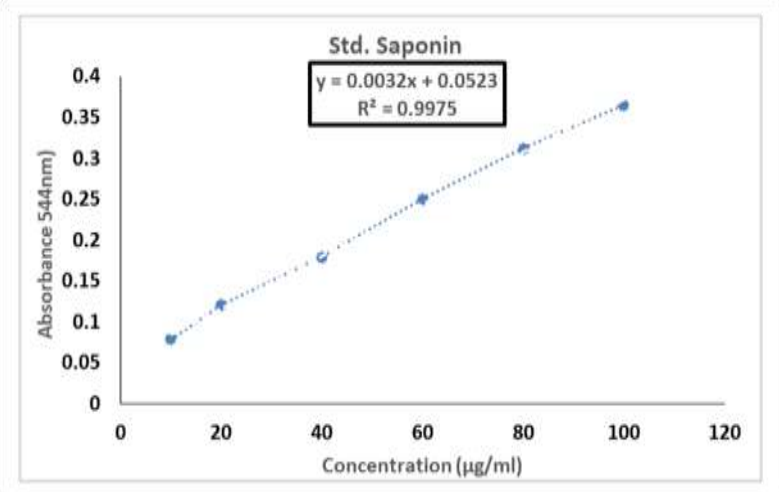

Figure 3: Calibration Curve for saponin using saponin

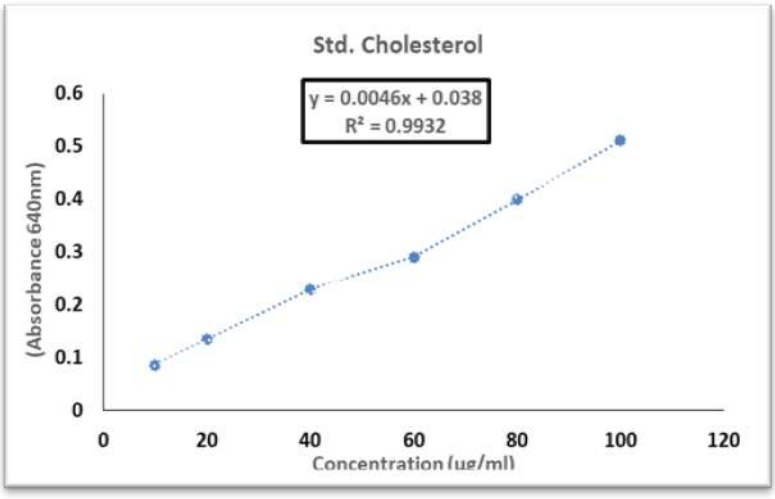

Figure 4: Calibration Curve for steroids using cholesterol

HPLC Analysis

The chromatograms of the Cinnamomum tamala containing flavonoid compounds at wavelengths of 280 nm are shown in figure 5. The peak retention periods for each flavonoid component are shown (Table 4) for each wavelength individually. By comparing chromatographic peaks with the retention time (Rt) with previous literature (20, 21) flavonoids contained in the extract were detected. This helped to identify the flavonoid compound present in the Cinnamomum tamala leaves. HPLC analysis of the hydroethanolic extract of Cinnamomum tamala leaves revealed the presence of kaempferol, ellagic acid, delphinidin -3-O-glucoside, quercetin, naringenin and myricetin malonyl glucoside (isomer).

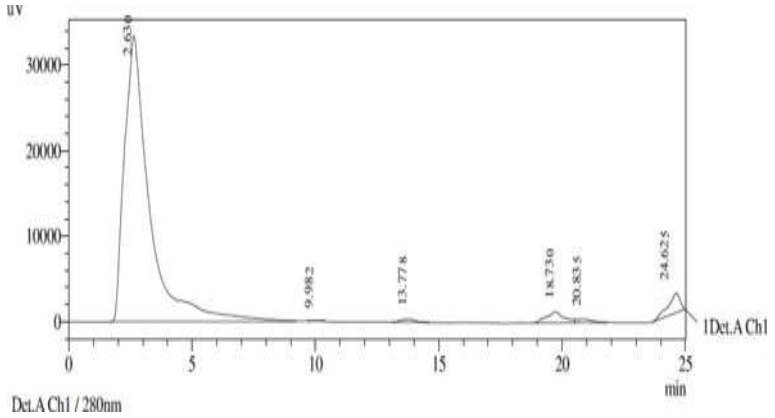

Figure 5: HPLC Chromatogram of hydroethanolic extract of Cinnamomum tamala leaves

Table 4: Compounds identified from hydroethanolic extract of Cinnamomum tamala leaves by HPLC Analysis

Peak	Ret. Time	Area	Height	Area %	Height %	Compounds identified by literature
1	2.630	2355427	33409	93.110	88.428	Kaempferol
2	9.9821	1309	60	0.052	0.158	Ellagic acid
3	13.778	14099	375	0.557	0.991	Delphinidin -3-O-glucoside
4	18.730	63495	1297	2.510	3.432	Quercetin
5	20.835	17742	406	0.701	1.074	Naringenin
6	24.625	77660	2235	3.070	5.916	Myricetin Malonyl glucoside (isomer)
Total		2529733	37780	100.000	100.000	

Gas Chromatography-Mass Spectrometry Analysis

By using GC-MS analysis, seven compounds in the extract were discovered. Table 5 lists the active ingredients along with their retention time (RT), molecular formula, molecular weight (MW) and concentration (%). The main substances in this sample are 1, 2- benzenedicarboxylic acid, di-ethyl ester, 3,7,11,15-tetramethyl-2-hexadecen-1-ol, octadecanoic acid, tetradecanoic acid, ethyl ester, phytol, and phthalic acid, ethyl isoporphyl ester. The use of the plant for a variety of diseases by traditional practitioners is justified by the presence of several bioactive components. The compounds identified from the hydroethanolic extracts of the Cinnamomum tamala leaves shows various biological activities (Table 6).

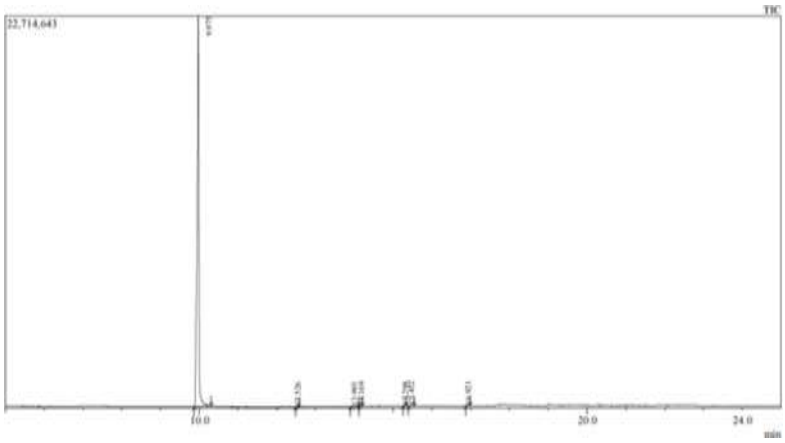

Figure 6: GC-MS Chromatogram of hydroethanolic extract of *Cinnamomum tamala*

Table 5: Identification of active compounds in hydroethanolic extract using GCMS

Peak	R. Time	Area %	Height %	Molecular Formula	Molecular Weight	Name of the compounds
1	9.975	98.82	98.96	$C_{12}H_{14}O_4$	222	1,2-Benzenedicarboxylic acid, diethyl ester
2	12.526	0.12	0.16	$C_{20}H_{40}O$	296	3,7,11,15-Tetramethyl-2-hexadecen-1-ol
3	13.993	0.31	0.12	$C_{18}H_{36}O_2$	284	Octadecanoic acid
4	14.169	0.13	0.16	$C_{16}H_{32}O_2$	256	Tetradecanoic acid, ethyl ester
5	15.298	0.09	0.12	$C_{10}H_{10}O_3$	178	Benzoic acid, 2-(1-oxopropyl)-
6	15.452	0.37	0.33	$C_{20}H_{40}O$	296	Phytol
7	16.921	0.16	0.15	$C_{13}H_{16}O_4$	236	Phthalic acid, ethyl isopropyl ester

Table 6: Biological activity compounds identified in using GCMS

R. Time	Name of the compounds	Biological activity
9.975	1,2-Benzenedicarboxylic acid, diethyl ester	Antimicrobial, Antifouling
12.526	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	Cancer-Preventive Antimicrobial anti-inflammatory, anti-diuretic Antioxidant
13.993	Octadecanoic acid	Lower LDL Cholesterol level, Antioxidant and anti-inflammatory
14.169	Tetradecanoic acid, ethyl ester	Antioxidant, cancer preventing, nematicide, Larvicidal and repellent activity.
15.298	Benzoic acid, 2-(1-oxopropyl)-	Antimicrobial Preservative

15.452	Phytol	Anticancer, Anti-inflammatory Hypocholesterolemic, Nematicide, Anticoronary, Antiarthritic, Hepatoprotective, Anti - androgenic,
16.921	Phthalic acid, ethyl isopropyl,Ester	Antioxidant, Antimicrobial

The bioactive ingredients of various species of utilized Cinnamon have been subjected to a limited amount of investigation. The existence of different phytochemicals with pharmacological and industrial uses, such as aromas, colors, gums, resins, pulp, and fiber, with a significant impact on the health and business sectors, have been discovered by phytochemical screening of cinnamon extracts. The plant produces the majority of the valuable secondary metabolites in small concentrations. Among the Cinnamomum species, the Cinnamomum tamala leaves exhibit various medicinal properties and used as a food flavor and spice (22). The leaves of Cinnamomum tamala shows various phytochemical properties with abundant presence of flavonoids, phenols, tannins, steroids and saponins (23). Phytochemical analysis of the leaf extract of Cinnamomum tamala revealed the presence of various bioactive compound which possess medicinal properties. Phytochemical analysis was carried out using different solvents such as ethanol, hexane, aqueous, hydroethanolic and petroleum ether.

However, it was determined that the hydroethanolic fraction have a greater potential since the majority of the bioactive components were found to be soluble in alcohol, which have higher polarity than most non-polar but lower polarity than water. Additionally, previous research revealed that alcoholic extract includes more bioactive components than extract from other solvents (24). Hence, the hydroethanolic extract of the leaf of Cinnamomum tamala is used for subsequent studies. The quantitative analysis for the total phenolic content present in the hydroethanolic extract of the leaf of Cinnamomum tamala was evaluated. The results of this investigation showed that the hydroethanolic leaf extract from Cinnamomum tamala have a greater concentration of phenols. Previous study reported that the phenols possess antiaging, antimicrobial, antitumor and anti-inflammatory properties (25). Presence of various phytochemicals such as flavonoids, phenols possess significant biological activity (26).

The total flavonoid content present in the hydroethanolic extract of the leaf of Cinnamomum tamala was assessed. The total flavonoids are in higher concentration in the hydroethanolic leaf extract. Flavonoids are secondary plant metabolites that are vital to many biological processes and plant responses to their environment. Flavonoids have anti-inflammatory and antibacterial characteristics in addition to antioxidant effects, which lower the risk of disease (27). The total saponin content was analysed in the hydroethanolic extracts of the leaf of Cinnamomum tamala. Saponin are found in high amount. Saponin has a wide range of pharmaceutical properties such as antifungal, antibacterial, anti-inflammatory, anti-parasitic, anti-cancer and anti-viral activities (28, 29).

The total steroid content present in the hydroethanolic extracts of the leaf of Cinnamomum tamala was evaluated. Steroid are found to be high in the hydroethanolic extracts of the leaf. Their anti-inflammatory and immunosuppressive actions have rendered them useful in treating rheumatoid arthritis. Due to its strong connection to the sex hormone, the steroid is frequently employed in the drug industry (30). HPLC analysis of the hydroethanolic extract of the leaf of Cinnamomum tamala revealed the presence of various flavonoids. Leukemia, sepsis, asthma, sclerosis, atherosclerosis, psoriasis, allergic rhinitis, ileitis/colitis, and rheumatoid arthritis were some of the disorders in which flavonoids were essential in reducing inflammation (31).Compounds such as Quercetin, Naringenin, Kaempferol, Myricetin possess anti-inflammatory activity and other flavonoids possess anti-oxidant property which reduces the risk of the disease (32). GC-MS analysis of the hydroethanolic extract of the leaf of Cinnammomum tamala shows the presence of different bioactive compounds which have various biological activities. Compounds like Octadecanoic acid possess anti-inflammotory and anti-arthritic activity (33). 1, 2-Benzenedicarboxylic acid possess anti-microbial activity (34). It has been found that phytol is effective in treating and preventing arthritis. Rheumatoid arthritis and perhaps other chronic inflammatory disorders can be treated using phytol, a potential novel category of pharmaceuticals (35). It has been discovered that ethyl ester has nematicidal, anti-arthritic, and hepato-protective properties. 3, 7, 11, 15-Tetramethyl-2-hexadecen-1-ol, Tetradecanoic acid, Phthalic acid, ethyl isopropyl ester possess anti-oxidant properties. Benzoic acid has anti- microbial activity (36).

4. Conclusion

The current study showed that the hydroethanolic extract of the leaves of Cinnamomum tamala have various bioactive components. Qualitative analysis of the leaf evaluates the presence of phytochemicals such as tannins, flavonoids, phenols, steroids, terpenoids, triterpenoids, alkaloids, glycosides, anthroquinones, anthocyanins and coumarins especially high in the hydroethanolic extract than other extracts. These phytochemicals possess several biological activities. Quantitative analysis shows the presence of phenols, flavonoids, saponins and steroids which has a significant properties. HPLC analysis of the hydroethanolic extract reveals the presence of various flavonoids that possess good pharmaceutical properties. GC-MS analysis of hydroethanolic extract of leaf of Cinnamomum tamala revealed the presence of secondary metabolites of anticancerous, antimicrobial, antioxidant, anti-inflammatory and anti-arthritic activities and provides a potential source of pharmaceutical application. The active biochemicals and phytochemicals in Cinnamomum tamala leaf extract may be the cause of the therapeutic effects. The study revealed that this plant have a considerable natural bioactive compound and may be beneficial in preventing various diseases.

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