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Vegetables: an immense source of neutraceuticals

[1]Riya Thakur, [1]Sarita Singh and [2]Ajay Haldar

[1]Scientist, Krishi Vigyan Kendra, Chhindwara (MP)
[2]Assistant Professor, GH Raisoni University, Saikheda, Chhindwara (MP)

Corresponding author:riyath29@gmail.com

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Abstract

The perception of people that "natural is good" is one of the main causes of popularity of neutraceuticals. Neutraceuticals is any substance that is a food or a part of food that provides medical or health benefits, including the prevention and treatment of disease. They covered all therapeutic areas such as anti-arthritic, pain killers, sleeping disorders, digestion, prevention of certain cancers, heart diseases, osteoporosis, blood pressure, cholesterol, depression, diabetes and beauty care. Vegetables are an important functional foods or neutraceuticals because they provide minerals and nutrients which are health promoting. Vegetables are rich sources of bioactive compounds such as flavonoids, carotenoids, anthocyanins, vitamins and other polyphenolics. Such compounds play a role in disease prevention or reduce disease risk factors through antioxidant activity by protecting against free radical damage, by modifying metabolic activation and detoxification of carcinogens. Each vegetable group contain a unique combination and amount of these neutraceuticals (vitamins, minerals, dietary fibre and phytochemicals), which distinguishes them from other groups. The cultivation of vegetable increases mean per capita income and knowledge of vegetable health benefits, have enable consumers to include a variety of health promoting neutraceuticals in their diet. Several studies are performed to identify the conditions for maintaining these neutraceuticals after harvesting and processing because of their undeniable positive effects on health. Nowadays, the health functionality of vegetable crops can be improved utilizing a variety of molecular and breeding techniques.

Key words: Vegetables, neutraceuticals, minerals, vitamins, health, disease.

Introduction

The quality of life in terms of income, spending and lifestyle has improved with economic development. However, it has also thrown up a major challenge in the form of `lifestyle diseases'. The first victim of this lifestyle change has been food habits. Consumption of junk food has increased manifold, which has led to a number of diseases related to nutritional deficiencies. Neutraceuticals can play an important role in controlling them. They covered all therapeutic areas such as anti-arthritic, pain killers, sleeping disorders, digestion, prevention of certain cancers, heart diseases, osteoporosis, blood pressure, cholesterol, depression, diabetes and beauty care. The term neutraceuticals, coined by Dr. Stephen de Felice, is derived from the words "nutrition" and "pharmaceutical", is a food or food product that provides health and medical benefits, including the prevention and treatment of disease. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered foods, herbal products, and processed foods such as cereals, soups, and beverages. A neutraceuticals is demonstrated to have a physiological benefit or provide protection against chronic disease. Their bioactive ingredients, the phytochemicals, sustain or promote health and occur at the intersection of food and pharmaceutical industries.

Vegetables are neutraceuticals because they provide minerals and nutrients which are health promoting. Vegetables are rich sources of bioactive compounds such as flavonoids, carotenoids, anthocyanins, vitamins and other polyphenolics. Neutraceuticals wealthy vegetables have medical health benefits including the prevention and treatment of diseases. "Functional" attributes of many traditional vegetables are being discovered, while new food products are being developed with additional neutraceutic components (Devi and Rehman, 2002). Vegetables form the most important component of a balanced diet. There has been an explosion of consumer's awareness regarding the vegetables with physiologically-active specific neutraceuticals. Such

products include food supplements, dietary supplements, value added processed vegetables as well as nonfood supplements such as tablets, soft gels, capsules etc. (Wildman, 2001). With the increased focus on neutraceuticals, there is much potential for new and exciting opportunities.

Ingredients of nutraceuticals

A nutraceutical is any non-toxic food extract supplement that has scientifically confirmed health benefits for the prevention and treatment of different diseases. There are different ingredients that have the potential of being incorporated into vegetables or its supplements because of its immense potential for protective and health-beneficial effects.

Vitamins

These substances are essential for normal body functions, cell function regulation, growth and development. They must be obtained from the diet, as the body cannot produce them in adequate amounts. Vitamins such as A, B6, C, and K are important to the human body and can be provided by vegetables.

Antioxidants

Antioxidants protect against highly reactive metabolic byproducts (known as free radicals) that cause cell damage in the human body. Vitamins, minerals, and phytochemicals contained in fruits and vegetables each have antioxidant activity. Carotenoids, selenium, Vitamin C and E are all examples of antioxidants. They have been investigated for their specific role in the prevention of cancers, heart disease, eye disease and other human health conditions.

Phytochemicals

Plants chemicals considered to be beneficial to health but are not essential nutrients are called phytochemicals. Carotenoids and flavonoids are examples of compounds that are considered phytochemicals. Associations between disease prevention and individual phytochemicals remain unproven, although many studies show the benefit of a diet high in vegetables. Further research is needed to directly attribute specific health benefits to specific compounds.

Carotenoids

Carotenoids are a class of pigments that are responsible for giving plants a red, yellow or orange colour. Lutein, beta-carotene, lycopene and zeaxanthin are examples of carotenoids that are important to the human diet. For optimal absorption in the human body, they are best consumed cooked with a little fat after they have been chopped or pureed. They are a very important source of vitamin A. They are being investigated for their role in heart disease, some cancers, and eye disease.

Lycopene

Lycopene gives tomatoes and some fruits their red colour. Most lycopene in our diet is obtained from cooked and processed tomato products. Lycopene may play a preventative role in certain cancers and heart disease.

Lutein and Zeaxanthin

Dark green and leafy vegetables are the predominant source of lutein and zeaxanthin in the human diet. They may play a role in preventing oxidative damage to the eye, and may reduce the risk of age related macular degeneration.

Beta-Carotene

Beta-carotene is responsible for the orange and yellow colour often seen in fruits and vegetables. Carrots, squash, sweet potatoes and spinach are good sources of beta-carotene. It has been investigated for its role in the prevention of cardiovascular disease and certain cancers.

Flavonoids

This is a large family of phytochemical compounds produced by plants. High intake of flavonoid rich foods have been shown to reduce the risk of cardiovascular disease, but whether this is due to specific, individual compounds remains to be proven. Anthocyanins are a subclass of flavonoids that give red, blue and purple colour. They have been associated with improving blood vessel health in humans. Quercetin is one of the most widely distributed flavonoids in the human diet, found in bulb crops. It may have antioxidant and anti-inflammatory activity, but firm conclusions on its role in heart disease, arthritis and eye disease still need to be shown.

Causes of rapid emergence

From the consumer's point of view neutraceuticals may offer many benefits:

- Avoid the side effect.
- May increase the health beneficial effect.
- May have naturally dietary supplement, so do not have unpleasant side effect.
- May increase the health value, our diet and improve medical condition of human.
- May easily be available and economically affordable. (Chouhan et al., 2013)

Table: 1 Vegetables as resource of different vitamin's with their uses

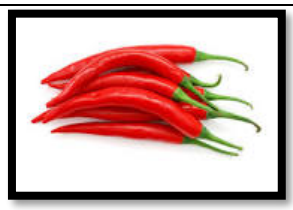
S.No.	Vitamins	Uses	Vegetable Sources
1.	Vitamin A (Retinol)	Helps in cell reproduction; stimulates immunity; helps vision and promotes bone growth and tooth development; helps maintain healthy skin, hair and mucous membranes	Amaranth Leaves, Broccoli, Brussels Sprout, Butternut Squash, Carrots, Chinese Cabbage, Peas, Pumpkin, Spinach, Swiss Chard
2.	Vitamin B1 (Thiamine)	Important in the production of energy; helps the body cells convert carbohydrates into energy; essential for the functioning of the heart, muscles and nervous system	Asparagus, Brussels Sprouts, French Beans, Lima Beans, Okra, Parsnip, Peas, Potato, Sweet Potato
3.	Vitamin B2 (Riboflavin)	Important for body growth, reproduction and red cell production	Amaranth Leaves, Artichoke, Asparagus, French Beans, Lima Beans, Peas, Pumpkin, Sweet Potato
4.	Vitamin B3 (Niacin)	Assists in the functioning of the digestive system, skin and nerves	Artichoke, Okra, Parsnip, Peas, Potato, Pumpkin, Sweet Potato, Peas, Soy Beans
5.	Vitamin B5 (Pantothenic acid)	Is essential for the metabolism of food as well as in the formation of hormones; lowers cholesterol level	Broccoli, French Beans, Okra, Parsnip, Potato, Pumpkin, Sweet Potato, Black Eye Peas, Lima Beans, Soy Beans, Peas
6.	Vitamin B6 (Pryidoxine)	Plays a role in the creation of antibodies in the immune system; maintains normal nerve function; helps in the formation of red blood cells	Amaranth leaves, Broccoli, Brussels Sprouts, Celeriac, French Beans, Green Pepper, Lima Beans, Okra, Peas Potato, Sweet Potato, Taro
7.	Vitamin B9 (Folic acid)	It helps to produce red blood cells as well as components of the nervous system; helps in the formation and creation of DNA; maintains normal brain function; critical part of spinal fluid	Amaranth leaves, Asparagus, Beetroot Broccoli, Brussels Sprouts, Chinese Broccoli, Chinese Cabbage, French Beans, Lima Beans, Okra, Parsnip, Peas, Potato, Spinach
8.	Vitamin C (Ascorbic acid)	Most important of all the vitamins; plays a significant role as an antioxidant, thereby protecting body tissue from oxidative damage and the harmful effects of free radicals, which are potentially damaging by-products of the body's metabolism	Amaranth leaves, Bok Choy, Broccoli, Brussels Sprouts, Butternut Squash, Green Pepper, Kale, Swiss Chard
9.	Vitamin E (Tocopherol)	Plays a significant role as an antioxidant, thereby protecting the body tissue from oxidative damage; important in the formation of red blood cells and the metabolism of vitamin K	Butternut Squash, Parsnip, Potato, Pumpkin, Spirulina, Swiss Chard, Taro
10.	Vitamin K (Phylloquinone)	Plays a critical role in blood clotting; regulates blood calcium levels and activates proteins involved in bone health	Artichoke, Asparagus, Broccoli Cabbage, Carrot, Cauliflower, Celery, Chinese Broccoli, Cucumber, Okra, Peas, Spinach

Table: 2 Vegetables as resource of traditional herbal neutraceuticals

S. No.	Vegetable	Neutraceutical Properties	Plant Part Used
1.	Onion	Used for heart diseases, diabetes, osteoporosis; has antiinflammatory, anticholesterol, anticancerous	Bulb and leaves

		and antioxidant properties	
2.	Garlic	Used in chemopreventation, cancer, diabetes, arteriosclerosis, lowering cholesterol, respiratory infections	Fresh or dried cloves, capsules, odorless tablets, tinctures, aged garlic extracts
3.	Amaranthus	Used in cardiovascular diseases; tapeworm expellant; relieve pulmonary problems	Leaves, seeds, oil from seeds
4.	Elephant Foot Yam	Used in gastric troubles and rheumatic pain; potent drug for the treatment of piles	Root
5.	Colocasia	Used in pitta, constipation, stomatitis, alopecia, hemorrhoids and general weakness	Leaves
6.	Tapioca	Leaves and pulped roots used as an application for tumors, coeliac disease	Leaves and root
7.	Asparagus	Tonic, astringent	Root
8.	Poi	Used in some testosterone boosting supplements; leaf juice is a demulcent, used in cases of dysentery; is a diuretic, febrifuge, laxative and to treat catarrh	Leaves
9.	Bathua	Used in bleeding piles, dysentery, cough and fever; used as antihelminthic, appetizer and laxative	Leaves and seeds
10.	Coriander	Antioxidastive; antibacterial; diurectic	Leaves, fruit and root
11.	Palak/spinach	Antioxidative; used to treat anaemia	Leaves
12.	Fenugreek	Used to treat gastritis, excess cholesterol, diabetes, skin inflammation	Seed, whole or powdered; capsules, tinctures
13.	Pumpkin	Antirheumatic; demulcent; diuretic; nervine; taenifuge	Fruit
14.	Ivy Gourd	Treatment of diabetes and skin eruptions; antioxidant; immune system modulator	Root, leaves and fruit
15.	Round Gourd	Anthelmintic activity	Fruit
16.	Bitter melon	Used to treat malaria, fever, diarrhoea, HBP dysentery, gonorrhea; laxative	Fruit
17.	Snake Gourd	Anti-inflammatory; Anti-diabetic	Leaves and fruit
18.	Bottlegourd	Used in urinary disorder, diarrhea, diabetes	Fruit
19.	Drumstick	An antiseptic; treats rheumatism, venomous bites	Bark, root, fruit, flowers, leaves, seed and gum
20.	Brinjal	Maintains blood cholesterol; helps in digestion; increases appetite	Fruit
21.	Potato	Useful in dyspeptia, skin diseases and cancer; due to high potassium, beneficial in high blood pressure and stroke	Tuber
22.	Tomato	Antioxidant, helpful in prevention of arterial diseases and cancer	Fruit
23.	Chilli	Antioxidant and anti-inflammatory properties	Fruit
24.	Peas	Antioxidant, anticancer, antifertility and abortifacient effect. Inhibits osteoporosis and obesity	Seeds
25.	Carrot	Potent anticancer, artery-protecting, antioxidant, relieve constipation, decrease cholesterol	Root

Table: 3 Phytochemicals From Vegetables

Tomato		Lycopene
Chilli		Capsaicin
Cabbage		Glucosinolates
Broccoli		Sulphoraphane
Onion		Quercitin
Garlic		Allicin
Carrot		Beta-Carotene & Caffeic acids
Asparagus		Carnitine

Kale		Zeaxanthin
Celery		Apigenin
Beans		Folate
Turnip		Ferulic acid

Conclusion and future prospects

- Neutraceuticals are currently receiving recognition as being beneficial in coronary heart diseases, obesity, diabetes, cancer, osteoporosis and other chronic and degenerative diseases such as Parkinson's and Alzheimer diseases.
- Use of vegetables as neutraceuticals strengthening current community based health services due to multi-factorial usages and potential.
- Due to multi-factorial health benefits, they are designated as "millennium food of century".
- In most of cases the knowledge is not well documented and disseminated, however, what so ever has been explored that is sufficient enough to understand the potential of vegetables in the form of household country medicine and betterment of humanity without much difficulties and cost. Still there is long way to go.
- Nowadays, it is necessary to work in the way to increase nutritional quality in vegetables and also their post harvest management.
- Future demand of neutraceuticals depends on consumer perception of the relationship between diet and disease.

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