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# HORTICULTURE PRODUCE AS FUNCTIONAL FOOD

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## Introduction

Functional foods refer to foods that provide physiological benefits beyond their basic nutritional value and contribute to the reduction of disease risk. The concept gained prominence in Japan during the 1980s, leading to the establishment of regulatory frameworks such as Foods for Specified Health Use (FOSHU). Horticultural crops represent an important category of functional foods, as they naturally contain diverse bioactive constituents that exert beneficial effects on human health when consumed in fresh or processed forms.

## Therapeutical potential of horticulture produce:

The needs of functional foods are increasing in modern diets because of change in lifestyle, food habits and health challenges. Rising lifestyle diseases such as obesity, diabetes, cardiovascular diseases, hypertension and cancer. Similarly, micronutrient deficiencies such as calcium, iron, iodine, vitamin A and vitamin D. Increased consumption of fast, processed foods and convenience foods, weak immunity, digestive disorders all these conditions created a necessary functional food which prevent nutrition deficiencies, promote healthy aging and sustainable healthcare systems. The major group of functional food from horticultural produce comes from fruits, vegetables, plantation and spice crops and medicinal and aromatic crops. This group of produce contains an array of bioactive compounds such as polyphenols, alkaloids, terpenes, vitamins and others contribute to disease prevention and health promotion (Banwo *et al.,* 2021). Eg. Grape wine rich in resveratrol and has cardio protective and anti-aging effects similarly banana fruit contains resistant starch and rich potassium which is good for maintaining gut health and blood pressure regulation. Green tea extract contains a bioactive compound 'catechin' which is a potent antioxidant and has antiobesity properties. Pomegranate and grape juices reduce oxidative stress and inflammation promoting cardiovascular health, turmeric milk (also called as golden milk) is valued for its anti-inflammatory and immune-boosting effects. Such functional beverages are particularly beneficial for children, elderly people, and patients recovering from illness.

## Functional food derivatives from horticulture produce:

Fruits, vegetables, plantation crops, spices, and medicinal and aromatic plants form the backbone of horticulture and play a vital role in human nutrition, health, and economic sustainability. These plant groups are valued not only for their nutritional contribution but also for their functional and therapeutic properties.

### 1. Fruits

Fruits are rich sources of natural sugars, vitamins, minerals, dietary fiber, and bioactive compounds such as flavonoids, carotenoids, and phenolic acids. Regular consumption of fruits supports immunity, improves digestion and helps

in the prevention of chronic diseases such as cardiovascular disorders and certain cancers. Their antioxidant properties protect cells from oxidative damage and promote overall health.

**Functional food products** from fruits are Fresh juices, smoothies, dried fruits (dried amla, raisins, figs, dried berries), leather, nutrition bars, fruit powders and neutraceutical capsules

**2. Vegetables**

They provide essential micronutrients, fiber, and phytochemicals required for normal physiological functioning. Leafy vegetables supply iron, calcium, and folates, while other vegetables contribute carotenoids, glucosinolates, and sulfur containing compounds. These components aid in detoxification, enhance gut health, and reduce the risk of lifestyle-related diseases (Zachariah *et al.,* 2025).

**Functional food products** from vegetables such as soups, fermented vegetables, dehydrated vegetables (Dehydrated tomatoes and carrots), powders, fortified purees *etc.,*

**3. Plantation crops**

The crops including tea, coffee, cocoa, coconut, and arecanut, are economically important and possess significant health-promoting compounds. Tea and coffee contain polyphenols and alkaloids with antioxidant and metabolic benefits, while coconut provides healthy fats and bioactive substances that support energy metabolism and immunity.

**Products:** Functional beverages, Tea-based beverages such as green tea, spiced tea, and herbal tea blends, energy drinks such as natural coconut water, edible oils, neutraceutical extracts and spice infused oils for combined lipid nutrition and anti-cholesterol activities.

**4. Spices**

These are concentrated sources of bioactive compounds and essential oils. They are widely used in small quantities for flavor, preservation, and medicinal purposes. Spices such as turmeric, ginger, pepper, and cinnamon exhibit antimicrobial, anti-inflammatory, digestive, and antioxidant properties, making them valuable functional food ingredients.

**Products:** Oleoresins, spice teas (prepared using ginger, cinnamon, clove, and cardamom), herbal teas and infusions, capsules and fortified foods.

**5. Medicinal plants**

The plants have been traditionally used for the prevention and treatment of various ailments. They contain secondary metabolites like alkaloids, glycosides, terpenoids, and phenolics that exhibit therapeutic effects (Abuajah e*t al.,* 2015). These plants contribute to immune modulation, stress management, and metabolic regulation.

**6. Aromatic plants**

The aromatic plants are valued for their essential oils, which are used in food, pharmaceuticals, cosmetics, and aromatherapy. The volatile compounds present in these plants possess antimicrobial, calming, and health-promoting properties, supporting both physical and mental well-being.

**Products from medicinal and aromatic crops:** Herbal powders, nutrient mix, herbal extracts, syrups and functional snacks.

Dietary fibre obtained from fruit and vegetable processing residues has gained considerable attention in functional food formulation. Pomace from apple, citrus, banana, cabbage, and carrot contains both soluble and insoluble fibre fractions that improve intestinal health, reduce cholesterol levels, and aid in blood glucose regulation. Jamun seed powder has also been reported to play a role in glycaemic control, making these by-products valuable functional ingredients.

**Table 1. Selected horticultural crops, principal functional ingredients, dominant bioactive constituents and associated health-promoting effects**

| Horticultural Produce | Functional Food Ingredient(s) | Major Bioactive Compound/Class | Key Health Benefits |
|---|---|---|---|
| **Apple** | Apple polyphenols, pectin | Flavonoids, dietary fibre | Cardioprotective, cholesterol lowering, gut health |
| **Banana** | Resistant starch, dopamine | Dietary fibre, phenolics | Glycemic control, digestive health, antioxidant |
| **Citrus fruits (Orange, Lemon)** | Vitamin C, hesperidin | Ascorbic acid, flavanones | Immunomodulatory, antioxidant, vascular protection |
| **Grapes** | Resveratrol | Stilbenes | Cardioprotective, anti-aging, anti-inflammatory |
| **Pomegranate** | Punicalagins | Ellagitannins | Anti-inflammatory, anticancer, heart health |
| **Mango** | Mangiferin | Xanthone | Antioxidant, antidiabetic, hepatoprotective |
| **Papaya** | Papain, carotenoids | Proteolytic enzyme, carotenoids | Digestive aid, antioxidant, immune support |
| **Tomato** | Lycopene | Carotenoid | Reduced risk of prostate cancer, cardioprotection |
| **Carrot** | β-carotene | Provitamin A carotenoid | Vision health, immune enhancement |
| **Cruciferous vegetables (Broccoli, Cabbage)** | Sulforaphane, glucosinolates | Sulfur-containing compounds | Anticancer, detoxification enzymes activation |
| **Spinach** | Lutein, folate | Carotenoids, vitamins | Eye health, anemia prevention |
| **Onion** | Quercetin | Flavonoid | Anti-inflammatory, antihypertensive |
| **Garlic** | Allicin | Organosulfur compound | Antimicrobial, cardioprotective |
| **Tea (Camellia sinensis)** | Catechins (EGCG) | Polyphenols | Antioxidant, neuroprotective, anti-obesity |
| **Coffee** | Chlorogenic acid | Phenolic acid | Antidiabetic, antioxidant |

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|---|---|---|---|
| **Cocoa** | Flavanols | Polyphenols | Cognitive function, cardiovascular health |
| **Turmeric** | Curcumin | Curcuminoids | Anti-inflammatory, anticancer, joint health |
| **Ginger** | Gingerols, shogaols | Phenolic compounds | Anti-nausea, anti-inflammatory |
| **Black pepper** | Piperine | Alkaloid | Enhanced bioavailability, digestive stimulant |
| **Cinnamon** | Cinnamaldehyde | Phenylpropanoid | Glycemic control, antimicrobial |
| **Tulsi (Holy basil)** | Eugenol | Phenolic compound | Stress reduction, immunomodulatory |
| **Ashwagandha** | Withanolides | Steroidal lactones | Adaptogenic, anti-stress, cognitive health |
| **Aloe vera** | Acemannan | Polysaccharide | Gut health, wound healing, immune support |

Health benefits may vary depending on cultivar, processing method and level of consumption.

**Conclusion:**

The cultivation and regular dietary incorporation of horticultural crops significantly enhance nutritional quality and health through their diverse bioactive compounds. Strengthening education and research related to the cultivation, utilization, and health benefits of fruits, vegetables, plantation crops, spices, and medicinal and aromatic plants is essential for improving nutrition security and supporting sustainable healthcare. Moreover, the development of value-added functional foods from horticultural produce not only meets consumer demand for health-oriented foods but also promotes entrepreneurship and sustainable utilization of agricultural resources.

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