

Comparative Study of Cinchona Cinnamon Bark

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Abstract: *Cinchona* which belongs to family Rubiaceae, got its importance from the centuries because of its antimalarial activity. Alkaloids present in this herb, quinine, cinchonine, quinidine and cinchonidine are the main, but percentage may vary in species to species. since the early 17 century, the sealkaloid are frequently used in Indian ayurvedic, siddha and traditional folk medicine to treating fever and still now in modern medicine cinchona alkaloids are used for the treatment of malaria as well as for other diseases and became the well-known drug after the treatment of malaria caused by Plasmodium Sp. Literature study revealed that along with the antimalarial activity the cinchona alkaloids has other potentially like anti-obesity, anticancer, anti-oxidant, anti-inflammatory, antimicrobial activity. Many herbal remedies have been employed in various medical systems for the treatment and management of different disease. Cinnamon is ever green tree of tropical area, a member of family Lauraceae, has been used in day to day routine as spice. Literature review on cinnamon revealed that in mainly contain essential oil and important compounds like cinnamaldehyde, eugenol, cinnamic acid and cinnamyl. It has got good anti-inflammatory, antioxidant, antimicrobial, antidiabetic, memory enhancer and many other Activities

Keywords: Cinchona, quinine, Alkaloids, Cinnamon, spice, Cinnamaldehyde.

I. INTRODUCTION

Cinchona, commonly known as peruvian bark, belongs to the family Rubiaceae, is Native to South America specifically from the andesrange. It can be found in India, Java, Cameroon, and Vietnam and in some other Asian and African countries. In India it is mainly found in hilly areas as a result of cultivation. Indonesia becomes the largest producer of cinchona throughout the world. Cinchona is a 10-20 m tall trees with straight trunk about 30 cm in diameter. It has a dense and irregular globular crown, darkly green, oval shaped leaf with a thick central nerve with full margin the colour of flower is white or pinkish with white hairs found in panicles and the fruit is dark brown 2-4 cm long with 3-4 seeds.

The main part of the plant which is mainly used for medicinal and other purpose is the bark that can be upto 30 cm long and 2-6 cm thick. more than 20 alkaloids containing 15% amount preferentially as quinine, quinidine, cinchonidine and cinchonine are found in the bark of cinchona combined with the principle active compounds such as tannins (3-10%)[1] Along with these ingredients the bark also contains, acids, essential oil and minerals, such as triterpiene, organic, phenolic, flavonoids, phytosterolquinidin alkaloids are collectively known as quinoline alkaloids mainly derived from tryphan by the modification of terpenoids indole and the terpenoid indole alkaloids are very common in the genus cinchona, more than 20 types of alkaloids have been isolated. However, it has been revealed than an average commercial yield of the cinchona alkaloids from the dry bark material plant are as follows: quinine (5-7%) quinidine (0.1-0.3%) cinchonine and cinchonidine (0.2-0.4%) .Among these, the most popular quinoline alkaloids known as are quinine, cinchonine, quinidine and cinchonidine.[2]

Cinchona bark and it's derived quinine alkaloids were the most effective treatment of malaria. initially the bark which was stripped from the tree was dried, crushed into small pieces and turned into various tinctures. cinchona officinalis is a medicinal plants one of the several cinchona species used for the production of quinine which is an antifever agent. It is especially useful in the prevention and treatment of malaria.[3]

Cinnamon

Cinnamon is the one of the most important species used daily by people all over the world. The bark of the various cinnamon species is one of the most important and popular species used worldwide not only for cooking but also in

traditional and modern medicines. Cinnamon primarily contains volatile oils and other derivatives, such as cinnamaldehyde, cinnamic acid and cinnamate. In addition to being an antioxidant, anti-inflammatory, anticancer, antidiabetic, antimicrobial, lipid lowering and cardiovascular-disease-lowering compound. Cinnamon has been reported to have activity against neurological disorders such as parkinson's and alzheimer's diseases. Cinnamon is the best spice available in terms of its best spice available in terms of its nutrition and health. It contains unique healthy and healing property due to the presence of active components.[4] Spices are mainly used for flavouring and they also have certain medicinal properties and are used in pharmaceutical, perfumery and cosmetics and several other industries.

A spice is a dried seed, fruit, root, bark or vegetative substance used in nutritionally insignificant quantities, as a food additive for flavour, colour, or as a preservative that kills harmful bacteria or prevents their growth. Many species are used for other purposes such as medicine, cosmetic, perfumery, or for eating as vegetables. Cinnamon is a spice obtained from the inner bark of several trees from the genus Cinnamomum that is used in both sweet and savoury foods.

The different parts of the plant possess the same array of hydrocarbons in varying proportion with primary constituent such as Cinnamaldehyde (bark), Eugenol (leaf) and Camphor (root). The three main components of the essential oil obtained from the bark of Ceylon Zeylanium or true cinnamon are trans-cinnamaldehyde, eugenol and linalool which represent 82.5% of the total composition.

The health benefits may also come from eating cinnamon those are lower cholesterol, reduced blood sugar level, heart disease, fight cancer, mouth fresheners, cures respiratory problems, brain tonic, infection, birth control, breastfeeding, reduces arrhythmias pain, anticlotting action, natural food preservers, headache and migraine, pimples and blackheads, muscle and joint pain relief.[5]

II. MATERIALS AND METHODS [6]

Plant profile

Chinchona



Fig 1. cinchona

Synonyms:- Jesuits bark, Peruvian bark, Cinchona, Cortex Cinchonane.

Biological source:- Cinchona consists of dried bark of the cultivated trees of *Cinchona officinalis* Linn.

Family:- Rubiaceae.

Geographical source:- It is indigenous to South America, Bolivia, Peru, Indonesia, Sri Lanka and India. In India it is grown in Nilgiris and Anamalai hills of Tamil Nadu. It is also grown in Darjeeling (West Bengal)

Description

Large shrubs or small trees with evergreen foliage, 5-15 m (16-49 feet) in height.

Leaves- opposite, rounded to lanceolate.

Flowers- white, pink or red.

Fruit- small capsule containing numerous seeds

Morphology

Table 1:- Macroscopic Characters of Cinchona [7]

Features	Stem bark	Root bark
Colour	Dull brown Grey	The inner and outer surface are in brown colour.

Odour	Slight characteristics	Slight characteristics
Taste	Intensity bitter and Astringent.	Bitter
Shape	In form of quills and curved piece	Curved twisted or irregular channelled.
Size	Length 30 cm , Thickness 2-6 mm.	Length 2-7 cm.
Outer surface	Dull brown Grey in colour rough mainly due to longitudinal and transverse cracks, fissures, ridges, greyish patches of moss or lichen. Exfoliation of the outer bark in some varieties.	Dark reddish brown in colour scaly and shows depression. Mosses and lichens are absent.
Inner surface	Striated and varying in colour from yellowish to reddish brown	Striated and reddish brown.
Fracture	Short in outer bark and fibrous in inner part.	Fibrous.

Taxonomical classification-[8]



Fig 2:- taxonomical classification of cinchona

Part used:- bark
 Kingdom:-Plantae
 Clade:- Tracheophytes
 Clade:- Angiosperms
 Clade:- Eudicots
 Clade:-Asterids
 Order:-Gentianales
 Family:-Rubiaceae
 Genus:- Cinchona
 Species:-C.officinalis

Chemical constituents

It consist of quinoline alkaloids, quinidine, quinine, cinchonine and cinchonidine are some commonly found alkaloids. In cinchona bark, these four chemical constituents present in bark are stereoisomer's of each other. Bitter Glycosides and starch grains are also present in cinchona. They also consist of calcium oxalate and crystalline acid.

Uses [9]

- Cinchona bark has antimalarial properties. It is also used in fever to reduce the body temperature and as an analgesic.
- The drug is also useful in cases related to cardiac problems like arrhythmia.
- The drug is also used as antiseptic and has been found to be useful in disease like cavities and ulcers.
- It is used to treat rheumatism and neuralgia.
- The chief chemical constituents of cinchona, quinidine, contains cardiac depressant property.
- It is used as bitter stomachic tonic.

Cinnamon[10]



Fig 3 :- Cinnamon

Synonyms:-Cinnamon bark, Kalmi- Dalchini, Ceylon Cinnamon.

Biological source:-Cinnamon consists of the dried inner bark of the shoots of coppiced trees of Cinnamon zeylanium.

Family:-Lauraceae

Geographical Source:-Cinnamomum Zeylanicum is widely cultivated in Ceylon, Java, Sumatra, West Indies, Brazil, Jamaica and India.

Description:-

It is a evergreen aromatic tree. The tree is commonly planted for ornamentals purposes.

Seeds:-These trees and are mainly propagated by seeds.

Bark:-It is a golden red bark and thick up to 1.5 cm that is dried and is the cinnamon spice. Small or medium sized tree usually up to 20-40 ft.

Leaves:- These are ablong-elliptic, ovale shape dark glossy green and with a three prominent nerves from the base. leathery and approximately 720 cm in length.

Flowers:-These are small in lax, yellow in colour, inconspicuous, paniculate.

Fruit:-Fruits are black, pulpy, aromatic, elliptical, drupes with single seed.

Taxonomical classification-



Fig 4:-Taxonomical Classification of Cinnamon

Kingdom:-plantae
Division:-Magnoliophyta
Class:- Magnoliopsida
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Order:-Laurales
Family:-Lauraceae
Genus:- Cinnamomum
Species:-C.Zeylanicum

Morphology

Colour:-outer surface is dull yellowish brown, inner surface is dark yellowish-brown.

Odour:-Fragrant.

Shape:-Compoundquills.

Size:-1 m in length and 1 cm in diameter.

Taste:-Aromatic and sweet followed by warm sensation.

Fracture:-Splintery.

Table 2:-Chemical Constituents of Cinnamon [11]

Bark	Cinnamaldehyde- 65 - 80% Eugenol-5-10%
Leaves	Cinnamaldehyde-1-5% Eugenol-70-95%
Root bark	Camphor-60%
Fruit	Trans-cinnamyl acetate & Beta-caryophyllene.
Cinnamomum Zeylanicum buds	Terpene hydrocarbons-78% alpha Bergamotene-27-38% Alpha-copaene-23.05% Oxygenated terpenoids-9%
Cinnamomum Zeylanicum flowers (E)	Cinnamylacetate-41-98% Trans-alphabergamotene-7-97% Caryophyllene oxide-7.2%

Cinnamon contains about 10% of volatile oil,tannin, mucilage, calcium oxalate and sugar. Volatile oil contains 50 to 65% cinnamaldehyde, along with 5 to 10% eugenol, terpene hydrocarbons and small quantities of ketones and alcohols.

Uses[12]

- 1) The bark is used as a carminative, stomachic and mild astringent, anti-viral, anti-bacterial.
- 2) It is also used as a flavouring agents, stimulant and antiseptic.
- 3) It is a coagulant and prevents bleeding and also increase the blood circulation in the uterus and advances tissue regeneration.
- 4) It lowers the blood sugar and risks of type 2 diabetes.
- 5) It helps in manage blood pressure.
- 6) It is a commercially used as spice and condiment. In preparation of candy, denitrifies and perfumes.
- 7) It is also used in the treatment of bronchitis,colds, palpitations, nausea, congestion, and liver problems.
- 8) Cinnamon usually causes no side effects.

1) Selection of plant

In the present study, I have selected the cinchona and cinnamon bark.

2) Collection of plant material

The bark of cinchona and cinnamon were collected from Samarth Institute of Pharmacy, Belhe.

3) Processing on plant material

The collected sample was cleaned, washed and shade dried for two days.Then the dried sample was grinded into proper size and kept in polythene bags for further study.



Fig 5:-Cinchona bark



Fig 6:-Cinchona powder



Fig 7:- Cinnamon bark



Fig 8:- Cinnamon powder

Table 3:-Pharmacological Activity of Cinchona and Cinnamon [13]

Activites	Cinchona	Cinnamon
Anti-inflammatory activity	The alkaloids in Cinchona are used to treat arthritis and nocturnal leg cramps because of its bitter taste, it is also used as a tonic drink cinchona bark has been used for antimalaria and anti-inflammatory purpose.	Hydroxycinnamaldehyde ,a compound present in cinnamon , extracts anti- inflammatory effects by inhibiting nitric oxide production by inhibiting nuclear factor (NF) Kappa B
Anticancer	Quinine influences the apoptosis during cancer cells and inhibit cells proliferation.	Cinnamon extracts showed anti-angiogenic effects by inhibiting the vascular endothelial growth factor (VEGE)
Antioxidant	Due to the presence of phenolic compounds, cinchona has effective antioxidant properties inhibition of lipid peroxidation, anti HIV ,anti- virus and anti tumor are the biological properties of phenols.	The high concentration of antioxidants in cinnamon may help protect the body from damaging inflammation, free radicals and serious disease like cancer.
Anti microbial	Plants have some beneficial microbes also the antibacterial effect of Cinchona alkaloids on staphylococcus aureus using the disc diffusion method is 8-18 mm according to the concentration of cinchona alkaloids it's antibacterial activity increases microprisms that are harmful to the human body, cinchona works against them. Bark of cinchona is used to cure disease induced by plasmodium falciparum and herpes.	Cinnamon has antimicrobial properties has been proven to fight fungal, bacterial.

Microscopic characters of cinchona and cinnamon:-

It includes observation of important tissue components of transverse section of cinchona and cinnamon bark.

Bark is all the tissues of the stem or the root of woody plants that bark are exterior to the cambium. botanically, bark is also known as periderm, periderm consists of three layers viz, cork (phellem) cork – cambium (phellogen) and secondary cortex (phelloderm) .

Commercially , bark consists of all the tissue outside the cambium. A young bark includes epidermis, cortex, pericyclic and phloem. Barks are obtained from the plants by marking longitudinal and transverse incisions through the outer layers followed by peeling. Barks may obtained from the stem or roots, due to the excessive growth produced by the cambium and cork cambium, the external tissue get tangentially stretched or torn and hence the epidermis is not found in the barks.

Barks exhibit several morphological and microscopical characters.

The morphological characters need special attention, as they help identification of the barks.

Procedure

- 1) Clean the platform and issue the apparatus.
- 2) Issue the sample of crude drugs.
- 3) Preparation of sample for sectioning.

Boiling of the sample.

Section cutting.

Transfer the section into watch glass containing water.

- 4) Staining process.

Take a clean watch glass and add the staining solution to it.

With the help of brush, transfer the section taken from watch glass containing water to stain solution and keep it for 2-3 minutes.

Transfer it to watch glass containing plane water so that excess stain is washed away, this stain is ready for mounting.

- 5) Mounting process.

Transfer the section to be mounted on the glass slide with the help of brush.

Add 1-2 drpos of water on the section with the dropper.

Place the clean cover slip over the section with the help of forceps and needle.

With the help of bottling paper, wipe out excess of water present outside the cover slip. The slide is ready for observation.

- 6) Take observation.

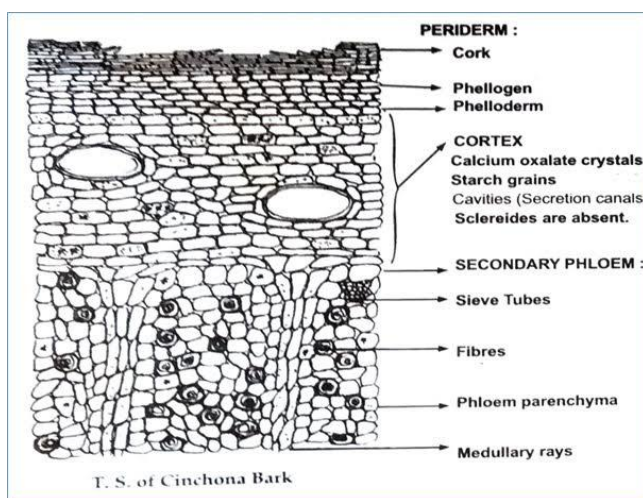
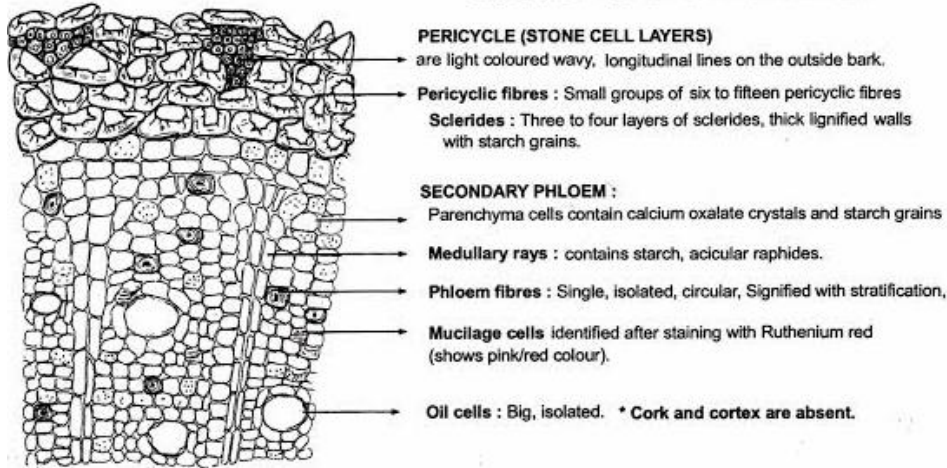


Fig 9:- T.S. of Cinchona Bark

3. CINNAMON

T. S. of Cinnamon Bark



T. S. of Cinnamon Bark

Fig 10 :- T.S. of Cinnamon Bark

Table 4: Microscopic Characters of Cinchona and Cinnamaon [6]

	Cinchona	
Periderm cork	Several layers of thin walled, flat polygonal cells with reddish brown content, impregnated with Siberian.	
Phellogen	2-3 layers of thin walled cells without any cellular content.	
Phelloderm	6-8 layers of thin walled rectangular cells without any cellular content.	
2) Cortex	Several layers of thin walled tangentially elongated cells containing reddish brown matter.	Cork and cortex are absent.
Calcium oxalate crystals	2-6 micron long, microsphenoidal crystals.	
Starch grains	Rounded, 6-10 micron in diameter.	
Sclereides are absent	Cavities are present.	
Pericycle (stone cell layers)		Produce the light coloured wavy, longitudinal lines on the outside of the bark.
Pericyclic fibers		Small groups of about 6-15 pericyclic fibers occurs at intervals.
Sclereides		3-4 layers of pitted sclerides, thickened lignified walls, isodimetric, slightly elongated tangentially with strach grains.
Secondary phloem		Parenchymaatousfew cells contains acicular calcium oxalate crystals and starch grains.

Sieve tubes	The compact cells being about 200 micron long 15-20 micron wide and having narrow companion cells; most of sieve tubes are compressed and collapsed	
Fibrous	Numerous, large, fusiform, lignified phloem fibres, having striated walls and fennel shaped pits, mostly isolated, some times in groups of 2-3 fibrous.	
Phloem parenchyma	Thin dark reddish brown walls, some with microprisms of calcium oxalate.	
Medullary rays	1-3 seriate, extended upto Cortex cells, radically elongated and contain starch grains	Biseriate, narrow at inner side, wider in the scleride band side, contains starch
Phloem fibres		Single, isolated, circular, signified with staratification, being above 12-22 to 35 micron wide and 200-500 to 600 micron long.

Preliminary Phytochemical Tests-[14]

The plant contain different types of constituents such as alkaloids, glycosides, terpenoids, tannins, saponoids, phenols etc.that exert physiological and therapeutic effects.The compounds which are responsible for the therapeutic property of the drug are usually secondary metabolites. A systematic study of crude drugs involves the through consideration of primary and secondary metabolites.

By performing the preliminary Phytochemical analysis on various fraction detect presence of various chemical constituent by performing chemical organic confirmatorytest for alkaloids, flavonoids, tannins, saponoids, phenols, terpenoids and glycosides was carried out by using standard procedure.



Fig 11 :- preliminary test

Phytochemical Test of SampleExtracts [15]

The cinchona and cinnamaon bark sample extracts were screened for alkaloids, tannins, flavonoids, saponoids, glycosides, terpenoids and phenols.The aqueous test solution of sample was prepared according to take a about 1 g of each crude extract was dissolved in 20 ml of distilled water and the results solution was used in tests.

Test of alkaloids (Mayer's and Wagner's tests)

About 2 ml of the test solution were transferred into 3 test tubes ; a few drops of Mayer's and Wagner's reagents were then added into the tubes. The

presence of alkaloids evidenced by the development of precipitates in the tubes that contained the test solution.

Test of Tannis

About 2 ml of test solution was added to 2 ml of water followed by drops of dilute ferric chloride solution (0.1%). A green to blue- green (catechic tannins) or a blue- black (Gallic Tannins) coloration were positive indicators.

Test of Phenols

About 1 ml of test solution was treated with drops of ferric chloride (5%) and observed for the formation of deep blue or black colour.

Test of Flavonoids

Flavonoids were tested by adding drops of lead acetate solution (10%) to a 1 ml of each extract.formation of a yellow precipitate showed the presence of flavonoids.

Test of Saponoids (Frothing Test)

About 2 ml of test solution were introduced in a test tube containing 2 ml of distilled water. The tube was stopped and shaken vigourously for about 15 seconds allowed to stand for 15 min, persistent frothing indicated the presence of saponoids.

Test of Terpenoids (Chloroform Test)

About 2 ml of chloroform were mixed with 2 ml of the test solution.to this mixture, 2 ml of concentrated sulphuric acid were added and heated for 120s in a water bath.A reddish brown colour that developed at the interface was evidence of the presence of terpenoids

Test of Quinine and Quinidine

Treat pieces with dilute sulphuric acid and observe under- violet light shows blue fluorescence.(Quinine)

Test of Glycosides

About 2 ml of test solution was dissolved in 4 ml of glacial acetic acid containing one drop of 5% ferric chloride solution which was under laid with 1 ml of concentrated sulphuric acid; A brown ring obtained at the interface indicate the presence of glycosides.

Table 5:- Preliminary test

Sr. No	Test	Test solution	Cinchona absent or present	Cinnamon absent or present	Cinchona	Cinnamon
1)	Test for alkaloids	Mayer's test	Red precipitate	Red precipitate	Present alkaloids	Present alkaloids
2)	TestforTannis	Ferric chloride solution	Blue Black ppt	Blue Black ppt	PresentTannis	Present Tannis
	Lead acetate solution	Whiteppt	White ppt	White ppt	PresentTannis	Present Tannis
3	Test for Phenols	Ferric chloride solution	Absent	Deep Blue	AbsentPhenol	PresentPhenol
4)	Test for Flavonoids	Leadacetatesol ution	Yellow ppt ch	Yellow ppt	Present Flavonoids	PresentFlavonoi ds
5)	Test of Saponoids	Frothing Test	Stable foams are forms	Stable foams are forms	Present Saponoids	PresentSaponoi ds
6)	Test for	Chloroform	Reddish brown	Absent	Presentterpenoi	Absent

	terpenoids	test	colour		ds	
7)	Test of quinine and quinidine	Dil. sulphuric acid solution	Blue fluorescence	Absent	Present Cinchona	Absent
8)	Test for Glycosides	Killer Killani test	Absent	Reddish brown layer present	Absent	Present Glycosides

Ash Value

The residue remaining left after incineration of the crude drug is termed as ash. Ash values are helpful in evaluating the quality purity of a crude drug. These values are important qualitative standards. Ash usually represent the inorganic salts like phosphates, carbonates and silicates of sodium, potassium, magnesium, calcium etc naturally occurring in drug or added in the drug for purpose of adulteration.

The object of calculated the ash value of vegetable drug is removal of all traces of organic matter which may otherwise interfere in any analytical determination.

The ash remaining following ignition of herbal material is determined by three different methods which measure total ash, acid insoluble ash, water soluble ash. Total ash is useful for detecting the low quality products, exhausted drugs, sandy and earthy matter present within the drugs.

Determination of Total Ash

Procedure-

- 1) Weighed about 3g of the air dried powdered drug in a tared silica crucible.
- 2) Now incinerate the drug by gradually increasing the temperature using the muffle furnace, until free from carbonaceous materials.
- 3) The ash obtained will be white or grayish white in colour.
- 4) Now cool the crucible and weight.
- 5) Calculate the percentage of total ash with reference to the air dried drug sample.

III. RESULT AND DISCUSSION

Several studies provide evidence of their cinchona which may have antipyretic, arrhythmias activity.

Cinnamon is a carminative stimulant and antiseptic mild astringent action.

Preliminary phytochemical analysis showed cinchona and cinnamon presence of alkaloids, flavonoids, tannis, saponoids, terpenoids glycosides and phenol compounds.

Table 6:-Result of Preliminary Test

Sr.no	Test	Cinchona	Cinnamon
1)	Test for Alkaloids	+	+
2)	Test for Tannis	+	+
3)	Test for Phenols	-	+
4)	Test for Flavonoids	+	-
5)	Test for Saponoids	+	+
6)	Test for Terpenoids	+	-
7)	Test of Quinine and Quinidine	+	-
8)	Test for Glycosides	-	+

Table 7 :- Result of Ash Value

Parameters	Cinchona	Cinnamon
Total Ash value	17%	7%

IV. CONCLUSION

The investigation of qualitative phytochemical analysis of barks of cinchona and cinnamon was found to be a beneficial constituents which may have a antipyretic, antimalarial activity and cinnamon is a carminative, stimulant and antiseptic, mild astringent action show.

In the qualitative phytochemical test of cinchona the quinine and quinidine is are the major constituents in plant extracts responsible for its antimalarial activity so the results obtain in this study showed a significant level of alkaloids, tannins, saponoids.

In the cinnamon cinnamaldehyde and transcinnamaldehyde is the major constituents in plant extracts responsible for the hypoglycemic, antimicrobial activity. So the results obtain in this study showed a flavonoids, alkaloids, tannins, Phenols, glycosides. From our findings, it can be conducted that selected crude drugs contain some significant phytochemicals and with the help of different antimalarial, antimicrobial, hypoglycemic activity.

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