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Comparative study of bioactive compounds in curry and coriander leaves: An update

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ABSTRACT

Curry (Murraya koenigii.) and coriander leaves (Coriandrum sativum) are most consumed leaves in various diets of Indian cuisines and other Asian countries includes Thailand, Malaysia, and Singapore. Both leaves are rich in many bioactive compounds like polyphenols, alkaloids and flavonoids which showed multiple bioactive functions like antioxidant, anticancer, antimicrobial antidiabetic and hepatoprotective. In addition to the basic bioactive compounds, they also rich in essential oil compound namely coumarine, bicyclomahanimbicine, mahanimbicine, phebalosin in curry leaves, whereas monoterpenoid-linalool found in coriander leaves. Based on the extensive richness of the bioactive nutrients both leaves act as a good store house for the functional compounds. In addition to the above bioactive functions, they also used in the household medicines for treating vomiting fever and stomach related disorders.

Keywords: Bioactive compounds, Coriander leaves (*Coriandrum sativum*), Curry leaves (*Murraya koenigii*.)

INTRODUCTION

High cost of the modern medicines and many side effects of those medicines lead people to switch around from modern medicines to the herbal medicines for the treatment of many infectious diseases [1]. Most of the herbal medicines depend on the bioactive compounds which act as a shield to many diseases [2, 3, 4, 5, 6, 7, 8]. These compounds are generally rich in many plants foods that are commonly consumed which in addition used in the preparation of traditional medicines and functional foods [9, 10, 11, 12, 13]. Curry (Murraya koenigii.) and coriander leaves (*Coriandrum sativum*) are among those plant foods which are long used in both medicine and foods for long centuries [14]. In, India both leaves are extremely used as seasoning ingredients in most of the curries. High vegetarian diet of Indian peoples extremely uses these spicy leaves in various dishes such as chutneys, curries and podies. The mature curry leaves contains moistures 63%, total nitrogen 1%, fat 6%, total sugar 14%, crude fiber 7% and ash 13%, whereas coriander fresh leaves contain moisture 88%, protein 3%, carbohydrates 2% and total ash 0.1% in addition to the bioactive compounds. This nutrient composition also varies with the geographical location of the plants.

Bioactive compounds of both leaves are proven to have many functional properties for the centuries. The functional compounds of curry leaves includes oxalic acid, vitamin A, koenigin, bicyclomahanimbicine, cyclomahanimbine, Murrayastine, coumarine, koenidine and pypayafolinecarbazole which has various bioactive functions such as antidiabetic, antioxidative, anticancer and antiulcer [15, 16]. Similarly, coriander leaves are also enriched with various compounds such as tartaric acid, gallic acid, diosmin, dicoumarin, 4-hydroxycoumarin apigenin, esculin,

luteolin and vicenin which have various health enhancing functions such as antioxidant, antidiabetic, antimutagenic and antidepressant activities [17, 18]. The curry and coriander leaves are shown in Fig.1.

Fig.1

Traditional medicinal uses of curry and coriander leaves

Health benefits of curry and coriander leaves are reported in classical literature of Indian, Greek and Latin for thousands of years [19]. Mostly fresh and green leaves are highly preferred in the medicines than the yellow or soft leaves due to the detoriation and loss of phytochemicals. Traditionally curry leaves are used in the treatment of various diseases includes diabetes mellitus, body pain, inflammation, and vomiting and kidney pain. They also used for the treatment of blood disorders and piles [20, 21]. In addition curry leaves are used for the treatment of poisonous animal bite. Similarly coriander leaves are also reported for the treatment of various diseases such as eczema, dry skin, erysipelas, inflammation. Further they also used for the treatment of abdominal discomforts and loss of appetite. In addition fresh coriander leaves juices are also used for the treatment of the headache [22].

Nutritional composition of curry and coriander leaves

Matured leaves of curry and coriander are rich in moisture (63.2% for curry leaves and 87.9% for coriander leaves), protein (1.15%of nitrogen for curry leaves and 3.3% for coriander leaves), carbohydrate (14.6% of total sugars for curry leaves and 6.5% for coriander leaves) and total ash (13.06% for curry leaves and 1.7% for coriander leaves). In addition, leaves are also rich in fibers, minerals and vitamins such as calcium, carotene, nicototinic acid and vitamin A in curry leaves and phosphorous, calcium, iron, vitamin B_2, niacin and vitamin C in curry leaves. Apart from the basic nutrients, both leaves contain various functional compounds which play a critical role in health healing functions of humans during consumption. Bioactive compounds seen in curry leaves include oxalic acid, resin, carbazole alkaloids and volatile oils which is rich in bicyclomahanimbicine, Mahanimbicine. Similar to that of curry leaves, coriander leaves are also rich in volatile oil, which gives a typical flavor to the food product namely alcohols: terpinen-4-ol (trace-3 percent), linalool (60-80 percent): ketones (7-9 percent): hydrocarbons; ρ-cymene (trace-3.5 percent), γ-terpinene (1-8 percent), and esters.

Common biological activities of curry and coriander leaves

Antioxidant activity

Higher concentration of the bioactive compounds seen in plants leaves showed higher antioxidant activities. From the safety point, herbal leaves are highly recommended for their antioxidant potential [23]. Among those leaves used for the culinary purpose, curry and coriander leaves are highly consumed in the countries of Asia like India, Malaysia, Singapore and Thailand. However, the antioxidant potential in turn depends on the total polyphenolic compounds, essential oils and other compounds. In curry leaves, the carbozole alkaloids that are recently isolated are of mahanimbine and koenigine, which showed higher antioxidant activities [24, 25]. The aryl hydroxyl group of alkaloids in curry leaves showed higher antioxidant potential. Recently Mitra et al. [26] reported that curry leaves showed higher antioxidant activity in cadmium induced oxidative stress in rats. Similar to the curry leaves, coriander leaves are also rich in phytochemicals such as polyphenols, carotenoids and essential oil like linalool, which shows higher free radical scavenging activity includes DPPH and FRAP [27, 28]**.**

Antimicrobial Activity

Antimicrobial activities of curry and coriander leaves are well reported [29, 30, 31]. The active compounds involved in the curry leaves are of carbazole alkaloids and essential oils [32, 33], whereas coriander leaves contains essential oils [34]. Recently, three antimicrobial alkaloids isolated from the curry leaves which are mahanine, mahanimbicine and mahanimbine, showed potent antimicrobial effect on the growth of antibiotic resistant bacteria [35]. Similar to that of curry leaves, coriander leaves showed antimicrobial activities of various microbes includes bacteria and fungi [36]. Higher inhibitory activity of various microbes by coriander essential oil is well reported. The active compound that isolated from coriander is of dodecenal which is twice effective than antibiotic drug such as gentamicin for killing salmonella [31].

Antidiabetic activity

Diabetes is a common problem in most developing countries and people prefer to take natural treatments than medicines. Various herbs are well reported to have antidiabetic activities, among them curry and coriander leaves also showed potential antidiabetic activity. The active compounds involve in the curry leaves are of Mahanimbine [37] which involves either increasing the secretion of insulin or by increasing the utilization of the glucose. Coriander leaves and seeds are also well reported for their antidiabetic activity by increased release of insulin from the pancreatic cells [38]. The incorporation in the diet or in the drinking water was effective to reduce the hyperglycemia; however no single compound from the coriander leaves is reported to have this beneficial function.

Hypocholesterolemic activity

Hypercholesterolemia is the major factor to many serious illness includes, hypertension, heart attack and cancer. Treating it with natural foods is mostly preferred among the developing and developed countries people. Among the commonly consumed leaves, curry leaves contains carbazole alkaloids, which has various beneficial activities like antioxidant, antilipedemic and antimicrobial [39]. It also depends on the dose level, the dose of 500 mg/kg was found to be highly efficient in reducing the blood cholesterol level in aged mice. Similarly, crude extract of coriander leaves and seed also showed potential lipid lowering effect in the rats [40]. Compared to coriander leaves, coriander seeds are rich in the functional oils showed higher lipid lowering effect with decreased cholesterol and triglycerides [41, 42]. Similarly effect of the coriander seeds on the lipid lowering effect in the rats was studied and found to be higher hypolipidemic effect.

Table 1: Pharmacological activity of various bioactive compounds in Curry and coriander leaves

.No	Pharmacological activities	Plants	Bioactive compounds
1	Antioxidant	Curry	Koenigine; Mukonicine; Mahanimbinine; Murrayacinine; Mahanimboline; Isomahanine
		Coriander	Apigenin; Ascorbic acid; Beta-carotene; Caffeic acid; Camphene
2	Antimicrobial	Curry	Murrayanol; Mahanimboline; Mahanimbinine; Murrayacinine
		Coriander	Alpha-phellandrene; Alpha-pinene;Alpha-terpinene; Apigenin
3	Antidiabetic	Curry	Murrayacinine; Isomahanimbine/ Mahanimbicine; Mahanimboline
		Coriander	Chlorogenic-acid; Ascorbic acid
4	Anticholesterol	Curry	Carbazole alkaloids
		Coriander	Crude extracts
5	Anticancer	Curry	Girinimbine; acarbazole
		Coriander	Alpha-pinene; Apigenin
6	Hepatoprotective	Curry	Flavonoids
		Coriander	Phenolic compounds

Anti-carcinogenic effect

Anticancer effects of various essential compounds in curry and coriander leaves are well studied. Among the compounds, mahanine, mahanimbicine, mahanimbine in the curry leaves showed potential anticancer effect on the human cell lines like human breast MCF-7, human cervical HeLa and murine leukemia cell lines [43]. Girinimbine, an active compound isolated from the curry plant was shown to have in vitro antitumor activity of the Raji cells. Pthalides are of group of compounds had found to be rich in coriander showed potentaial anticancer activities in various cell lines. Similarly, Chithra and Leelamma [42] studied the effective role of the coriander crude extract on the antitumor effect of colon cancer and found to be highly efficient. Another potential compound such as pthalides found in coriander also showed potential anticancer effect.

Hepatoprotective

Hepatotoxicity is the most common disease in that group of peoples involves long term consumption of alcohol. In order to prevent the hepatic failure, patients prefer mostly natural medicines that are commonly consumed in the daily foods. Among the plant leaves that are highly hepato protective, curry and coriander leaves are mostly dominant which in turns regulates many diseases includes hyperlipedemic, diabetes and hepatotoxicity [44, 45, 46, 47, 48]. The bioactive compounds that are highly protective are of alkaloids, flavonoids and phenolic compounds. Both curry and coriander leaves are rich in these compounds found to be highly hepatoprotective. In *In vitro* studies of the crude ethanolic extract at various doses (200, 400 and 600 mg/kg body weight) of curry leaves showed higher hepatic protective function [49]. Similarly, coriander extract showed higher hepatic protective with increasing liver function and enzymes on those of rats induced by the toxicity carbon tetrachloride [50].

CONCLUSION

Due to increasing knowledge of the nutritive value of foods, people are much focused on the foods rich in active functional compounds. Mostly in the indigenous foods, peoples consumed in a group of many plant foods rich in functional compounds with multiple functional activities like antioxidant, antidiabetic, anticancer and antimicrobial. Thus the present review concludes that the curry and coriander leaves are rich in many functional compounds showed quite similar bioactive functions on various diseases. However, much study needs to focus on the synergistic effect of these compounds isolated from curry and coriander on various diseases.

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