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THE ADVANTAGES OF BIOACTIVE PHYTOCHEMICALS IN INDIAN FOOD FOR HEALTH AND THEIR ROLE IN DISEASE PREVENTION

Soniya Ashok Ranveer
Maharashtra Animal and Fishery Sciences University, Nagpur
Corresponding author email: soniyaranveer11@gmail.com

ABSTRACT

This article explores the pivotal role of nutrients, phytochemicals, and antioxidants in promoting health and preventing diseases. From historical nutrient studies to the recent surge in interest in phytochemicals, the article delves into the multifaceted aspects of nutrition. Emphasis is placed on functional foods and the disease-preventing potential of dietary fiber. Antioxidants, including carotenoids and flavonoids, are examined for their epidemiological impact on cancer and cardiovascular diseases. Additionally, the article elucidates the detoxifying functions of food phytochemicals and the inhibitory roles of blocking and suppressing agents in carcinogenesis. A comprehensive overview of phytosterols, phytonutrients, and their immunological significance is presented, emphasizing the need for precise dietary intake to combat non-communicable diseases.

INTRODUCTION

Studies since the mid-19th century have focused on identifying essential nutrients in foods, their metabolism and functions and dietary deficiency. Food technology and food processing have focused on conserving these nutrients in processed foods as well as researching human requirements of these nutrients and strategies to combat nutritional deficiency diseases among underprivileged population groups. Foods, particularly those of plant origin, contain a wide range of non-nutrient phytochemicals that are elaborated by plants for their own defence and other biological functions.

PHYTOCHEMICALS IN PLANT FOODS

Many plants and herbs are considered to have medicinal value, and their phytochemicals present in commonly consumed plant foods are normally non-toxic and have the potential to prevent chronic diseases. For the last two to three decades, there has been a surge of interest in plant foods as a source of phytochemicals that may have a useful role in the prevention of chronic diseases such as cancer, diabetes, cardiovascular disease, cataract, and gallstone. Functional foods, which are foods derived from naturally

occurring substances, provide health benefits beyond basic nutrition and have been studied extensively to establish their efficacy and understand the underlying mechanism of their action.

Several nutrients like vitamin E, provitamin A, ascorbic acid, and selenium also have disease-preventing and health-promoting potentials, just like phytochemicals. Research on the health-promoting and disease-preventing potential of phytochemicals in foods has grown so much in recent years that this branch of research has been named bionutrition.

DIETARY FIBER AND NON-STARCH POLYSACCHARIDES

Dietary fibre (DF) and non-starch polysaccharides (NSP) are essential components of plant foods, which have been shown to reduce blood glucose levels in diabetes, lower blood cholesterol levels for cardiovascular disease treatment, and prevent bowel cancer. The disease-preventing potential of DF depends on the proportion and quantity of different polysaccharide components present in a given food. DF components exert their beneficial effects mostly through swelling properties and increasing transit time in the small intestine, reducing the rate of glucose release and absorption. They also bind bile salts, promoting cholesterol excretion from the body and reducing blood cholesterol levels. They can also have adverse nutritional effects by binding dietary calcium, magnesium, zinc, and iron, reducing their bioavailability. Dietary fibre intake in India is generally recommended to be around 40 g for an adult, with diets based predominantly on unrefined cereals and plant foods easily achieving this level. Dietary fiber intake in India varies from 60 to 70 g/day, depending on the type of cereal consumed. Nearly 80% of the fiber content of diets consumed in India, particularly among the low-income group, is contributed by cereals.

ANTIOXIDANTS IN DISEASE PREVENTION:

Antioxidants play a crucial role in disease prevention, as reactive oxygen species, cause tissue damage and contribute to various diseases. The body has protective mechanisms against dangerous oxygen free radical species generated in situ and those derived from external sources, such as superoxide dismutase, glutathione reductase, and selenium. Foods contain a variety of antioxidants, both nutritive and nonnutritive, including carotenoids, phenols, and flavonoids. Plant foods, such as green leafy vegetables, fruits, and yellow vegetables, are rich in these antioxidants. Vitamin C and vitamin E prevent carcinogenic formation, while flavonoids and phenolic compounds protect selenium and polyunsaturated fatty acids from oxidative damage. However, the potency of antioxidants in vivo depends on their bioavailability and oxidant levels in the food.

EPIDEMIOLOGICAL RESEARCH ON ANTIOXIDANT PHYTOCHEMICALS:

Dietary antioxidant phytochemicals including carotenoids, phenolic compounds, and flavonoids may prevent cancer and cardiovascular disease, according to epidemiological research. Elevated levels of blood carotenoids, such as lutein, zeaxanthin, and lycopene, have been associated with a reduced risk of lung cancer. Regular intake of flavonoids, such as quercetin and kaemferol, by the elderly reduces the risk of death from coronary heart disease. In conclusion, antioxidants and antioxidant-rich foods have been shown to have a beneficial impact on the prevention and treatment of non-communicable diseases, such as cancer.

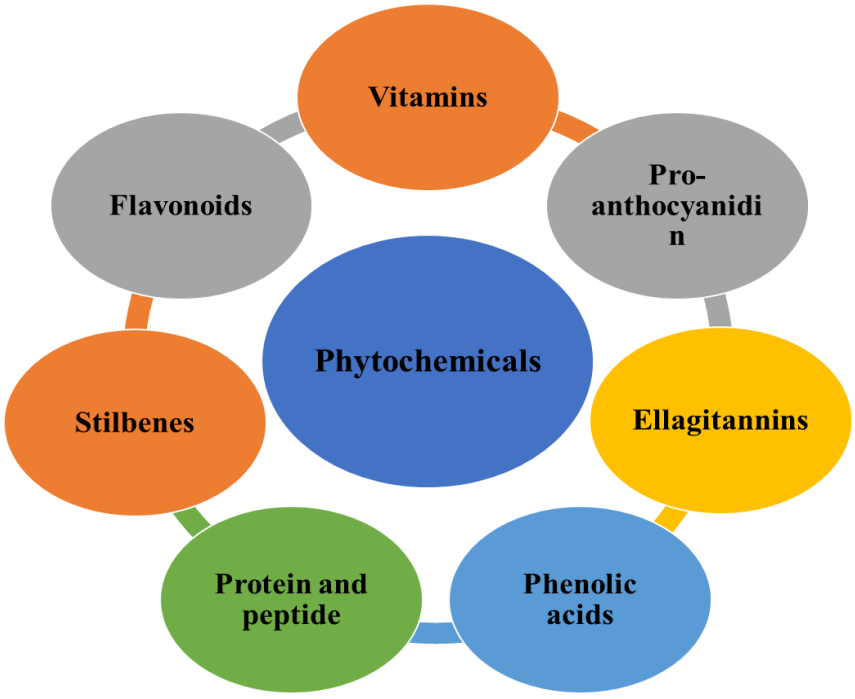

Fig: Digestion and bioavailability of bioactive phytochemicals

Food phytochemicals eliminate chemical toxicants and carcinogens, preventing disease. They remove toxins through phase I and phase II metabolism. Phase I metabolism involves oxygenation, oxidation, reduction, and dehydrogenation; phase II involves conjugation. Many phytochemicals in food are nontoxic xenobiotics that stimulate phase I metabolic enzymes. Toxicity from carcinogen exposure depends on phase I and phase II enzyme balance. Strong inducers of MFO include safrole, xanthenes, flavones, and indoles. Coumarin derivatives in fruits and vegetables can induce glutathione-S-transferase and inhibit chemical carcinogenesis. Crucifera vegetables include indole derivatives such indole-3 acetic acid and isothiocyanates, which induce phase II drug metabolism enzymes and are anticarcinogenic.

BLOCKING AND SUPPRESSING AGENTS IN CARCINOGENESIS

Several minor chemical constituents of foods inhibit carcinogenesis by acting as blocking and suppressing agents. Blocking agents enhance metabolic disposal of carcinogens and prevent active carcinogens from reaching the target tissue or cell. Suppressing agents inhibit carcinogenesis at the cellular level, and compounds with antioxidant properties can also inhibit the formation of carcinogens from their precursors. Neuropharmacological chemicals in foods, such as 5-hydroxy tryptamine, noradrenaline, tyramine, and dopamine, are present in small quantities in foods like bananas, annanas, tomatoes, avocados, and spices. These biogenic amines' pharmacological and physiological effects are unknown. Ancient medicine believed certain meals improved brain function, learning, and conduct and sharpened mental agility. Studies on malnourished children have linked anaemia, PEM, and vitamin A deficiencies to brain, mental, and learning impairment.

PHYTOSTEROLS AND PHYTONUTRIENTS

Phytosterols, such as stigmasterol, sitosterol, and campesterol, are widely distributed in the plant kingdom and in plant foods. These plant sterols have hypocholesterolaemic potential and have been shown to have a positive effect on both humoral and cell-mediated immune function. Vitamin C and carotenoids may have beneficial effects on immune function, reducing cancer risk by enhancing tumor control. Phytonutrients in plant foods contain a wide range of chemical compounds that impart taste and flavor to food. Most foods, particularly fruits, vegetables, and spices, contain very small quantities of volatile compounds, which may have beneficial biological functions in the body.

Desirable dietary intake of phytonutrients is needed to provide maximal protection against non-communicable diseases like diabetes, cancer, cardiovascular disease, and cataract. Precision quantitative data on the content of phytochemicals in commonly consumed foods and their bioavailability and biological potency is needed to formulate special diets for preventing specific diseases.

CONCLUSION

This comprehensive exploration underscores the significance of nutrition in disease prevention and health promotion. The interplay of nutrients, phytochemicals, and antioxidants in functional foods demonstrates promising avenues for combating ailments such as cancer and cardiovascular diseases. Understanding the delicate balance of blocking and suppressing agents in carcinogenesis sheds light on potential preventive measures. Moreover, the immunological impact of phytosterols and phytonutrients signifies their crucial role in fostering overall well-being. As we advance, precision in quantifying and

harnessing these nutritional elements becomes paramount for formulating targeted diets, offering a proactive approach against prevalent non-communicable diseases.

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