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EFFECT OF *CORRIANDER SATIVUM* EXTRACT ON MICRONUCLEUS FORMATION IN BONE MARROW CELLS OF *SWISS ALBINO* MICE

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ABSTRACT
Coriander (Coriandrum sativum L.) being an annual herb is most commonly used for seasoning purpose. Its plant seeds, leaves and roots are edible, although they have very distinct flavors and uses. *Coriandrum sativum* Linn is a widely used medicinal plant throughout India and popular in various Indigenous System of Medicine like Ayurveda, and Siddha. Plants have been used for medical purposes since the beginning of human history and are the basis of modern medicine. In this study, the protective effect of *Corriander sativum* extract has been tested against cyclophosphamide (CP)-induced micronuclei formation in mouse bone marrow cells. The three test doses, namely 100, 150 and 200 mg/kg body weight of *Corriander sativum* extract provided protection when given 24 hr prior to the single ip administration of cyclophosphamide (50 mg/kg body weight). A dose dependent inhibition of micronuclei formation was observed which was statistically significant ($p<0.05$) as compared to the cyclophosphamide group. It was observed that *Corriander sativum* extract alone could not induced micronuclei formation at the test dose 100 mg/kg body weight. Therefore, it's seemed to have a preventive potential against CP-induced micronuclei formation in Swiss mouse bone marrow cells.

KEYWORDS: *Corriander sativum, Micronucleus, Mutagenic, Genotoxic.*

INTRODUCTION
Coriander (*Coriandrum sativum* L.) which belongs to the family Apiaceae (Umbelliferae) is mainly cultivated from its seeds throughout the year (Mhemdi et al., 2011). India is the biggest producer, consumer and exporter of coriander in the world with an annual production of around three lakh tonnes. It is an annual, herbaceous plant which originated from the Mediterranean and Middle Eastern regions and known as medicinal plants. It contains an essential oil (0.03 to 2.6%) (Nadeem et al., 2013). All parts of this herb are in use as flavoring agent and/or as traditional remedies for the treatment of different disorders in the folk medicine systems of different civilizations (Sahib et al., 2012). Coriander closely resembles flat leaf parsley. This resemblance makes many people confused between the two however, coriander has strong fragrance and parsley has mild fragrance. It grows best in dry climates however it can grow in any type of soil like light, well drained, moist, loamy soil, and light to heavy black soil (Verma et al., 2011). It is highly reputed ayurvedic medicinal plant commonly known as "Dhanya" in India. This plant is highly aromatic and has multiple uses in food and in other industries. Plants have played a critical role in maintaining human health and civilizing the quality of human life for thousands of years (Dhankar et al., 2011). It is also used to flavor sausages. All parts of plant are edible, fresh leaves can be used for garnishing and are common ingredient in many foods like chutneys and salads. The green herb is also employed for the preparation of either steam-distilled essential oil or the solvent extracted oleoresin (Nadia and Hala, 2012). Coriander has been reported to posses many pharmacological activities like antioxidant (Darughe et al., 2012), anti-diabetic (Eidi et al., 2012), anti-mutagenic (Cortes et al., 2004), antilipidemic (Sunil et al., 2012), anti-spasmodic (Alison et al., 1999). Dried coriander fruit is an important ingredient in pickle making. It is sometimes used to mask odd flavors (Parthasarathy et al., 2008). Its fruits contain vegetable oil with a high concentration of monounsaturated fatty acids, especially of petroselinic acid. This oil can be extracted using various techniques; most commonly three different techniques are used: steam distillation, organic solvent extraction (soxhlet), supercritical fluid extraction (Mhemdi et al., 2011). Moreover, coriander oil is used as an antimicrobial agent as it possesses broad spectrum antimicrobial activity (Silva et al., 2011). This oil can be encapsulated in alginates, chitosan etc. so as to enable isolation, protection, transport and release of its active components like vitamins, flavours, peptides, minerals, fatty acids, polyunsaturated fatty acids,

antioxidants, enzymes and living cells (Cristian, 2013). Coriander powder and its essential oil are considered as natural food preservatives including antibacterial, antifungal and antioxidant properties (Politeo et al., 2007). We have therefore undertaken antimutagenic effect in Swiss mouse bone marrow cells of mice.

MATERIALS AND METHODS

Animal

The study was conducted on random bred, 6-7 weeks old and 24- 28 gm body weight male *Swiss albino* mice. They were maintained under controlled conditions of temperature and light (light: dark, 12 hrs: 12 hrs.). They were provided standard mice feed and water *ad libitum*.

Chemical

Cyclophosphamide was purchased from Sigma Chemical Co. (St Louis, MO, USA). Other Reagent grades chemical were procured locally.

Extract Preparation

The identification of the plant *Coriandrum sativum* was done by botanist. After the drying of leaves powder was defatted with petroleum ether (1000 ml) and the residue was extracted in 50% methanol with the help of soxhlet extraction unit. The sample was collected and concentrated in water bath at 40-50^{o}C and dried in hot air oven at 40^{o}C. The dried powder was kept in air tied box.

Micronucleus Assay

For the micronucleus assay, the extract at the volume of 0.2 ml at different doses level such as 500, 1000 and 1500 mg/kg body weight was injected 24 hours before the treatment of cyclophosphamide, to six animals. The positive control group received single i. p. injection of 50 mg/kg cyclophosphamide in 0.9% saline. The animals were sacrificed by cervical dislocation and bone marrow cells were harvested. The slides were prepared essentially as described by Schmid (1975) and modified by Aron *et al.*, (1980). After staining with May-Gruenwald and Giemsa, a total 1000 cells were scored at the magnification of x1000 (100 x 10x) for each group. The data are expressed as the average number of micronucleated cells/thousand polychromatied erythrocytes cells (PCE) cells/animals (±SE) for a group of six animals. The results were compared with the vehicle control group using Student's't' test with significance determined at $p<0.05$.

RESULTS

Corriander sativum ***extract*** ip at 100, 150 and 200 mg/kg body weight was found to inhibit the micronuclei formation induced by CP given ip at 50 mg/kg body weight. A dose dependent response was remarkable and statistically significant (Table 1). In the positive control group CP induced micronucleus formation at the dose of 50 mg/kg body weight. It was noteworthy that different doses of *corriander sativum* and CP used in the present experiments were not cytotoxic for PCE/NCE (normochromatid erythrocytes) ratio in *Corriander sativum* extract treated and positive control as compared to the solvent control group, which remained unchanged.

Table 1: Effect of Corriander sativum extract on micronucleus formation in mouse bone marrow cells

Sl	GROUPS	MN PCE ± SE	PCE/NCE ± SE
1.	Positive control Cyclophosphamide alone (50mg/kg)	4.10 ± 1.20	0.49 ± 0.56
2.	*Corriander sativum extract* (100 mg/kg) + cyclophosphamide (50mg/kg)	2.10 ± 1.43*	0.98 ± 0.99
3.	*Corriander sativum* ext. (150 mg/kg) + cyclophosphamide (50mg/kg)	1.65 ± 1.10*	1.56 ± 0.33
4.	*Corriander sativum* ext. (200 mg/kg) + cyclophosphamide (50mg/kg)	1.10 ± 0.54*	1.84 ± 0.86
4.	Solvent (water)	0.30 ± 0.54	0.98 ± 0.30

* denotes statistically significant as compared to cyclophosphamide group at $p<0.05$.

DISCUSSION

Herbs and spices are processed in foods from early times for seasoning as well as to increase shelf life of food and to restore health. Coriander is one of miraculous herb that functions as both, spice as well as herbal medicine. Although plant can be grown throughout the year, it is processed to increase its palatability, profitability and facilitate international trade. The leaves and fruits are highly fragrant and contain nutrients like fat, proteins, vitamins minerals etc. Its health benefits activities ranging from antibacterial to anticancer activities. Most important and well characterized property of coriander is its use as antioxidant. Due to its multifunctional uses and protective and preventive action against various chronic diseases, this herb is righty called as "herb of happiness". Moreover, processing of fruits and leaves of coriander is the best way to preserve this herb.

The medicinal value of plants lies in some chemical substances that have a definite physiological function in the human body. Different phytochemicals have been found to possess a wide range of medicinal properties, which may help in protection against various diseases. For example, alkaloids protect against chronic diseases; saponins protect against hypercholesterolemia and steroids and triterpenoides show the analgesic properties

(Geetha, *et. al.,* 2014). The mutagenic effects of Coriandrum sativum extract were evaluated by Ames test. Mutagenicity was present when the Coriandrum sativum extract caused mutagenicity when used in high concentrations in both Salmonella typhimurium TA97 and TA102 strains (Reyes, *et. al*., 2010). The antimutagenic activity of was also observed in coriander juice against the mutagenic activity of 4-nitro-ophenylenediamine, m-phenylenediamine and 2-aminofluorene was investigated using the Ames reversion mutagenicity assay (his- to his+) with the S. typhimurium TA98 strain as indicator organism (Cortés-Eslava, et. al., 2004).

In this study the *Coriander sativum* extract ip at 50 and 100 mg/kg body weight was found to inhibit the micronuclei formation induced by CP given ip at 50 mg/kg body weight. A dose dependent response was remarkable and statistically significant (Table 1). In the positive control group CP induced micronucleus formation at the dose of 50 mg/kg body weight. It was noteworthy that different doses of Coriander and CP used in the present experiments were not cytotoxic for PCE/NCE (normochromatid erythrocytes) ratio in *Coriander sativum extract* treated and positive control as compared to the solvent control group, which remained unchanged.

Experimental data revealed that there might be correlation between total phenolic and antioxidant capacity of different extracts of lemon grass. However, some literature demonstrated that antioxidant was not solely dependent on phenolic content but it may be due to other phytoconstituents as tannins, triterpenoid or combine effect of them. Another set of experiment the genotoxic study was also done which shows a better effect against cyclophosphamide as positive control and shown antimutagenic agent. So, in future it can be used as an alternate to synthetic antioxidant and antimutagenic agent. Much effort has needed to increase *Coriander sativum as* a dietary supplement in food so as to acquire antioxidant potential in our body naturally to fight against oxidative stress and other harm generated by free radicals and to protect against mutagenic effect induced by cyclophasphomide. Furthermore, detailed studies on the isolation and characterization of the plant extract as well as in vivo and in vitro assays will be necessary in discovering new biological agent for various disease.

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