

Cancer chemoprevention with garlic and its constituents

Advance metastasized cancers are generally incurable; hence an effort to prolong the process of carcinogenesis through chemoprevention has emerged consistent with this notion. In recent years, a considerable attention has been placed to identify naturally occurring chemopreventive substances capable of inhibiting, retarding or reversing the process of carcinogenesis. A number of phenolic substances, particularly those present in dietary and medicinal plants, have been shown to possess substantial anticarcinogenic and antimutagenic activities. Epidemiological observations and laboratory studies, both in cell culture and animal models have indicated

anticarcinogenic potential of garlic and its constituents, which has been traditionally used for varied human ailments around the world. Chemical analysis has indicated that protective effects of garlic appear to be related to the presence of organosulfur compounds mainly allyl derivatives. Several mechanisms have been presented to explain cancer chemopreventive effects of garlic-derived products. These include modulation in activity of several metabolizing enzymes that activate and detoxify carcinogens and inhibit DNA adduct formation, antioxidative and free radicals scavenging properties and regulation of cell proliferation, apoptosis

and immune responses. Recent data show that garlic-derived products modulate cell-signaling pathways in a fashion that controls the unwanted proliferation of cells thereby imparting strong cancer chemopreventive as well as cancer therapeutic effects. Researchers working at Industrial Toxicology Research Centre, Lucknow, India in a review also discussed mechanistic basis of cancer chemopreventive effects of garlic-derived products, their implication in cancer management and ways and means to take these agents from bench to real life situations [Shukla Yogeshwer and Kalra Neetu, Cancer chemoprevention with garlic and its constituents, *Cancer Lett*, 2007, **247**(2), 167-181].

Estimation of minerals, nitrate and nitrite contents of medicinal and aromatic plants used as spices, condiments and herbal tea

In a study by researchers at Department of Food Engineering, Faculty of Agriculture, University of Selcuk, Konya, Turkey the minor and major mineral contents of 31 kinds of medicinal and aromatic plant collected from the south region of Turkey in 2004 were established by inductively coupled plasma atomic emission spectrometry (ICP-AES). The samples were composed of Al, Ca, Fe, K, Mg, Na, P and Zn. The highest mineral concentration were measured between 57.70-2962.74 mg/kg Al, 1160.04-16452.88 mg/kg Ca, 44.83-1799.5 mg/kg Fe, 3570.73-27669.72 mg/kg K, 477.17-4313.59 mg/kg Mg, 1102.62-20912.33

mg/kg Na, 443.60-9367.80 mg/kg P and 7.18-48.36 mg/kg Zn. The highest values of Ca, K and P were established in *Foeniculum vulgare* Mill. (bitter fennel) (16452.88 mg/kg), *Ocimum minimum* Linn. (basil) (27669.72 mg/kg) and *F. vulgare* (9367.80 mg/kg), respectively. The heavy metal contents were determined too low in all samples.

Nitrate and nitrite contents of samples were analysed using the phenolicdisulphonic acid method and the diazotisation method of the American Public Health Association, respectively. These nitrate and nitrite values were established to vary widely depending on

the different plant species. While nitrate contents were high in most cases and varied from 12.15 mg/kg Small-leaved lime (*Tilia cordata* Mill.) to 238.85 mg/kg myrtle (*Myrtus communis* Linn.), nitrite contents were established between 3.69 mg/kg sesame (*Sesamum indicum* Linn.) to 52.70 mg/kg basil (*Ocimum minimum*). Generally, nitrate contents of samples were found very high compared with nitrite values [Özcan MM and Akbulut M, Estimation of minerals, nitrate and nitrite contents of medicinal and aromatic plants used as spices, condiments and herbal tea, *Food Chem*, 2008, **106**(2), 852-858].

Effect of cooking on the antioxidant properties of coloured peppers

Pepper (*Capsicum annum* Linn.) has long been recognized as an excellent source of antioxidants, being rich in ascorbic acid and other phytochemicals. Researchers working at Japan, China and Taiwan conducted a study to investigate the effect of different cooking methods on the antioxidant properties of coloured peppers. Six varieties of peppers were subjected to different cooking methods, such as microwave heating, stir-frying and boiling in water, for 5 min individually. The cooked and raw peppers were analyzed for radical-scavenging activity (RSA) and total polyphenol content (TP) using 1,1-diphenyl-2-picrylhydrazyl-high-pressure liquid chromatography (DPPH)-HPLC and Folin-Ciocalteu methods, respectively. The samples were



also evaluated for ascorbic acid content (AsA) by HPLC. Total carotenoid content was determined spectrophotometrically. Results suggested that there is no significant ($P>0.05$) difference in RSA, TP, AsA and total carotenoid contents between the cooked and raw peppers when processed for 5 minutes. However, the cooked peppers show marked differences ($P<0.05$) in the RSA, TP and AsA when cooked for 5 min in boiling

water with further reduction observed after boiling for 30 minutes. This may be due to the leaching of antioxidant compounds from the pepper into the cooking water during the prolonged exposure to water and heat. Therefore, it is vital to use less water and cooking time and also to consume the water used for boiling so as to obtain the optimum benefits of bioactive compounds present in peppers. It is concluded that microwave heating and stir-frying without using water are more suitable cooking methods for pepper, to ensure the maximum retention of antioxidant molecules [Chuah Ai Mey, Lee Ya-Chi, Yamaguchi Tomoko, Takamura Hitoshi, Yin Li-Jun and Matoba Teruyoshi, Effect of cooking on the antioxidant properties of coloured peppers, *Food Chem*, 2008, **111**(1), 20-28].

Effect of temperature cycling on allinase activity in Garlic

Allinase, which catalyzes the conversion of alliin to allicin, the principal component of potential medicinal value in garlic, is a thermo-labile enzyme. The potential for allicin formation is determined by the quantity of allinase that remains active after the process of preserving garlic by drying by scientists at Canada. The kinetics of enzymatic activity loss during drying by temperature cycling or by constant temperature were evaluated and compared. Allicin-forming potential



was 91% preserved by temperature cycling from 40 to 60°C. It was found that sugars present in the garlic and the high molecular mass of the enzyme were

responsible for protection against degradation at high drying temperatures. Preservation of the enzymatic activity under cyclical conditions occurred mainly with exposure to low temperatures for drying periods longer than those of constant drying conditions [Lagunas Lilia L Méndez and Castaigne François, Effect of temperature cycling on allinase activity in garlic, *Food Chem*, 2008, **111**(1), 56-60].

Chemomodulatory action of *Foeniculum vulgare* Mill. (Fennel)

Researchers working at School of Life Sciences, Jawaharlal Nehru University, New Delhi, India examined the chemopreventive effect of different doses of test diet of *Foeniculum vulgare* Mill. (Fennel) seeds on DMBA-induced skin and B(a)P-induced fore-stomach papillomagenesis in Swiss albino mice. According to them this may be the first report of Fennel seeds exhibiting a significant reduction in the skin and the fore-stomach tumour incidence and tumour multiplicity as compared to the control group. Further, biochemical assays showed a significant increase in the content/activities of phase I enzymes



especially in the case of 6% test diet. A concomitant increase in the activities of the phase II enzymes were observed with all the doses of test diet under study. A significant enhancement in the activities of antioxidant enzymes were observed

especially at 4 and 6% test diets of Fennel. Glyoxalase I activity and the content of reduced glutathione were significantly elevated. Expectedly, the levels of peroxidative damage along with lactate dehydrogenase activity, exhibited a significant reduction at all three doses of test diets. These findings were indicative of chemopreventive potential of Fennel against carcinogenesis [Singh B and Kale RK, Chemomodulatory action of *Foeniculum vulgare* (Fennel) on skin and forestomach papillomagenesis, enzymes associated with xenobiotic metabolism and antioxidant status in murine model system, *Food Chem Toxicol*, 2008, **46**(12), 3842-3850].

Relationship between vegetative and rhizome characters and final rhizome yield in micropropagated ginger plants

The scientists at Indian Institute of Spices Research, Calicut, Kerala, India carried out studies on correlation and path analysis for yield and yield contributing characters in two types of micropropagated ginger plants (plantlets directly regenerated from aerial stem explants and plantlets regenerated from aerial stem derived callus) over first and second generations in two varieties, viz. cultivar 'Jamaica' and 'Varada'. Irrespective of the regeneration method, the *in vitro* derived plants showed high

positive correlation and maximum positive direct effect of circumference of cormlets, length of cormlets and number of cormlets with the rhizome yield in the first generation. But tiller number exhibited negative correlation and negative direct effect with the rhizome yield in the first generation. In the second generation of the aerial stem regenerated plants, tiller number, number of nodes per cormlets, circumference of cormlets, number of cormlets and plant height exhibited high positive correlation and maximum direct

effect with rhizome yield. However, in the second generation also, the callus regenerated plants showed the same trend as in the first generation. Even though the tiller number showed positive significant correlation with rhizome yield, it showed negative direct effect with the yield [Lincy AK, Jayarajan K and Sasikumar B, Relationship between vegetative and rhizome characters and final rhizome yield in micropropagated ginger plants (*Zingiber officinale* Rosc.) over two generations, *Sci Hort*, 2008, **118**(1), 70-73].

Recurrent somatic embryogenesis and plant regeneration in *Coriandrum sativum* Linn.

The scientists at Chungbuk National University, Cheongju, South Korea and Karnatak University, Dharwad, India established an efficient method of repetitive somatic embryogenesis and plant regeneration in *Coriandrum sativum* Linn. Embryogenic callus was induced from cotyledon and hypocotyl segments on Murashige and Skoog (MS) medium with 4.52 μ M 2,4-dichlorophenoxy acetic acid (2,4-D), upon subculturing on medium having same level of 2,4-D at an interval of 3

weeks developed somatic embryos, which progressed to cotyledonary stage through early developmental stages of somatic embryogenesis. The transfer of somatic embryos at an early cotyledonary and cotyledonary stage in clumps in succession to fresh 4.52 μ M 2,4-D supplemented medium developed embryos in a cyclic manner. Upon transferal to embryogenic clumps (cotyledonary embryos) to modified MS medium (4g/l KNO₃, 0.29g/l NH₄NO₃, 3mg/l thiamine HCl, 0.5mg/l pyridoxine HCl, and 5mg/l nicotinic acid),

the embryos irrespective of the cycles underwent maturation and germination. Germinating embryos transferred to half-strength MS medium favoured healthy growth of plantlets. The system of recurrent somatic embryogenesis in coriander offers a system for genes transfer and also scale-up production of modified plants [Murthy HN, Hahn EJ and Paek KY, Recurrent somatic embryogenesis and plant regeneration in *Coriandrum sativum* L., *Sci Hortic*, 2008, **118**(2), 168-171].

Development of shelf stable pepper based appetizers

The scientists at Defence Food Research Laboratory, Siddarthanagar, Mysore, India developed three pepper-based appetizers in the form of convenient beverage mixes. The optimization of ingredients in the formulations of spiced drink mix, spiced tomato mix and chakota soup mix was achieved using response surface methodology with statistical design software. The active ingredient

pepper was 1.5 and 2.8/100g as black pepper and 9/100g as white pepper with total pungency (expressed as piperine, g/100g) of 0.08, 0.155, 0.155 in spiced drink mix, chakota soup mix and spiced tomato mix, respectively. The appetizer mixes packed in paper/Al foil/polythene (PFP) and polypropylene (PP) pouches were stored at ambient temperature as well as 37°C. Periodic evaluation

(2-months interval) revealed that spice drink mix and spiced tomato mix had a shelf-life of 6 months, while it was 8 months for chakota soup mix packed in PFP pouches under ambient conditions (18–33°C) [Wadikar DD, Majumdar TK, Nanjappa C, Premavalli KS and Bawa AS, Development of shelf stable pepper based appetizers by response surface methodology (RSM), *LWT-Food Sci Technol*, 2008, **41**(8), 1400-1411].

Identification and estimation of a novel fluorescent compound in nutmeg

The scientists at Bhabha Atomic Research Centre, Trombay, Mumbai, India isolated a novel fluorescent naphthaquinone derivative from the hexane extract of commercial nutmeg (*Myristica fragrans* Houtt.). The compound was identified as 2-methyl-1, 4, 4a, 8a-tetrahydro-endo-1, 4-methanonaphthalene-5, 8-dione from its NMR, IR and mass spectral data. Absence

of this compound in green nutmeg suggested its formation during sun drying. Exposure of the spice to gamma radiation (0.5–10kGy) resulted in an increase in its content with dose further signifying its formation via a photochemical pathway. Quantification of this increase by thin layer chromatography (TLC)–densitometry as a means of rapid detection of gamma-irradiated nutmeg is suggested. A dose-

dependent increase in the presently identified compound suggests a possibility of monitoring its content in the processed product as a means of measuring absorbed dose [Chatterjee Suchandra, AnanthaKumar Arul, Variyar Prasad S and Sharma Arun, Identification and estimation of a novel fluorescent compound in nutmeg, *J Food Comp Anal*, 2008, **21**(7), 577-581].