



A Study on Antioxidant Activity and Reducing Properties of Few Flavone Extracts from Common Indian Spices and Herbs

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ABSTRACT

Flavonoids are found concentrated in fruits and flowers of plant. They are the essential oils with various medicinal properties like anti-inflammatory, anti-thrombogenic, antidiabetic, anticancer, anti-allergic, antimicrobial etc. In this present investigation we have collected samples of *Elettaria zingiberaceae*, *Cinnamomum zeylanicum*, *Calendula officinalis*, *Rosa indica* and *Polianthes tuberosa*. Carried out both soxhlet (hot) and cold methods of extraction. Both the extracts were subjected to antioxidant and reducing power assays. There was effective extraction of flavanones in hot condition for both *Elettaria zingiberaceae* (50 %) and *Cinnamomum zeylanicum* (40%) hence the antioxidant property has also been enhanced with respect to the standard antioxidant.

Keywords: *Elettaria zingiberaceae*, *Cinnamomum zeylanicum*, *Calendula officinalis*, *Rosa indica*, *Polianthes tuberosa*. Antioxidant activity and Reducing power assay.

1.0 INTRODUCTION AND LITERATURE REVIEW

Flavonoids are major part of human diet and form a large family of [polyphenolic](#) plant compounds. There are six major subclasses of flavonoids, they are anthocyanidins, flavan-3-ols, flavonols, flavanones, flavones, and isoflavones. Fruit and vegetable diets including Flavonoids are potential health promoters. The physicochemical properties of flavonoids influence their metabolic fate, i.e., their digestion, absorption, and biotransformation. The [bioavailability](#) of these polyphenols *in vivo* is a major determinant in their ability to exert biological activities relevant to human health. The [bioavailability](#) of these polyphenols *in vivo* is a major determinant in their ability to exert biological activities relevant to human health. Many of the biological effects of flavonoids appear to be related to their ability to modulate a number of [cell-signalling](#) cascades. Flavonoids have been shown to exhibit anti-inflammatory, anti-thrombogenic, antidiabetic, anticancer, and neuroprotective activities through different mechanisms of action *in vitro* and in animal models (Satomi Yano 2007).

Flavonoids are widely distributed in plants, fulfilling many functions. Flavonoids are the most important [plant pigments](#) for flower coloration, producing yellow or red/blue pigmentation in petals designed to attract [pollinator](#) animals. In higher plants, flavonoids are involved in UV filtration, symbiotic nitrogen fixation and floral pigmentation. They may also act as chemical messengers, physiological regulators, and cell cycle inhibitors. Flavonoids secreted by the root of their host plant help *Rhizobia* in the infection stage of their [symbiotic](#) relationship with legumes like peas, beans, clover, and soy. *Rhizobia* living in soil are able to sense the flavonoids and this triggers the secretion of [Nod factors](#), which in turn are recognized by the host plant and can lead to root hair deformation and several cellular responses such as ion fluxes and the formation of a [root nodule](#). In addition, some flavonoids have inhibitory activity against organisms that cause plant diseases, e.g. *Fusarium oxysporum* (Galeotti, 2007).

Flavonoids have been shown to have a wide range of biological and pharmacological activities in *in vitro* studies. Examples include anti-[allergic](#), [anti-inflammatory](#), [antioxidant](#), [anti-microbial](#) ([antibacterial](#), [antifungal](#), and [antiviral](#)), anti-[cancer](#), and anti-[diarrheal](#) activities. Flavonoids have also been shown to inhibit [topoisomerase](#) enzymes and to induce [DNA mutations](#) in the [mixed-lineage leukemia \(MLL\) gene](#) in *in vitro* studies. However, in most of the above cases no follow up *in vivo* or [clinical](#) research has been performed, leaving it impossible to say if these activities have any beneficial or detrimental effect on human health.

Antioxidant activity of flavonoids

Research shows that flavonoids are poorly absorbed in the human body (less than 5%), with most of what is absorbed being quickly metabolized and excreted. These findings suggest that flavonoids have negligible systemic antioxidant activity, and that the increase in antioxidant capacity of blood seen after consumption of flavonoid-rich foods is not caused directly by flavonoids, but is due to production of [uric acid](#) resulting from flavonoid [de polymerization](#) and [excretion](#).

In view of the above findings it was envisaged that flavonoids and its derivatives are highly beneficial to human beings if the absorption tendencies are increased. Five most commonly used flavonoid sources were selected and literature survey was carried out. The five plants and their details follow.

1.1a CARDAMOM

Cardamom/Cardamon belonging to the Kingdom- Plantae, Order- Zingiberales and Family – Zingiberaceae (Khan, 1990) is a spice made from the seeds of several plants in the genera *Elettaria* and *Amomum* of the *Zingiberaceae* family. Both genera are native to India, Bangladesh, Bhutan, Indonesia, Nepal and Pakistan. They are recognized by their small seed pods, triangular in cross-section and spindle-shaped with a thin papery outer shell and small black seeds.

Both types of cardamom are used as flavorings and cooking spices in both food and drink. It is also used as medicine. *E. cardamom* (green cardamom) is used as a spice, a masticatory and in medicine. Medicinally cardamom is widely used to bring relief from digestive problems in ayurveda. Though they are not used in Western medicines for their medicinal properties, but are used as a flavouring agent for medicinal preparations. In the ancient world, cardamom was used to bring relief from digestive problems.

In India, green cardamom is broadly used to treat infections in teeth and gums, to prevent and treat throat troubles, congestion of lungs and pulmonary tuberculosis, inflammation and eyelids and also digestive disorders. It is also reportedly used as an antidote for both snake and scorpion venom (Umesh Rudrappa).

The seeds contain palmitic and oleic as dominant fatty acids, besides linoleic and linolenic acids, along with α -tocopherol, desmosterol and campesterol. 1,8-Cineole gives a harsh 'eucalyptol' smell to the oil if present in high proportion. α and β -pinene, α -terpene, α -terpinol, α -terpinyl acetate, terpinene-4ol, borneol, nerol, nerolidol, geraniol, geranyl acetate, linalool and linalyl acetate (Prajapati 2003). Leaves of cardamom have been reported to show antioxidant properties.

1.1b CINNAMON

Cinnamomum zeylanicum/verum belonging to the family Lauraceae. Cinnamon is a spice obtained from the inner bark of several trees of genus *Cinnamomum*, which is used in both sweet and savoury foods.

According to the U. S. National Library of medicine, cinnamon can be used to help treat muscle spasms, vomiting, diarrhea infections, loss of appetite and erectile dysfunction. Cinnamon may lower blood sugar in people with type-1 or type-2 diabetes (Abed, 2012, Cassia Oxford Dictionary) consuming up to 6 grams of cinnamon per day reduces serum glucose, triglyceride, LDL cholesterol and total cholesterol in people with type-2 diabetes. In accordance with National Institutes of Health (Cinnamon, 1989) cinnamaldehyde – a chemical found in *Cassia cinnamon* could help fight against bacterial and fungal infections. Reports of cinnamon bark having properties to fight Alzheimer's disease are seen. A study of Indian medicinal plants revealed that cinnamon may potentially be effective against HIV (Cassia Oxford Dictionary) according to authors the most effective extracts against HIV-1 and HIV-2 are respectively *Cinnamum cassia* (bark) and *Cardiospermum helicacabum* (shoot and fruits)

The flavor of cinnamon is due to an aromatic essential oil that makes up 0.55 to 1% of its composition. The pungent taste and scent comes from cinnamic aldehyde (about 90% of the essential oil from the bark) and by reaction with oxygen it darkens in colour and forms resinous compounds. Other chemical components of the essential oil include ethyl cinnamate, eugenol (leaves), o-methyl eugenol, benzaldehyde, cinnamaldehyde, 1- α -pinene, 1- α and 1- β -phellandrene, p-cymene, benzyl benzoate, cinnamyl alcohol, β -caryophyllene, linalool, methyl chavicol, flavones and polyphenols (Prajapati, 2003).

Cinnamon extracts can be used as food antioxidant together with the improvement of food palatability.

1.1c MARIGOLD

Marigold/Gols bloom/ Ganda/ Coltha or *Calendula officinalis* belonging to Calenduleae family and *Calendula* genus has forever been associated with auspicious occasions and is considered ideal for the purpose of larger than life celebrations.

Marigold is used for stomach upset, ulcers, hemorrhoids, conjunctivitis, varicose veins, poor eye sight, menstrual period problems, eye infections, inflammations and for wound healing. It is antiseptic. If the marigold flower is rubbed on the affected part it brings relief in pain and swelling caused by a wasp or bee. A lotion made from the flowers is most useful for sprains and wounds. Water infusion of freshly gathered flowers is beneficial in fever. Marigold flowers are mostly in demand for the treatment of alopecia. Internally it is used to treat bladder and kidney problems, blood in urine, uterine bleeding and many more.

Yellow dye has also been extracted from the flowers. Pigments in marigold are sometimes extracted and used as the food coloring for humans and livestock.

Flavonoids extracted from marigold flowers were investigated for their dyeing potential. Patulitrin (1) and (2) have been isolated and found to be the main flavonoids present in the dyeing bath. It was found that growing location was important in the amount of flavonoid present in the flowers. It was found that water-ethanol mixture gave high extraction efficiency and allowed selective extraction of 1 and 2 (Nitin, 2013).

The flowers of marigold have been reported to have antioxidant and antibacterial properties.

The chemical composition of the plant include triterpenes, resins, bitter glycosides, volatile oil, steroids, flavonoids, mucilage and carotenes (Prajapati, 2003).

1.1d ROSE

ose belongs to Rosaceae family and has the scientific name *Rosa indica*. Aromatic oil 'rose oil' extracted from this amazing flower finds purposes ranging from perfumery and aromatherapy to medicines. Rose oil is the costliest volatile oil used in premium grade perfumes and cosmetics. Rose oil contains extraordinary therapeutic properties and is found helpful in cases of skin redness or inflammation and where moisturisation and regeneration are needed. This essential oil possesses cooling, relaxing and toning properties. It can be used in the treatment of a wide range of stress related conditions and can also be used for hyperactivity in children. Besides these, rose oil is also great for hangovers, easing menstrual discomfort, depression and symptoms of menopause. When applied on the skin this sweet oil makes it glowing and charming besides softening it (Garden guides).

In general the rosaceae family members possess vitamins like C, A, B¹, B², B³ and K, flavonoids, tannins, polyphenols, carotenoids, vanillin, volatile oilcitronellol, geraniol, nerol, geranic acid..etc. (Prajapati, 2003).

1.1e TUBAROSE

Tubarose the *Polianthes tuberosa* an origin of South America is cultivated for its essential oil. The tubarose essential oil is one of the most precious oils in the world and is renowned for its mesmerizing aroma and fragrance.

2.0 Past approaches and accomplishments

Spices and flowers are rich sources of flavonoids and its derivatives. Natural flavonoids have been shown to possess innumerable biological activities, however the antioxidant activities of the same have still to be studied in detail. Metal ions, such as [iron](#) and [copper](#), can [catalyze](#) the production of [free radicals](#). The ability of flavonoids to [chelate](#) (bind) metal ions appears to contribute to their [antioxidant](#) activity *in vitro*.

3.0 MATERIAL AND METHOD

3.1 SAMPLE COLLECTION AND IDENTIFICATION

Plant samples were collected from Chickmagalur District between January to February. Date and location of each collection were recorded with photographs and preserved as herbarium. Specimens were compared with known standard species and identified.

3.2 FLAVANONE EXTRACTION

Freshly collected plant samples were extracted for flavones, using standard methods.

The antioxidant analysis and reducing power assay were carried out by standard methods (H.A. Abd El-aal and F.T. Halaweish, 2013). Standards and control were adopted wherever necessary. All the experiments were carried out in triplicate and averaged.

4.0 RESULTS AND DISCUSSION

The findings are summarized in Table-1.

SL. NO.	PLANT NAME	METHOD	ANTI OXIDANT POWER(%)	REDUCING POWERmg/g
01	<i>Elettaria zingiberaceae</i>	HOT	50	27
		COLD	50	1.7
02	<i>Cinnamomum zeylanicum</i>	HOT	32	25
		COLD	40	2.8
03	<i>Calendula officinalis</i>	HOT	12	3.8
		COLD	15.2	2.7
04	<i>Rosa indica</i>	HOT	23	38
		COLD	23	43
05	<i>Polianthes tuberosa</i>	HOT	16	3.6
		COLD	16	6.9
05	Standard		95.33	86.21
06	Control		---	--

Table -1: Antioxidant power and reducing power of flavanoid extracts

5.0 CONCLUSION

- 1) The present study has tried to give a novel easy and less cumbersome method of isolation of flavones from plant extracts.
- 2) It was found that effect of temperature on extraction process directly influenced the activity of the extract.
- 3) There was effective extraction of flavanones in hot condition for both *Elettaria zingiberaceae* (50 %) and *Cinnamomum zeylanicum* (40%) hence the antioxidant property has also been enhanced.
- 4) The reducing power cold extracts of *Elettaria zingiberaceae* (27 mg/g) were significant as indicated by high absorption. The reducing power assay of *Cinnamomum zeylanicum* (25 mg/g) has been found to be very less in comparison with the antioxidant properties of the same. There was considerable increase in the reducing properties of Rose extracts (43 mg/g).

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