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Editorial

Zingiber Officinale (Ginger): Panacea for Anticancer Drug-Induced Organ Toxicities

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Understanding the physiological and genetic mechanisms by which diet and individual food components influence health and disease, science of nutrition has been progressed during the last several decades. Nutrition is essential to support life but can also be considered as a causation of many chronic diseases. Several natural antioxidants present in spices and herbs were evaluated for their beneficial effect in human. Some of the natural products described as dietary supplements or nutraceuticals [1].

Zingiber officinale (Ginger) belongs to Zingiberaceae family. The part of the plant commonly used is rhizome which is an indispensable component of curry. Ayurveda, recommends ginger as diaphoretic, carminative, expectorant, antispasmodic, astringent, appetite stimulant and also as a diuretic agent. Studies reported several pharmacological effects including antimicrobial, anti-allergic, anti-neuroinflammatory, anti-oxidant and anticancer effects [2-4]. It is also considered as an essential ingredient in many preparations of traditional Chinese medicines.

Exposure to drugs and chemicals often causes organ toxicity. Such toxic effect is greater for organs that are capable of metabolizing chemicals. Factors that determine the toxicity include the ability of the target organs to metabolize the chemical as well as the pharmacokinetics and metabolic fate of the compound.

Liver and kidneys are the major organs affected by many chemicals and drugs. Many of the intermediates that are formed from during the metabolic process are highly reactive radicals and toxic. Additionally, considerable attention has also been focused on the involvement of oxygen free radical in such organ damages. Toxic injury to liver has to be primarily concerned to its capacity to detoxify the chemicals entered. Acetaminophen (Paracetamol) at higher doses was found to be toxic to hepatocytes. Free radicals induced oxidative stress was the major mechanism involved in such toxicity. Results of the previous study demonstrated that ginger could ameliorate the liver toxicity [5].

A large number of synthetic cancer chemotherapeutic drugs developed were found to be harmful to the host systems. The two major adverse reactions concerned to the cancer chemotherapy are cardiotoxicity induced by doxorubicin and cisplatin-induced nephrotoxicity. Both are commonly used drugs in combination regimen against malignancy. Cisplatin, Cis-Diamminedichloroplatinum (II) is extensively used for the management of malignancy associated with bladder, ovary, head and neck and testis, found to be toxic to kidneys at higher doses. Higher doses are more effective and used clinically for the management of advanced malignancy in ovary. However, such high dose therapy manifests irreversible toxicities including renal dysfunction. Extract of ginger administered with cisplatin was found to be effective to ameliorate the nephrotoxicity. Furthermore, the ginger did not interfere in the antitumor repose of cisplatin, which was evident from the solid tumor model in mice. Co-administration of ginger extract with cisplatin did not change the tumor reducing efficiency of cisplatin [6].

Antitumor antibiotic, Adriamycin (Doxorubicin) which is produced from the species of Streptomyces is commonly used in the treatment of soft and solid human malignancies. Similar to cisplatin, higher doses of doxorubicin (more than 500 mg/m2) are more efficacious but manifest irreversible organ toxicities such as cardiomyopathy which may lead to congestive heart failure even several years after the high dose therapy. Oxidative stress was described as the pathogenesis of adriamycin-induced cardiomyopathy. It can also cause severe hepato and nephrotoxicity. Ginger administration prior to the doxorubicin challenge could ameliorate both the cardio and nephrotoxicity [8].

The mechanism in all the above preclinical studies was ascribed to its antioxidant activity. Administration of ginger could enhance the cellular as well as systemic enzymatic and non-enzymatic antioxidants status. Such effect can be correlated to the phytochemicals present. The major phytochemicals reported in ginger are non-volatile pungent compounds- gingerols, shogaols and volatile oil components - zingiberene and zingiberol [9]. Antioxidant activity was reported for gingerols and shogaols [10]. Beneficiary effect of gingerol as a bioenhancer, emphasizes its remarkable role in pharmacotherapy. Gingerol can facilitate better absorption by regulating GI tract function and thus enhances the bioavailability of many drugs including ethionamide (56%), Ketoconazole (125%), Azithromycin (78%), and Zidovudine (105%) and antituberculosis drug, Rifampicin (65%). Ginger can also enhance the bioavailability of commonly used anti-cancer drug, 5-fluorouracil [11]. Food

and drug administration, US has listed the ginger as 'generally recognized as safe'. Further, administration of 1g of ginger powder 2 - 3 times/day for 2.5 years did not produce any toxic effects [12]. Accounting the overall beneficiary effects of ginger, clinical trials are warranted to explore its pharmacological benefit in cancer chemotherapy as an adjuvant to ameliorate the possible organ damage.

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