

A DIVERSE THERAPEUTICALLY USEFUL HERB ; **CINNAMON**

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Abstract

Cinnamon is obtained as a bark from the plant, *C. Verum*. An over the counter available herb contributes to many health benefits. In vitro and vivo studies said cinnamon is good for health and specially helps in maintaining low blood sugar level. It has also been found that cinnamon possesses these activities- anti-fungal, antiviral, anti-microbial, anti-tumour, antioxidant, hypotension, lipid lowering, cholesterol and gastro protective properties. Cinnamon is widely used in anti tumour activity as a herbal medicine. cinnamon have the potential to be used as a antibacterial agent. The present paper will enlighten about the healing properties of the Cinnamon and how a common man can even be benefitted by the use of this herb/spice.

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INTRODUCTION

Botanical classification of cinnamon is: division Magnoliophyta; class Magnoliopsida; order Magnoliales; family Lauraceae and genus *Cinnamomum*.^[1] Sri Lanka and South India are the native place of cinnamon's origin. About 60% of cinnamon is produced from Sri Lanka in the form of cinnamon bark or quills, leaf oil and bark oil.^[2]

Cinnamon spice is found in market as quills or powder and it is an aromatic and flavouring compound. Cinnamon is easily crushed and powdered as it is brittle in nature and when it is extracted from plant it has a single spiral curl. The flavour of cinnamon is less intense, less bitter and its after taste is sweet and the colour of cinnamon bark is pale yellowish brown.^[1]

Composition of cinnamon per 100g is: Water 10.00g; Energy 355kcal; Proteins 4.50g; Fat 2.20g; Carbohydrates 79.8g; Ash 3.50g; Calcium 1.60g; Phosphorus 50mg; Sodium 10mg; potassium 400mg; Iron 4.10; Thiamine 0.140mg; Riboflavin 0.21mg.^[2] Vitamins(mg/100g): B₁ 0.14; B₂ 0.21; C 39.8; Niacin 1.9; A 175 I.U.^[1]

Cinnamon contains different volatile oils like Bark oil, Leaf oil, Root bark oil, Flower oil and Fruit oil. Leaf oil and bark oil are mainly used in perfumery and flavouring.

Bark oil- Cinnamon bark contains volatile oil which varies from 0.4 to 2.8% and the major component of bark oil is cinnamaldehyde.

Leaf oil- Depending on the location and method of distillation *Cinnamomum verum* leaves contain 0.23-3.0% volatile oil and the major component of leaf oil is eugenol, varied from 65 to 92%.

Root bark oil- The root bark of *C. Zeylanicum* contains 2-3% volatile oil and the major component of root bark oil is camphor. As a chief component cinnamon contains camphor (56.2%) and 1,8-cineole (11.7%).

Flower oil- Cinnamon's buds and flowers contained 0.04% volatile oil and the major component of flower oil is (E)- cinnamyl acetate (22%).

Fruit oil- 0.32 and 0.33% volatile oil are respectively contained by the fruits and pedicels of fruits of cinnamon. The fruit oil contain 43.4%(E)- cinnamylacetate and 27.4 % linalool and pedicelsof fruits oil contains (E)- cinnamyl(58.1%), linalool (13.1%) and β - caryophyllene (11.1%).^[2]

In widely cinnamon used as a spice but it also used as flavouring agent in bakery products, chewing gum, and deserts. In Indian cuisine cinnamon is used in currie, pilaus and it is very important in ingredient in garam masala. It is commonly used in beverages, pickels, chutney and ketchup to enhance their flavour. In the food industry cinnamon is very commonly used for de-odouring or masking in the USA. Mainly cinnamon's bark oil is used in the flavouring industry, where it is used in meat and fast food seasonings, baked goods, sauce, confectionary, pickles, cola-type drinks, tobacco flavour and in dental and pharmaceutical preparations. Cinnamon have anti-fungal and anti- bacterial agent, therefore it slowing meat spoilage, so its use as a spice for meat dishes in warmer climates is sensible. From ex-eugenol cinnamon leaf oil the iso-eugenol is derived and it is another flavouring agent in confectionary and liqueurs.^[1]

For centuries cinnamon has been used by several cultural practices. Due to many stated health benefits, cinnamon possesses a rising popularity in culinary uses. In many studies *Cinnamomum aromaticum* (cassia) and *Cinnamomum zeylanicum* are used as a subject. In vitro and vivo studies said cinnamon is good for health and specially helps in maintaining low blood sugar level. It has also been found that cinnamon possesses these activities- anti-fungal, antiviral, anti-microbial, anti-tumour, antioxidant, hypotension, lipid lowering, cholesterol and gastro protective properties.^[3]

Cinnamon has medicinally and pharmacological properties. In Ayurvedic and Unani medicine cinnamon present as an ingredient. Cinnamon bark is antonic, aphrodisiac, anthelmintic. In the treatment of heart disease, urinary disease, bronchitis, itching, biliousness, parched mouth and diarrhoea, vata cinnamon bark is very useful. Also very useful in hydrocoele, flatulence, piles and

headache,^[2] arthritis, menstrual disorder, oedema, flu, cold, hiccups, muscle tension, liver problem, nausea and vomiting. From low metabolic pain it assist uterine contractions during labour pain and menstrual pain.^[1]

Cinnamon's bark, fruits, leaves, root bark, buds, and flowers has volatile oils which is isolated by hydro distillation or steam distillation and supercritical fluid extraction. Volatile oils of stem bark and root bark consist of two major compounds cinnamaldehyde and camphor, respectively and the major component of leaf oil is eugenol. In flowers, fruits and fruit stalks Transcinnamyl acetate is present as a major compound. Volatile oils are help in antidiabetic, antioxidant and antimicrobial activities.^[4]

REVIEW OF LITRATURE

The study shows the role of different component of cinnamon in different disease.

Role of cinnamon in Diabetes mellitus-

Cinnamon mainly helps in maintaining blood glucose level in type 2 diabetes mellitus. It consist methyl hydroxy chalcone polymers which helps in lowering blood sugar level.^[5] Various in vitro and in vivo researches shows the effect of cinnamon in insulin. A research in diabetic mice proved that cinnamon decrease the blood glucose level, triglyceride level and total cholesterol while increasing the level of HDL cholesterol. The first research of cinnamon's effects in type 2 diabetes mellitus was done in Pakistan. The study was taken for 40 days in three different doses of cinnamon powder is 1, 3 and 6 g per day and all doses shows the same effects in reducing blood glucose level in fasting state (18-29%), LDL cholesterol (7-27%), total cholesterol (12-26%) and triglyceride (23-30%) levels.^[6]

A study mentioned that cinnamon polyphenol's (CP) activity as a insulin in cells of people and animal with type 2 diabetes mellitus. Cinnamon polyphenol increase the activity of tyrosine phosphorylation to activates insulin receptor (IR) and inactivates the insulin receptor by decrease the activity of phosphatase. Amount of insulin receptor β (IR β) and glucose transporter 4 (GLUT4) protein are increased by cinnamon polyphenol and the protein increases the activity of glycogen synthase and glycogen accumulation with decreases the activity of glycogen synthase

kinase-3 β (GSK3 β).^[7] Cinnamon is also used as diabetes medicine in Ayurveda. Therapeutically it is proved that cinnamaldehyde, works as an anti-diabetic agent.^[2]

Anticancer activities of cinnamon-

Cinnamon is widely used in anti tumour activity as a herbal medicine. A study shows in vitro and in vivo anti-tumour activity of cinnamon. Cinnamaldehyde is the component of cinnamon which is used to control proliferation of many human cancer cell lines like ovarian, breast, leukaemia and lungtumour cells. Recently a comparative study shows the cytotoxic effect of aqueous extract of cinnamon (ACE) which is extracted from *C. Zeylanicum* with commercial cinnamaldehyde on different cell lines. In this comparative study ACE proved that it is more cytotoxic in the presence of polyphenolic compounds than commercial cinnamaldehyde. A recent study proved that aqueous extract of cinnamon (ACE-c) from bark of *Cinnamomum cassia* L. family Lauraceae inhibit the cancer cell growth in a human cervical cancer cell line.^[8]

Anti-inflammatory activities of cinnamon-

The study found the cinnamon (*cinnamomum zeylanicum*) bark essential oil (CBEO) effects on human skin cells, earlier it was not elucidated. In a validated human dermal fibroblast system, a model of chronic inflammation and fibrosis the study investigated the activity of commercially available CBEO. Firstly on 17 protein biomarkers it evaluated the impact of CBEO. In inflammation and tissue remodeling, 17 protein biomarkers play a very critical role. On genome-wide gene expression impact of CBEO was also evaluated. On skin cells CBEO showed strong anti-proliferative effects and the production of many inflammatory biomarkers significantly inhibited. Global gene expression is significantly modulated by CBEO and the CBEO also altered signaling pathways, numerous of which are important in inflammation, cancer biology and tissue remodeling. Therefore the study proved that cinnamon bark essential oil (CBEO) is an anti-inflammatory agent.^[9]

A study shows that on acute inflammation in mice was effective because the ethanolic extract (70%) of cinnamon and another study shows that on ocular inflammation in rabbits was found to be effective as an anti inflammatory agent because of 'Ophthacare' containing 0.5% cinnamon, which is a herbal ophthalmic preparation.^[2]

Antioxidant activities of cinnamon-

Due to the antioxidant property, cinnamon and its essential oil have been used as preservatives in food.^[2] This is a study which shows the effect of cinnamon supplementation on antioxidant status in women with polycystic ovary syndrome (PCOS). The study was conducted on obese PCOS patients in the age group between 20-38 years. 42 people were supplemented by 3 cinnamon capsules (each one contains 500mg cinnamon) and the other 42 people were supplemented by placebo daily for 8 weeks. Data of anthropometric measurement, fasting blood samples and dietary intake were collected at the starting and the end of the research. For analysing the data they used paired t test, independent t test and analysis of covariance. The result of the study shown serum total antioxidant capacity was significantly increased by cinnamon. Therefore it is proved that cinnamon supplementation increase antioxidant status in our body.^[10]

A study was conducted on fish were fed on diets enriched with 0.0, 0.25, 0.5, 0.10, 3.0, 5.0 and 10.0 g cinnamon nanoparticles (CNP) for 8 weeks to evaluate the effect of dietary CNP on the growth performance, antioxidant and digestive enzymes activities. Fish were challenged against hypoxia stress or pathogenic bacteria (*Aeromonas hydrophila*) infection after the feeding trial. Over the control diet fish performance was improved with increasing the CNP levels. Against *A. Hydrophila* infection CNP protected the fish and during hypoxia stress among all treatments, no fish mortality was observed. After bacterial challenge also there no fish mortality was observed. Therefore the study proved that CNP increase the antioxidant activity.^[11]

Antimicrobial activities of cinnamon-

Cinnamon oil and its extracts shows many anti microbial activity against bacteria, fungi, virus, etc.^[2] This is a study which shows the antimicrobial activity of cinnamon. Cinnamaldehyde and essential oil are component of cinnamon and both are effective in growth of bacteria (*Staphylococcus aureus*, *E. Coli*, *Enterobacter aerogenes*, *Pseudomonas aeruginosa*, *Vibrio parahaemolyticus*, *Vibrio cholerae* and *Salmonella typhimurium*), fungi including yeasts (*C. albicans*, *C. Tropicalis*, *C. Glabrata*, and *C. Krusei*), filamentous molds (4 isolates, three *Aspergillus* spp. and one *Fusarium* sp.) and dermatophytes (*Microsporum gypseum*, *Trichophyton rubrum* and *T. Mentagraphytes*). By agar dilution method their minimum concentration method (MIC) as determined and varied only slightly. Both oil and

cinnamaldehyde's minimum inhibition concentrations (MIC) for bacteria ranged from 75 µg/ml to 600 µg /ml, for yeasts from 100 µg /ml to 450 µg /ml, for filamentous fungi from 75 µg /ml to 150 µg /ml, and for dermatophytes from 8.8 µg /ml to 37.5 µg / ml. Therefore the antimicrobial effectiveness is due to cinnamon is proved by this study.^[12]

Antibacterial activities of cinnamon-

As we all know cinnamon have the potential to be used as a antibacterial agent.^[2] This is a study which shows the antibacterial activity of cinnamon. In this study they investigated the antibacterial activities of the essential oils from leaves of two *Cinnamomum osmophloeum* clones (A and B) and their chemical constituents. In the antimicrobial tests the nine strains of bacteria, including *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterococcus faecalis*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, methicillin- resistant *Staphylococcus aureus* (MRSA), *Klebsiella pneumoniae*, *Salmonella sp.*, and *Vibrio parahemolyticus*, were used. Antimicrobial tests result shows that the indigenous cinnamon B leaf essential oils had an excellent inhibitory effect. Against the other seven strains of bacteria the minimum inhibitory concentrations (MICs) of leaf oil were 250 µg/ml and 500 µg/ml against both *K. Pneumoniae* and *salmonella sp.*. Against the *E. Coli*, *P. Aeruginosa*, *E. Faecalis*, *S. Aureus*, *S. Epidermidis*, MRSA, *K. Pneumoniae* *Salmonella sp.*, and *V. Parahemolyticus* the MICs of cinnamaldehyde were 500, 1000, 250, 250, 250, 250, 1000, 500, and 250 µg/ml , respectively. Therefore the results proved that *C. Osmophloeum* leaf essential oil and cinnamaldehyde are beneficial for health and used as a natural anti-bacterial additives.^[13]

Antifungal activities of cinnamon-

Cinnamomum osmophloeum possesses significant antifungal activity. To check the antifungal activity of leaf essential oils and dominant constituent from *C. Osmophloeum*, collected the essential oils of leaves from three clones (A, B, and C) from Haw-Lin experimental forest were extracted and by gas chromatography analyzed their components. By the antifungal test results demonstrated that essential oil of both B and C leaves had strong inhibitory effects. Against five strains of white rot fungi and four strains of brown rot fungi the antifungal activities of these two leaf oils at 100 ppm were all 100%. The major compound in *C. Osmophloeum* leaf essential oils is cinnamaldehyde, which possessed the strongest antifungal activities compared with the other

components. Against both *Corioulus versicolor* and *Laetiporus sulphurous* its antifungal indices were 100%. Against both *C. vesicolor* and *L. Sulphurous* the minimum inhibitory concentration (MIC) was 50 and 75 ppm, respectively. Therefore in this study comparisons of the antifungal indicates of cinnamaldehyde's congeners proved that cinnamaldehyde exhibited the strongest antifungal activities.^[14]

Effect of cinnamon on Menstruation-

Just before or during menstruation primary dysmenorrhea is defined as a cyclic and painful cramps pelvic occurs, which effects daily activities. In young women primary dysmenoechea is one of the most common gynaecologic disorders, which affect half of menstruating women. By ovulation prostaglandin is produce and this is the main cause of primary dysmenorrhea. Due to intestinal spasms during menstruation, nausea, vomiting and diarrhoea are associated with primary dymenorrhea. This is a study which shows the cinnamon effect on primary dysmenorrhea. The study was conducted on 76 Iranian female college students from Ilam University of Medical Sciences (west of Iran) during 2013-2014. Under 76 students 38 received placebo (capsules containing starch, three times a day, TDS) and 38 received cinnamon (capsules containing 420mg cinnamon, TDS), in 24 hours. To determine the severity of pain and nausea visual analogue scale (VAS) was used. By counting the number of saturated pads vomiting and menstrual bleeding were assessed and during the first 72 hours of the cycle the parameters were recorded in the group. The amount of menstrual bleeding of cinnamon group was lower than the placebo group ($P < 0.05$ and $P < 0.001$, respectively). At various intervals the pain severity score in the cinnamon group was less than the placebo group (4.1 ± 0.5 vs. 6.1 ± 0.4 at 24 hours, 3.2 ± 0.6 vs. 6.1 ± 0.4 at 48 hours, and 1.8 ± 0.4 vs. 4.0 ± 0.3 at 72 hours, respectively) ($P < 0.001$). The severity of nausea and the frequencies of vomiting of cinnamon group were lower than placebo group at various intervals ($P < 0.001$, $P < 0.05$). Therefore the study proved that cinnamon is effective on reducing pain, menstrual bleeding, nausea and bleeding with primary dysmenorrhea, without side effects and it can be regarded as a safe and effective treatment for dymonrrohea in young womens.^[15]

Cinnamon effects on Metabolic Syndrome-

Globally, cardiovascular diseases (CVDs) are the major risk factors of death in recent days. CVD is one of the most undeniable reasons of metabolic syndrome. Metabolic syndrome is a complex of diseases which includes insulin resistance, high blood sugar, obesity, high blood pressure and dyslipidemia. All over the world *Cinnamomum verum* is a medicinal global plant which has been used daily by people. Cinnamon has a positive effect in reducing blood pressure, plasma glucose, obesity and ameliorating dyslipidemia which use as decreasing metabolic syndrome's complications agent. On traditional medicine based evidence and recent scientific based evidence proved that cinnamon and its active ingredients such as cinnamaldehyde, cinnamyl acetate and its active ingredients like cinnamaldehyde, cinnamate, cinnamic acid and eugenol in the forms of aqueous and alcoholic extracts have a variety of therapeutic effects. Cinnamon extracts ameliorate the different aspects of metabolic syndrome including high blood, dyslipidemia, obesity and high blood pressure. Therefore the investigation showed that cinnamon is a cardiovascular protective agent and has a potential effect in reducing metabolic syndrome complications due to its anti-diabetic, anti-oxidant, anti-inflammatory and beneficial effects in lipid profile. ^[16]

Anthelmintic activity of Cinnamon-

Anti-inflammatory and antimicrobial effects of cinnamon (*Cinnamomum verum*) have shown, but effects on parasitic worms of the intestine have not been investigated. Against the swine nematode *Ascaris suum*, extracts of cinnamon bark were shown to have potent in vitro Anthelmintic properties. Cinnamon bark extract's analysis revealed high concentrations of paranthocyanidins (PAC) and trans-cinnamaldehyde (CA). To thiolysis and HPLC-MS analysis, the PAC were subject which demonstrated that they were exclusively procyanidins, had a mean degree of polymerization of 5.2 and 21% of their inter-flaven -3-ol links were A-type linkages. The PAC purification revealed that although they had activity against *A. Suum*, most of the potency of the extract derived from CA. To CA *Trichuris suos* and *Oesophagostomum dentatum* larvae were similarly susceptible. To test even CA could decrease *A. Suum* infection in pigs in vivo and CA was targeted as an encapsulated dose or administered daily in the diet. After all, infection was not significantly reduced but it is advised that the rapid absorption or metabolism of CA in vivo may prevent it from being present in sufficient concentration in situ to exert efficacy. Therefore the study proved that cinnamon bark is effective in Anthelmintic activity. ^[17]

Cinnamon effects on Helicobacter pylori-

In this study on Helicobacter pylori Ethanol and methyl chloride extracts of cinnamon were compared to show their effect. The reason behind to inhibit growth of H. pylori methylene chloride extract was found and ethanol extract counteracted its urease activity. At concentration range of common antibiotics, cinnamon extract (from methylene chloride) inhibited H. Pylori. In solid medium (egg yolk emulsion agar) complete inhibition in vitro was achieved by 50 µg/ml and by 15 µg/ml in liquid medium (supplemented brain heart infusion broth). On whole cell urease cinnamon extracts were more inhibitory than on free urease.^[18]

CONCLUSION

Cinnamon is obtained from the plant C. Verum and the origin of cinnamon is from Sri Lanka and South India. In the market it is found as a quills or powder. Cinnamon is generally used as a spice and the after taste of cinnamon is sweet. Nutritionally cinnamon consist water, energy, carbohydrate, protein, fat, ash, vitamins and minerals. Chemically cinnamon consists of bark oil, leaf oil, root bark oil, flower oil and fruit oil.

Cinnamon is widely used in food industry to enhance the flavour of foods like used in meat and fast food seasonings, pickles, baked goods, sauce, cola-type drinks, confectionery and liqueurs.

As we all know cinnamon is used as a spice to enhance the flavour of foods but cinnamon is also have the many medicinal properties like helps in maintaining low blood sugar level. Cinnamon possesses these activities- antiviral, anti-fungal, antibacterial, anti- microbial, anti-inflammatory, antioxidant, anti-tumour, hypotension, lipid lowering, cholesterol and gastro protective properties. Cinnamon also helps in the treatment of heart disease, urinary disease, bronchitis, itching, biliousness, parched mouth, arthritis, menstrual-disorder, oedema, flu, cold, hiccups, muscle tension, liver problem, diarrhoea, nausea and vomiting. Therefore the whole study shows that cinnamon is very beneficial for our health and helps in reduce and cure the diseases or disorders.

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