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Murraya koenigii (L.): The plant with inbuilt antioxidant and anti-inflammatory potential for chronic metabolic disorders

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A B S T R A C T

Murraya koenigii L. is an aromatic herb popularly known as Curry leaf or *Karivepaku* and is mostly used in folk medicine since years. The plant contains vital phytoconstituents in various parts with good medicinal value and is being attracted by the Ayurveda and pharma industry for knowing its therapeutic potential. The leaves of the plant are being used widely among the population because of its good aroma and has the potential to treat chronic metabolic disorders. The leaves contain antioxidant, anti-inflammatory and anticancer properties.

Introduction

The plant is commonly known as curry leaf and is native of India and widely distributed in Srilanka, Malaysia and Southeast Asia and is mainly used in folk medicine because of its high end medicinal properties (Satyavati *et al*., 1987). It belongs to the family, Rutaceae which comprises of more than 150 genera and 1600 species in the World. In India, it is widely distributed in Andhra Pradesh, Karnataka, Tamilnadu, Assam, Himalayas, and Maharashtra. The plant is grown in kitchen gardens, roadsides and vacant places of fields. It adds flavour to the food and is used for the preparation of powders. It is used as an antiemetic, antidiarrheal, febrifuge, blood purifier, tonic, stomachic, antipyretic, antidiabetic, antiobesity, and as a flavoring agent in curries and chutneys. The oil is used externally for bruises, in the soap and perfume industry (Dey and Lepcha, 2017 and Jain *et al*., 2012). The plant contains useful constituents that possess antioxidant, anti-inflammatory and anticancer properties.

Antioxidant properties

Reactive oxygen species (ROS) include singlet oxygen (O_2), hydrogen peroxide (H_2O_2), superoxide anion (O_2• −) and the hydroxyl radical (•OH) lead to oxidative stress which ultimately lead to cell death and tissue injury (Brand *et al*., 2004). The

compounds of *M. koenigii* like mahanine, isomahanine, koenoline, koenimbine, mahanimbine, girinimbine, isolongifolene and O-methylmurrayamine exhibit profound antioxidant properties (Gill *et al*., 2013). The benzene fraction of *M. koenigii* exhibited free radical scavenging activity. The benzene fraction showed maximum antioxidant capacity (3510.4 μmol) at 100 μg/mL followed by ethyl acetate (1982.3 μmol), petroleum ether (1967.2 μmol), and acetone (1783.1 μmol) fractions (Zahin *et al*., 2013).

Fig.1 *Murraya koenigii* L.Plant

Aqueous leaf extract offered protection to the gastric mucosa against piroxicam-induced damage in a dose-dependent manner. Aqueous curry leaf extract pre-administered at 100 mg/kg body weight dose reduced ulcer index by 86.7% against piroxicam fed animal group (**P $\leq$ 0.001), but almost complete protection was rendered when 200 mg/kg BW and 300 mg/kg BW doses were administered. Lipid peroxidation levels were lowered and reduced glutathione content was also protected in a dose-dependent manner by aqueous curry leaf extract. Altered biomarkers *viz*., lipid peroxidation levels, protein carbonyl content, reduced glutathione (GSH), non-enzymatic total sulfhydryl group content (TSH), oxidized glutathione (GSSG) content and GSH–GSSG ratio were restored to control values when rats were pre-treated with aqueous curry leaf extract at 200 mg/kg BW dose before feeding piroxicam at 30 mg/kg BW dose (Syed *et al*., 2014). Dejan Orcic *et al*. (2011) explained that Phenolic compounds present in plants act as antioxidant or free radical scavengers due to their OH groups, which devoted directly to the antioxidant action.

Ali Ghasemzadeh *et al*., 2014 reported that, Myricetin was the most abundant flavonoid in curry leaf and also expressed that the antioxidant potential in curry leaf was due to the presence of flavonoids and phenolics. Sun *et al*. (2012) and Takasawa *et al*. (2011) confirmed that Myricetin exerted powerful biological effects including anticancer and antioxidant activities.

In general, the antioxidant activity of flavonoids is attributed to substitution pattern and structure of hydroxyl groups. In flavonoid structure, the 3',4'-orthodihydroxy configuration in the ring B and the 4-carbonyl group in the ring C define the radical scavenging activity. Presence of 3- and 5-OH groups gives a catechol-like structure in the ring C which exhibits antioxidant activity of flavonoids (Wojdyło *et al*., 2007).

Anti-inflammatory activity

Tissue injury, cell damage, infections due to pathogens, and alterations in biochemicals lead to a biological response called inflammation. In neurological disorders, the important components involved in inflammatory processes are believed to be mast cells, ependymal cells, microglia, astrocytes, and macrophages. Release of pro-inflammatory cytokines is an important mechanism by which immune cells regulate the inflammatory response and contribute to various inflammatory and autoimmune disorders (Bashkatova *et al*., 2004).

Stimulation of cells with Lipopolysaccharide leads to a cascade of intracellular signalling events that ultimately result in the production and secretion of cytokines and other inflammatory mediators that constitute the pro-inflammatory response. Chemical Compounds present in curry leaf, inhibited the release of pro-inflammatory cytokines like TNF-α and IL-6 and reduced the LPS induced TNF-α and IL-6 production (Yedukondalu *et al*., 2016).

Prasad *et al*., (2011) reported that the methanol extracts of leaves (400 mg/kg) of curry leaf has got potent anti-inflammatory effect in albino rats. Darvekar *et al*., (2011) reported that ethanolic extract (250 mg/kg) of curry leaf possessed significant anti-inflammatory effects. Susanna *et al*. (2015) concluded that methanolic extracts of *Murraya koeniigi* leaves (200mg/kg) exhibited significant inhibition of inflammation.

Iman *et al*., 2017 evaluated the anti-inflammatory activity of girinimbine in curry leaf against lipopolysaccharide/interferon-gamma-induced inflammation in RAW264.7 cells. The compound showed decreased levels of NO overproduction and pro-inflammatory cytokine levels IL-1β and TNF-α.

Phytoconstituents like murrayakonine A, O-methylmurrayamine A, and mukolidine exhibited anti-inflammatory activity by inhibiting TNF-α and IL-6 release in LPS-induced inflammation (Yedukondalu *et al*., 2016).

Future perspective

Modern drugs have many applications in the treatment of various diseases. However, they have side effects on the biological system. Hence, the identification and characterization of phytoconstituents will provide an alternate method for the disease treatment without any side effects.

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