Cinnamon: A Multifunctional Medicinal Plant

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ABSTRACT: Cinnamon (Cinnamomum zeylanicum), belongs to family Lauraceae, is an evergreen tree, a member of family Lauraceae, has been used in daily routine as a condiment and spice found in tropical area of India. Cinnamon is mainly composed of essential oils and its other constituents are cinnamic acid, cinnamate and cinnamaldehyde. It possesses excellent anti-oxidant, anti-inflammatory, anti-ulcer, hypoglycemic, anti-microbial and hypolipidemic activities. It can be used as safer and useful drug in allergic conditions also. So, cinnamon can be used as a potential constituent in pharmaceutical industry.

Key words: Cinnamon, antioxidant, anti-inflammatory, anti-microbial

INTRODUCTION

Cinnamon (Cinnamomum zeylanicum) is a small evergreen tree, 10-15 meters tall, belongs to the family Lauraceae and is native to South India and Sri Lanka (Jakhetia et al., 2010). The word cinnamon comes from the Greek kinnamomon. There are found four major varieties of cinnamon, Cassia cinnamon (Cinnamomum cassia) and Ceylon cinnamon (Cinnamomum zeylanicum) are the most popular among them. Ceylon cinnamon is sometimes said to be "true cinnamon (Vangalapati et al., 2012). Flowers of cinnamon are of greenish colour, which are arranged in panicles and have a distinct odour. Its flavour is due to the presence of aromatic essential oils which makes up 0.5 to 1% of its composition (Jakhetia et al., 2010). Cinnamon barks are also widely used as flavoring agent in foods and for various other applications in drugs (Kankeaw and Masong, 2015).

Cinnamon has also been used traditionally as a remedy for oral diseases like gum swelling and toothache (Abidin et al., 2013).
Phytochemistry

Cinnamon is comprised of a range of resinous compounds, including cinnamate, cinnamaldehyde, cinnamic acid and several essential oils (Rao and Gan., 2014).

Table 1: Constituents of Cinnamon

<table>
<thead>
<tr>
<th>Parts of Cinnamon</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit</td>
<td>β-caryophyllene</td>
</tr>
<tr>
<td></td>
<td>Trans-cinnamyl acetate</td>
</tr>
<tr>
<td>Buds</td>
<td>Alpha Bergamotene - 27.38%</td>
</tr>
<tr>
<td></td>
<td>Terpene hydrocarbons - 78%</td>
</tr>
<tr>
<td></td>
<td>Oxygenated terpenoids - 9%</td>
</tr>
<tr>
<td></td>
<td>Alpha - Copaene - 23.05%</td>
</tr>
<tr>
<td>Flowers</td>
<td>Trans-alpha bergamotene - 7.97%</td>
</tr>
<tr>
<td></td>
<td>Cinnamyl acetate - 41.98%</td>
</tr>
<tr>
<td></td>
<td>Caryophyllene oxide - 7.2%</td>
</tr>
<tr>
<td>Leaves</td>
<td>Eugenol - 70 to 95%</td>
</tr>
<tr>
<td></td>
<td>Cinnamaldehyde - 1 to 5%</td>
</tr>
<tr>
<td>Bark</td>
<td>Eugenol - 5 to 10%</td>
</tr>
<tr>
<td></td>
<td>Cinnamaldehyde - 65 to 80%</td>
</tr>
<tr>
<td>Root Bark</td>
<td>Camphor - 60%</td>
</tr>
</tbody>
</table>

The major compounds identified and isolated in cinnamon (*C. zeylanicum*) belong to two chemical classes: volatile phenols and polyphenols. Among polyphenols, vanillic acid, caffeic acid, gallic acid, protocatechuic acid, p-coumaric acid, and ferulic acid are present. However, with regards to volatile components, the chemical composition of cinnamon essential oils depends on the part of the plant from which they are extracted. The other minor volatile compounds are hydrocarbons and oxygenated compounds i.e., benzyl benzoate, β-caryophyllene, linalool, cinnamyl acetate and eugenyl acetate (Nabavi et al., 2015). Some compounds which are present in lesser percentages those are Cinnamic acid, Coumarin, Hydroxyl Cinnamaldehyde, Cinnamyl alcohol, Cinnamyl acetate, Borneol etc. (Vangalapati et al., 2012).

Antioxidant activity

Free radicals are produced in pathological or normal cell metabolisms which possess one or more unpaired electrons (peroxyl, superoxide, hydroxyl). These free
Some phenolic substances in propolis

[Chemical structures of various phenolic compounds]

Chemical Structures of some important chemical constituents of Cinnamon (Vangalapati et al., 2012).

Fig 1: Chemical structures of the active compounds of Cinnamon
radicals are the main source of lipid peroxidation. Antioxidants thus play a vital role to protect the human body against damage by reactive oxygen species (ROS). Plants containing bioactive ingredients have been reported to possess strong antioxidant activities (Thakur et al., 2013).

Spices are rich sources of polyphenolic compounds which have strong antioxidant abilities and could be used to change the synthetic antioxidants in food systems and offer additional health benefits (Hossain et al., 2008). Cinnamon possesses antioxidant potential, which is mainly due to the presence of phenolic compounds. Chicoric acid is found to be the main phenolic substance responsible for antioxidant activity. As alkyl amide does not exhibit antioxidant potential on its own, yet increases the antioxidant potential of chicoric acid (Jamshidi et al., 2014). Fruit of cinnamon which is an unconventional and underutilized part possesses adequate amount of phenolic antioxidant and can even be used as protective agent against mutagenesis. Cinnamon oil can act as important endogenous antioxidant and may also protect against tissue damage. It is a natural product which is safe in all respect and is rich in polyphenolic constituents that exhibits antioxidant activity in-vitro (Sharma et al., 2015). Cinnamon is also known as a functional food source of antioxidants which help decrease oxidative stress by inhibiting the enzyme 5-lipoxygenase thereby enhancing insulin sensitivity (Roghelia and Patel, 2015).

**Antimicrobial activity of Cinnamon**

Spices have gained a lot of attention in their valuable physiological functions and antimicrobial potential. Cinnamon is found to be the oldest and most popular spices used as food ingredient. The essential oil of cinnamon is most commonly used in the food industry because of its special aroma in addition to its medicinal properties. Cinnamon oil possesses a wide range of antimicrobial potential against gram-negative and gram-positive bacteria (Hussein et al., 2014). Cinnamon barks is used as flavoring agent in food preparation and also for various applications in anticancer, antioxidant, medicine and antibacterial properties. The essential oil from bark is a rich source of trans-cinnamaldehyde having antimicrobial potential against food poisoning, plant and animal pathogens, and spoilage caused by fungi and bacteria (Pooja et al., 2013; Kankeaw and Masong 2015; Anand et al., 2016).

**Anticancer Activity**

Cinnamon is also very effective for anticancer activity (Herdiwiani et al., 2016). The fractions and aqueous extract of cinnamon restrain vascular endothelial growth factor subtype 2 (VEGFR2) kinase activity, thereby preventing the angiogenesis involved in cancer. Cinnamon anticancer activity against azoxymethane- (AOM-) induced colon cancer in Swiss albino mice has been conducted. Treatments with the aqueous extracts of cinnamon enhance the activities of
the antioxidant and detoxifying enzyme gluathione-transferase (GST) with a concomitant reduction in lipid peroxidation levels in animals with colon cancer compared to controls (Rao and Gan., 2014).

**Anti-inflammatory activity**

Medicinal plants and their components are found to have the anti-inflammatory activities. Cinnamon and its essential oils also possess the anti-inflammatory activity. Several flavonoid compounds like gossypin, hesperidin, gnaphalin, hibifolin, oroxindin, hypolaetin, and quercetin have anti-inflammatory activities (Jakhetia et al., 2010; Rao and Gan., 2014).

**Anti-diabetic activity**

Cinnamon is also very effective in the treatment of diabetes mellitus. It reduces stress, enhances metabolism and the body immune system to fight against disease. As it is very helpful in improving the insulin discharge to check blood glucose levels and reverses resistance to the hormone (Maheshwari et al., 2013). The phytoconstituents from cinnamon has been isolated and coined as “insulin-potentiating factor” (IPF), while the antidiabetic potential of cinnamon bark have also been shown in streptozotocin-induced diabetic rats. While comparing the IPF potential of many spices showed that the aqueous extract of cinnamon was found to be 20-fold more than the other spices (Jakhetia et al., 2010; Rao and Gan., 2014).

**Lowering Cholesterol level**

The phytoconstituents of Cinnamon like polyphenol type-A polymer are also capable of reducing the level of triglycerides and LDL cholesterol in the blood, thereby preventing a number of heart diseases. Just addition of a pinch of cinnamon to your food or tea and coffee can be very beneficial to your health (Maheshwari et al., 2013; Anand et al., 2016).

**CONCLUSION**

Spices are very important for pharmaceutical industry and drug development. Bark of Cinnamon is broadly used as a spice due to its distinctive odour of essential oils. Main chemical constituents of cinnamon are Cinnamic acid, Euginol, Cinnamaldehyde and essential oils. Cinnamon is reported for its anti-oxidant, anti-ulcer, anti-diabetic, anti-microbial and anti-inflammatory activity in scientific literature. Cinnamon is found very safe in acute toxicity in animals and being used as spice for all ages.
REFERENCES


Cinnamon are the Cinnamomum zeylanicum (Cinnamomum cassia et al., 2010). The word cinnamon comes from native to South India and Sri Lanka (Jakhetia INTRODUCTION (Cinnamomum zeylanicum). Cinnamon barks are sometimes said to be “true cinnamon (Van-)

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