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Review

Pharmacological properties and their medicinal uses of *Cinnamomum*: a review

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Abstract

Objectives *Cinnamomum* (Family Lauraceae) is traditionally used for flavouring food and in pharmaceutical preparations against various ailments. Detailed literature on the ethnobotanical and pharmacological properties of *Cinnamomum* is segregated and not present in well-documented form. In the present review, we have been trying to gather its detailed medicinal as well as pharmacological properties. The ethnobotanical and pharmacological properties of *Cinnamomum* were collected by searching several scientific databases, that is PubMed, Elsevier, Google Scholar, Science Direct and Scopus.

Key findings The plant extracts have been reported to possess astringent, warming stimulant, carminative, blood purifier, digestive, antiseptic, antifungal, antiviral, antibacterial, antioxidant, anti-inflammatory and immunomodulatory properties and also help to reduce cholesterol and blood sugar levels. A wide range of phytochemical compounds including aldehydes, acetate, alcohol, terpinenes, flavonoids, alkaloids, anthraquinones, coumarins, phenols, saponins, tannins, carboxylic acid, hydrocarbons, camphene, spathulenol, fatty acids, actinodaphnine, butanolides, lignans, steroids, propenoids and kaempferol glycosides are found in various parts of plant.

Summary This review provides detailed information about history, traditional uses, phytochemistry and clinical impacts of cinnamon as a spice and medicine. So we recommend further study on the clinical, medicinal, purification and identification of the most effective antibacterial activity of cinnamon to cure various infectious diseases.

Introduction

Cinnamomum derived from the Greek word 'kinnamomon' which means 'spice'[1] and 'sweet wood'.[2] Around 250 species of this genus are identified around the world.[3,4] Different parts contain some primary constituents, that is cinnamaldehyde and trans-cinnamaldehyde (Cin), present in the essential oil of its bark contributing to the fragrance and various biological activity,[5] eugenol (leaf) inhibit several different MDR pathogenic bacteria[6,7] and camphor (root).[8] This genus contains four main economically important cinnamon species, that is *Cinnamomum verum* ('true cinnamon', Sri Lankan or Ceylon cinnamon), *Cinnamomum cassia* (Chinese cinnamon), *Cinnamomum burmannii* (Java or Indonesian cinnamon) and *Cinnamomum loureiroi* (Vietnamese or Saigon cinnamon).[9] Cinnamon have immense aromatic potential are used in food and pharmaceutical industry. Its leaf and bark have digestive, blood purifier, astringent, carminative, warming stimulant, antiseptic, antibacterial, antifungal and antiviral properties and can help to reduce cholesterol and blood sugar levels. Camphor is one of the important chemical compounds derived from *C. camphora*, employed in pharmaceuticals, especially liniments and insecticides.[2] Its bark contains procyanidins and catechins[10] which is used as spices for cooking as well as very useful to cure type 2 diabetes mellitus[11–13] and insulin resistance medicine.

Table 1 summarizes the chemical constituents, pharmacological activity and medicinal properties of various *Cinnamomum* species.

Materials and Methods

The current review was conducted using a complete and organized search of the available literature. The searches were performed using various databases, including PubMed (http://www.ncbi.nlm.nih.gov/pubmed), Science Direct (http://www.sciencedirect.com/), Scopus (http://www.scopus.com/), Scirus (http://www.scirus.com/) and Google Scholar (http://www.scholar.google.com/) using the terms, for example *Cinnamomum* spp., phytochemistry, pharmacological activity, cinnamon, antibacterial antimicrobial and traditional uses. Scientific names and synonyms were validated through www.theplantlist.org and www.tropicos.org.

History

Cinnamon is used in different culinary practice from thousands of years.[14] Due to its high healing significance, it has been used as antiemetic, antidiarrhoeal, antiflatulent and stimulant agent in Ayurvedic medicine.[15] Egyptian people used it for mummification.[16] Portuguese imported the spice (*C. zeylanicum*) from Sri Lanka to European countries during the 16th and 17th centuries.[14] In Java, cinnamon cultivation started in the 17th century during the Dutch occupation, and it exported by East India Company to European countries.[16] Sri Lanka became the main source of cinnamon oils after Ceylon cinnamon cultivation reduces, which is used in pharmaceutical and food industries. Chinese cinnamon oil is also used by pharmaceutical industries.[16]

Distribution

This genus was described by Schaeffer, Jacob Christian (H. von) Schaeffer, in the year 1760. About 250 species of *Cinnamomum* are found in the tropical and subtropical regions, frequently in Asia and some in South and Central America and Australia.[17]

Botanical description

This genus contains small, evergreen trees and shrubs of 10–15 m tall. Plants are found in China, Australia, South-East Asia and Africa. The leaves are ovate–oblong and 7–18 cm long.[18] Flowers are greenish in colour and arranged in panicles. The fruit is a 1-cm purple berry with a single seed.[19,20] It grows in tropical rain forests at various altitudes from highland slopes to lowland forests including marshy places and on well-drained soils. However, they become extremely rare in latitudes with seasonal climatic conditions.[18,20]

Traditional uses

Its timber is used for decoration, furniture, cabinet and plywood manufacture. *C. javanicum* have tough timber used for construction and house building. The term cinnamon is the dried bark of *C. zeylanicum* and *C. aromaticum*[21] used in preparing chocolate, beverages, spicy candies and liquors.[22] True cinnamon obtained from *C. verum* bark which is one of the most required spice.[23] Several species are also used as substitutes for the true cinnamon. The four main commercially available cassias are *C. cassia*, *C. tamala*, *C. burmannii* and *C. loureirii*. *C. burmannii*, *C. iners*, *C. porrectum*, *C. rhynchophyllum* and *C. soegengii* are used as spice and flavouring food in Sabah. Java cinnamon (*C. burmannii*) which is also known as 'keningau' is commonly found in the foothills of the Crocker Range and Keningau. As an ingredient, distilled cinnamon oils are also used in flavouring foods and drinks. Diarrhoea and malaria can be cure by the bark of *C. burmanii*.[24] *C. politum* bark is mixed with hot drinks to give strength and relieve muscle pain. Crushed leaves and bark paste of *C. crassinervium* are used for headache. *C. rhynchophyllum* and *C. soegengii* leaves are used to treat stomach ache and food poisoning.[24] In Peninsular Malaysia, leaf juice of *C. iners* is used as a poultice by the Sakai ethnic group for rheumatism. *C. javanicum* root decoction is used to treat fatigue and chest pain, while *C. crassinervium* is used for stomach ache. The roots of *C. iners*, *C. porrectum* and *C. subcuneatum* are boiled, and its decoction is given after childbirth and also for treating fever. The roots of *C. subcuneatum* are used in pain relief on rheumatic joints. *C. porrectum* seed oil can also be used for rheumatism. The bark and fruits are also used in perfumes. *C. porrectum* used as a scent for soap and *C. verum* as perfumes. The mucilage of *C. iners* is used in the manufacture of mosquito coils, fragrant joss sticks and formica.[25] Cinnamon possesses strong antifungal, antibacterial, antitermitic, larvicidal, nematicidal, and insecticidal properties.[26–31]

Clinical aspects

Several clinical studies on cinnamon are conducted due to its high remedial potential. According to Clinical Trials Govt. database, a total of 26 clinical trials including six studies, 14 completed studies, two recruited studies, two terminated studies and two active studies have been done. However, most of these studies still under process (Table 2).[32]

Table 1 The chemical constituents, antimicrobial activity and medicinal properties of various *Cinnamomum* species

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
1.	*Cinnamomum aureofulvum* Gamble	Leaf	*Aldehydes*: (E)-Cinnamaldehyde, benzaldehyde.[38] *Acetate*: (E)-Cinnamyl acetate, benzyl acetate.[38] *Alcohol*: Benzyl alcohol.[38] *Terpinenes*: (Z,Z)-Farnesol, 1,8-cineole, borneol, guaiol, myrcene, terpinen-4-ol, β-caryophyllene, γ-terpinene, α-guaiene, α-terpineol[38]	Antimicrobial activity,[38] platelet-activating factor (PAF) receptor-binding antagonist activity[39]	Headache[38]
		Bark	*Acetate*: (E)-Cinnamyl acetate, benzyl acetate.[38] *Aldehydes*: (E)-Cinnamaldehyde, benzaldehyde.[38] *Terpinenes*: (Z,E)-Farnesol, (Z,Z)-farnesol, 1,8-cineole, borneol, camphene, guaiol, limonene, myrcene, p-cymene, terpinen-4-ol, terpinolene, zingiberene, β-bisabolene, β-caryophyllene, β-fenchol, β-pinene, γ-terpinene, α-bisabolol, α-cadinol, α-phellandrene, α-pinene, α-terpinene, α-thujene[38]		
2.	*Cinnamomum bejolghota* (Buch.-Ham.) Sweet	Leaves	*Acetate*: Linalyl acetate.[40] *Flavonoids*: Cinnamaldehyde.[41] *Terpinenes*: 1,8-Cineole, a-terpinol linalool, nerolidol, terpinen-4-ol, β-caryophyllene, β-phellandrene, δ-3-carene, α-farnesene, α-phellandrene, α-pinene[40]	Allergen-reduction activity,[42] anthelmintic activity,[43] antiacetylcholinesterase activity,[44] antidiabetic activity,[45,46] antimicrobial activity,[47–50] antioxidant activity[44,45,51,52]	Abdominal disorders,[53] body ache,[54] cholelithiasis,[55,56] cough and cold,[57] carminative, diarrhoea, dyspepsia,[58] flatulence,[54] food borne illness,[55] gall stone,[53] gynaecological complexity,[48,54] hepatomegaly,[59] hepatitis,[60] headache,[53] influenza,[57] liver complaints,[61,62] malaria,[59] nausea,[58] oral problems,[40] ostalgia,[48] pyrexia,[40] rheumatoid arthritis,[54] skin disease,[53] stomach pain,[63] tooth ache,[55] ulcer,[48] urogenital diseases,[40,55,56] wounds[53,64]
		Bark	*Acetate*: Dihydrocarveol acetate, dihydrolinalool acetate, isobornyl acetate, Z-α-trans-bergamotol acetate, α-bisabolol acetate.[65] *Aldehyde*: Hexanal, tetradecanal,[66] E-2-hexyl cinnamaldehyde, limonene aldehyde, Z-cinnamaldehyde.[65] *Alcohol*: 1-Hexanol[20], α-amyl cinnamyl alcohol.[65] *Terpinene*: 1,8-Cineole, α-pinene, linalool, α-terpinene, α-thujene, γ-terpinene, ρ-cymene.[65,66] (Z)-β-ocimene, (E)-nerolidol, (E)-β-ocimene, camphene, cis-piperitol, endo-fenchol (α-fenchol), geraniol, geranyl acetate, germacrene-D, limonene, nerol, neryl acetate, myrcene, sabinene, spathulenol, terpinen-4-ol, terpinolene, trans-β-terpineol, trans-piperitol, β-caryophyllene, β-elemene, β-pinene, β-selinene, δ-cadinol, δ-guaiene (α-bulnesene), α-cadinol, α-humulene, α-panasinsene, α-phellandrene, α-selinene, α-terpineol.[66] 13-epi-manoyl oxide, 3Z-cembrene A, 7-epi-α-selinene, borneol, camphor, E-β-ocimene, epi-α-cadinol, guaiol, isoborneol, myrcene, phytol, pinene, sabinene, sclareolide, terpinen-4-ol, Z, E-geranyl linalool, α-humulene, α-trans-bergamotene, α-zingiberene, γ-terpineol, δ-3-carene, ρ-mentha-2,4 (8)-diene[65]		
		Flower	*Aldehyde*: α-Campholenal.[66] *Acetate*: Cis-pinocarvyl acetate.[66] *Alcohol*: α-Caryophyllene alcohol.[66] *Terpinen*: (Z)-β-Ocimene, (E)-nerolidol, (E)-β-ocimene, (E,E)-farnesol, 1,8-cineole, borneol, camphene, carvone, endo-fenchol (α-fenchol), linalool, limonene, p-cymene, myrcene, terpinen-4-ol, trans-carveol, trans-verbenol, tricyclene, verbenone, β-caryophyllene, β-elemene, β-pinene, β-selinene, δ-cadinol, δ-selinene, α-humulene, α-panasinsene, α-pinene, α-selinene, α-terpineol, α-thujene[66]		

Table 1 (*Continued*)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
3.	*Cinnamomum burmannii* (Nees & T. Nees) Blume	Leaf	*Alcohols*: Cyclohexane methanol.[67] *Aldehydes*: Trans-cinnamaldehyde.[68] *Acetate*: Trans-cinnamyl acetate; bornyl acetate[68]; acetate; bornyl acetate.[67] *Terpinenes*: (−)-Spathulenol; caryophyllene; D-borneol; eucalyptol; guaiol[67,68]	Anticancer activity,[69,70] antidiabetic activity,[71] anti-inflammatory activity,[72,73] antimicrobial activity,[74,75] antioxidant activity,[71,73,76] antipyretic activity,[77] cytotoxicity,[73] gene expression and immune response activity,[78,79] gastroprotective activity,[80] hepatoprotective activity,[81] immunomodulatory activity,[82] neuroprotective activity,[83] ultraviolet (UV) protective activity/sun protection activity,[84] wound healing activity,[85] toxicological studies,[86,87] antidiabetic activity[71]	Arthralgia,[68] arthritis,[88,89] bellyache,[88] chest complaints,[68] colic,[89] cough & cold,[88,89] diarrhoea,[89] diabetes,[68] dyspepsia,[68,89] dysuria,[88] flatulent,[68,89] gripe,[68] influenza,[89] malaria,[68] nausea,[68,89] pains,[68] periodontal disease,[68] pyrexia,[88,89] puerperium,[88] respiratory tract problems,[90] rheumatic arthritis,[68,89] rheumatic arthralgia,[68] rhinitis,[88] soft tissue contusion,[68] sprain,[68] traumatic injury,[68] traumatic haemorrhage[68]
		Fruit	*Flavonoid*: Anthocyanins, proanthocyanidins.[68] *Terpenes*: Camphene; caryophyllene; citral; elemene; fenchol; guaiene; linalool; myrcene; nerolidol; pinene; sylvestrene; terpineol.[68]		
		Shoot	*Terpenes*: Camphene; caryophyllene; citral; elemene; fenchol; guaiene; linalool; myrcene; nerolidol; pinene; sylvestrene; terpineol[68]		
		Plant peel	Amino acid: Melanin[68]		
4.	*Cinnamomum cambodianum* Lecomte	Bark	*Terpinenes*: 4-Terpineol, cadalene; isospathulenol; viridiflorol; α-cadinol; α-epi-cadinol; α-terpinene, α-terpinol, α-terpinolene, β-spathulenol; β-terpineol, γ-terpinene[91,92]	Antiallergic activity,[93] antimicrobial activity,[91] antioxidant activity,[92] cytotoxicity,[91] hepatoprotective activity[94]	Gynaecological troubles,[95] indigestion,[96] liver complains,[95] menstrual pain,[96] sprains and injuries,[96] tuberculosis[96]
		Leaf	*Terpinenes*: (E)-β-Ocimene; (*E*)-β-santalol; camphene; *cis*-α-santalol; *epi*-α-bisabolol; spathulenol; germacrene B; isospathulenol; limonene; linalool oxide (pyranoid); *neo-allo*-ocimene; *o*-cymene; phytol; sabinene; terpinen-4-ol; trans-nerolidol; verbenone; α-bisabolol; α-pinene; α-terpinene; α-terpineol; α-thujene; β-myrcene; β-spathulenol; β-vetivenene; γ-terpinene; δ-3-carene.[91] *Terpenoids*: 1,8-Cineole; carvone; geraniol; guaiol; teresantalol; α-amorphene; α-phellandrene; α-santalene; γ-eudesmol[91]		
5.	*Cinnamomum caryophyllus* (Lour.) S. Moore		*Acetates*: Bornyl acetate; neryl acetate.[97] *Aldehydes*: (E)-Cinnamaldehyde.[97] *Terpenes*: (E)-Nerolidol; 1,8-cineole; 2,5-cyclohexadiene-1-one; borneol; camphene; camphor; carvacrol; ledol; linalool; methyl eugenol; myrtenal; piperitone; terpineol-4-ol; trans-carveol; trans-pinocarveol; tricyclene; verbenene; verbenone; β-caryophyllene; β-myrcene; β-pinene; ρ-cymene; ρ-cymenene; α-pinene; α-ylangene.[97]	Hepatoprotective activity[94]	Abdominal disorders, cholera and digestive stimulant[98]
6.	*Cinnamomum culilaban* (L.) J. Presl		*Carboxylic acid*: Asam propanoat (propionic acid).[99] *Hydrocarbons*: Naftalen (naphthalene).[99] *Terpinenes*: Sparthulenol (spathulenol); terpinol; timol (thymol); verbanol; verbenone[99]	Antimicrobial, antioxidant activity, toxicological studies[100]	Bone pain,[100] Cholera,[100,101] constipation,[101] gynaecological problems,[100] rheumatism [100]
7.	*Cinnamomum filipedicellatum* Kosterm.	Leaf	*Aldehyde*: Cuminaldehyde.[102] *Terpinenes*: Carvone; germacrene B; limonene; linalool; p-cymen-7-ol; p-cymene; piperitone; terpinen-1-ol; terpinen-4-ol; trans-carveol; α-terpineol[102]	Antimicrobial[102], hepatoprotective[103]	Urinary problems,[103] wounds[103]
		Bark	Anthraquinones, cardiotonic glycosides, cyanogenic glycosides, leucoanthocyanins, saponins, steroids, triterpenes[103]		

Table 1 (Continued)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
8.	*Cinnamomum glanduliferum* (Wall.) Meisn.	Leaf	*Acetate*: Bornyl acetate; neryl acetate.[104] *Terpinenes*: Caryophyllene oxide; limonene; p-cymene; sabinene; terpinen-4-ol; α-pinene[104–106]; camphene; cis-sabinene hydrate; β-pinene; γ-terpinene[104,105]; eucalyptol; germacrene B; germacrene-D; globulol; spathulenol; terpinolene; trans-caryophyllene; trans-sabinene hydrate; β-elemene; β-myrcene; δ-2-carene; α-humulene; α-thujene.[105] (E)-nerolidol; 1,8-cineole; carvone; cis-linalool oxide (furanoid); eugenol; geranial; linalool; myrcene; piperitone; thymol; trans-carveol; trans-linalool oxide (furanoid); trans-sabinene hydrate; β-selinene.[104] 1,8-cineole; carvacrol; elemicin; germacrene-D-4-ol; trans-ocimene; β-caryophyllene.[106] linalool; α-phellandrene; α-terpineol.[104,106] α-terpinene; α-thujene[104,105]	Anticancer,[107] anti-inflammatory,[105] antimicrobial,[107,108] cytotoxic,[109] gastroprotective,[105] larvicidal[110]	Abdominal disorders,[111,112] asthma,[112] bronchitis,[113] cough and cold,[114,115] diabetes,[63] dizziness,[106] dysentery,[114] dyspepsia,[112] gonorrhoea,[111] infestation,[63] head ache,[116] kidney trouble,[63] nausea,[116] oral,[40] pneumonia,[55,113] pyrexia,[55] respiratory problems,[112] rheumatism,[55] shivering,[116] snake bite,[112] tooth ache,[117] wounds[117]
		Stem	*Terpinenes*: Camphene; caryophyllene oxide; *Cis*-sabinene hydrate; eucalyptol; limonene; p-cymene; sabinene; terpinene-4-ol; terpinolene; trans-caryophyllene; trans-sabinene hydrate; β-myrcene; β-pinene; γ-terpinene; δ-2-carene; α-humulene; α-pinene; α-terpinene; α-terpineol; α-thujene[105]		
		Bark	*Terpinenes*: Borneol; camphene; camphor; cubenol; eucalyptol; fenchol; guaiol; isoborneol; limonene; p-cymene; sabinene; terpinen-4-ol; terpinolene; α-humulene; α-phellandrene; α-pinene; α-terpinene; α-terpineol; α-thujene; β-myrcene; β-pinene; γ-terpinene[107]		
9.	*Cinnamomum glaucescens* (Nees) Hand.-Mazz.	Leaf	*Acetate*: Geranyl acetate.[118] *Aldehyde*: Heptanal; hexanal.[104] *Terpinenes*: (E)-Nerolidol; limonene; linalool[104,118]; (E)-β-ocimene; (E, E)-α-farnesene; epi-β-santalene; safrole; β-pinene[104]; (Z)-citral; (Z)-β-ocimene; bicycloelemene; borneol; camphene; caryophyllene oxide; farnesol; geranila; geraniol; germacrene-D; O-cymene; sabinene; selina-4(15), 7(11)-diene; terpinen-1-ol; terpinen-4-ol; trans-sabinene hydrate; α-gurjunene; α-humulene; α-phellandrene; α-pinene; α-terpinene; α-terpineol; α-terpinolene; α-thujene; β-bisabolene; β-myrcene; β-selinene; γ-elemene; γ-terpinene; δ-cadinene[118]	Antimicrobial,[119,120] antioxidant,[119] cytotoxicity,[109,120] larvicidal,[117] nematicidal,[117] toxicological[119]	Arthritis,[119] blood circulation,[119] body aches,[117] boils,[63] bronchitis,[55,121] cough and cold,[122] eruption,[63] inflammation,[119] infestation,[117] kidney trouble,[63,117] muscles and joints complications,[119] muscular spasm,[117] myalgia,[119] pyrexia,[63] rheumatism,[119] toothache,[117,122] urinogenital diseases[40]
		Fruit and seed	Methyl cinnamate, thymol, safrole, cineole, eugenol, linalool, linalyl acetate and nerol; methyl cinnamate; 1,8 -cineole, α-terpineol[58]		
		Fruit and pericarp	*Terpinenes*: 1,8-Cineole; camphor; linalool; sabinene; β-pinene; α-terpineol; α-thujene[119,123]; (2)-β-ocimene; (E)-β-ocimene; camphene; carvacrol; caryophyllene oxide; geranial; geraniol; limonene; myrcene; p-cymen-8-ol; p-cymene; p-elemene; spathulenol; terpinen-4-ol; terpinolene; β-bisabolene; β-caryophyllene; β-phellandrene; β-selinene; γ-terpinene; δ-terpineol; α-bergamotene; α-cubebene; α-humulene; α-phellandrene; α-pinene; α-selinene; α-terpinene[117]; cis-ocimene; DL-limonene; thujene[119]		
		Root	*Acetate*: Neoiso-3-thujanol acetate.[122] *Aldehyde*: Benzaldehyde; cuminal.[122] *Terpinenes*: (2E,6E)-Farnesal; (2Z,6E)-farnesol; (E)-caryophyllene; 1,8-cineole; 1-epi-cubenol; 14-hydroxy-9-epi-(E)-caryophyllene; ascaridole; cadalene; camphene; carvone; caryophyllene oxide; cis-linalool oxide (furanoid); cis-linalool oxide (pyranoid); cubebol; epi-cubebol; geranial; geraniol; isoborneol; linalool; myrcene; neral; nerol; o-cymene; p-cymen-7-ol; p-cymene; piperitone; sabinene; spathulenol; terpinen-4-ol; terpinolene; thuj-3-en-10-al; thuja-2,4(10)-diene; trans-calamenen-10-ol; trans-carveol; trans-pinocarveol; trans-sabinol; trans-verbenol; verbenone; viridiflorol; α-cadinol; α-cubebene; α-humulene; α-phellandrene; α-pinene; α-terpinene; α-terpineol; α-thujene; β-eudesmol; β-pinene; γ-terpinene; δ-cadinene; δ-terpineol; τ-muurolol[122]		

Table 1 (*Continued*)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
10.	*Cinnamomum iners* Reinw. ex Blume	Leaves	*Aldehyde*: Cinnamic aldehyde.[124] *Acetate*: (E)-phytol acetate.[125] *Fatty acid*: Linoleic acid.[126] *Terpinenes*: Terpene[124]; (E)-caryophyllene; (E)-nerolidol; (E)-β-ocimene; geraniol; linalool; β-pinene; β-selinene; α-humulene; α-pinene; α-selinene[125]; (+)-aromadendrene, (−)-bornyl acetate, 2,6-octadien-1-ol, 2-propen-1-ol, 3-allyl-6-methoxyphenol, alloaromadendrene, aromadendrene,benzyl benzoate, borneol L, cadinol, calarene, caryophyllene, caryophyllene oxide, *cis*-linalool oxide, *cis*-α-bergamotene, cyclohexene, dodecanal, epiglobulol, geraniol, germacrene-D, isospathulenol, linalool, naphthalene,1,2,3,4,4a,7-hexahydro, nerolidol, palustrol, propanoic acid, spathulenol, terpinen-4-ol, tetradecanal, *trans*-linalool oxide, viridiflorol, α-amorphene, α-cadinol, α-copaene, α-copaene, α-cubebene, α-humulene, α-longipinene, α-muurolene, α-terpineol, β-bisabolene, β-elemene, β-selinene, δ-cadinene[127]	Analgesic.[128] anticancer,[129,130] antidiabetic,[131,132] antihyperlipidaemic,[132] anti-inflammatory,[130] antikinase,[133] antimicrobial,[134–136] antioxidant,[130,133,137] antiplasmodial,[138] glutathione-S-transferase inhibitory activity,[139] toxicological studies[128,140]	Abdominal pain,[115] appetite problems,[141] asthma[142], breathing problem[141], body ache[54], cardiac disorders[143], constipation[134], cough and cold [142,144], diarrhoea[145], digestive ailments[141], dysentery[62,146], dyspepsia[124], dyspnoea[144], flatulence[124], gynaecological disorder[95], headache[147], influenza[148], insects bite[149], jaundice[150], nausea and vomiting[115,151], postpartum[115,147], pyrexia[95,124], rheumatism[152], stomach complains[134,145], urinary diseases[124], wounds[153]
		Stem	*Acetate*: (E)-Phytol acetate.[125] *Terpinenes*: 1,8-Cineole, α-terpinol, terpinen-4-ol[16]; (E)-caryophyllene; (E)-nerolidol; (E)-β-ocimene; geraniol; linalool; β-pinene; β-selinene; α-humulene; α-pinene; α-selinene[125]		
11.	*Cinnamomum insularimontanum* Hayata	Fruit	*Terpinenes*: 4-Terpineol; borneol; camphene; caryophyllene; cineol; Citral; citronellal; citronellol; geraniol; limonene; β-myrcene; β-pinene; α-pinene[154]	Anticancer,[155] anti-inflammatory,[154] antioxidant,[130] antiviral,[156] cytotoxicity[156]	Headache,[157] blood circulation[157]
		Root	Actinodaphnine[155,158]		
		Stem	Cinnamic acid; cinnamyl alcohol; coumarin; kaempferitrin; kaempferol; p-hydroxybenzoic acid; stigmasterol; β-sitosterol[158]; polysaccharides; dehydrosulfurenic acid; 15α-acetyldehydrosulfurenic acid[157]		
		Leaf	Polysaccharides, dehydrosulfurenic acid, 15α-acetyldehydrosulfurenic acid[157]		
12.	*Cinnamomum javanicum* Blume	Plant	2,6-Dimethyl-1,7-octadiene-3,6-cliol; 2,6-dimethyl-3,7-octadiene-2,6-cliol; 4-hydroxy-4-methyl-2-pentanooe 2-butoxyethanol; 5-ethenyldihydro-5-methyl-2(3H)-furanone; 6-ethenyltetrahydro-2,2,6-trimethyl-2H-pyrao-3-ol; 8,11-octadecadienoic acid, methyl ester; acetic acid; benzaldehyde; eucalyptol; hexadecanoic acid, methyl ester; palmitic acid vinyl ester; phytol; styrene; tetradecanal; trans-linalool oxide; tridecanal[159]	Anticholinesterase,[160] antimicrobial,[159,161] antioxidant,[159,160] antityrosinase,[160] antiviral,[162] cytotoxicity,[162] platelet-activating factor (PAF) receptor-binding antagonist,[39] toxicological studies[162]	Abdominal disorders,[17] abortion,[163] abscess,[164] chest pain,[17] fatigue,[17] gynaecological disorder,[163] lethargy,[17] postpartum,[162] spasmodic colic,[165] sexual debility[163]
13.	*Cinnamomum kotoense* Kaneh. & Sasaki	Leaves	2″-O-cis-p-Coumaroyl-4″-O-trans-p-coumaroylafzelin[166] (+)-catechin; (+)-syringaresinol, (−)-catechin, (−)-epicatechin, (−)-sesamin, 3-O-α-L-[2,4-di-(E)-p-coumaroyl]rhamnopyranoside; 3-O-α-L-[2-(Z)-p-coumaroyl-4-(E)-p-coumaroyl]rhamnopyranoside; cinnakotolactone, clemaphenol A, ferulic acid, isoeugenol, isokotomolide A, isolinderanolide B; isoobtusilactone A, kotomolide A and B, obtusilactone A; p-hydroxybenzaldehyde, palmitic acid, pluviatilol, secokotomolide A, stearic acid; stigmasterol, stigmasteryl-D-glucoside, syringaldehyde, vanillic acid, vanillin, β-sitosterol, β-sitosterol-D-glucoside[167–169]	Anticancer,[168–171] antioxidant,[172] antiproliferative,[167] antitubercular,[173] osteoinductive effect,[174] toxicological[171]	Headache,[157] blood circulation[157]
		Fruit	*Butanolides*: isoobtusilactone, obtusilactone A.[175] *Lignans*: (+)-syringaresinol.[175] *Steroids*: β-sitosterol, stigmasterol[175]		

Table 1 (Continued)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
		Stem	(+)-Catechin, (−)-4′-hydroxy-5,7,3′-trimethoxyflavan-3-ol, (−)-catechin, (−)-sesamin, (±)-syringaresinol, 2,6-dimethoxy-1,4-benzoquinone, 2-acetyl-5-dodecylfuran, 2-acetyl-5-methylfuran, 4-hydroxybenzaldehyde, apigenin, benzoic acid, docosanoic acid, genkwanin, isoobtusilactone A, kaempferol, kotodiol, kotolactone A and B, lauric acid, lincomolide B, margaric acid, methyl palmitate, methyl stearate, palmitic acid, protocatechuic acid, quercetin, secokotomolide, squalene, stearic acid, stigmasterol, stigmasteryl-3-O-β-D-glucoside, syringaldehyde, tetracosane trans-coumaric acid, trans-ferulic acid, trans-phytol, vanillin, β-sitosterol β-sitosterol-3-O-β-D-glucoside[173]		
14.	*Cinnamomum laubatii* F.Muell	Leaf	*Propenes*: Safrole.[176] *Propenoids*: Methyl eugenol.[176] *Terpinenes*: (E)-β-Ocimene; 1,8-cineole; bicyclogermacrene; C15 H26 O (A); C15 H26 O (B); camphene; caryophyllene oxide; cubeban-11-ol; cubenol; epicubenol; globulol; humulene; limonene; myrcene; p-cymene; sabinene; spathulenol; terpinolene; viridiflorol; β-caryophyllene; β-cubebene; β-elemene; β-pinene; β-selinene; δ-3-carene; α-phellandrene; α-pinene; α-selinene; α-terpinene; α-thujene[176]	Anticancer[177]	Flatulence,[178] gynaecological complains,[178] urinary disease[178]
15.	*Cinnamomum loureiroi* Nees	Bark	Phenols,[179] alkaloid, anthraquinones, coumarins, flavonoid, phenols, saponins, tannins.[180] *Flavonoids*: Cinnamic aldehyde[179,181]; 3-methoxycinnamaldehyde; cinnamaldehyde.[181] *Hydrocarbons*: Copaene; α-amorphene; β-cadinene.[181] *Terpinenes*: Caryophyllene; phellandrene; pinene[179,182]; cadinadiene-4,9; cubenol; limonene; α-cedrene oxide; α-guaiene; α-myrcene; β-pinene[181]	Antidiabetic,[46] anti-inflammatory,[180,183] antiviral[184]	Abdominal pain,[180] atherosclerosis,[180] blood pressure lowering,[180] carcinogenesis,[180] cardiovascular diseases,[180] chest congestion,[180] cholesterol lowering,[180] conjunctivitis,[180] cough and cold,[180] diarrhoea,[179] erectile dysfunction,[180] flatulence,[179] headache,[180] indigestion,[180] inflammations,[182] muscular strains,[182] nausea,[179,182] neuralgia,[180] rheumatism,[180,182] sore throat,[180] tooth ache,[180] vaginal problems,[180] vomiting,[180,182] wound,[180] yeast infections[180]
16.	*Cinnamomum macrocarpum* Hook.f.	Bark	*Aldehydes*: Benzaldehyde; hydrocinnamaldehyde.[185] *Carboxylic acid*: Benzoic acid; butanoic acid; propanoic acid.[185] *Fatty acid*: Isovaleric acid.[185] *Flavonoids*: Cinnamaldehyde.[185] *Hydrocarbons*: Copaene; cyclohexene; naphthalene; γ-cadinene.[185] *Terpinenes*: (+)-α-Terpineol; 1,3-cyclohexadiene; 1,4-cyclohexadiene; 1,6-cyclodecadiene; 1,6-octadien-3-Ol; 1,6-octadiene; 2-norbornanol; 3-carene; 4-terpineol; bicyclo hept-3-ene,-3-care; camphene; camphor; caryophyllene; cineole; cubenol; cymene; cymol; eucalyptol; linalool; nerolidol A; sabinene; spathulenol; β-myrcene; β-pinene; γ-elemene; γ-muurolene; δ-cadinene; α-caryophyllene; α-cubebene; α-fenchol; α-humulene; α-phellandrene; α-pinene; α-selinene; α-terpinene; α- terpinolene[185]		
		Leaf	*Carboxylic acid*: Benzoic acid; butanoic acid; propanoic acid.[185] *Flavonoids*: Cinnamaldehyde.[185] *Hydrocarbons*: 1-Naphthalenol; copaene; naphthalene; β-cadinene; δ-cadinene.[185] *Terpinenes*: (−)-Bornanone; 1,3-cyclohexadiene; 1,4-cyclohexadiene; 1,6-cyclodecadiene; 1,6-octadien-3-Ol; 3-carene; 4-carvomenthenol; 4-terpineol; bicyclo α-thujene; caryophyllene; cedr-8-ene; cineole; cis-α-bisabolene; cymene; cymol; eucalyptol; germacrene-D; linalool; sabinene; spathulenol; thujene; β-myrcene; β-pinene; γ-terpinene; η-ocimene; α-(+)-pinene; α-caryophyllene; α-cubebene; α-humulene; α-phellandrene; α-terpinene; α-terpinolene,[185] camphor, cis-calamenene, germacrene B[186]	Anticholinesterase,[160,186] antioxidant,[160,186] antityrosinase[160]	Cough and cold,[187] diarrhoea,[187] dysentery,[187] rheumatism,[188,189] sciatica pains[189]

Table 1 (*Continued*)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
17.	*Cinnamomum mercadoi* S.Vidal	Leaves	Sapogenin; alkaloids, safrole[190]	Analgesic,[190] antidiarrhoeal,[191] anti-inflammatory,[190] antimicrobial,[190,192,193] antioxidant[192,194]	Appetite,[194] bloating,[194] bronchitis,[194] cough and cold,[194] diabetes,[195] dysentery,[194] headaches,[115] flatulence,[194] intestinal troubles,[115] neuralgic pains,[194] menstrual problems,[194] pyrexia,[194] rheumatism,[191] skin diseases,[194] sinus,[194] Stomach troubles,[194] toothache,[194] tuberculosis,[115] vomiting,[194] yeast infections[194]
		Seed	Sapogenin[190]		
		Roots	Safrole[190]		
		Bark	*Terpinenes*: 1,8-Cineol; camphene; limonene; linalool; myrcene; p-cymene; sabinene; terpinen-4-ol; terpinolene; β-pinene; γ-terpinene; α-pinene; α-terpinene; α-terpineol[196]		
18.	*Cinnamomum micranthum* f. *kanehirae* (Hayata) S.S.Ying	Leaf	*Aldehyde*: Benzaldehyde.[197] *Hydrocarbons*: α-Copaene; γ –cadinene.[197] *Terpinenes*: (−)-nerolidol; (−)-terpinen-4-ol; 1,8-cineole; 10-epi-cubebol; 3-carene; caryophyllene oxide; cis-linalool oxide; cis-β-ocimene; citronellol; citronellol acetate; E-citral; epi-cubenol; geraniol; germacrene-D; guaiol; limonene; linalool; nerol; p-cymene; sabinene; spathulenol; T-cadinol; T-muurolol; trans-linalool oxide; trans-β-caryophyllene; trans-β-ocimene; Z-citral; α-cadinol; α-humulene; α-muurolene; α-phellandrene; α-pinene; α-terpinene; α-terpineol; α-terpinyl acetate; α-thujene; α-ylangene; β-elemene; β-myrcene; β-pinene; β-selinene; γ -muurolene; γ -terpinene; δ-cadinol; δ-selinene; δ-terpineol[197]	Anticancer[198,199], antimicrobial[200]	Dispel apathy,[198] lung problems,[198] nervous depression[198]
19.	*Cinnamomum mollissimum* Hook.f.	Leaf	*Carboxylic acid*: Benzoic acid.[201] *Terpinenes*: Linalool; spathulenol; β-caryophyllene; α -terpineol [201,202]; carvacrol; d-cadinene; nerolidol; p-cymene; sabinol; T-cadinol; terpinen-4-ol; viridiflorol; zingiberene; β-bisabolene; β-farnesene; β-maaliene; γ-farnesene; α -cadinol; α -caryophyllene; α -phellandrene; α -selinene[201]; bisabolol; bisabolol oxide A; dehydrolinalool; E-β-ocimene; limonene; myrcene; β-bisabolene; β-pinene; γ-terpinene; δ-cadinene; α-cadinene; α-cadinol; α-humulene; α-pinene; α-thujene.[202] 1,8-cineole[20,203]	Antimicrobial,[20,204] antioxidant,[205] antityrosinase,[205] insecticidal[203]	
		Bark	*Alkaloids*: Hernagine, hernovine, isocorydine, N-methylhernagine, N-methylhernovine.[205] *Carboxylic acid*: Hexanoic acid.[201] *Terpinenes*: Cineole; copaene; limonene; linalool; terpinen-4-ol; β-caryophyllene l429; β-elemene; β-pinene; γ-muurolene; α -caryophyllene; α -phellandrene; α-pinene; α -terpineol[201]		
		Wood	*Terpinenes*: Cineole; linalool; nerolidol; β-maaliene; γ-muurolene; α-phellandrene; α-terpineol[201]		
20.	*Cinnamomum oliveri* F.M.Bailey	Bark	*Terpinenes*: Camphor, Pinene[206]	Antimicrobial,[204,207], toxicological[204,207]	Cough and cold,[208] diarrhoea,[178] dysentery,[178] gastrointestinal tract,[208] inflammation,[204] phthisis,[208] rheumatism,[204] skin disorders,[204] swellings[204]
		Leaves	*Terpinenes*: Borneol; camphene; camphor; limonene; linalool; myrcene; p-cymene; spathulenol; viridiflorol; β-caryophyllene; β-pinene; δ-cadinene; α-cadinol; α-pinene; α-terpineol[176]		

Table 1 (Continued)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
21.	*Cinnamomum osmophloeum* Kaneh.	Twig	3-O-[β-D-Xylopyranosyl-(1 → 2)-α-L-arabinofuranoside], 7-O-α-L-rhamnopyranoside; sagittatin A.[166] L-borneol, α-terpineol, p-allylanisole, *trans*-cinnamaldehyde, L-bornyl acetate, eugenol, α-copaene, β-caryophyllene, cinnamyl acetate, α-caryophyllene, curcumene, δ-cadinene, α-calacorene, elemicin, e-nerolidol, spathulenol, caryophyllene oxide, *trans*-β-elemenone, γ-eudesmol, caryophylla-4 (14), 8(15)-dien-5.α-ol, δ-cadinol, T-cadinol, cadalene, guaiol acetate[209] *Kaempferol glycosides*: (kaempferol 3-O-β-D-xylopyranosyl-(1 → 2)-α-L-arabinofuranosyl-7-O-α-L-rhamnopyranoside, kaempferol 3-O-β-D-xylopyranosyl-(1 → 2)-α-L-rhamnopyranosyl-7-O-α-L-rhamnopyranoside, kaempferol 3-O-β-D-glucopyranosyl-(1 → 2)-α-L-arabinofuranosyl-7-O-α-L-rhamnopyranoside, kaempferol 3-O-α-L-rhamnopyranosyl-(1 → 2)-α-L-arabinofuranosyl-7-O-α-L-rhamnopyranoside, kaempferol 3-O-β-D-apiofuranosyl-(1 → 2)-α-L-arabinofuranosyl-7-O-α-L-rhamnopyranoside, kaempferol 3-O-β-D-glucopyranosyl-(1 → 2)-α-L-rhamnopyranosyl-7-O-α-L-rhamnopyranoside, kaempferol 3-O-β-D-glucopyranosyl-(1 → 4)-α-L-rhamnopyranosyl-7-O-α-L-rhamnopyranoside, kaempferitrin, kaempferol 7-O-α-L-rhamnopyranoside[210]	Anticancer,[130,211] antidiabetic,[212,213] antidyslipidaemic,[214] anti-inflammatory,[209,215] antimicrobial[216,217], antioxidant,[213,218] cardioprotective,[219] cytotoxicity,[220] hair growth,[221] hepatoprotective,[222] hypolipidaemic effect,[223] hypouricaemic effects,[224] immunomodulatory,[225] larvicidal,[29] pancreas-protective effect,[226] tyrosinase,[220,227] wound healing,[227] xanthine oxidase inhibitory[224]	Arthritis,[228] cough and cold,[228] diabetes,[228] infection,[222] inflammation,[228] nerve pains,[228] pyrexia[228]
		Bark	*Flavonoids*: (E)-Cinnamaldehyde; (Z)-cinnamaldehyde.[229] *Hydrocarbon*: Phenol; γ-muurolene[229] *Terpinenes*: 1,8-Cineole; 2-hydroxy-1,8-cineol; 4-terpineol; camphene; caryophyllene; caryophyllene oxide; cedrol; citronellol; copacamphene; d-carvone; geranial; geraniol; geranyl acetate; isoborneol; limonene; linalool; menthone; myrcene; neral; nerol; ocimene; p-cymene; phytol; piperitone; spathulenol; T-cadinol; terpinolene; trans-linalool oxide; β-pinene; γ-cadinene; γ-humulene; α-pinene; α-terpinene; α-terpineol; α-terpinyl acetate[229]		
		Leaves	*Flavonoids*: cis-Cinnamaldehyde; trans-cinnamaldehyde[5,230,231]; cinnamaldehyde.[232] *Hydrocarbon*: γ-Cadinene; δ-cadinene; α-copaene [232]; copaene.[231] *Terpinenes*: Camphor; γ-muurolene[230,232]; limonene; linalool[231]; camphene; caryophyllene oxide[5,230,231]; geraniol; α-cadinol; α-humulene[5,230]; β-pinene; α-terpineol[231]; geranyl acetate; α-caryophyllene; α-muurolene[116,230]; guaiol; β-caryophyllene; β-phellandrene; γ-elemene; T-cadinol[230]; caryophyllene[231,232]; β-bourbonene[232]; 1,8-cineol; cedrol; spathulenol; T-muurolol; trans-β-caryophyllene; δ-cadinene; δ-cadinol[5]; p-cymene; α-pinene[5,231]; (+)-4-carene; (E)-ocimene; 3-carene; cis-β-terpineol; D-limonene; eucalyptol; germacrene-D; neral; nerol; sabinene; terpin-4-ol; terpinolene; β-humulene; β-myrcene; γ-terpinene; α-farnesene; α-phellandrene; α-thujene[231]		
		Stem	*Flavonoids*: Kaempferol; kaempferol 3-O-α-L-rhamnopyranoside; kaempferol 7-O-α-L-rhamnopyranoside; kaempferol 3-O-α-L-rhamnopyranoside-7-O- α-L-rhamnopyranoside; kaempferol 3-O-α-L-rhamnopyranosyl-(1-2)- α-L-rhamnopyranoside[233]		
		Heartwood and roots	9,9′-Di-O-feruloyl-5,5′-dimethoxysecoisolariciresinol, (7′S,8′R,8R)-lyoniresinol-9-O-(E)-feruloyl ester, (7′S,8′R,8R)-lyoniresinol-9,9′-di-O-(E)-feruloyl ester, secoisolariciresinol, (−)-lyoniresinol[211]		

Table 1 (*Continued*)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
22.	*Cinnamomum parthenoxylon* (Jack) Meisn.	Root bark	*Fatty acid*: Myristic acid; palmitic acid; pentadecanoic acid[234]; *Hydrocarbons*: Alloaromadendrene; guaiazulene; γ-cadinene; δ-cadinene; α-copaene.[234] *Terpinenes*: Cadalene; caryophyllene oxide; germacrene-D; spathulenol; valencene; viridiflorol; β-bisabolene; β-elemene; β-selinene; δ-cadinol (torreyol); α-cadinol; α-humulene; α-muurolene[234]	Antidiabetic,[235] anti-inflammatory,[236] antileukaemic,[237] antimicrobial,[50,238,239] antioxidant,[240] antityrosinase,[205] cytotoxic,[239] haemagglutinating,[241] hepatoprotective,[240] RNA N-glycosidase activity[241]	Anaemia,[242] amenorrhoea,[243] backache,[243] blood circulation,[243] childbirth,[236] dysentery,[235] dyspepsia,[243] impotence,[243] pertussis,[235] pyrexia,[238] rheumatism,[165,244] rheumatoid arthritis,[235] stomach troubles,[238] traumatic injury,[244] wound[245]
		Wood	*Aldehydes*: Benzaldehyde; piperonal.[234] *Fatty acid*: Myristic acid; palmitic acid; pentadecanoic acid.[234] *Terpinenes*: δ-Cadinol (torreyol); α-cadinol[234]		
		Stem bark	*Aldehyde*: Benzaldehyde.[41] *Flavonoid*: Cinnamaldehyde.[41] *Terpinenes*: 1,8-Cineole; borneol; bicyclogermacrene; camphene; camphor; caryophyllene oxide; linalool; myrcene; terpinen-4-ol; terpinolene; β-caryophyllene; β-cymene; β-phellandrene; β-pinene; α-farnesene; α-humulene; α-phellandrene; α-pinene; α-terpinolene[41]		
		Leaves	(3R, 4R, 3R, 4R)-6,6′-Dimethoxy-3, 4, 3′,4′-tetrahydro-2H, 2′H-[3, 3′]bichromenyl-4, 4′-diol; 1,2,4-trihydroxybenzene; 4-hydroxybenzaldehyde; daucosterol; herbacetin; kaempferol-3-O-α-L-rhamnoside; quercetin-3-O-α-L-rhamnoside; β-sitosterol,[246] methyl eugenol, β-sitosterol and stigmast-4-en-3-one.[205] *Flavonoid rutinosides*: Scopoletin, isorhoifolin, epicatechin, blumenol A, 4-hydroxybenzoic acid, rutin, hexadecanoic acid methyl ester, nicoflorin.[240] *Aldehyde*: Benzaldehyde.[41] *Terpinenes*: 1,8-Cineole; borneol; camphene; caryophyllene oxide; linalool; myrcene; terpinen-4-ol; terpinolene; β-caryophyllene; β-cymene; β-phellandrene; β-pinene; γ-terpinene; α-humulene; α-pinene; α-terpinolene[41]		
		Bark	Safrole, methyl eugenol, elemicin[247]		
23.	*Cinnamomum rhynchophyllum* Miq.	Leaf	Benzyl benzoate, cis-β-guaiene, eugenol, limonene, linalool, methyl(E)-cinnamate, methyl eugenol, myrcene, p-cymene, sabinene, safrole, spathulenol, terpinen-4-ol, terpinolene, α-humulene, α-phellandrene, α-pinene, α-terpinene, α-terpineol, α-thujene, β-phellandrene, β-pinene, β-selinene, β-caryophyllene, γ-terpinene, δ-3-carene, δ-cadinene[20]	Antimicrobial,[20] insecticidal[203]	Antiaging,[248] food poisoning,[17] intestinal problem,[115] sexual debility,[248] stomach ache[17]
		Bark	(E)-Asarone, benzyl benzoate borneol, camphor, linalool, methyl(E)-cinnamate, methyl eugenol, p-cymene, sabinene, safrole, spathulenol, terpinen-4-ol, α-humulene, α-pinene, α-terpineol, α-thujene, β-caryophyllene, γ-terpinene[20]		
24.	*Cinnamomum scortechinii* Gamble	Leaf	*Hydrocarbons*: α-Copaene; δ-cadinene.[249] *Terpinenes*: (E)-Nerolidol; (Z)-nerolidol; (Z)-β-ocimene; allo-ocimene; borneol; camphor; geranial; geraniol; globulol; limonene; linalool; myrcene; neral; nerol; sabinene; spathulenol; terpinen-4-ol; terpinolene; viridiflorol; α-bisabolol; α-humulene; α-muurolene; α-phellandrene; α-pinene; α-terpinene; α-terpineol; β-caryophyllene; β-phellandrene; β-pinene; β-selinene; β-sesquiphellandrene; γ-muurolene; γ-terpinene; δ-3-carene.[249]	Anticholinesterase,[160] antimicrobial,[20] antioxidant,[160] antityrosinase,[160] insecticidal,[203] platelet-activating factor (PAF) receptor-binding antagonist activity[40]	Influenza[148]
		Bark	*Hydrocarbons*: α-Copaene; δ-cadinene.[249] *Terpinenes*: (E)-Nerolidol; (E,E)-α-farnesene; (Z)-nerolidol; 1,8-cineole; borneol; camphene; caryophyllene oxide; cis-linalool oxide (furanoid); citronellal; farnesene; Geranial; geraniol; limonene; linalool; neral; nerol; p-cymen-8-ol; p-cymene; sabinene; spathulenol; terpinen-4-ol; terpinolene; α-cubebene; α-fenchol; α-humulene; α-pinene; α-selinene; α-terpineol; β-bisabolol; β-caryophyllene; β-elemene; β-eudesmol; β-pinene; β-selinene; β-sesquiphellandrene; γ-eudesmol; δ-elemene[249]		

Table 1 (*Continued*)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
25.	*Cinnamomum sintoc* Blume	Leaf	*Hydrocarbons*: α-Cadinene; γ-cadinene; δ-cadinene.[250] *Terpinenes*: 1,8-Cineole; caryophyllene oxide; germacrene-D; limonene; linalool; myrcene; p-cymene; terpinen-4-ol; trans-linalool oxide; α-cadinol; α-humulene; α-terpineol; β-caryophyllene; β-elemene; β-pinene; γ-elemene; γ-muurolene; γ-terpinene[250]	Analgesic,[251] anti-inflammatory,[251] antimicrobial,[252] insecticidal,[203] platelet-activating factor (PAF) receptor-binding antagonist activity[39]	Abdominal pain,[253] animal bites,[254] diarrhoea,[253] dysentery,[251] fatigue,[115] flatulence,[252] epilepsy,[254] intestinal complaints,[253] insects bite,[253] inflammation,[251] mouth freshener,[253] numbness,[253] pyrexia,[115,252] rheumatism,[254] snake bite,[253] swelling,[254] syphilis,[253] tiredness,[115] ulcer[253]
		Bark	1,8-Cineol, 4-terpineol, aromadendrene, benzyl benzoate, borneol, bornyl acetate, camphor, caryophyllene oxide, derivative eugenol, eugenic acid, eugenol, germacrene, globulol, hexadecanoic acid, isomyristicin, isopulegol, juniper camphor, L-limonene, L-linalool, methyl eugenol, myristicin, safrole, spathulenol, trans-caryophyllene, thymol, viridiflorol, α-cadinol, α-calacorene, α-curcumene, α-muurolene, α-terpineol, α-copaene, β-caryophyllene, γ-muurolene, δ-cadinene, δ-cadinol.[251] *Aldehyde*: Dodecanal; tetradecanal; undecanal.[250] *Fatty acid*: Tetradecanoic acid.[250] *Hydrocarbons*: Dodecane; γ-cadinene; δ-cadinene.[250] *Terpinenes*: 1,8-Cineole; borneol; camphene; cis-linalool oxide; cubenol; epi-α-cadinol; geraniol; germacrene B; limonene; linalool; myrcene; nerol; p-cymene; terpinen-4-ol; trans-linalool oxide; α-humulene; α-muurolene; α-pinene; α-selinene; α-terpineol; α-thujene; α-ylangene; β-elemene; β-pinene; β-selinene; γ-muurolene; γ-terpinene[250]		
		Wood	*Aldehyde*: Benzaldehyde; decanal; Dodecanal; hexanal; octadecanal; tetradecanal; undecanal.[250] *Fatty acid*: Hexadecanoic acid; octadecanoic acid; pentadecanoic acid; tetradecanoic acid.[250] *Hydrocarbons*: Dodecane; α-copaene; γ-cadinene.[250] *Terpinenes*: 1,8-Cineole; cis-linalool oxide; epi-α-cadinol; linalool; p-cymene; terpinen-4-ol; trans-linalool oxide; α-humulene; α-terpineol; α-ylangene[250]		
		Twig	*Aldehyde*: Benzaldehyde; tetradecanal.[250] *Hydrocarbons*: α-Copaene; γ-cadinene; δ-cadinene.[250] *Terpinenes*: (E)-β-Farnesene; (E,E)-α-farnesene; 1,8-cineole; cis-linalool oxide; linalool; p-cymene; terpinen-4-ol; trans-linalool oxide; α-terpineol; β-caryophyllene; β-elemene[250]		
26.	*Cinnamomum subavenium* Miq.	Root	3,4-Methylenedioxy-5-methoxy cinnamyl alcohol; eugenol; isoobtusilactone A; myristicin; obtusilactone A,[255] subamol.[256] isoobtusilactone A, obtusilactone A, eugenol, myristicin, cinnamyl alcohol[255]	Anticancer activity,[130,257] anti-inflammatory,[130] antioxidant,[130,172,255] antityrosinase,[258], enzyme inhibitory[259]	Abdominal pain, chest pain, diarrhoea, hernia, nausea, rheumatism, stomach aches, swellings, vomiting[260]
		Stem	(+)-Catechin, (+)-syringaresinol, (−)-epicatechin, (−)-sesamin, ferulic acid, isolinderanolide B, linderanolide B6, p-hydroxybenzaldehyde, palmitic acid, secosubamolide, stearic acid, stigmasterol, stigmasteryl-D-glucoside, subamolides A-C, syringaldehyde, vanillic acid, vanillin, β-sitosterol, β-sitosterol-D-glucoside[257]		

Table 1 (*Continued*)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
		Leaf	(3R,4R)-p-Menth-1-ene-3,4-diol 3-O-β-D-glucopyranoside; (3R,4S,6R)-p-menth-1-ene-3,6-diol 3-O-β-D-glucopyranoside; (3S,5R,6S,7E)-megastigma-7-ene-3,5,6,9-tetrol; (4R)-p-menthane-1,2α,8-triol 1α, 6β-dihydroxy-5,10-bis-epi-eudesm-15-carboxaldehyde-6-O-β-D-glucopyranoside; 3,4,5-trimethoxyphenyl-1-O-β-D-glucoside; 3-hydroxy-4,5-dimethoxyphenyl-β-D-glucopyranoside; acaricide B1; D-threo-guaiacylglycerol 7-O-β-D-glucopyranoside; wilsonol G; wilsonol H; α-D-glucoside.[261] (2R)-naringenin 5-O-β-D-glucopyranoside; (2S)-naringenin 5-O-β-D-glucopyranoside; (aR)- and (aS)-subavenoside A; (aR)- and (aS)-subavenoside B; (aR)- and (aS)-subavenoside C; (aR)- and (aS)-subavenoside D; (aR)- and (aS)-subavenoside E; (aR)- and (aS)-subavenoside F; (aR,7R)-6,7-dihydrosubavenoside A; (aR,7R)- and (aS,7S)-6,7-dihydrosubavenoside D; (aR,7R)-dihydrisosubamol; (aS,7S)-6,7-dihydrosubavenoside A; 1-butyrylphloroglucinol β-D-glucopyranoside; 3-hexenyl β-D-glucopyranoside; 3-O-α-L-rhamnopyranoside; 3-O-α-L-rhamnopyranosyl-(1 → 6)-β-D-glucopyranoside; 3-O-β-D-glucopyranoside; 7-O-β-D-glucopyranoside; kaempferol; 9,12-Di-O-methylsubamo; chavicol 4-O-β-D-apiofuranosyl-(1 → 6)-β-D-glucopyranoside; D-1; dihydrodehydrodiconiferyl alcohol β-D-xylopyranoside; epicatechin; gibberellin; hydroxytyrosol; nine flavonoids, catechin; phloridzin; two tannins, cinnamtannins B-1[259] *Fatty acids*: Hexadecanoic acid[262] *Hydrocarbons*: Cadalene; pentacosane; tridecane; α-copaene; δ-cadinene.[262] *Others*: (E)-Methyl cinnamate; (E)-α-ionone; (Z)-isoeugenol; benzyl benzoate; cis-calamenene; cis-α-bergamotene; cubenol; dodecene; elemol; geranyl acetate; geranyl formate; methyl eugenol; trans-pinocarveol; α-cubebene; α-cyperone.[262] cinnamtannins B-1 and D-1,[259] subamone[263] *Terpinenes*: (E)-Nerolidol; (E)-β-farnesene; 1,8-cineole; aristolone; borneol; camphene; cis-linalool oxide; geranial; geraniol; linalool; myrcene; neral; p-cymene; patchouli alcohol; spathulenol; terpinen-4-ol; trans-linalool oxide; viridiflorol; α-bisabolol; α-cadinol; α-humulene; α-muurolene; α-muurolol; α-pinene; α-terpineol; β-bisabolene; β-caryophyllene; β-pinene; β-selinene; γ-muurolene; γ-terpinene[262]		
		Bark	*Fatty acids*: Hexadecanoic acid; Pentadecanoic acid; Tetradecanoic acid[262] *Hydrocarbons*: Cadalene; tridecane; δ-cadinene.[262] *Terpinenes*: (E)-Nerolidol; 1,8-cineole; aristolone; borneol; camphene; cis-linalool oxide; geranial; geraniol; linalool; myrcene; neral; p-cymene; patchouli alcohol; spathulenol; terpinen-4-ol; trans-linalool oxide; viridiflorol; α-bisabolene; α-bisabolol; α-cadinol; α-cedrene; α-muurolene; α-muurolol; α-pinene; α-terpineol; β-bisabolene; β-cedrene; β-pinene; β-selinene; γ-muurolene; γ-terpinene[262]		

Table 1 (*Continued*)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
27.	*Cinnamomum sulphuratum* Nees	Leaf	*Fatty acid*: Palmitic acid (hexadecanoic acid).[264] *Flavonoid*: (E)-Cinnamaldehyde[41] *Hydrocarbons*: α-Amorphene; α-copaene; δ-cadinene[264] *Terpinenes*: (E)-Nerolidol; camphor; perillene; γ-terpinene; α-fenchol[41]; 1-linalool[265]; α-phellandrene[266]; citronellol; β-pinene[41,265]; β-caryophyllene[41]; β-phellandrene[41]; linalool[41]; (Z)-β-ocimene[264,266]; α-muurolene; spathulenol[41,264]; 1,8-cineole; caryophyllene oxide; p-cymene; terpinen-4-ol; α-humulene; α-terpineol[41]; limonene; β-pinene[195,264]; caryophyllene alcohol; germacrene-D; α-cadinol; α-muurolol; α-selinene; β-bisabolene; β-elemene; β-selinene[264]; borneol; cis-linalool oxide (furanoid); citronellal; geranial; geranyl acetate; myrcene; neral; terpinolene; trans-linalool oxide (furanoid)[41,195]; camphene; geraniol; nerol; α-pinene[41,195,265]; geranyl formate; piperitone; α-fenchol[195]	Anti-inflammatory[267], antimicrobial[268], hepatoprotective[103]	Arthritis,[269] backache,[103] cholera,[265] cough and cold,[270] diabetes,[271] dyspepsia,[265] headache,[270] insects bite,[270] menstrual problems,[272] oral problems,[270] pyrexia,[265,272] worm infestation[272], wounds,[103] urinary problems[103]
		Stem bark	*Flavonoid*: (E)-Cinnamaldehyde; (Z)-cinnamaldehyde[41,195] *Hydrocarbon*: δ-Cadinene[41,195]; α-copaene[41,195,264] *Terpinenes*: Camphor; caryophyllene oxide; β-phellandrene; β-pinene[41]; limonene; linalool; β-pinene[41,195,264]; spathulenol[264]; 1,8 cineole; borneol; camphene; geranial; p-cymene; terpinen-4-ol; β-bisabolene; β-caryophyllene; α-fenchol; α-humulene; α-muurolene; α-pinene; α-terpineol[41,195]		
		Bark	Anthraquinones, cyanogenic glycosides, glycosides, leucoanthocyanins, saponins, steroids, triterpenes[103]		
28.	*Cinnamomum tenuifolium* (Makino) Sugim.	Leaves	Ethyl 3,5-dihydroxy-4-nitrobenzoate[273]; 2,3-dihydro-6,6-dimethylbenzo[b][1,5]dioxocin-4(6H)-one[274]; (+) spathulenol, 1,8-cineole, 1-phellandrene, 2 borneol L, benzaldehyde, bicyclo, bornyl acetate, calarene, camphene, carvone, caryophyllene oxide, elemol, limonene, linalool, p-cymen-8-ol, sabinene, terpinen-4-ol, α-pipene, α-terpineol, β-eudesmol, β-myrcene, β-pinene, γ-gurjunene, δ-selinene, δ3-carene.[275] *Enzyme*: l-Kaurene.[276] *Hydrocarbons*: d-δ-Cadinene; l-copaene; ε-cadinene.[276] *Terpenes*: 1,8-Cineole; camphene; camphor; cis-linalool oxide; citronellol; d-cis-yabunikkeol; geraniol; l-caryophyllene; l-linalool; l-trans-yabunikkeol; l-α-phellandrene; l-α-terpineol; limonene; nerol; p-cymene; terpinen-4-ol; trans-linalool oxide; β-elemene; β-myrcene; β-pinene; α-cadinol; α-humulene; α-pinene[276]	Antiangiogenic,[277] anticancer,[278] antimicrobial,[279] antioxidant,[280] antiplatelet aggregation[281]	Anaemia,[282] arthralgia,[282] gastrointestinal pain,[282] lochia,[282] lumbago,[282] respiratory tract problems[90]
		Twig	*Enzyme*: l-Kaurene[276] *Hydrocarbons*: d-δ-Cadinene; l-copaene; ε-cadinene.[276] *Others*: 3-Hexen-1-ol; calamenene; elemol; eugenol; l-carvone; methyl eugenol; safrole; undefined ketone; unidentified alcohol; unidentified sesquiterpene hydrocarbon(SHC); β-calacorene; α-calacorene; α-terpinyl acetate.[276] *Terpenes*: 1,8-Cineole; camphene; camphor; cis-linalool oxide; citronellol; d-cis-yabunikkeol; geraniol; l-caryophyllene; l-linalool; l-trans-yabunikkeol; l-α-phellandrene; l-α-terpineol; limonene; nerol; p-cymene; terpinen-4-ol; trans-linalool oxide; β-elemene; β-myrcene; β-pinene; α-cadinol; α-humulene; α-pinene[276]		
		Branchlets	*Hydrocarbons*: d-δ-Cadinene; l-copaene; ε-cadinene.[276] *Terpenes*: 1,8-Cineole; camphene; camphor; cis-linalool oxide; citronellol; d-cis-yabunikkeol; geraniol; l-caryophyllene; l-linalool; l-trans-yabunikkeol; l-α-phellandrene; l-α-terpineol; limonene; nerol; p-cymene; terpinen-4-ol; trans-linalool oxide; β-elemene; β-myrcene; β-pinene; α-cadinol; α-humulene; α-pinene[276]		

Table 1 (Continued)

S. No.	Plant	Part used	Chemical constituent	Pharmacological activity	Medicinal use
		Stem	Tenuifolide A [(4S,3Z)-4-hydroxy-5-methylene-3-heptacosylidenedihydrofuran-2-one]; isotenuifolide A [(4S,3E)-4-hydroxy-5-methylene-3-heptacosylidenedihydrofuran-2-one]; tenuifolide B [3-(1-methoxyeicosyl)-5-methylene-5H-furan-2-one]; secotenuifolide A {methyl[(2E)-2-[(1R)-1-hydroxy-2-oxopropyl]heptacos-2-enoate]}; tenuifolin {(3-methoxy-5H-9,11-dioxabenzo[3,4]cyclohepta[1,2-f]) inden-7-yl) methanol}[278]; (+)-sesamin, (+)-syringaresinol, 4-allylcatechol, alpinenone, catechin, *epi*catechin, eugenol 4-O-methyl ether, ferulic acid, isoobtusilactone A, isotenuifolide A, myristicin, obtusilactone A, p-hydroxybenzaldehyde, palmitic acid, secotenuifolide A, stearic acid, tenuifolide A and B, tenuifolin, β-sitostenone, β-sitosterol, β-sitosterol-D-glucoside[278]		
29.	*Cinnamomum travancoricum* Gamble	Bark	Anthraquinones, cardiotonic glycosides, cyanogenic glycosides, leucoanthocyanins, saponins, steroids, triterpenes,[103] essential oils, fixed oils, sapanin, sugar, tannins, triterpenoids[109]	Antimicrobial,[268] cytotoxic,[109] hepatoprotective[103]	Asthma,[283] backache,[103] cough and cold,[283] dental diseases,[283] mouth diseases,[283] thirst,[283] vomiting,[283] wounds,[103] urinary problems[103]
		Leaf	Essential oils, sapanin, sugar, tannins, triterpenoids.[109]		
30.	*Cinnamomum tazia* (Buch.-Ham.) Kosterm. ex M.Gangop.	Leaf	*Flavonoids*: (Z)-Cinnamaldehyde; cinnamaldehyde (=(E)-cinnamaldehyde).[41,284] *Hydrocarbon*: Azulene.[114] *Terpinenes*: (E)-Nerolidol; 1,8-cineole; borneol; camphene; caryophyllene oxide; cis-linalool oxide (furanoid); limonene; linalool; p-cymene; sabinene; terpinen-4-ol; trans-linalool oxide (furanoid); β-pinene; α-pinene; α-terpineol.[41,284] cineol; limonene; terpineol[114]	Antioxidant[285]	Asthma,[286] bronchitis,[286] cardiac problems,[114] diarrhoea,[286] dysentery,[55] muscular strains,[114] nausea,[286] rheumatism,[114] stomach disorder,[41,284] skin diseases[114]
		Stem	*Flavonoids*: (Z)-Cinnamaldehyde; cinnamaldehyde (=(E)-cinnamaldehyde)[41] *Hydrocarbon*: Azulene.[114] *Terpinenes*: (Z)-β-Farnesene;(E)-nerolidol; (E,E)-α-farnesene; 1,8-cineole; borneol; camphene; caryophyllene oxide; linalool; p-cymene; terpinen-4-ol; β-caryophyllene; β-pinene; α-humulene; α-pinene; α-terpineol[41]; cineol; limonene; terpineol[114]		
		Root bark	*Flavonoids*: (Z)-Cinnamaldehyde; cinnamaldehyde (=(E)-cinnamaldehyde)[41] *Terpinenes*: (E)-Nerolidol; (E,E)-α-farnesene; 1,8-cineole; borneol; camphene; caryophyllene oxide; cis-linalool oxide (furanoid); limonene; linalool; p-cymene; T-cadinol; terpinen-4-ol; terpinolene; trans-linalool oxide (furanoid); β-caryophyllene; β-pinene; α-cadinol; α-humulene; α-pinene; α-terpineol[41]		
31.	*Cinnamomum walaiwarense* Kosterm.	Bark	Anthraquinones; cardiotonic glycosides; cyanogenic glycosides; leucoanthocyanins; saponins; steroids; triterpenes[103]; essential oils; fixed oils; sapanin; sugar; tannins; triterpenoids[109]	Antimicrobial,[268] antioxidant,[287] cytotoxic,[109] hepatoprotective,[103] hypoglycaemic[287]	Backache,[103] headaches,[288] menstrual problems,[288] pyrexia,[288] urinary problems,[103] wound[103]
		Leaf	Essential oils; sapanin; sugar; tannins; triterpenoids[109]; benzyl benzoate[287]		
32.	*Cinnamomum wightii* Meisn.	Bark	Cinnamic aldehyde, cinnamyl acetate[289]	Antioxidant,[290] cytotoxic,[109] hepatoprotective,[103] larvicidal[291]	Abdominal disorders,[289,292] colic,[292] constipation,[292] cough and cold,[289,292] diarrhoea,[292] dysuria,[289,292] gynaecological disorders,[292,293] headache,[293] indigestion,[289,292] insect bite,[292] mumps,[289] nerves disorder,[294] paralytic disorders,[292] pyrexia,[293] rheumatism,[292] stress,[294] worm infestation,[292] wounds[293]
		Leaves	*Flavonoid*: Cinnamic aldehyde; quercetin- 3-0-rutinoside; terpinenes: α-pinene; p- cymene; β-pinene; limonene; geraniol[292]		
33.	*Cinnamomum wilsonii* Gamble	Bark	Cinnamic aldehyde; eugenol; methyl eugenol; mucilage; phellandrene; tannin[295]	Anticancer,[296] antioxidant,[297] immunomodulatory[296]	Abdominal disorders,[295,296] anaemia,[295] lumbago,[295] wounds[295,296]
		Leaves	(+)-(6S,7E,9Z)-Abscisic ester; apocynol A, lasianthionoside A, wilsonols A-I[296]		

Table 2 Details of clinical trials[32] with keyword 'cinnamon'

Clinical trials	Title	Status	Study results
NCT01301521	Cinnamon trial-lifestyle intervention plus water-soluble cinnamon extract on lowering blood glucose in pre-diabetics	Active, not recruiting	No results available[32]
NCT03778099	The effect of cinnamon on ovulation induction in women with polycystic ovary syndrome	Recruiting	No results available[32]
NCT01302743	Cinnamon bark, water-soluble cinnamon extract, and metformin for treatment of type 2 DM	Terminated	No results available[32]
NCT01847053	Bioavailability study of cinnamon in healthy subjects	Completed	No results available[32]
NCT00331279	The effect of cinnamon extract on insulin resistance parameters in polycystic ovary syndrome: a pilot study	Completed	No results available[32]
NCT00445354	Randomized controlled clinical trial of cinnamon to lower haemoglobin A1c	Completed	No results available[32]
NCT00371800	The effect of cinnamon on HbA1c among adolescents with type I diabetes	Completed	No results available[32]
NCT01483118	Cinnamon extract on menstrual cycles in polycystic ovary syndrome (PCOS)	Completed	The changes in insulin resistance parameters in overweight patients with PCOS between baseline and after 6 months of daily cinnamon compared to the corresponding change in patients receiving 6 months of placebo. Higher values of insulin resistance represent a worse outcome. A higher value homoeostasis model of insulin resistance indicates more insulin resistance so higher values are worse outcomes (a score of >2 is considered healthy for adults with scores >5 being considered severe insulin resistance). For the Quant. Insulin Sensitivity Check Index, a lower value indicates more insulin resistance so lower values are worse outcomes (values can range from 0.45, which is considered normal in health individuals and 0.30, which is characteristic of diabetes)[32]
NCT00237640	Effect of cinnamon on glucose and lipid levels in non-insulin dependent type 2 diabetes mellitus	Completed	No results available[32]
NCT00951639	Cassia cinnamon for glucose uptake in young women	Completed	No results available[32]
NCT00846898	Is there a metabolic effect of cinnamon on HbA1c, blood pressure and serum lipids in type 2 diabetes mellitus?	Completed	No results available [32]
NCT00970541	Effect of cinnamon extract on insulin resistance in polycystic ovary syndrome	Terminated	No results available[32]
NCT03061916	Cinnamon and ginger in comparison to chlorhexidine gluconate 0.2% on oral *Streptococcus mutans*	Unknown status	No results available[32]
NCT03219411	Effects of Cinnamon supplementation on glucose metabolism in patients with pre-diabetes	Active, not recruiting	No results available[32]
NCT02942056	The effect of cinnamon cassia on diabetes control and cardiometabolic risk factors in adults with type 2 diabetes mellitus	Not yet recruiting	No results available[32]
NCT00479973	The anti-diabetic and cholesterol-lowering effects of cinnamon and cassia bark	Unknown status	No results available[32]

Table 2 (*Continued*)

Clinical trials	Title	Status	Study results
NCT02455778	Effect of oral cinnamon intervention in metabolic syndrome	Completed	No results available [32]
NCT01027585	The effects of cinnamon on postprandial blood glucose, and insulin in subjects with impaired glucose tolerance	Completed	No results available[32]
NCT03711682	Reducing plasma glucose effect of cinnamon in type 2 diabetic patients in the Municipality of Comasagua	Completed	No results available[32]
NCT01734187	Efficacy and safety of fermented cinnamon vine powder on decrement of body fat	Unknown status	No results available[32]
NCT03813914	A new supplement for the 'metabolic syndrome'	Completed	No results available[32]
NCT01350284	The effect of natural food flavouring on gastrointestinal and cardiovascular physiological responses	Completed	No results available [32]
NCT03061799	Efficacy and safety of HPC-03 for postmenopausal symptom	Unknown status	No results available[32]
NCT01530685	Gycabiane and glycemic control of prediabetic subjects	Unknown status	No results available [32]
NCT02074423	A human clinical trial evaluating the effect of MealShapeâ „¢ on blood glucose level following consumption of standard meal	Completed	No results available[32]
NCT03388762	RCT of a polyherbal dietary supplement for prediabetes	Recruiting	No results available[32]

Chemical composition of cinnamon

Polyphenols and volatile phenols are the two chemical classes which are isolated from *C. zeylanicum*. Cinnamon mostly contains ferulic acids, caffeic, gallic, vanillic, protocatechuic and *p*-coumaric along with the polyphenols (Figure 1a).[33] The chemical composition of cinnamon essential oil in regard to volatile components is depended on the plant part from which they are extracted. Cinnamaldehyde (Figure 1b) with a content ranging from 90% to 62%–73% is the most represented substance extracted from bark essential oil.[34] Hydrocarbons and oxygenated compounds (i.e. benzyl benzoate, β-caryophyllene, cinnamyl acetate, linalool and eugenyl acetate) are the other minor volatile compounds (Figure 1b). Eugenol having higher concentration >80% and (E)-cinnamyl acetate and caryophyllene is the main component of cinnamon leaf oil and cinnamon flowers and fruit (Figure 1b).[35–37]

Conclusion

Modern and traditional medicinal along with the chemical and pharmaceutical system is mostly dependent on medicinal plants for their drug requirements. Aromatic plants are mostly used for fragrances, cosmetics and health beverages. Researchers and scientist examine the medicinal plants to improve the drug development. At present scenario, about three-quarters of the world population depends on these medicinal plants for health concerns. Cinnamon bark has various chemical compounds used as a spice all over the world. Cinnamon has been shown to possess different biological and pharmacological actions for the treatment of various diseases such as cancer, diabetes, inflammation, microbial infection, nerves disorder, abdominal disorder, asthma, bronchitis, urinary infection, arthritis, anaemia and blood pressure because of their bioactive compounds. So, cinnamon as a multipurpose medicinal spice plays an important role in modern medicine system. As we know, in modern era all people attracted to herbal medicine to treat various ailments safely. Therefore, in this review, we summarized the pre-existing studies on the in-vivo and in-vitro pharmacological activity of *Cinnamomum*. However, various scientists identified many compounds but extensive research is still needed to explore the mechanism and function of other unidentified compounds to fight which can be used to cure several diseases.

Declarations

Conflict of interest

The authors declare no conflict of interests.

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Author contributions

All authors participated in the search and analysis of the articles and books, and also in the writing of the manuscript. All authors have read and approved the final manuscript.

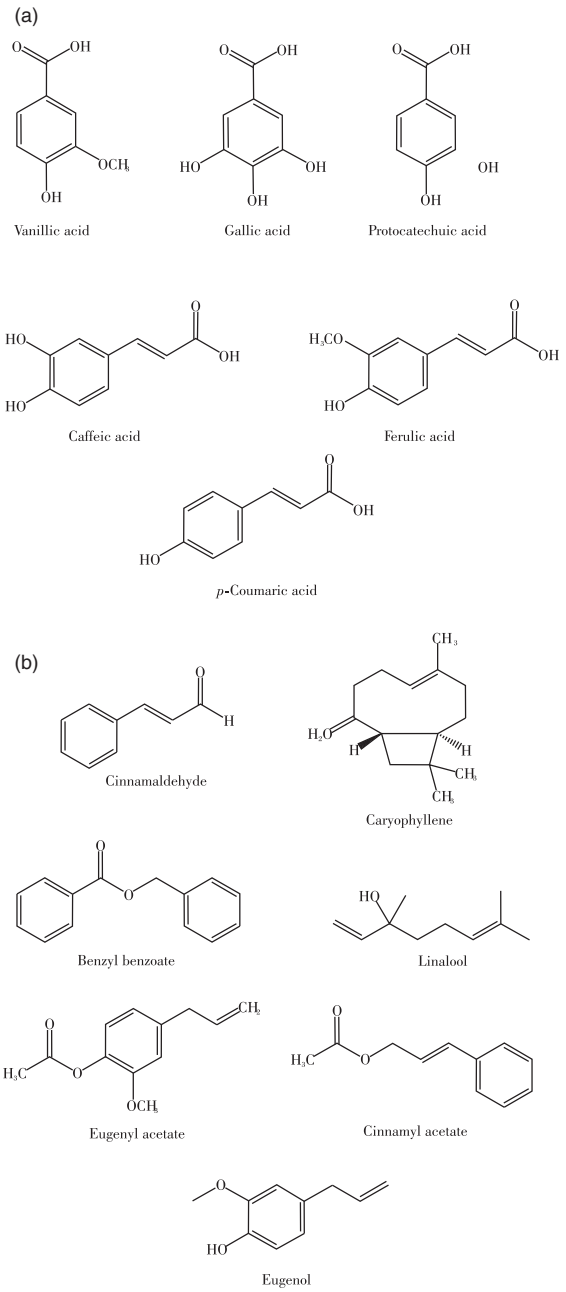

Figure 1 (a) Polyphenolic constituents and (b) chemical compounds of cinnamon essential oil.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Figure S1. Benefits of cinnamon.