
Document heading: Review Article

Neutraceutical: A Review

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Received: 20-06-2019 / Revised: 26-07-2019 / Accepted: 05-08-2019

Abstract

Nutraceutical is regarded as the bioactive substance and natural bioactive compounds include a broad diversity of structures and functionalities that provide an excellent pool of molecules for the production of therapeutic compounds. In this article, we have a tendency to gift a review work on varied nutraceuticals found naturally beside the recent progress that has been done on them. The health promoting effects of varied styles of nutraceuticals that has been claimed is additionally enclosed during this article.

Keywords: Functional foods; Nutraceuticals; Bioactive compounds; Dietary supplements.

Introduction

Nutraceuticals may be a broad term that describes any substance extracted from food sources with extra health advantages together with the fundamental nutritional price already gift in them. They act non-specifically to promote general well-being of the individuals and also to control and prevent virulent conditions. The term “nutraceutical” combines 2 words – “nutrient” (a nutritive food component) and “pharmaceutical” (a medical drug) [1].

The name was coined in 1989 by author DeFelice, founder and chairman of the Foundation for Innovation in Medicine, an American organization located in Cranford, New Jersey.

They have remarkable role in human nutrition which has recently become one of the most important areas of investigation.

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Categories of Nutraceuticals

These can be grouped into the following three broad categories: 1. Substances with established nutritional functions, such as vitamins, minerals, amino acids and fatty acids - Nutrients 2. Herbs or biology product as concentrates and extracts - Herbals three. Reagents derived from other sources (e.g. pyruvate, chondroitin sulphate, steroid hormone precursors) serving specific functions, such as sports nutrition, weight-loss supplements and meal replacements – Dietary supplements.

Nutrients

Nutrients are the substances that give nourishment essential for the upkeep of life and for growth. Water and fat-soluble vitamins and antioxidants are the most commonly known nutrients and their potential health benefits have been associated with dietary intake or supplementation. Antioxidants help in the prevention of cancer and cerebrovascular diseases such as atherosclerosis. It has been found that the mixture of fat-soluble vitamin, C and beta carotene are often employed in the reduction of beta-lipoprotein reaction and resultant hardening of the arteries [2]. Vitamin supplements stimulate the production of macrophage and T cells and thus increase antibody titre response to clinically relevant vaccines.

Herbals

Plants are used for the treatment of diverse acute and chronic diseases since ages and such ancient medication remains wide practiced nowadays. Various components of plants like seeds, berries, leaves, roots, flowers and bark are used for medicinal purposes which contain numerous nutraceuticals. The accumulation of information of such plants over many years will facilitate find effective suggests that of making certain correct health care.

Dietary supplements

A dietary supplement is supposed to supply nutrients which can otherwise not be consumed in spare quantities. Supplements as typically understood embody vitamins, minerals, fibre, fatty acids, or amino acids, among other substances. There are more than 50,000 dietary supplements available and the most common ones are multivitamins [3].

Benefits of Nutraceuticals

Since years, nutraceuticals have played an important role in the overall well-being of humans. Several bioactive molecules are being identified to possess health benefits which continue to garner research interest so that safe and cost-effective molecules can be discovered for oral administration.

Cancer treatment

There is a tremendous need in clinics to impair cancer progression through non-invasive therapeutic approaches as all the currently available cancer therapeutic options are expensive but none of them are safe. The use of natural compounds to realize this is often of importance to boost the standard of lifetime of young patients throughout their treatments.

Some promising natural compounds that have shown wonderful results in vitro and in vivo are: Chebulagic acid, Apigenin, Norcantharidin, Saffron/Crocin, Parthenolide, Longikaurin E, Lupeol, Spongistatin 1, and Deoxy-variolin B [4].

Withania somnifera (WS), commonly known as Ashwagandha, is one of the most powerful plants and is considered a major plant in ayurvedic medicine (an ancient form of medicine in Asia). The effectiveness of therapy has been shown to reinforce and therefore the

aspect effects of therapy agents are reduced once its extract was employed in combination and furthermore, the constituents do not interfere with their tumour-reducing actions [5]. Recently, it has been found that the plant contains withanolides which have antitumorigenic properties and this property has been demonstrated in experimental models [6].

Chemotherapy-induced peripheral pathology (CIPN) may be a serious dose-limiting side-effect. Vitamin E may help prevent CIPN. l-glutamine, goshajinkigan, and omega-3 are also promising in the prevention of the effects of CIPN [7].

Caffeic acid phenethyl organic compound (CAPE) may be a natural bioactive compound that comes from natural propolis and has been rumoured to possess anti-cancer properties [8]. Metastatic cell behaviours are stimulated by the up regulation of voltage-gated channels and this ester has shown to block voltage-gated sodium channels in several cell lines from different cancers.

Sulforaphane (SFN) is a metabolic by product of cruciferous vegetables and in broccoli, it is present in very high concentrations. Its anticancer potency and the underlying mechanisms have been studied extensively using various cell cultures and experimental models [9].

Beta-sitosterol (BS) is a plant derived nutrient and is found to possess anticancer properties against breast cancer, prostate cancer, colon cancer, lung cancer, stomach cancer, ovarian cancer, and leukaemia [10]. It interferes with multiple cell signalling pathways, including cell cycle, apoptosis, proliferation, survival, invasion, angiogenesis, metastasis and inflammation.

Synergistic effects of assorted mixtures of dietary natural product in conjunction with curcumin, quercetin, soybean isoflavones and silibinin are delineated that have potential for the treatment of glandular carcinoma [11]. Various factors are prompt that facilitate within the decrease of neoplastic cell replication and increase within the probability of remission. For the prevention and successful treatment of cancers, it is necessary that dietary supplements with high doses of vitamin C are consumed in at-risk populations along with some changes in lifestyle.

Antioxidant properties

An antioxidant could be a molecule that inhibits the oxidation of alternative molecules. Oxidation is a chemical reaction that can produce free radicals,

leading to chain reactions that may damage cells [12]. Certain groups of substances such as vitamins, carotenoids, flavonoids and minerals possess antioxidant characteristics. These substances help to boost immune and digestive systems and modulate inflammatory and degenerative processes in the body [13]. According to a recent study, dietary modification through the intake of antioxidants can help in the prevention of skin cancer [14].

Resveratrol (3,5,4'-trihydroxy-trans-stilbene), is a type of natural phenol, is produced naturally by several plants in response to injury or when the plant is under attack by pathogens such as bacteria or fungi. Food sources of resveratrol embrace the skin of grapes, blueberries, raspberries, and mulberries [15]. It has been shown to be a scavenger of a number of free radicals. Its inhibitor property is especially because of its impact as a cistron regulator. Downregulation of the expression and activity of the oxidase enzyme helps in the inhibition of the production of reactive oxygen species. The polyphenolic compound stimulates mitochondrial biogenesis and thus reduces superoxide generation in mitochondria. Upregulation of the tetrahydrobiopterin-synthesizing enzyme GTP cyclohydrolase I prevent superoxide production from uncoupled endothelial nitric oxide synthase. Moreover, the expressions of a variety of antioxidant enzymes are also increased by resveratrol [16].

Treatment for osteoarthritis

Osteoarthritis (OA) is that the commonest kind of inflammatory disease, affecting millions of people worldwide. It occurs when the protective cartilage on the ends of the bones wears down over time. Although osteoarthritis can damage any joint in the body, the disorder most commonly affects joints in hands, knees, hips and spine. There's no famous cure for degenerative arthritis, but treatments can help reduce pain and maintain joint movement.

Some substances seem to show medicinal drug activity primarily through the inhibition of COX-2, of an enzyme which is responsible for inflammation and pain. The C-phycoyanin (CPC) based nutraceutical and constituents could also be ready to mediate three primary infective mechanisms of osteoarthritis: inflammation, chondral degeneration, and oxidative stress in vitro [17]. Oral supplementation of chondroitin sulfate and glucosamine helps repair the articular surface in degenerative arthritis. Chondroitin-S reduces the concentration of the pro-inflammatory cytokines and transcription factor

involved in inflammation. GlcN.S enhances gristle specific matrix elements and prevents scleroprotein degeneration in chondrocytes by inhibiting hydrolytic enzymes, and preventing the oxidation of lipids and proteins. Chondroitin-S and GlcN.S are slow-acting drugs that alleviate pain and partly restore joint function in OA patients [18]. Recently, Methylsulfonylmethane (MSM) and boswellic acids (BA) have well tried to be effective supplements for the management of inflammation and degeneration of joints [19]. Nowadays, glucosamine is becoming a popular OA supplement. It is an endogenous monosaccharide which is an important precursor in the biosynthesis of glycosylated proteins and lipids. Most glucosamine dietary supplements are derived from a polymer, chitin, found in the exoskeleton of shellfish and crabs. Several kinds of glucosamine supplements that embrace sulphate, hydrochloride and n-acetyl salts are sold in pharmacies, supermarkets and health food-stores [20].

Maintenance of cardiovascular health

Cardiovascular issues, or issues that have an effect on heart and blood vessels, are some of the greatest overall health problems worldwide.

Hypertension (HTN or HT), also called as high blood pressure or arterial hypertension, is a chronic medical condition in which the blood pressure in the arteries is persistently elevated. It is present if the resting blood pressure is persistently at or above 140/90 mmHg for most adults [21].

There are many nutraceuticals having lowering impact on blood pressure that embrace minerals, lipids, whole proteins, peptides, amino acids, probiotics, and vitamins. It has been shown that the utilisation of K, L-arginine, vitamins C and D, cocoa flavonoids, beetroot juice, some probiotics, coenzyme Q10, controlled release melatonin, aged garlic extract, and coffee helps in controlling hypertension [22]. When hypertension is associated with elevated levels of homocysteine (Hcy), it is known as hyperhomocysteinemia. Endoplasmic reticulum (ER) stress is induced by homocysteine in endothelial cells which lead to inflammation in the blood vessels and can ultimately result in ischemic injury.

Black tea (BT) protects against hypertension-associated epithelial dysfunction through alleviation of ER stress.

Therefore, BT supplements will sway be helpful for hypertensive patients [23].

Stroke could be worldwide major reason behind the mortality and morbidity. Ischemic stroke happens once an artery to the brain is blocked. The brain depends on its arteries to bring recent blood from the heart to lungs. The blood carries O₂ and nutrients to the brain, and takes away carbon dioxide and cellular waste. If an artery is blocked, the brain cells (neurons) cannot make enough energy and eventually stops working.

Alpha-linolenic acid (ALA) is an essential omega-3 polyunsaturated fatty acid found in seeds like canola, walnut, chia and flax. According to a recent study, ALA may be an efficient brain preconditioned against stroke [24]. If daily diet is enriched in ALA, then devastating damage caused by stroke can be prevented.

Other common food nutraceuticals

Regular consumption of fruit and vegetables helps in the prevention of cancer, stroke, cardiovascular disease, Alzheimer disease, cataracts, and age-related problems. There are many purposeful foods that contain important amounts of bioactive elements which can offer fascinating health benefits [25].

Lycopene is that the natural substance (part of the pigment group) answerable for the ruby color in several foods, most particularly in tomatoes. Dietary intakes of tomatoes and tomato products have incontestable to scale back risks of cancer and heart diseases [26]. Apart from antioxidant properties of lycopene, there are several other mechanisms which are responsible for its beneficial properties. These embrace regulation of intercellular gap junction communication, hormonal and immune system and modulation of metabolic pathways [27].

Lycopene supplements have shown to enhance body functioning within the patients diagnosed with metabolic syndrome. There was a big modification within the the inflammation standing, insulation resistance additionally improved and the sterol levels were also controlled in such patients [28].

Spices are aromatic or pungent vegetable substances used to flavour foods and have been used as preservatives for thousands of years. Spices have also been recognized to possess medicinal properties like digestive stimulant action, hypolipidemic effect, antidiabetic influence, antilithogenic property, antioxidant potential, anti-inflammatory property, antimutagenic, and anticarcinogenic potential of spices [29]. Curcumin (diferuloylmethane) could be a yellow pigment that springs from the rhizomes of turmeric

and is that the major active ingredient in turmeric. Since years it has been used extensively in Ayurvedic medicine. It is non-toxic and exhibits a variety of therapeutic properties, including antioxidant, analgesic, anti-inflammatory and antiseptic activities. It has also shown to have positive effect in the treatment of arthritis [30].

Curcumin acts as associate epigenetic regulator in numerous diseases and disorders. It inhibits deoxyribonucleic acid methyltransferases (DNMTs) that functions as a deoxyribonucleic acid hypomethylating agent; modulates simple protein modifications via regulation of simple protein acetyltransferases (HATs) and simple protein deacetylases (HDACs); and regulates of smallRNAs (miRNA) [31].

The clinical implication of native curcumin is hindered thanks to low solubility, physico-chemical instability, poor bioavailability, rapid metabolism, and poor pharmacokinetics.

Therefore, there's a desire to enhance curcumin's pharmacology, systemic bioavailability, and biological activity which can be done by encapsulation curcumin or by loading into nanoform(s) [32].

Quercetin is a one of a broad group of natural polyphenolic flavonoid substances found in many fruits, vegetables, leaves and grains, particularly abundant in onions and apples. It acts as a robust reductant and protects body tissue against aerobic stress.

It acts as antioxidant by improving normal cell survival and as prooxidant induces apoptosis in cancerous cells whereby prevents tumour proliferation. Quercetin has been associated with numerous important properties like anti-viral, anti-inflammatory, antibacterial and muscle relaxing properties.

It conjointly acts as modulator of genes that are associated with cell cycle, signal transduction, and xenobiotic metabolism [33].

Coconut, *Cocos nucifera*, is cultivated to provide a large number of products which have nutritional and medicinal values. Coconut oil comprises medium-chain fatty acids (MCFA) which are easily absorbed and metabolised by the liver, and can be converted to ketones.

Ketone bodies is also useful to folks with memory impairment, as in Alzheimer's (AD) as they will be used as another energy supply within the brain [34].

Milk proteins are precursors of many different biologically active peptides which are inactive within the sequence of the precursor proteins but can be released by gastro-intestinal digestion of milk, fermentation of milk with proteolytic starter cultures or enzymatic proteolysis [35].

These peptides are unit claimed to be health enhancing nutraceuticals for food and pharmaceutical functions.

Whey, the liquid which remains after milk has been curdled and strained is an excellent source of bioactive compounds.

Whey macromolecule contains 2 hundredth of total milk macromolecule and it's wealthy in branched and essential amino acids, purposeful peptides, antioxidants and immunoglobulins.

It gives benefits against a wide range of metabolic diseases such as cardiovascular complications, hypertension, obesity, diabetes, cancer and phenylketonuria.

Whey proteins have shown to boost recovery rate from and defend skin against prejudicial radiations [36].

Angiotensin converting enzyme (ACE) inhibitor peptides can exert an antihypertensive effect.

Immunomodulating casein peptides are found to stimulate the proliferation of human lymphocytes and also the vegetative cell activities of macrophages.

Antimicrobial peptides have been shown to kill sensitive microorganisms [37]. Antithrombotic peptides inhibit the fibrinogen binding to a specific receptor region on the platelet surface and also inhibit aggregation of platelets.

Casein phosphopeptides will type soluble insect powder salts and will operate as carriers for various minerals particularly metallic element [38].

Buckwheat (*Fagopyrum esculentum*) could be a plant cultivated for its grain-like seeds, and also used as a cover crop.

Flour obtained from buckwheat is of great nutritional value as it contains high levels of proteins, polyphenols and minerals. Its antioxidant property is due to high levels of quercetin present. It has been shown to cut back risks of lipidaemia and pressure and improve weight regulation [39].

Litchi chinensis belongs to the Sapindaceae family and is well-known in the Indian traditional system for its traditional uses. All parts of the plant are rich sources of phytochemicals--epicatechin; procyanidin A 2 and procyanidin B2; leucocyanidin; cyanidin glycoside, malvidin glycoside, and

saponins; butylated hydroxytoluene; isolariciresinol; kaempferol; rutin; and stigmasterol [40]. It is a rich source of antioxidants, so it protects from degenerative diseases and prevents arthritis. It is also effective to protect from asthma.

Wild apple fruit (*Malus sylvestris*) could be an asensible supply of polyphenolic compounds that have therapeutic effects on several diseases caused by reactive atomic number 8 species and aerobic stress (e.g. cardiovascular or degenerative diseases, atherosclerosis, diabetes, osteoporosis, cancer, dermatitis, phototoxicity) [41]. It has been indicated that wild apple fruit might be taken into consideration as a source of antioxidant substances for food, dermo cosmetic and cosmetic industry.

Seaweeds belong to a group of marine plants known as algae which consumed as sea vegetables in several Asian countries. Fucosterol (24-ethylidene cholesterol) could be a steroid alcohol that may be isolated from alga, seaweed, and diatoms. It exhibits various biological therapeutics, including anti-cancer, anti-diabetic, anti-oxidant, hepatoprotective, anti-hyperlipidaemic, anti-fungal, anti-histaminic, anti-cholinergic, anti-adipogenic, anti-photodamaging, anti-osteoporotic, blood cholesterol reducing, blood vessel thrombosis preventive, and butyryl cholinesterase inhibitory activities [42].

Grape could be a natural supply of polyphenols with exceptional biological activities that has crystal rectifier to the event of many new grape-based food additives, dietary supplements, and bulk nutraceuticals which include grape seed oil, grape seed and skin powders, and pomace extracts. Grape-derived nutraceuticals even have a large variety of biological activities, which includes antioxidant, anti-inflammatory, and antimicrobial properties [43]. Special attention is paid to the role of biotechnology in manufacturing a "new generation" of grape nutraceuticals by exploitation plant cell technology and matter and gene-splicing techniques.

Oryzanol is present in rice bran oil which possesses a variety of health benefits which include reduction of cholesterol in blood, improvement of capillary action of blood vessels, anti-aging effect and others. Biscuit could be a wide utilised cereal based mostly processed food and also the fortification of oryzanol into the biscuits will be wont to offer inhibitor wealthy, extremely stable and acceptable purposeful food to the consumer.

The intake of fibre in the diet helps in the reducing the risk and lowering the incidence of numerous diseases. It has been found that dietary fibre from whole foods or supplements could cut back the chance of upset by up humour liquid body substance bodily fluid body fluid | humo | humour } lipids and reducing serum total and low-density lipoprotein (LDL) cholesterol concentrations in adults and children. High fibre intake is also associated with reduced risk of colorectal and breast cancer [45].

Fibre consumption is related to high organic process worth and inhibitor status of the diet, enhancing the results on human health.

Chronic exposure to star UV radiation damages skin, increasing its thickness and reducing its physical property, and causes carcinoma. It has been shown that olive leaf extract helps in the prevention of UVB induced skin damage and tumour growth [46]. Red Ginseng (the roots of *Panax ginseng* C.A. Meyer) is employed clinically in China, Korea and Japan for numerous diseases, together with coronary artery disease, hypertension and stress etc.

The oral administration of Red Ginseng extract may be useful as a health supplement for protection against photoaging [47].

Ginger root/rhizomes (*Zingiber officinale* Roscoe) is standard as a remedy for travel illness, nausea and stomach upset and is employed for wind, colic, irritable viscus, loss of appetite, chills, cold, flu, poor circulation, catamenial cramps, stomach upset (bloating, heartburn, flatulence), indigestion and gastrointestinal problems such as gas and stomach cramps. Dietary supplements containing preparations of those roots area unit being employed by customers, and clinical trials area unit being disbursed to gauge their medication or antiemetic drug properties [48].

The exact mechanism accountable for the antiemetic effects of ginger is unknown; but, the ginger phytochemicals, especially 6-gingerol, 8-gingerol, 10-gingerol, and 6-shogaol, may function as a 5-hydroxytryptamine (5-HT₃) antagonist, NK1 antagonist, antihistaminic, and possess prokinetic effects [49].

It has been shown that 6-gingerol is a secure and potent chemotherapeutic/chemo preventive compound that acts through cell cycle arrest and induction of necrobiosis in human oral and cervical tumour cells [50,51].

Future Prospects

The production of nutraceuticals is rising joined of the foremost world food industries because it offers rise to improved aid and redoubled life span.

Since sizable amount of healthful herbs, spice and trees area unit found in Asian nation, it's changing into a serious producer and bourgeois of purposeful foods and nutraceuticals.

Currently, research is being focused on traditional herbal extracts which were earlier linked with prevention of chronic diseases and health enhancement along with the establishment of their safety and efficacy.

The role of nutraceuticals in the prevention of various diseases is not necessarily due to a single compound, but due to the cumulative effect of several components present in the product. Therefore, it is important to conduct biomarker research for the comparison of preventative effects for different kinds of food. Moreover, standards should also be established to assess the prevention of diseases. New products developed by the popularity of variation in purposeful food and nutraceuticals composition for specialised markets which may result in the assembly of plants with biochemically uniform manufacture having extremely certain health and organic process properties. Measures should be taken to decrease the costs of the functional foods to the industry by finding new methods to isolate, characterize and purify them from various sources. Better characterization of the products is required to optimize the advantages to human and animal health by the applying of recent approaches in genetics, proteomics and metabolomics. Public awareness about the health promoting effects and value-added properties of food products can help in the expansion of the global market.

Conclusion

Under nutrition and micronutrient deficiencies contribute substantially to the global burden of disease, especially, developing countries where rates of under nutrition and increased exposure to infectious diseases caused by crowding and inadequate sanitation are very high. The worldwide nutraceuticals market is growing day by day in the form of dietary supplements and functional foods and beverages. But dietary supplements are not as effective as their natural sources.

Nutraceuticals is also accustomed improve health, delay the aging process, prevent chronic diseases,

increase life expectancy, or support the structure or function of the body.

Therefore, there is a need for the development of methods to increase the nutritional value of the foods and this can be achieved by the use of biotechnology. Biotechnological methods can be used for studying and cloning of various genes which can help to induce the expression of bioactive compounds. Development of nutraceuticals for novel health advantages, elucidating mechanisms of action of these products, development of study systems such as in vitro co-culture cell models can help in the elimination of various health issues. Modeling new intake habits victimization the prevailing information is required for the ultimate ideal of 'health for all' vision.

In the present review much effort has been devoted to provide their diseases modifying indications related to oxidative stress including allergy, cardiovascular, cancer, diabetes, eye, immune, inflammatory and hypertension.

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