



Modern Medicinal Use of Cinnamon

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ABSTRACT

Cinnamon is economically important due to their broad uses in the food and pharmaceutical industries. In addition of aroma, essence and functional food industry applications, the health benefits of cinnamon at clinical set-up have been explored in last one decade. Numerous studies *in-vitro* and *in-vivo* in animals and humans have demonstrated arrays of beneficial health effects, such as anti-inflammatory, anti-microbial, reducing cardiovascular disorders, boosting cognitive function and reducing risk of colonic cancer. But there are still lack of well design randomised placebo control trials to substantiate these health claims. Few recent well designed RCTs in allergic rhinitis and chemotherapy-induced weight loss and alopecia strengthened the medicinal properties of cinnamon. In addition of systematic relief of associated disease ailments, special cinnamon extract showed effective in improvement of work productivity, regular activities and quality of life questionnaire. The treatment was found to be safe and well-tolerated during these studies.

Keywords: Cinnamon; Traditional use; Modern use; Allergic rhinitis; Chemo-adjuvant; Chemotherapy; Immunomodulator

INTRODUCTION

Cinnamon (*Cinnamomum verum*, synonym *C. zeylanicum*) is a small evergreen tree, 10-15 meters tall, belonging to the family Lauraceae, native to Sri Lanka and South India. The flowers, which are arranged in panicles, have a greenish colour and have a distinct odour. The fruit is a purple one-centimetre berry containing a single seed. Its flavour is due to an aromatic essential oil which makes up 0.5% to 1% of its composition [1].

Cinnamomum verum (also known as *Cinnamomum zeylanicum* (CZ) or Ceyloncinnamon) and *Cinnamomum cassia* (also known as Cassia cinnamon (CC) or Chinesecinnamon) are the most popular species in the world. Nevertheless, the genus *Cinnamomum* actually consists of approximately 250 species with distinctive genotype and phenotype [2].

These plants are economically important due to their broad uses in the food and pharmaceutical industries. The aroma and essence industries are the major users of cinnamon due to its fragrance, but this can be incorporated into different varieties of food products and also as functional food ingredients in vitamins, minerals, probiotics, phyosterols and antioxidants.

But cinnamon is explored for medicinal use in last decade and will portrait it's journey in different health domains in this article [3].

LITERATURE REVIEW

Chemistry

Cinnamon consists of a variety of resinous compounds, including cinnamaldehyde, cinnamate, cinnamic acid, and numerous essential oils (Table 1). The spicy taste and fragrance are due to the presence of oxidised cinnamaldehyde. As cinnamon ages, it darkens in color, improving the resinous compounds. The presence of a wide range of essential oils, such as trans-cinnamaldehyde, cinnamyl acetate, eugenol, L-borneol, caryophyllene oxide, β -caryophyllene, L-bornyl acetate, E-nerolidol, α -cubebene, α -terpineol, terpinolene and α -thujene, has been reported. One important difference between CC and CZ is their coumarin (1,2-benzopyrone) content. The levels of coumarins in CC appear to be very high and sometime impose health risks if consumed regularly in higher quantities (The German Federal Institute for Risk Assessment) [4].

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Table 1: Chemical constituents of different parts of cinnamon.

Part of the plant	Compound
Leaves	Cinnamaldehyde and Eugenol
Bark	Cinnamaldehyde and Eugenol
Root bark	Camphor
Fruit	Trans-cinnamyl acetate and caryophyllene
Buds	Terpene hydrocarbons, alpha-bergamotene, alpha-copaene, oxygenated terpenoids
Flower	(E)-Cinnamyl acetate, trans-alpha-bergamotene, caryophyllene oxide

DISCUSSION

Traditional use of cinnamon

In addition to being used as a spice and flavoring agent, cinnamon is also added to chewing gums due to its mouth refreshing effects and ability to remove bad breath. Cinnamon is also used as tooth powder and to treat tooth aches, dental problems or almicrobiota and bad breath due to its wide range of anti-microbial properties. Cinnamon is a coagulant and prevents bleeding. Cinnamon also increases the blood circulation in the uterus and advances tissue regeneration. In native ayurvedic medicine Cinnamon is considered a remedy for respiratory, digestive and gynaecological ailments [5].

Table 2: Pharmacology and clinical data of cinnamon.

Activity	Compound type	Study type	Clinical outcome
Antioxidant	Phenolics (polymers), cinnamaldehyde and eugenol from fruit, leaf and bark	<i>In-vitro, in-vivo</i> including human	Free radical scavenging activity and lipid peroxidation Hepato-protective, antiinflammatory (reduce angiogenesis) Anti-secretagogue and anti-gastric ulcer effects
Anti-microbial	Essential oil and aldehyde from bark, leaf	<i>In-vitro, in-vivo</i> including human	Significant anti-microbial properties including the human rotavirus
Anti-diabetes	Phenolics (polymers such as hydroxycinnamic acid and naphthalene methyl ester), Cinnamaldehyde and from fruit, leaf and bark	<i>In-vitro, in-vivo</i> including RCT	Significant antihyperglycemic effect by lowering both total cholesterol, triglyceride levels and increasing HDL-cholesterol Increase insulin sensitivity and post-prandial satiety

Modern medicinal use

The health benefits of cinnamon at clinical set-up have been explored in last one decade. Numerous studies *in-vitro* and *in-vivo* in animals and humans have demonstrated arrays of beneficial health effects, such as anti-inflammatory, anti-microbial, reducing cardiovascular disorders, boosting cognitive function and reducing risk of colonic cancer. But there are still lack of well design randomised placebo control trials to substantiate these health claims. Few recent well designed RCTs in allergic rhinitis and chemotherapy-induced weight loss and alopecia strengthened the medicinal properties of cinnamon. Table 2 describes the various physiochemical properties and clinical outcomes of cinnamon [6].

Anti-allergic (allergic rhinitis)	Cinnamon bark polyphenols, particularly type-A proanthocyanidins	<i>In-vitro, in-vivo</i> including RCT	Significant symptomatic relive from allergic rhinitis/hay fever as nasal spray
Anti-cancer (chemotherapy)	Cinnamon bark polyphenols, particularly type-A proanthocyanidins	RCT	Demonstrated significant clinical promise in preventing chemotherapy-induced weight loss and alopecia in breast cancer chemotherapy patients

Allergic rhinitis

Allergic Rhinitis (AR), commonly referred to as hay fever, is a common IgE-mediated inflammatory immune disease of the nasal mucosal membrane, affecting more than 500 million individuals worldwide and also counts among the 10 most frequent reasons for a medical consultation. AR is an inflammation of the nasal passages, usually with three cardinal symptoms namely, sneezing, nasal obstruction and mucous discharge with nasal itching [7].

Two recent RCTs showed that the standardized hydroalcoholic extract of *Cinnamomum zylanicum* bark (TAPP-CZ-IND02) showed significant reduction of day time and night-time nasal congestion, itchy eyes and nasal pruritus within 24 hours [5,6]. Trials also showed statistically and clinically improvement in Quality of Life Questionnaire (RQLQ). Further, IND02 nasal spray is effective in improvement of work productivity and regular activities [8].

Chemotherapy-induced hair and weight loss

Cancer, in the broadest sense, is characterized by the deregulation of molecular and cellular mechanisms. The current cancer therapies are typically surgery, radiation or chemotherapy. Chemotherapy and radiotherapy are the most widely used treatments in medical practice; however, these treatments have serious side effects that may not only decrease further cancer drug options, but also decrease patients' quality of life. This type of treatment is usually accompanied by a large number of side effects and deleterious effects on patient health, such as nausea, loss of appetite and weight, significant hair loss, anaemia, spinal cord injury, kidney damage, mucositis, etc. These side effects affect in an important way the quality of life of people who undergo these treatments. There are a number of studies describing the therapeutic activity of natural products, both in the treatment of cancer and in the reduction of side effects induced by conventional treatments, which have been highlighted in scientific literature [9].

Cancer treatment options

The treatment of cancer has relied primarily on the use of various forms of cytotoxic chemotherapy and radiation therapy. Most chemotherapeutic drugs target fast-dividing cells and mitosis (cell division) impairment. These interventions have had profound positive results on many hematological malignancies and a few solid tumors, especially germ cell and some childhood malignancies. However, in most cases, the effectiveness of

cytotoxic treatments has been limited by the side effects and immuno-suppression, with susceptibility to opportunistic pathogens which remained as the major obstacles for the successful clinical use. Toxicity of anticancer agents is the primary reason for patients to discontinue the treatment [10].

Chemo adjuvant approach

The nutritional approach may be the means of helping to raise cancer therapy to a new level of success as supplementing or supporting the body with natural phytochemicals not only reduce adverse side effects but also improve the effectiveness of chemotherapeutics. However, most of the nutritional therapies have not been tested by rigorous clinical trials and while some natural therapies have stood the test of time, very little information is available to validate their efficacy [11]. Many anticancer drugs attack rapidly dividing cells, including not only malignant cells but also in hair follicle cells and induce alopecia. Recently, cinnamon bark extract demonstrated its ability to promote apoptosis pathway and selective killing of tumor cells in addition to suppression of tumor progression including the prevention of alopecia and weight loss. This study demonstrated that the patients on the treatment with IND02 had shown significant protection from chemotherapy-induced severe weight loss (cachexia) and alopecia (reduced hair density and %hairs in the anagen phase and increased %hairs in telogen phase) which was seen in the placebo group. IND02 treatment was found safe and well-tolerated during the study [12].

CONCLUSION

Cinnamon bark research came many miles ahead from the culinary use as a spice and traditional medicinal use. Several of its medicinal properties and safety are now validated through modern scientific methods *in vitro* and animal studies. These include anti-diabetic, anti-inflammatory, cardioprotective and neurological disorders. Cinnamon bark extract already showed strong clinical evidence in the treatment of diabetes mellitus for sugar control and prevention of complications. Primary driving force for the potential of cinnamon bark for immune system benefits is polyphenols, especially pro-anthocyanidins. The true multifaceted clinical potential of cinnamon polyphenols is surfaced only recently with clinical evidence for immune/allergic inflammatory conditions such as allergic rhinitis and chemotherapy side effects. The ability of cinnamon polyphenols on immune system protection is now being explored for various protective/prophylactic applications/uses against chronic allergic

rhinitis conditions, viral infections) flu-like symptoms) and side effects of chemotherapy to improve quality of life.

Based on the recent RCT, the patients on the treatment with particular extract of cinnamon had shown significant protection from chemotherapy-induced severe weight loss (cachexia) and alopecia (reduced hair density and %hairs in the anagen phase and increased %hairs in telogen phase). The treatment was found safe and well-tolerated during the study. Standardized cinnamon bark extract has therapeutic potential to be beneficial as a chemo-adjuvant in preventing breast cancer chemotherapy-induced weight loss and alopecia.

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