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## **Medicinal and Nutritional Perspective of Cinnamon: A Mini-review**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author SM designed the study, wrote the protocol and first draft of the manuscript. Author BG managed the analyses of the study and literature searches. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

The present review establishes the medicinal and nutritional perspectives of Cinnamon. In today's era, there are so many processed foods available in the market that saves time but processed foods have many adverse effects on health. Cinnamon has significant benefits for human health, particularly as an anti-inflammatory, antitumor, anticancer, antidiabetic and anti-hypertriglyceridemia agent, mainly due to its phytochemical constituents such as phenolic and volatile compounds. So, people are more aware of the usage of the natural herbal product in the diet. Cinnamon (*Cinnamomum verum*) is the most consumed spice in the world. Cinnamaldehyde is the bioactive component present in the cinnamon. The nutrient content found in cinnamon is in a good amount. Macro and micronutrients such as energy, carbohydrate, vitamin A and C, calcium, iron, magnesium are present. Cinnamon is also known for its health benefits such as antioxidant, anticancer, antibacterial, immunomodulatory and metabolic syndrome. Thus, cinnamon is very beneficial to combat diseases. It is concluded that cinnamon is very useful and beneficial for the maintenance of health and it is helpful in the prevention of diseases.

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## 1. INTRODUCTION

It is well said that “health is wealth” because in the present time people are more conscious about their health and diet. Now the day’s people are looking for natural and herbal products to maintain their good health. Cinnamon is the bark of the tree, which is good in nutritive value. Cinnamon is the world’s most frequently consumed spices and is used as a herbal remedy. Cinnamon has been used for centuries, as flavour modifiers to make food more palatable. Its ingredients impart characteristic flavour and spicy aroma to food.

Sri Lanka is the major Cinnamon growing country along with Seychelles, Madagascar, and India. De Guzman and Siemonsma [1]. It is indigenous in Sri Lanka, which still produces the largest quantity and best quality, mainly in the form of quills. This genus contains evergreen trees or shrubs belongs to the Lauracaceae family contain around 250 species in tropical and subtropical regions, mostly in Asia and some in South and Central America, and Australia [2]. Cinnamon is a highly valued spice whose bark is widely used as a spice. Various industries for foodstuff, flavouring agent for fragrance and essence perfumes, and medicinal products mainly use it in cookery as a spice. In the past few decades, consumers have chosen foods not only for their nutritional values but also for their additional health benefits [3].

Cinnamon has significant benefits for human health, particularly as an anti-inflammatory, antitumor, anticancer, antidiabetic, and anti-hypertriglyceridemia agent, mainly due to its phytochemical constituents such as phenolic and volatile compounds [4].

## 2. METHODOLOGY

The current review was conducted using a complete and organized search of the available literature on the medicinal plant cinnamon. The searches were performed using various databases, including Scopus (<http://www.scopus.com/>), PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>), Scirus (<http://www.scirus.com/>), Science Direct (<http://www.sciencedirect.com/>) and Google Scholar (<http://www.scholar.google.com/>).

**Cinnamon Cultivation:** Cinnamon is produced globally about 27,000-35,000 annual tons. Cinnamon is mostly produced in Madagascar, China, Seychelles, Sri Lanka and little scale in Vietnam and India. It is a hardy plant mostly cultivated in different weather conditions at the optimal temperature of between 20 to 30°C with a range between 1250 to 2500 mm by dried seed and vegetative propagation [5].

**Chemical Constituents of Cinnamon:** Cinnamon consists of a variety of resinous compounds, including cinnamaldehyde, cinnamate, cinnamic acid, and numerous essential oils [6]. Singh et al. [7] reviewed that cinnamon has a bitter taste and fragrance due to active components cinnamaldehyde and oxygen absorption. As cinnamon ages, it darkens in color, improving the resinous compounds [7].

**Nutritive Value of Cinnamon:** Nutrients is very important for the function and regulation of the human body system. Cinnamon is one of the major sources of spices used in the preparations of the food items. Although it has good nutrient content as shown in Tables 2,3,4. Cinnamon is a good source of macro and micronutrients and gives aroma and flavour in the foods. It is a good source of energy, carbohydrate and vitamins, and minerals.

### 2.1 Medicinal Properties of Cinnamon

**Antioxidant Activity:** Mancini Filho et al. reported various antioxidant activities with the different extracts of Cinnamon as aqueous, ether and methanolic extracts [8]. The function of free radicals inside the getting older process and carcinogenesis is well established. Extracts from cinnamon including ether, aqueous extracts, and methanolic extracts have established antioxidant pastime. The volatile oils of cinnamon display widespread antioxidant assets at awareness ranging from 100 to 200 elements according to million. Jayaprakasha et al. [9] Cinnamon extract has confirmed motion in reducing plasma lipid peroxidation level that’s a biomarker for oxidative strain. Cinnamon extract has also located to have a powerful loose radical scavenging pastime. Given the confirmed antioxidant hobby of cinnamon, extracts of the same should play a tangible position inside the management of doubtlessly malignant disorders plus improving their long-term analysis.

**Table 1. Part of the plant and compound**

Part of the plant	Compound
Leaves	Cinnamaldehyde: 1.00 to 5.00% Eugenol: 70.00 to 95.00%
Bark	Cinnamaldehyde: 65.00 to 80.00% Eugenol: 5.00 to 10.00%
Root bark	Camphor: 60.00%
Fruit	<i>trans</i> -Cinnamylacetate (42.00 to 54.00%) and caryophyllene (9.00 to 14.00%)
<i>C. zeylanicum</i> buds	Terpene hydrocarbons: 78.00% <i>alpha</i> -Bergamotene: 27.38% <i>alpha</i> -Copaene: 23.05% Oxygenated terpenoids: 9.00%
<i>C. zeylanicum</i> flowers	E)-Cinnamyl acetate: 41.98% <i>trans-alpha</i> -Bergamotene: 7.97% Caryophyllene oxide: 7.20%

**Antimicrobial Activity:** Volatile oils from cinnamon confirmed big activity in opposition to *Streptococcus faecalis* [10]. *C. zeylanicum* is discovered to be effective in opposition to *C. albicans* and may be used in the control of oral thrush [11]. *C. zeylanicum* was observed to inhibit the boom of *S. aureus*, that's the aetiology in angular cheilitis, parotitis, stomatitis and cellulitis. Furthermore, consequently, *C. zeylanicum* extract may want to have a beneficial role in the control of these orofacial conditions [12]. *C. zeylanicum* is likewise determined to be effective in opposition to *Candida glabrata*, *Candida parapsilosis*, *Candida krusei*, and *Candida tropicalis*, which inside the beyond have verified a few resistance to conventional antifungal agents. Similarly to this, *C. zeylanicum* is also validated to demonstrate antiparasitic hobby [13].

**Table 2. Macro nutrients- (per 100 gm)**

Constituent	Value
Energy	247 kcal/ 1035 KJ
Protein	3.99 g
Total fat	1.24 g
Ash	3.6 g
Carbohydrate	80.59 g

**Table 3. Nutritive value of minerals**

Constituent	Value
Calcium	1002 mg
Iron	8.32 mg
Magnesium	60 mg
Phosphorus	60 mg
Potassium	431 mg
Zinc	1.83 mg
Copper	0.339 mg
Manganese	17.466 mg

In 2012, Guerra et al. reviewed the combination of *C. zeylanicum* essential oil and antibiotics antibacterial activity to see the synergistic and additive effects [14]. Moreover, there is also

similar result reported by Yap et al. that the combination of cinnamon bark essential oil and piperacillin induced a decrease in the registered MIC values against a clinical strain of beta-lactamase-producing *E. coli*. The authors concluded that reduced use of antibiotics could be employed as a treatment strategy to decrease the adverse effects and possibly to reverse the beta-lactam antibiotic [15].

**Table 4. Nutritive value of vitamins**

Constituent	Value
Vitamin C	3.8 mg
Vitamin A	295 IU
Thiamine	0.002 mg
Riboflavin	0.041 mg
Niacin	1.332 mg
Pantothenic acid	0.558 mg

## 2.2 Antimicrobial

**Immunomodulatory activity:** *C. tamala* and *C. cassia*, specifically, have sure procyanidinoligomeric compounds that play a widespread role in immunomodulatory motion. Cinnamtannin D1, one of the procyanidinoligomeric compounds, reduces the extent of interferon- $\gamma$  and interleukin-2 (IL-2) and suppresses the not on time hypersensitivity reaction, thereby enhances immunomodulatory motion [16]. This shows the beneficial position of cinnamon in the management of autoimmune illnesses together with pemphigus, lichen planus, recurrent aphthous stomatitis, and lupus erythematosus.

**Anti Cancer Activity:** One of the studies reported that Cinnamon oil is a solution in the treatment like cancer, Tumors, Gastric Cancers and Melanomas. Cinnamaldehyde and Eugenol the chemical constituents found good results in leukemia and lymphoma cancer cells. These have been used to develop nutraceuticals in this

study that have been proven fairly effective in fighting Human Colon Cancer Cells (Eugenol) and Human hepatoma cells (Cinnamaldehyde) [17].

**Cinnamon and metabolic syndrome:** Based on recent scientific-based evidence and traditional medicine, cinnamon and its active ingredients such as cinnamic acid, cinnamaldehyde, eugenol and cinnamate in the forms of alcoholic and aqueous extracts have a variety of therapeutic effects on metabolic syndrome. Cinnamon extracts also ameliorated the Different aspects of Metabolic syndrome such as dyslipidemia, high blood glucose, obesity, and high blood pressure. some research also reported that cinnamon and its constituents have a potential effect and cardiovascular protective effects in decreasing metabolic syndrome such as anti-oxidant, anti-diabetic, anti-inflammatory and helps in reducing lipid profile [18-20].

**Anti-diabetic Activity:** The short intake of cinnamon as 2 g in type 2 diabetes patients has been helped to reduce blood pressure and levels of hemoglobinA1C [21].

Verspohl et al. evaluated the outcomes of *C. cassia* bark or its extracts on blood glucose and plasma insulin tiers in rats underneath diverse conditions. The cassia extract was slightly more efficacious than an equivalent amount of cassia bark. A decrease in blood glucose ranges turned into observed in glucose tolerance check (GTT), while it became not apparent in rats that were now not challenged by way of a glucose load. The elevation in plasma insulin turned into direct considering that a stimulatory in vitro effect of insulin release from INS-1 cells (insulin-secreting cellular line) changed into finding. Some of the results recommended that the cassia extract has an immediate anti-diabetic efficiency [22].

**Cardiovascular Diseases:** Cinnamon was found to inhibit the atherosclerosis process by the prevention of apoA-1 glycation and inhibition of cholesteryl ester transfer protein (CETP) in hypercholesterolemic zebrafish. Cinnamon extract treatment significantly reduced the rate of **dyslipidemia** and aided in the maintenance of the atherogenic index (total cholesterol—HDL-C/HDL-C) compared to dexamethasone control in atherosclerotic rats [23].

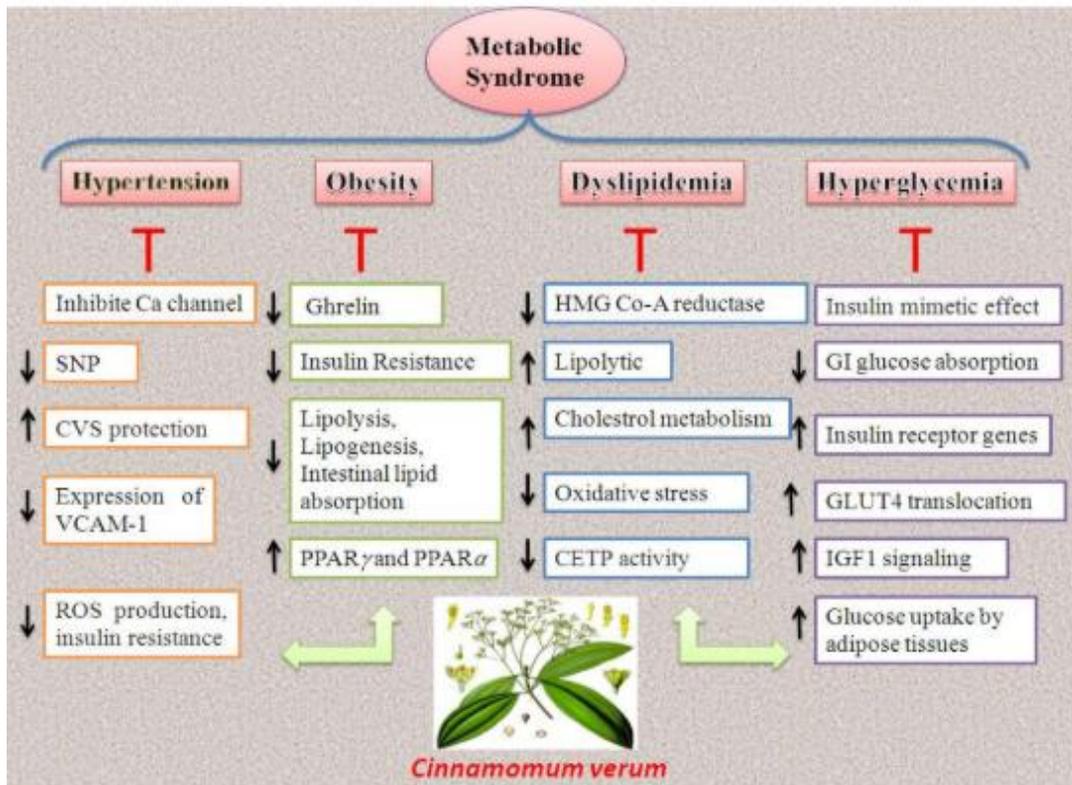


Fig. 1. Cinnamon in ameliorating metabolic syndrome [24]

**Antiobesity:** Cinnamon species are abundant in anti-obesogenic effects with Polyphenolic compounds. *In vitro* studies showed that polyphenolic compounds could inhibit differentiation of adipocyte; also they inhibited lipolysis [25], lipogenesis [26] or intestinal lipid absorption [27] that they tend to lower weight. Polyphenolic compounds are inducers of fatty acid oxidation [26] or antagonist at cannabinoid receptors [28] and attenuate the inflammatory changes [29].

**Traditional uses:** Cinnamon has been called one of the maximum common spices and food flavoring additives due to the fact ancient instances [30]. For instance, it has been used as a taste in chocolates and chewing gum because of the fine and fresh impact that develops within the mouth. It additionally suggests beneficial consequences on oral fitness and is used for toothaches, oral infections, and to eliminate bad breath. Cinnamon has additionally been used to deal with pimples and melisma [31]. Moreover, it has been used for the remedy of gastrointestinal and colonic [32]. Ayurvedic literature indicates that cinnamon has effective antiemetic, anti-diarrheal, anti-flatulent, and stimulant sports [33]. Cinnamon has a coagulant effect and consequently, it may be used in opposition to hemorrhaging [34]. Cinnamon vital oil could be also used in aromatherapy, that's the healing use of plant vital oils that may be absorbed into the frame through the skin or the olfactory gadget. A research article confirmed the advantages deriving from the use of cinnamon oil in rubdown for alleviating menstrual pain [35].

**Adverse effects of Cinnamon:** In therapeutic doses, spices are generally considered as safe that produces adverse effects in excessive consumption and in long term usage. The most common adverse effects reported with common and cassia cinnamon were related to contact irritation or allergic reaction with skin or mucous membranes [36,37].

### 3. CONCLUSION

Cinnamon is mostly cultivated in different regions of the world in different weather conditions. Cinnamon and its active constituents like cinnamaldehyde have various usage and limited dose such as 2 g to improve the health effects. Cinnamon can be inculcated in the diet in various forms that help to make a healthy individual. Cinnamon and its active constituents have beneficial effects on diabetes, obesity, and decrease lipid profile. Traditionally cinnamon is

used for various purposes such as flavour and aroma. It is also used for the treatment of various common health issues like toothache, oral infection and bad breathe. Excess intake of cinnamon can be adversely affected health. Thus, it is concluded that cinnamon is very useful and beneficial for the maintenance of health and it is helpful in the prevention of diseases.

### CONSENT

It is not applicable.

### ETHICAL APPROVAL

It is not applicable.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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