Chapter-16

Bioactivities and Biochemical Characterization on Cinnamomum Tamala - A Review

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Abstract

Cinnamomum tamala (CT) is a member of lauraceae family, used as spice in Indian food and also as medicine in Indian. It is distributed in India, Asia and Australia. Chemically it is rich in terpenes, flavones and tannins but major one is Eugenol (Monoterpenes). In flavonoid group, it contains quercetin, quercetrin, Kaempferol and its derivatives such as Kaempferol-3-O-rhamnoside, Kaempferol - 3 - O- glucopyranoside, Kaempferol – 3 – O - sophoroside and Kaempferol 3, 7-di-O-rhamnopyranoside. Other flavones are Myricetin, 3,4,5,7-tetrahydroxy flavone and 3,3,4,5,7-pentahydroxyflavone. It is associated with different biological activities such as antioxidant, antifungal, antidiabetic, immunomodulator etc. In this review, we collect information about their habit and habitate, chemical constituent and their reported biological activities.

Keywords: Cinnamomum Tamala, Antioxidant, Diabetes, Immunomodulation, Antiviral.

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1. INTRODUCTION

Cinnamomum tamala known as Tejpat in Hindi and Bengali, Indian cassia lignea in English, and tejpatra in Sanskrit. It is a moderate sized evergreen tree attaining a height of 8 m, and a girth of 150 cm. It is distributed in India in North-Western Himalaya, Sikkim, Assam, Mizoram and Meghalaya and cultivated in Nainital (Uttaranchal), Kangra (Himanchal Pradesh and Tripura for leaves. Internationally it is found in tropical and sub-tropical Asia, Australia and Pacific region of South Asia. It is rich in Terpenes, tannins and flavones as main constituent. It contains Monoterpenes (65.6 %) containing trans-sabinene hydrate (29.8 %), (Z)-β-ocimene (17.9 %), myrcene (4.6 %), α-pinene (3.1 %), βsabinene and sesquiterpenes (32.9 %) containing germacrene A (11.9 %), Eugenol and α-gurjunene as major constituent (Mir, Ali and Kapoor, 2004) and flavones such as Kaempferol, Quercetin and its derivatives (Bhardwaj, Chand, Gupta, and Jain, 1983). It contains some higher boiling constituent such as trans-carveol, citronyl acetate and Farnesol (Rana, Langoljam, Verdeguer, Blázquez 2012). The reported flavones are Kaempferol and its derivatives such as Kaempferol-3-O- rhamnoside, Kaempferol-3-Oglucopyranoside, Kaempferol-3-O-sophoroside and Kaempferol 3,7-di-O-rhamnopyranoside. Other flavones are Quercetin, Quercetrin, Myricetin, 3,4,5,7-tetrahydroxy flavone and 3,3,4,5,7- pentahydroxyflavone. On the basis of GCMS of hexane and methanolic fraction of CT leaves Eugenol is approximate 70 % in hexane fraction and 60 % in methanolic fraction (Chaurasia and Tripathi, 2011). The plant leaves were reported with many biological activities whose detailed are as:

1. Antidiarrheal Activity

The study of Antidiarrhoeal activity was done by Rao, Vijayakumar, Sairam, Kumar, 2008. They prepare 50% ethanolic extract of Cinnamomum tamala leaves which contain eugenol 3.8% w/w, and total tannin is 247.5 mg/g. The Antidiarrhoeal activity of C. tamala extract was checked on experimentally induced diarrhea and found that oral treatment of 25, 50 and 100 mg/kg body weight produced a dose-dependent reduction in the total amount of faecal matter in castor oil-induced diarrhea. The result indicates that the Indian spice C. tamala is useful to treat diarrhea.

2. Antidiabetic Activity

Diabetes is known as silent killer and for the protection of individual, many research program were managed throughout the world. There are two ways for testing of drugs. One is alloxan induced hyperglycemia which induces diabetes by free radicals mechanism and another way is by streptozotocin which

induces diabetes by destroying beta cells of pancreas. The extract of different polarity of CT leaves were tested on both model by many researcher and found that the CT leaves extract significantly lowered the blood glucose level, and maintained body weight and lipid-profile parameters towards normal range (Kumar, Vasudeva,Sharma, 2012). Bisht and Sisodia in 2011 used Ethanolic extract of CT leaves @ 200 mg/kg BW for 40 days to streptozotocin induced diabetic rats and found that extract significantly lowered the blood glucose level, and maintained body weight and lipidprofile parameters towards near normal range. Another experiment for their antidiabetic activity was performed by Chaurasia and Tripathi, in 2011 in alloxan induced hyperglycemia. In their experiment hyperglycemia was induced by alloxan @ 100 mg/kg body weight and antidiabetic property of different fraction of CT leaves was evaluated on one weak treatment at the dose of 200 and 400 mg/kg body wt. In the experiment, hexane fraction was found to be most active which reduces increased blood glucose by enhancing insulin secretion from beta cell of pancrease. A clinical trial was performed (Singh, Upadhyay, Tewari and Tripathi, 1985) in Institute of medical Sciences, Banaras Hindu University, Varanasi by using as CT leaves in powder form at the dose of 1 Tea Spoon Full Thrice in a day for the period of three months. The response was estimated on the parameter of Joslin's Clinica, in C. tamala group 50% cases were in good control, 33.33% were in fair control and 16.67% cases were in poor control.

3. Anti-Inflammatory Response

The study was performed by Chaurasia and Trpathi in 2011 by in vitro (lipopolysaccharide(LPS) induced NO production in rat peritoneal macrophages) as well as in vivo methods (Carrageenan induced paw odema in rats). Different extract of CT leaves @ 200 and 400 mg/kg BW was given to rat having carrageenan induced paw odema and volume of paw odema was measured by platythesometer for next 4 hours. It was found that that non polar fraction is most active among all and has significant effect on first phase of inflammation. Nitric oxide is also mediators of inflammation and non polar fraction was found to be most active for the suppression of LPS induced NO production in rat peritoneal macrophages.

4. Antioxidant Activity

Antioxidant activity of different fractions of CT leaves as well as their volatile oil was assessed by different researchers by in vivo and in vitro methods. Kumar, Vasudeva and Sharma, S. (2012). And Amma, Rani, Sasidharan and Sreekumar in 2012, Emily and Macedo 2022, reported lipid peroxidation activity of CT leaves by measuring Malondialdehyde (MDA) content in vivo as well as by in vitro method such as DPPH method. Chaurasia

et al estimated antioxidant activity of different fractions of CT leaves (hexane, ethyl acetate, methanol and total methanolic fraction) in chemical system such as ABTS radicals, Superoside radicals, Hydroxyl radicals and Lipid Peroxidation and found that that non polar fraction (hexane fraction) was most active towards their antioxidant activity. Devi, Kannappan and Anuradha in 2007 determine antioxidant activity of methanolic extract of CT leaves on Brain synaptosomes of normal as well as diabetic rats. Result showed that there is damage of brain synaptosomes in diabetic rats but treatment of diabetic rats by methanolic extract, reduced the damage of Brain synaptosomes. Antioxidant enzymes related to Lipid Peroxidation (LPO), Superoxide dismutase (SOD) and catalase were measured by Eswaran, Surendran, Vijayakumar, Ojha, Rawat and Rao in 2010 in ulcered rat on treatment of Ethanolic extract of CT leaves and found that the antioxidant enzyme levels of LPO and SOD were decreased while administering ethanolic extract of CT leaves at different doses in comparison to control values (Untreated ulcered rat). Contrary to this the level of CAT enzyme showed significant increase.

5. Gastroprotective

Gastroprotective activity of CT leaves was observed by Eswaran, Surendran, Vijayakumar, Ojha, Rawat and Rao in 2010 in ulcer induced by different agents in rat. The ulcered rats were treated with Ethanolic extract of CT leaves orally and H(+)K(+)ATPase activity and gastric wall mucous were tested in Ethanol-induced ulcer model. Antioxidant enzyme activities was carried out in CRS-induced ulcer model, and various gastric secretion parameters like volume of gastric juice, acid output, and pH value were estimated in PL-induced ulcer model. A significant reduction in lesion index was observed in ulcer animals treated with Ethanolic extract of CT leaves at different doses when compared with ulcerated rats in all models. A significant decrease occurred in the level of H(+)K(+)ATPase, volume of gastric juice, and acid output. Simultaneously the level of gastric wall mucus and pH were increased significantly. Thus it was concluded that Cinnamomum tamala leaves possess significant gastro protective activity.

6. Immunomodulation

Immunomodulation property of CT leaves was studied by Chaurasia and Tripathi in 2011 and Chaurasia, Mishra and Tripathi in 2010. The non polar part of CT leaves was extracted with hexane and solvent free extract was given orally to rats for 10 days @ 400, 800 and 1600 mg/kg BW. Its effect was studied on peritoneal macrophage functions, Cell mediated and humoral immunity. For the analysis of macrophage function, Phagocytosis in macrophages, Respiratory burst and NADPH content, Super oxide production

and LPS induced NO production were measured. In cell mediated immunity, Sheep Red Blood Cells (SRBCs) induced delayed type of hypersensitivity (DTH) and concanavalin A induced lymphocyte proliferation were observed and for humoral immunity, SRBC induced antibody production was assessed by agglutination method. Result showed that on all these parameters, CT leaves reduces macrophage function, reduced DTH response, blastogenesis and antibody production. In an another experiment of Chaurasia, Mishra and Tripathi in 2010, normal rats were treated with hexane fraction of CT leaves for 30 days @ 400, 800 and 1600 mg/kg BW and their growth rate, organ weight, mitotic index, bone marrow cellularity and haematological parameters were measured. It was found that CTH significantly suppressed growth rate, increase of spleen and thymus weight and low bone marrow cellularity but have no any cellular degradation. In hematological examination, it inhibited total white blood cell and lymphocytes count and increased per cent of polymorphs. It was concluded that CTH have significant immunosuppressive property at 1600 mg/kg BW but have little effect on 800 and 400 mg/kg BW.

7. Antiviral Property

Antibiofilm potential of an essential oil from Cinnamomum tamala against P. aeruginosa biofilms repored by Sanaulla and Rubini, in 2017. The synergistic effects of the essential oil along with a commercially available DNase (DNaseI) and a DNase (MBD) isolated from a marine bacterium were explored for its antibiofilm activity. The results showed that the synergized action has maximum efficacy in inhibiting young and preformed biofilms. The synergized effect of essential oil and DNaseI showed 70% inhibition against matured biofilms of P. aeruginosa. The essential oil from C. tamala also showed quorum sensing inhibitory potential as it could inhibit the swarming motility behavior of P. aeruginosa. The synergistic action of essential oil and DNases offers a novel alternate therapeutic strategy for combating P. aeruginosa biofilm associated infections.

2. SUMMARY

From the above it is concluded that:

1. Cinnamomum tamala is rich in terpenes, flavones and tannins. Eugenol and Cinnamaldehyde is the chief constituent of the plant. Reported flavones are quercetin, quercetrin, Myricetin, 3, 4, 5, 7- tetrahydroxy flavones, 3,3,4,5,7-pentahydroxyflavone, Kaempferol and its derivatives such as Kaempferol-3-O-rhamnoside, Kaempferol – 3 – O - glucopyranoside, Kaempferol – 3 - Osophoroside and Kaempferol 3, 7- di - Orhamnopyranoside.
2. It is antidiabetic and immunosuppressive and non polar fraction is most active among all. It has ability to enhance the insulin secretion from beta

cells of pancreas. It suppresses macrophage function (Phagocytosis, Respiratory burst, Nitric oxide production, NADPH content and protect H2O2 induced iNOS degradation). In cell mediated immunity, it suppresses sheep red blood cells (SRBCs) induced DTH response and concanavalin A induced blastogenesis in peripheral blood lymphocytes and in humoral response, it suppresses SRBC induced antibody production.

3. It is good antioxidant and anti-inflammatory agent but non polar fraction is post active because their EC50 value is least among all fractions. It suppresses superoxide production, Nitric oxide production, hydroxyl radical production and lipid per oxidation. It improves the activity of antioxidant enzymes such as SOD, Catalase and Lipid peroxidase. It suppresses carrageenan induced inflamation in paw odema and acts on first phase of inflammation.
4. It is potent gastroprotective and antifungal and antidiarrleal and antiviral agent. Their antifungal activity was observed in volatile oil and gastroprotective and antidiarrheal activity was observed in ethanolic extract of Cinnamomum tamala leaves. Antiviral activity was observed in Essential oil of the plant leaves.

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