COMMON everyday fruits, vegetables, grains and spices contain many constituents that have been shown to prevent cancer. A balanced diet, therefore, containing these foods can keep the onset of cancer at bay.

Chemoprevention is increasingly being considered as a strategy to block or reverse carcinogenesis from the very early stages. It is an inexpensive, cost effective and easily applicable approach to cancer control.

Several epidemiological studies indicate that fruits and vegetables have health promoting factors that prevent diseases, particularly cardiovascular and cancer. Plant nutrients providing this protection include micronutrients, as well as non-nutrient components of the diet. Nutrients that show modulatory effects in experimental cancers include macronutrients such as fats, carbohydrates, proteins, fibres and micronutrients such as vitamins – folic acid, riboflavin, β-carotene, retinol, α-tocopherol, vitamin B12 – and minerals such as selenium, zinc, magnesium and calcium. However, a number of non-nutritional components in our diet also possess anticarcinogenic and antimutagenic properties.

Nutritive Chemopreventers
A number of micronutrients in diet, including vitamins A, C and E, carotene, selenium and calcium have cancer preventive properties. Most of these agents are antioxidants. Epidemiological studies have shown that the incidence of certain forms of cancer is highest in people with a low dietary intake of the above nutrients.

Non-nutritive Chemopreventers
There are many non-nutrients in diet with plausible cancer preventive effects. During the past few years, as research on the relationship between diet and cancer has increased, data from both epidemiological and experimental studies indicate that cereals, vegetables, fruits and certain beverages contain a variety of potential cancer-preventing substances.

Cereals: Cereals like wheat, rice, maize, millet, sorghum are principal constituents of food. They provide protein, vitamins, trace elements and varying amounts of non-starch polysaccharide (dietary fiber). Although, dietary fiber is not a supplier of calories or essential nutrients, it is important for intestinal functioning. The dietary fibre lowers the intestinal pH, binds to bile acid and shortens the intestinal transit time. Bile acids are believed to be one of the factors involved in colon carcinogenesis by regulating gene expression. The prevalence of colon cancer in India is much lower as compared to western population, probably because of higher unprocessed cereal intake.

Vegetables: The potential of green leafy vegetables, beans of all varieties, cruciferous vegetables like cabbage,
brussels sprouts, canola (*Brassica napus* L.), kale, cauliflower and broccoli as a food source for human consumption is being considered to increase the variety of nutritious vegetables available to consumers. Scientific evidence supports that consumption of green leafy vegetables may reduce individual risk factors for some diseases. Umbelliferae vegetables like carrots, celery, parsnips, alliums namely onions, garlic and chives, solanaceous vegetables like potato, tomato and brinjal have significant levels of cancer protecting non-nutrients.

**Fruits:** Fruits contain antioxidant compounds broadly called polyphenols that are known to reduce oxidative stress. The antioxidant properties of these compounds are responsible for their anticancer, antiviral and anti-inflammatory properties. They can also prevent capillary fragility and platelet aggregation. All the citrus fruits, grapes, apples, strawberries, plums, pineapple, and melons have high levels of protective phytochemicals. All the other fruits and dried fruits also possess some amounts of antioxidant activity. Some of them also have anti-inflammatory and antimicrobial properties.

**Spices:** Spices and condiments that are a part of the Indian diet have chemical constituents containing antioxidant, antimitogenic and anticarcinogenic properties. Turmeric, cloves, ginger, thyme, anise, mustard, and cinnamon have antioxidant and antimitogenic properties. Some of them also have many other beneficial effects like hypcholesterolaemic, hypoglycaemic, anti-inflammatory and antimicrobial properties.

### Mechanisms of Action of Chemopreventers

The mechanism of action of chemoprevention by phytochemicals is complex and is classified according to the site of action or by specific type of action. The activity could be the result of simultaneous action of several factors on the same event. It appears that most chemopreventers act primarily as antioxidants, antimitogens, immunomodulators and anticarcinogens. Chemoprevention may occur through detoxification mechanism or by antimitogenic processes at both the initiation and promotion steps of carcinogenesis.

#### Detoxicators:
These phytochemicals induce drug metabolizing enzymes in the body and act by detoxifying the harmful substances capable of producing harmful effects. The antineoplastic effects of inducing and inhibiting agents in foods focus on specific monooxygenases like the aryl hydrocarbon hydroxylase (AHF), uridine diphosphate (UDP), and glutathione-S-transferases.

#### Antimutagens:
Carcinogens bind to the cell macromolecules namely DNA, RNA and proteins and result in mutagenic events leading to cell transformation and neoplastic changes. Some phytochemicals prevent these changes from occurring either by directly binding to the carcinogens or their metabolites or by metabolizing and eliminating toxic xenobiotics. At the National Institute of Nutrition (NIN), Hyderabad extensive research has been carried out on some of the non-nutritive chemopreventers such as garlic, onion, turmeric, green leafy vegetables (spinach, amaranth, gogu) and cabbage.

Plant foods including vegetables, fruits and spices possess phytochemicals that have antioxidant activity. Spices such as turmeric, onion and garlic were shown to be potent antimutagens in vitro and in vivo conditions. These were also shown to induce the drug metabolizing enzymes involved in detoxification of harmful substances in the tissues. Studies on turmeric have established its anticarcinogenic potential in animals. In humans, turmeric and curcumin reduced urinary mutagen excretion by smokers, and the precancerous lesions in reverse smokers.

Evidence from epidemiological studies indicates that diets high in fruits and vegetables with phytomutrients and low in certain types of fat, along with moderate caloric intake and fibre rich food are associated with reduced cancer risk. Besides the protective effects of nutrients and non-nutrients their synergistic effect is also to be considered.

Therefore, dietary preventive measures or promotion of healthy dietary habits and life styles, though demanding, are perhaps the right answer for cancer prevention.

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