Nutraceutical-prophylactic and Therapeutic Role of Functional Food in Health

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Abstract:

This paper reviews the potential of functional foods in our daily life. A functional food with new ingredients gives an additional function to human health. Above their basic nutritional value functional foods deliver enhanced benefits. The functional food industry is growing rapidly in recent years. Epidemiological studies as well as in vivo, in vitro, and clinical data showed that plant-based functional foods are able to reduce the risk of different chronic diseases, such as cancer. These biologically active plant chemicals are known as ‘phytochemicals’. Not only phytochemicals, also there are other animal products considered as functional foods for their potential role in human health. Foods containing probiotics, prebiotics, or plant sterols are also considered as functional foods. The aim of this review was to focus on the role of functional foods on human health. The research work to understand the relationship between different beneficial foods and human health system and to explore the role of the functional foods against various diseases will be an important aspect scientifically, clinically as well as socio-economically. Finally, functional foods will be successful depending on several factors including their effectiveness, safety, and quality.

Keywords: Inflammation; Anti-oxidant; Phenolic compounds; Scavenger activities; Phytochemicals; Anti-carcinogenic agents

Introduction

The industrialized world of this century forced to deal with new challenges such as excess healthcare costs, longer life expectancy and changes in living manner. Nutritionists have enthusiastically accepted the idea of ‘optimal nutrition’, which focuses on optimising daily diet quality in terms of its nutraceutical value for the proper health. As a result, development of functional foods or nutraceuticals comes into play [1,2]. The demand of functional food is increasing due to more health awareness.

The term ‘nutraceutical’ coined by DeFelice in 1989 and the Foundation for Innovation in Medicine [3,4]. The term ‘functional foods’ was first introduced in Japan. The processed foods containing nutritious ingredients that support healthy body functions are known as functional foods [5,6]. According to International Food Information Council (IFIC) the functional foods are dietary components with a health benefit beyond basic nutrition [4,7]. On the other hand, International Life Sciences Institute of North America (ILSI) also defines functional foods as physiologically active food components which provide health benefits [5,8]. Another definition by Health Canada described the functional food which is capable to reduce the risk of chronic diseases. To improve its bioavailability some components of functional foods could be changed by applying new technology [9]. Scientific research is very useful aspect for the production of ‘functional food’. According to some journal, functional food is a food with added or concentrated ingredients, which improves health [10]. European consensus publication regarded functional food as healthy food with beneficial and additional nutritional effects on human body. On 10th International Conference in Santa Barbara, CA, 2012, a new definition for ‘functional food’ announced as ‘natural or processed foods that contains known or unknown biologically-active compounds with health benefit for the prevention, management, and/or treatment of chronic disease’ [11].

Baby foods, sport drinks, enriched cereals, breads and other foods are considered as functional foods. There were some reports that, the Vitamin B-enriched flour was found to protect pellagra; vitamin D-enriched milk was effective in eliminating rickets and iodine-fortified salt decreased incidences of goitre [12]. Functional foods are different from medical foods and are distributed and regulated separately. Functional foods could be consumed freely as part of our everyday life, whereas medical foods and drugs are consumed when recommended by medical professionals (Table 1). The aim of this review was to focus on the role of functional foods on human health and to understand its use against different diseases and about its production in the industry.

Functional Foods from Plant Sources

Epidemiological evidence (in vivo and in vitro) and clinical trial data indicates that a plant-based diet can reduce the risk of various chronic diseases. In 1992, a review of 200 epidemiological studies demonstrated that risk of cancer was half to the people who consumed more fruits [13]. This work demonstrated that, bioactive compounds of plant based diets can reduce risk of cancer. Cereals and its ingredients are very good source of dietary fibre, proteins, energy, minerals, vitamins. Wheat, oat, barley, flaxseed, brown rice and soy products are important cereal based functional food and nutraceuticals [14]. The fermented cereals can be used for the growth of probiotic microorganisms also [15]. This review demonstrates health benefits of some plant based functional food.
Oats

Oats, commonly known as Avena sativa are considered as a minor cereal crop which comes under Poaceae family. Higher level of protein, lipids, vitamins, minerals antioxidants and phenolic compounds accounts for the nutritional significance of oats (Table 2) [16]. Oat products are good source of β-glucan, a soluble fibre which has the cholesterol-lowering capacity [17], reduce low density lipoprotein [7], contain antioxidant compounds [17], and improves gastrointestinal function and glucose metabolism [18]. Human clinical trials conducted on hyper-cholesterolemic subjects demonstrated 5% reduction in serum cholesterol due to intake of 60 g oatmeal or 40 g oat bran containing 3 g of β-glucan [7].

| Difference         | Functional foods                                                                 | Medical foods                                                                                                           | Prescription drugs                              |
|--------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Uses               | Energy enhancement; weight management; bolster gut, bone or heart health; disease risk reduction; memory improvement | Dietary management of a disease or condition with distinctive nutritional requirements (e.g. difficulty swallowing, loss of appetite, nutrition repletion post-surgery) | Treatment of disease, symptom, or condition      |
| Method of obtainment | No prescription or supervision needed; consumer selects                          | Used with medical supervision                                                                                          | Prescribed by health provider                   |
| Distribution channels | Supermarkets, drugstores, online, major retailers                                 | Hospitals, pharmacies, drugstores, online                                                                            | Pharmacies, hospitals                            |
| Regulatory body     | No specific body, but is considered food and is therefore subject to FDA regulation (FDA regulates any specific health claims that might be made) | No additional FDA review/approval needed, but must abide by regulations concerning foods, e.g. labeling (FDA regulates any specific health claims that might be made) | FDA approval needed, a multiyear, multistage review process |
| Amount consumed     | As desired                                                                        | As needed                                                                                                              | As prescribed                                   |

Table 1: Comparing functional foods with medical foods and drugs.

Oats

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Soy

Asian countries are consuming soy foods for centuries [19]. Soy has been in the spotlight during the 1990s. Soybean (Glycine max) consists of mainly isoflavones which are a group of naturally occurring heterocyclic phenols which perform several health-promoting functions [20]. Soy contains high quality protein and it plays preventive and therapeutic roles against diseases like cardiovascular disease (CVD), cancer, osteoporosis, and the alleviation of menopausal symptoms [7,21]. The cholesterol-lowering effect of soy is the well-documented physiological effect. There is strong evidence that soy-based diets consumption leads to decrease total cholesterol, LDL cholesterol, serum lipid concentration, and triglyceride levels [22]. According to meta-analysis of 38 separate studies (involving 743 subjects), consumption of soy protein significantly reduced LDL cholesterol (12.9%), total cholesterol (9.3%), and triglycerides (10.5%) [23]. Isoflavones is the key component for the cholesterol-lowering effect of soy. Soy proteins help to decrease LDL synthesis in liver and it can reduce insulin/glucagon ratio [24]. Isoflavones are heterocyclic phenols structurally similar to the estrogenic steroids. Among the isoflavone, genistein and daidzein are the most notable and soybeans are the significant dietary source [7,25]. Various studies reported that isoflavones can prevent intestine, prostate, stomach and breast cancers [26-29]. Another study described that soybeans contain several classes of anti-carcinogens, including protease inhibitors, phytosterols, phenolic acids, saponins, isoflavones and phytic [26,30,31]. The molecular structure of isoflavones is similar to human estrogens and bind to both estrogen receptors ERα and ERβ but prefer ERβ [32]. Reports demonstrated that, consumption of soy decreases the chance of estrogen-dependent cancer [33]. Soy increases bone density [34,35] and also helps to reduce menopausal symptoms.

Rice

Rice is the most significant cereal crops and a staple food for most of the world’s population. Rice is a very good reservoir of hypoallergenic protein and lysine. Protein quality of rice superior to that of wheat and corn [36]. Amino acid composition of rice protein was better than soy protein and casein [37]. It can be a suitable ingredient for infant food formulations [38]. Rice based fermented foods are highly acceptable because of its calorie value [39]. Chung et al. [40] stated that white rice with combination of 8% pigmented giant embryonic rice (Keununjami) is functional food which has strong hypolipidemic and anti-obesity properties. Choi et al. [41] described the anti-diabetic property of germinated brown rice extract.

| Components          | Oat groat | Oat gum | Oat bran | Oat hull fibre |
|---------------------|-----------|---------|----------|----------------|
| Total dietary fibre | 60-90     | -       | 120-240  | 900-970        |
| β-glucan            | 35-50     | 600-800 | 55-90    | -              |

Table 2: Composition of oat fibre and β-glucan (g/kg dry weight) [16,18].
Maize

Among the versatile emerging crops, maize is the most important because of its adaptability with varied agro-climatic conditions. Globally, it is considered as queen of cereals for its highest genetic yield potential. After rice and wheat, maize is the third most important cereal for human food stuff by contributing 9% to Indian basket and 5% to World’s dietary energy supply [50]. Decortication by abrasion are feasible to obtain smooth texture of cooked products from maize because of its hardness and size and fine grinding is essential [51]. In Pharmaceutical industry, to release tablet formulation immediately pre-gelatinized maize starch was used and it was also considered for sustained release formulations [52,53].

Barley

Barley (Hordeum vulgare) grain is used as feed, malt, and food [36]. Barley is used as flour, as semolina, and as whole-dehulled grain. Barley is rich in dietary fibre, both insoluble and soluble fibre. Fibre constituents of barley have protective and therapeutic effects against various metabolic disorder like cardiovascular diseases, certain cancers and type-2 diabetes [54-57] β-glucan, which is a major component of soluble fibre implicated in hypercholesterolemia, hypoglycemia, and decreases the incidence of chemically induced colon cancer in preclinical model, lowers postprandial plasma glucose and ameliorates insulin resistance [58,59]. Multiple varieties of dishes such as soups, couscous and bread are made by barley products [60].

Millets (Eleusine coracana)

Millets belongs to the family Poaceae. Millets are small seeded, annual cereal grasses which can survive in less fertile soil [61]. Millets include sorghum (Jowar), proso millet (Chena), pearl millet (Bajra), foxtail millet (Kakum), finger millet (Ragi), little millet (Kutki), kodo millet (Kodon), barnyard millet (Sanwa), and brown top millet [61,62].

Eleusine coracana is widely cultivated in the arid areas of Africa and Asia. Finger millet is one of the oldest crops in India [63]. In India, it is cultivated over an area of 2.65 million hectares [64]. Millet is considered as one of the important staple foods in some parts of Africa and India (FAO). In India, finger millet was processed by grinding, malting, and fermentation for products like beverages, idli, dosa, and roti [65]. Germinated finger millet can be a good substrate for statins (anti-hypercholesterolemic metabolites) production [66]. Various in vitro and in vivo studies demonstrated its blood glucose lowering, cholesterol lowering and wound healing properties [67]. It can be used for the preparation of dietary foods for anaemia patients and geriatric food formulation [68]. Several work demonstrated the antioxidant properties of millet [69-74]. Finger millet also possesses antimicrobial activities [72,75,76]. Protein glycation, one of the complications of diabetes, was inhibited by methanolic extract of finger millet [67,77]. Chethan et al. [78] reported that finger millet phenolics can inhibit aldose reductase and snake venom phospholipases (PLA2) too. Among the cereals and millets, finger millet is the richest source of calcium (344 mg%) and potassium (408 mg%).

Sorghum (Sorghum bicolor)

Sorghum is a cereal which belongs to the family Poaceae. It is considered as major source of carbohydrates and proteins. Sorghum is used as human food worldwide [79]. Pigmented sorghum is a good source of dietary phenolics, mainly flavones, flavanones and deoxyanthocyanidins. Several research has demonstrated anti-cancer activities of phenolic compounds of sorghum, especially 3-deoxyanthocyanidins and it is effective on various cancer such as skin melanoma, liver, colon, breast, esophagus, and bone marrow [80-86]. Other than cancer, sorghum also effective against several diseases such as diabetes, dyslipidemia, hypertension, obesity and inflammation [87].

Table 3 showing composition of different varieties of cereals expressed as 100 g of edible portion.

| Parameter   | Rice       | Wheat     | Maize      | Sorghum    | Millets   |
|-------------|------------|-----------|------------|------------|-----------|
| Water (%)   | 12         | 12        | 13.8       | 11         | 11.8      |
| Protein (g) | 7.5        | 13.3      | 8.9        | 11         | 9.9       |
| Fat (g)     | 1.9        | 2         | 3.9        | 3.3        | 2.9       |
| Carbohydrates (g) | 77.4 | 71 | 72.2 | 73 | 72.9 |
| Fibre (g)   | 0.9        | 2.3       | 2          | 1.7        | 3.2       |
| Ash (g)     | 1.2        | 1.7       | 1.2        | 1.7        | 2.5       |
| Ca (mg)     | 32         | 41        | 22         | 28         | 20        |
| P (mg)      | 221        | 372       | 268        | 287        | 311       |
| Fe (mg)     | 1.6        | 3.3       | 2.1        | 4.4        | 68        |
| K (mg)      | 214        | 370       | 284        | 350        | 430       |
| Mg (mg)     | 88         | 113       | 147        | n.d.       | 162       |
| Riboflavin (mg) | 0.05 | 0.12      | 0.12       | 0.15       | 0.38      |
| Niacin (mg) | 1.7        | 4.3       | 2.2        | 3.9        | 2.3       |
| Thiamin (mg) | 0.34      | 0.55      | 0.37       | 0.38       | 0.73      |

Table 3: Composition of different varieties of cereals expressed as 100 g of edible portion [88].

Fig (Ficus carica)

Figs belongs to the Moraceae family. Semi-arid climate is suitable for fig. Figs are usually dried and stored for later consumption. Medicinal value of figs already documented in various research papers and it has been demonstrated that figs has positive impact to treat respiratory, anti-inflammatory disorders, anti-cancer, antiviral, cardiovascular, aphrodisiac, hairnursetive [89,90], anti-diabetic, hypolipidemic [91,92], antipyretic [93], antibacterial [94,95], antifungal [96], scavenging activity and immune response [97]. It was demonstrated that ripe dried fig has potential effect on gastrointestinal, inflammatory disorders [98], and anti-infertility [99,100]. The Wildlife Conservation Society of New York reported that, wild figs are considered as ‘keystone’ fruit due to its high calcium content [101]. Hepatoprotective activity of figs has been demonstrated previously [102]. Other than fruits, latex of fig also has various medicinal importance. Leaves of fig tree are very useful to treat diabetes and contact dermatitis [92].

Fenugreek (Methi)

Fenugreek (Trigonella foenum-graceum) is a semi-arid crop belongs to Fabaceae family and is cultivated worldwide [103,104]. Fenugreek seeds and green leaves are used in food as well as in medicinal
application. Fenugreek paste, locally termed as ‘Cemen’ is a popular food in Turkey [105], which is prepared from ground fenugreek seeds. Crushed fenugreek seed is used to make ball to make clarified butter. Fenugreek has strong spicy and seasoning type sweet flavour [106]. Aromatic and flavourful fenugreek is a popular spice and is widely used for well-known medicinal properties [107]. India is a major producer of fenugreek and also a major consumer of it for its medicinal application. It is used as a functional food, traditional food and nutraceuticals.Singhal et al. [108] demonstrated hypo-cholerolemic activities of fenugreek seeds and Basch et al. [109] reported that fenugreek seeds lowered serum cholesterol, low-density lipoprotein (LDL) and triglyceride in hypercholesterolemic patients. According to Basch et al. [109] Fenugreek consumption in diet reduced triglyceride accumulation in the liver. Fenugreek also used as an antibacterial, anticancer, anticoagulant, and anti-diabetic agent. It helps to improve digestion. Fenugreek contains different alkaloids, flavonoids and saponins [110,111]. Grover et al. [112] reported that fenugreek seed showed hypoglycaemic and anti-hyperglycaemic activity in diabetic mice. The aqueous extract of fenugreek showed significant positive effect on ulcer. It has soothing effect on gastric and gastritis ulcer [113]. Fenugreek possess various bioactive compounds, among them trigonelline, galactomannan, diosgenin, 4-hydroxyisoleucin, and soluble dietary fibre fraction are important [114,115]. Several study revealed anti-diabetic property of diosgenin in animal model [116-118]. Recently, Bahmani et al. [119] demonstrated that, trigonelline which is bioactive compound of fenugreek is responsible for anti-diabetic property of fenugreek and it decreases blood cholesterol too. Diaszhin is one of the important bioactive compounds of fenugreek and it is used as contraceptive pills [119]. Dietary fibre of fenugreek seed is used for cooking [120,121] and it is very active to reduce postprandial hyperglycemia in preclinical model and decrease serum lipids [122,123]. Fenugreek provides natural food fibre and other nutrients required for human body [124]. Saponins are found to be in maximum concentration in the fenugreek [125] and Cholin content is very high in fenugreek [126]. Fenugreek seed is rich in multivitamin such as Vitamin-A (1040 IU per 100 g), B1 (0.41 mg per 100 g), B2 (0.36 mg per 100 g), C (12.0 mg per 100 g), nicotinic acid (1.1 mg per 100 g) and niacin (6.0 mg per 100 g) [127].

**Cordyceps mushroom**

*Cordyceps militaris* is widely distributed in China, Tibetan Plateau, Bhutan, Nepal and north east India at high altitude. In traditional Chinese medicine it is used as a tonic herb [128]. *C. militaris* has traditionally been used as a functional food and several bioactive compounds like adenosine, cordycepin, polysaccharides, mannitol, and ergosterol have been isolated from it [129,130]. It can be used to treat various inflammatory disorders and boosting the immune system [131]. Several researches demonstrated its promising activity in various inflammatory disease models like ovalbumin-induced asthma, dextran sodium sulphate (DSS)-induced colitis, and croton oil-induced ear oedema [132]. Humoral immune hyper-function was inhibited by cultivated Cordyceps and it improved liver function of post-hepatic cirrhosis patients by up regulate the level of the serum complement [133]. Recently, *C. militaris* cultivated on germinated soybean (GSC) extract and it was very effective against allergy and Type I hypersensitive animal model [132,134]. Cordycepin isolated from hot water extracts of *C. Sinensis* might be a good drug candidate against anticancer and antimitastatic [135]. 100 g of *Cordyceps militaris* contains 2.01 g manitol and 24.71 g trehalose free sugar. It is rich in polyunsaturated fatty acids (68.87%) than saturated fatty acids (23.40%). Various organic acids were found in this mushroom as oxalic, citric and fumaric acids (0.33, 7.97 and 0.13 g/100 g, respectively). Among the phenolic acids, only 0.02 mg p-Hydroxybenzoic acid was found in 100 g of this mushroom and d-tocopherol concentration was 55.86 lg/100 g [136]. This functional food has been used as drug and need further research by modern scientific approach for accurate phytochemical and bioactive compounds.

**Flaxseed**

*Flax (Linum usitatissimum)* is a blue flowering annual herb comes to Linaceae family. It produces golden yellow to reddish brown coloured flat seed. It has been used for medicinal purposes for over 5000 years [137,138]. More than 50 countries cultivate flaxseed [138,139]. According to Oomah [140], World's largest producer and exporter of flaxseeds is Canada. Scientific research has focused on fibre-associated compounds known as lignans. The richest source of mammalian lignan precursors is flaxseed [141,142]. Flaxseeds are very effective in several diseases like diabetes, arthritis, neurological disorders, osteoporosis, cardiovascular disease, cancer and various chronic non-communicable [143-145]. Consumption of flaxseed has also shown to lower LDL cholesterol [146,147] and platelet aggregation [148]. Several researches supported the chemo protective activities of the omega-3s and lignan phytoestrogens of flaxseed in human and animals [149-171]. Estrogen-dependent cancers can be prevented by mammalian lignans. In rodents, flaxseed has been shown to decrease tumours of the colon and mammary gland [155,164,172-176] as well as of the lung [177]. Different studies demonstrated that, consumption of flaxseed reduce breast [168,178,179] and prostate cancer [180-182]. It has also been reported that the ingestion of 10 g of flaxseed daily elicited several hormonal changes associated with reduced breast cancer risk [183]. Recent study revealed the anti-hepatotoxicity property of flaxseed oil [184]. In vivo, in vitro and in silico study reported that, dietary flaxseed might be a good approach to treat muscle dystrophies [185].

**Tomatoes (Solanum lycopersicum)**

Tomato is an important vegetable because of lycopene which is the primary carotenoid found in this fruit [186]. Different products are obtained from tomato, such as ketchup, sauces, and soups [187,188]. The tomatoes are rich in various bioactive compounds such as lycopene, β-carotene, phenolic compounds, flavonoids, glycoalkaloids, tomatine pro-vitamin A and vitamins C and E [189-197]. A clinical study by Giovannucci et al. [198] demonstrated that, tomato can reduce developing advanced prostate cancer [198]. Recent study revealed dietary lycopene consumption protect from prostate cancer by ERG protein expression [199]. Other than prostate cancer, it also has positive effect on breast, digestive tract, cervix, bladder, and skin cancer [200,201]. Along with peroxyl radicals scavenging capacity lycopene can also scavenge nitrogen dioxide and hydrogen peroxide [202,203]. Lycopene is the most effective as singlet oxygen quencher in biological systems [204]. Several work demonstrated that lycopene bioavailability of processed tomato is more than unprocessed tomato [205-207]. Recent study showed the hypolipidemic activities of processed tomato juice in animal model [208]. Tomato drink can reduce about 42% DNA damage in lymphocyte caused by oxidative stress [209].

**Pumpkin (Cucurbita pepo)**

*Cucurbita pepo* (pumpkin) comes under the family Cucurbitaceae. Cultivation of pumpkin originated in central Africa on 5500 BC
Pumpkin is one of the well-known plants which have been used as functional food [213]. It is very rich source of fatty acids like palmitic (C 16:0), stearic (C 18:0), oleic (C 18:1) and linoleic (C 18:2), linolenic (C18:3), sterols, gamma aminobutyric acids, proteins and peptides, polysaccharides, para-aminobenzoic acid and fixed oils, essential fatty acid such as omega 6 and omega 9, phytoestrogens, and antioxidants such as tocopherols, carotenoids, vitamin A and vitamin E [214-222]. Various ethnomedical studies demonstrated that Cucurbita pepo is used as an herbal, analgesic urinary disorders, antimicrobial, anti-ulcer, anti-diabetic, anti-cancer, and antioxidant in various diseases [212,223-230]. Low dose pumpkin showed hypoglycaemic activity by decreasing triglycerides, LDL and CRP (C-reactive protein) and high dose pumpkin decreased cholesterol [231]. Pumpkin is used as anti-diabetic traditionally medicine worldwide [232,213]. Several studies reported that pumpkin exhibits anti-diabetic activities in mice model [233-238]. Another research demonstrated anti-diabetic effect of tocopherol fraction of pumpkin seed oil in Wistar rats [239,240]. Pumpkin helps to improve pancreas β cells functionality by increasing the number of insulin positive cells [241]. It is also very effective against alcohol induced hepatic damage [242-244]. Recent research stated that, the pumpkin seeds are very useful to manage the benign prostatic hyperplasia [245].

**Garlic**

Garlic (*Allium sativum*) was originated in Central Asia [246] and is used universally as a flavouring agent as well as traditional medicine and a functional food to enhance physical and mental health [247]. The health benefits of garlic are numerous, including anti-diabetic, cholesterol-lowering properties, chronic inflammation, cancer chemopreventive anti-aging, antibiotic, and anti-hypertensive, increase blood circulation, anti-gastric cancer, antioxidant [246,248-254]. Garlic mixed with calcium hydroxide to form paste and applied to treat carbuncle [255]. Garlic has various medicinal values due to its oil and water-soluble, sulphur-containing elements [256-262]. The whole garlic bulb contains alliin, a derivative of the amino acid cysteine. Alliin is converted to allicin by allinase [13]. Allicin is responsible for the pungent odour of fresh garlic [263,264]. Alliin was the first natural compound which has both carbon and sulfur-centered stereochemistry [265]. Allicin have been investigated for their chemo-preventive properties [7]. Water content is 65% of fresh weight of garlic and the bulk of the dry weight is composed of mainly fructans, a fructose-containing carbohydrates, followed by other compounds like fibre, sulfur compounds, free amino acids and protein [266]. Several work demonstrated that, garlic extract capable to reduce diet-induced hypercholesterolemia [267]. Garlic has also been used for the prevention of CVD. The cardio protective effects are more likely due to its cholesterol-lowering effect. A meta-analysis [268] demonstrated that, an average of 900 mg garlic/day can reduce 9% serum cholesterol. Some authors suggested that garlic can reduce total cholesterol levels by 12% [269,270]. Although another study reported that, 12 weeks of garlic treatment was ineffective to reduce cholesterol in hypercholesterolemia subject [271,272]. Anti-tumorogenesis activity of garlic has been demonstrated in several preclinical models [250]. Several epidemiological studies demonstrated that, stomach cancer risk can be reduced by increasing allium intake [273]. In a clinical study with more than 40,000 postmenopausal women showed that, garlic consumption can reduce nearly 50% risk of colon cancer [274]. Antimicrobial activity of garlic has been documented from long time and Mr. Louis Pasteur also demonstrated the same [247,275-285]. Several recent studies also reported the promising effect of aequous garlic extracts against various bacteria as antibacterial agent [286-289]. Recent study demonstrated that, allicin and other organosulfur compounds from garlic showed promising antibacterial effect on methicillin-resistant *Staphylococcus aureus* (MRSA) which are now considered as a major hospital acquired pathogen all over the world [290]. It has been shown hepatoprotective activities of garlic in several studies also [291-293]. Due to hepatoprotective property of garlic, it can be a very good supplementation with first line anti-TB drugs [294]. Antimicrobial activity of garlic against *Mycobacterium tuberculosis* was firstly documented in 1946 [295]. Another study reported that, being promising antimicrobial agent, aqueous extract of garlic can be useful for dental caries and periodontitis [296].

**Cranberry (Vaccinium macrocarpon)**

Cranberry belongs to the Ericaceae family and 90% of total production of it contributed by North America and Canada [297]. Intake of cranberry juice significantly increases plasma antioxidant level [298-300]. Cranberry juice has been recognized as efficacious in the treatment of urinary tract infections since 1914 [301]. Several investigations have exhibited the ability of proanthocyanidins of cranberry juice to inhibit the attachment of *Escherichia coli* to uroepithelial cells [302-305]. Cranberry is beneficial to various diseases like cardiovascular disease, lipoprotein oxidation, and atherosclerosis [299,306,307]. Several *in vitro* studies supported the anti-cancer property of cranberries [308-313].

**Cocoa (Theobroma cacao)**

*Theobroma cacao* is commonly known as cacao tree or cocoa tree. The cocoa tree originated from ancient Central America [314]. Cocoa and cocoa-rich chocolates are very popular and widely consumed food component [315-317]. Cocoa is beneficial on blood pressure, vascular, platelet function and insulin resistance [315]. Cocoa beans and their parts are important ingredients for making chocolate. Cocoa is among the richest sources of polyphenols [318] and the total polyphenol content of the cocoa bean is about 6-8% by dry weight. Flavonoids, polyphenols, and procyanidins are the most important bioactive compounds with disease preventive characteristics [314]. Cocoa and cocoa products are recognized for health benefits related to hypertension, diabetes, anaemia, cardiovascular diseases, atherosclerosis, obesity, tuberculosis, fever, gout, kidney stones, mental fatigue, poor sexual appetite, neurodegenerative diseases and cancer [314,319-324]. Recent metaanalysis study stated the blood pressure lowering property of cocoa rich food [325] and it has been found that, in addition to the hypotensive effects, cocoa flavonoids reduce adipose tissue by stimulating thermo genesis and lipolysis [326]. Recent research demonstrated that, cacao osmotin and its derived peptides might be a good drug candidate against pathogenic fungi [327].

**Peanut**

Peanut is an important crop worldwide and by-products of peanut contain vitamins, proteins, antioxidants, fibers, polyphenols, and minerals. These ingredients are used in many processed foods. Some reports described that, peanuts are also source of flavonoids, phytoestrogens and phenolic acids which are able to block the absorption of cholesterol from diet. Peanut also contains 20 amino acids and known for its disease preventive properties [328].
Strawberry

Strawberries, a rich source of phytochemicals and vitamins are considered as functional food for their preventive and therapeutic health benefits. Strawberry is also known for its antioxidant capacity [329,330]. Many studies found its anti-inflammatory, antihyperlipidemic, antihypertensive, or antiproliferative effects principally via downregulation of NF-κB activity [331-336]. Strawberries are a significant source of flavonoids. Flavonoids have been shown to have direct antibacterial activity [337-339]. Different epidemiological studies support the protective effects of strawberries against cancer, inflammation, cardiovascular mortality and hypertension [335,340]. Some studies demonstrated that, strawberries can reduce oxidant stress [341,342]. Different epidemiological and clinical studies observed cardio-protective effects of strawberries. Pinto et al. [343] using in vitro models reported the role of strawberry phytochemicals in managing hyperglycemia and hypertension. Another report demonstrated berry polyphenols as a potential phytotherapy in obesity and hyperglycemia [344]. Strawberry has been shown to exert anticarcinogenic effects [331,345]. Stoner et al. [346,347] showed the effects of freeze-dried strawberries on the inhibition of tumors in rodents.

Tannins (a specific strawberry polyphenols) showed significant anticancer effects in human breast, cervix, and colon carcinoma cells [348,349]. Ellagic acid found in strawberries demonstrated anticancerogenic effects in several human cancer cell models in some studies [350,351]. Several studies described the role of strawberries in curing age-related neurodegenerative disorders [352-354].

Table 4 showing examples of foods with higher content of specific nutraceutical substances.

| Lactobacilli, Bifidobacteria | Yogurt and other dairy |
|-------------------------------|-----------------------|
| Catechins                     | Cocoa                 |
| Lignans                       | Flax                  |
| Cyclic peptides, cordycepin, 10-membered macrolides, cephaporpholides C, E and F, pyridine-2,6-dicarboxylic acid and 2-carboxymethyl-4-(30-hydroxybutyl) furan, dipicolinic acid | Cordyceps militaris |

Table 4: Examples of foods with higher content of specific nutraceutical substances.

Functional Foods from Animal Sources

Some animal products with potential beneficial effects on human health are considered as functional foods. Some examples are as follows:

Fish

Fish contain animal protein. Fish oils contain the omega-3 (n-3) polyunsaturated fatty acids, vitamins and minerals [355]. The omega-3 fatty acid is an essential class of polyunsaturated fatty acids (PUFAs). Omega-3 fatty acids can reduce the rate of cardiovascular diseases or CVD [356] and it can also lower triglyceride level [357]. Studies by Kris-Etherton et al. [358] reported the effects of omega-3 fatty acids to reduce the incidence of CVD. Some observational studies report a decrease in cardiovascular disease with higher fish oil intake [359]. Omega-3 fatty acids also decrease the risk of thrombosis [360].

Consumption of 35 g of fish per day has been shown to reduce the risk of total mortality by cardiovascular disease [361]. Fish oil also plays role in decreasing weight and waist circumference [362]. The evidence of fish oil supplements lowering triglycerides has been found in dialysis patients [363]. Saccone and Berghella reported that, fish oil supplements appeared to be associated with greater weight at birth of the child [364]. Another report demonstrated that, supplementation of fish oil improves the quality of life in patients with chronic heart failure [365]. Some studies reported that, patients with a higher consumption of fish are less likely to have type 2 diabetes as compared to patients with lower fish consumption [366]. Recent randomized, controlled clinical trial by Pase et al. [367] showed the effects of long-chain omega-3 fish oils on cognitive and cardiovascular function.

Dairy products

Dairy products are considered as functional foods as they are rich of calcium. Fermented dairy food products could prevent diseases such as hypertension. Calcium helps preventing osteoporosis and possibly colon cancer. Other than calcium, many other components in fermented dairy products are known as probiotics. Probiotics are microorganisms with health benefits to the host animal by improving its intestinal microorganisms. Probiotics are termed as functional foods which can alter and modify pre-existing intestinal flora [368,369].

Both beneficial (e.g. *Bifidobacterium* and *Lactobacillus*) and detrimental (e.g. *Enterobacteriaceae* and *Clostridium* spp.) bacteria inhabit the human gastrointestinal tract. Among these bacteria, lactic acid bacteria are used in food fermentation [370-372]. Probiotics are
known for their anti-carcinogenic, hypo-cholesterolemic and antagonistic actions against gut pathogens. Probiotics are used in colon cancer risk reduction [373,374]. This is because lactic acid cultures are able to alter the activity of faecal enzymes such as β-glucuronidase, azoreductase, nitroreductase which plays a role in the development of colon cancer [375,376].

The prebiotics are defined as 'non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a few number of bacteria in the colon and thus improves host health' [377]. These include starches, dietary fibres, sugar alcohols, and oligosaccharides [378]. Among these prebiotics oligosaccharides found naturally in many fruits and vegetables and have received great attention for their health benefits [379]. Prebiotics as food additives are valuable for functional foods and also helps in preventing diet-related diseases [380]. The prebiotic concept has been further extended to understand the effect of the synbiotics which is a mixture of pro-and prebiotics [377]. Many such synbiotic products are currently on the market in different countries. Recently our group demonstrated the use of combination of probiotic microbial strains supplemented in food as possible therapeutic and prophylactic agent to fight against inflammation and degeneration in Inflammatory Bowel Diseases (IBD) [381].

**Beef**

Meat and meat products contain important source of protein, fat, and several functional compounds [382]. Thomas and others [383] described the importance of animal meat for the high quality proteins as well as for its contribution to food security in the rural livelihoods. In 1987, conjugated linoleic acid (CLA) was first isolated from beef. CLA is an anti-carcinogenic fatty acid and it is a mixture of isomers of linoleic acid. CLA consists mixture of two isomers, cis-9, trans-11 and trans-10, cis-12. Conjugated linoleic acid has been approved as GRAS (generally recognized as safe) in USA since 2008 [384]. CLA increases in cooked foods and it acts as a weight-reduction agent. Reports showed that, CLA acts as a protective agent in mammary carcinogenesis and aberrant colonic crypt foci in rats [385]. On the other hand, dairy cow milk contains conjugated linoleic acid by dietary modification [386]. Conjugated linoleic acid isomers also reported to block lipogenic genes expression in rats [387]. Meat processing and preservation technologies are essential for food security and also helps to supply good-quality and affordable meat products. Many authors have reported different methods and technologies to extend the shelf life of fresh meat [388].

**Animal foods**

Some animal foods such as vitamin-like substances, coenzyme Q10, α-lipoic acid and others are considered as physiologically active compounds. According to some reports carnitine is an essential nutrient in infancy [389]. Coenzyme Q10 is a vitamin-like substance and plays an important role in the generation of cellular energy in the human body. It also helps in healthy cardiovascular effects [390]. α-Lipoic acid has been known for its antioxidant activity [391].

Table 5 showing some examples of nutraceutical substances grouped by food source and Table 6 showing some of the food ingredients approved by Food Safety and Standards Authority of India (FSSAI) in India.

| Plants | Animal | Microbial |
|--------|--------|-----------|
| α-Glucan, Ascorbic acid γ-Tocotrienol Quercetin Luteolin Gallic acid Indole-3-carbonol Indole-3-carbonol Pectin Daidzein Glutathione Potassium Allicin S-Limonene Genistein Lycopene Hemicellulose Lignin Capsaicin Geraniol β-Ionone α-Tocopherol β-Carotene Nordihydrocapsaicin Selenium Zeaxanthin Minerals MUF A | Conjugated Linoleic Acid (CLA) Coenzyme Q10 Eicosapentaenoic acid (EPA) Docosahexaenoic acid (DHA) Spingolipids Choline Calcium Selenium Creatine Zinc Minerals | Saccharomyces boulardii (yeast) Bifidobacterium bifidum B. longum Lactobacillus acidophilus(LC1) L. acidophilus (NCFB 1748) Streptococcus salivarius (subsp. Thermophilus) |

**Impact of Urbanization on Health and Functional Food Market**

The direct and indirect beneficial effects of functional food depend on environmental factors such as place and time of cultivation. The benefits and risks of functional foods to individuals and populations as a whole must be determined carefully.

Industrialization, globalization and urbanization, these three factors influences Indian life-styles and food habit. In India, incidence of lifestyle related health problems such as diabetes, cardiovascular diseases, hypertension and obesity increasing rapidly [392]. Day by day people are becoming disease prone due to the stressful work and less physical activity [393]. Work related stress leads to many diseases such as hypertension and cardiovascular diseases [392]. Choice of foods and diet structure such as fast food and added sugar in the diet gradually changing the human health quality [394]. In this current scenario functional food plays an important promising role in the healthy human life. Indian consumers’ markets are increasing for a healthy food as well as demand of functional foods are increasing in Indian food industry.
Table 6: Some of the food ingredients approved by food safety and standards authority of India (FSSAI) in India.

| Ingredient    | Industry Usage                                      | Health Claims                                                                 |
|---------------|-----------------------------------------------------|-------------------------------------------------------------------------------|
| Omega 3 and 6 | Functional foods (fortified foods): e.g. omega fortified malted beverages | Prevention from inflammatory and autoimmune diseases, also reducing cholesterol, and hence, various heart risks. |
| Probiotics    | Functional foods: e.g. probiotic Yogurt/dahi improve intestinal microflora and aid better digestive health. | Improve intestinal microflora and aid better digestive health.               |
| Beta glucan   | Functional beverages: e.g. soya milk drinks         | Soluble fibre that soaking up the cholesterol.                                |
| Phytoestrogens| Functional foods: e.g. rice bran forfities oil      | Reduce the risk of many kinds of cancers, cholesterol and risk of coronary heart disease. |
| Tocopherols   | Functional foods: e.g. rice bran forfities oil      | Cholesterol lowering potential. Prevent or delay heart disease and related Complications, cataracts, macular degeneration, prostate and other cancers. |
| Ginseng       | Dietary supplements: e.g. Tonicsand stimulants      | Cures lethargy, arthritis, impotence, senility, ani-aging properties.         |
| Beta-carotene | Dietary supplements: e.g. Beta-carotene in antioxidants | Prevent night blindness, skin problem, enhance immunity, protect toxins and cancers |

Indian Functional Food and Nutraceutical Market Size and Growth

Among the developing countries, India is the most potential market for nutraceuticals and dietary supplement products. Nutraceutical market is growing rapidly in comparison to other sectors of Indian food market.

According to Ernst and Young study, Indian functional food market in 2008 was about INR 30 billion, apart from the dietary supplements and it has grown at a CAGR (compound annual growth rate) of 18% as compared to a world average of 7% [392]. Indian functional food market deals with products like fruits, vegetables, fortified juices, energy drinks, fresh dairy products, confectionary, breakfast cereals, and fibre rich foods which imparting the desired health benefits and physiological changes. Main ingredients of these products are probiotics, prebiotics, omega fatty acids fortified foods, tocopherols, phytoestrogens, xylitol, soy, gluten and whey proteins. In 2010, about 116 new functional food products were launched in India [395]. Out of these, 80 products were targeted at enhancing the cardio vascular functioning and the rest 36 at promoting the immunity.

Conclusion

Functional foods are an important part of healthy lifestyle that also includes a balanced diet and physical activity. Functional foods will be successful depending on several factors including their effectiveness, safety, and quality. Our understanding of functional foods by scientific research will enhance the knowledge on long-term health benefits. Some functional dairy products support healthy heart by lowering blood pressure. Epidemiological studies needed to cope with enormous mobilize the body’s physiological network encompassing the neuro-immuno-endocrine cycles and help maintain optimum health. More future research on food items will expand the existing knowledge of functional food as well as developing specific strategy in the biodiversity management.

References

1. Ashwell M (2002) Concepts of functional foods. International Life Sciences Institute (ILSI) Europe Concise Monograph Series, Brussels.
2. Pushpangadan P, George V, Sreedevi P, Biney AJ, Anzar S, et al. (2014) Functional foods and nutraceuticals with special focus on mother and child care. Annals of Phytotherapy 3: 4-24.
3. DeFelice SL (2002) FIM Rationale and proposed guidelines for the nutraceutical research and education act-NREA.
4. Kalra EK (2003) Nutraceutical–definition and introduction. AAPS PharmSci 5: E25.
5. Henry C (2010) Functional foods. Eur J Clin Nutr 64: 657-659.
6. Kumar J, Pal A (2015a) An Overview of Prospective study on Functional Foods. International Journal of Recent Scientific Research 6: 5497-5500.
7. Hasler CM (1998) Functional foods: their role in disease prevention and health promotion. Food Technology 52: 57-62.
8. Bagchi D (2008) Neutraceutical and Functional Food Regulations. Elsevier: New York.
9. Roberfroid MB (1999) What is beneficial for health? The concept of functional food. Food Chem Toxicol 37: 1039-1041.
10. Keservani RK, Kesharwani RK, Vyas N (2010) Nutraceutical and Functional Food as Future Food: A Review. Der Pharmacia Lettre 2: 106-116.
11. Texas (2015) Functional Food Center, Dallas, Texas.
12. (2013) USA Food and Beverage Market Study.
13. Block G, Patterson B, Subar A (1992) Fruit, vegetables, and cancer prevention: a review of the epidemiological evidence. Nutr Cancer 18: 1-29.
14. Truswell AS (2002) Cereal grains and coronary heart disease. Eur J Clin Nutr 56: 1-14.
15. Charalampopoulos D, Wang R, Pandiella SS, Webb C (2002) Application of cereals and cereal components in functional foods: a review. Int J Food Microbiol 79: 131-141.
16. Wani SA, Tajamul SR, Bazaria B, Ahmad NG, Amir G, et al. (2014) Oats as a functional food: a review. Universal Journal of Pharmacy 3: 14-20.
17. Malkky I, Myllmäki O, Teinila K, Koponen S (2004) Method for preparing an oat product and a foodstuff enriched in the content of beta-glucan. US Patent 6: 797-307.

18. Malkky I, Virtanen E (2001) Gastrointestinal effects of oat bran and oat gum: A review. Lebensm Wiss Technol 34: 337-347.

19. Xiao CW (2008) Health effects of soy protein and isoflavones in humans. J Nutr 138: 1244S-9S.

20. Jackson CJ, Dini JP, Lavandier C, Rupasinghe HPV, Faulkner H, et al. (2002) Effects of processing on the content and composition of isoflavones during manufacturing of soy beverage and tofu. Process Biochemistry 37: 1117-1123.

21. Zheng X, Lee SK, Chun OK (2016) Soy Isoflavones and Osteoporotic Bone Loss: A Review with an Emphasis on Modulation of Bone Remodeling. J Med Food 19: 1-14.

22. Song WO, Chun OK,HWang I, Shin HS, Kim BG, et al. (2007) Soy isoflavones as safe functional ingredients. J Med Food 10: 571-580.

23. Anderson JW, Johnstone BM, Cook-Newell ME (1995) Meta-analysis of 25. Chen TR, Wei QK (2008) Analysis of bioactive aglycone isoflavones during processing of soy protein and soy foods. J Chromatogr A 1216: 2-29.

24. Davidson M (2008) A review of the current status of the management of mixed dyslipidemia associated with diabetes mellitus and metabolic syndrome. Am J Cardiol 102: 19L-27L.

25. Chen TR, Wei QK (2008) Analysis of bioactive aglycone isoflavones in soybean and soybean products. Nutrition Food Science 38: 540-547.

26. Messina M, Barnes S (1991) The role of soy products in reducing risk of cancer. J Natl Cancer Inst 83: 541-546.

27. Rowland I, Faughnan M, Hoey L, Wähälä K, Williamson G, et al. (2003) Preclinical findings of the effects of soy protein intake on serum lipids. N Engl J Med 333: 276-282.

28. Fang CY, Tseng M, Daly MB (2005) Correlates of soy food consumption in women at increased risk for breast cancer. J Am Diet Assoc 105: 1552-1558.

29. Ufiłalean A, Schneider S, Ionescu C, Lalk M (2015) Soy Isoflavones and Breast Cancer Cell Lines: Molecular Mechanisms and Future Perspectives. Molecules 21: E13.

30. Romani A, Vignolini P, Galardi C, Aroldi C, Vazzana C, et al. (2003) Polyphenolic content in selected diluents and maize starch mucilage binder on the tablets formulation of the crude aqueous extract of Vernonia galamensis. Int J Pharm 375: 2746-2756.

31. Brennan CS, Cleary LJ (2005) The potential use of cereal (103) (104)-b-D-glucans as functional food ingredients. J Cereal Sci 42: 113.

32. Pins JI, Kaur H (2006) A review of the effects of barley b-glucan on cardiovascular and diabetic risk. Cereal Foods World 51: 811.

33. Wood P (2010) Oat and rye b-glucan: properties and function. Cereal Chem 87: 315S-30.

34. Izypornycky MS, McMillan T, Bazin S, Kletke J, Dushnicky L (2014) Milling of Canadian oats and barley for functional food ingredients: Oat bran and barley fibre-rich fractions. Cereal Sci 94: 573-586.

35. Bhatty RS (1999) The potential of hull-less barley. Cereal Chem 76: 589-599.

36. Behall KM, Scholfield DJ, Hallfrisch JG (2002) Fasting glucose and insulin and measures of insulin resistance of men after consumption of whole wheat/brown rice or barley. J Am Coll Nutr 21: 486.

37. Nout MJ (2009) Rich nutrition from the poorest-cereal fermentations in Africa and Asia. Food Microbiol 26: 685-692.

38. Lenaerts V, Moussa I, Dumoulin Y, Mebsout F, Chouinard F, et al. (1998) Cross-linked high amylose starch for controlled release of drugs: recent advances. J Control Release 53: 225-234.

39. Autamashih M, Isah AB, Allagh TS, Ibrahim MA (2011) Effects of selected diluents and maize starch mucilage binder on the tablets formulation of the crude aqueous extract of Vernonia galamensis. Int J Pharm 375: 2746-2756.

40. Brennan CS, Cleary LJ (2005) The potential use of cereal (103) (104)-b-D-glucans as functional food ingredients. J Cereal Sci 42: 113.

41._null

42. Kumar J, Kumar J, Singh SP, Tuli R (2014) Association of satellites with a mastrevirus in natural infection: complexity of Wheat dwarf India virus disease. J Virol 88: 7093-7104.

43. Shewry PR (2009) Wheat. J Exp Bot 60: 1537-1553.

44. Sapirstein HD, David P, Preston KR, Dexter JE (2007) Durum wheat bread making quality: Effects of gluten strength, protein composition, semolina particle size and fermentation time. Journal of Cereal Science 45: 150-161.

45. Baudjis AJ, Lu C, Clydesdale FM, Decker EA (2000) Potential of wheat-based breakfast cereals as a source of dietary antioxidants. J Am Coll Nutr 19: 3085-3115.

46. Ottes A, Cagindii O (2006) Cereal based functional foods and nutraceuticals. Acta Sci Pol Technol Aliment 5: 107-112.

47. Kim KH, Tsao R, Yang R, Cui SW (2006) Phenolic acid profiles and antioxidant activities of sheet bran extracts and the effect of hydrolysis conditions. Food Chem 95: 466-473.

48. Yu L, Nanguet AL, Beta T (2013) Comparison of Antioxidant Properties of Refined and Whole Wheat Flour and Bread. Antioxidants (Basel) 2: 370-383.

49. Shewry PR, Hey SJ (2015) The contribution of wheat to human diet and health. Food and Energy Security 4: 178-202.

50. Saikumar R, Kumar B, Kaul J, Kumar A (2012) Maize research in India: historical prospective and future challenges. Maize Journal 1: 1-6.

51. Null MJ (2009) Rich nutrition from the poorest-cereal fermentations in Africa and Asia. Food Microbiol 26: 685-692.

52. Lemaerts V, Moussa I, Dumoulin Y, Mebsout F, Chouinard F, et al. (1998) Cross-linked high amylose starch for controlled release of drugs: recent advances. J Control Release 53: 225-234.

53. Autamashih M, Isah AB, Allagh TS, Ibrahim MA (2011) Effects of selected diluents and maize starch mucilage binder on the tablets formulation of the crude aqueous extract of Vernonia galamensis. Int J Pharm 375: 2746-2756.

54. Brennan CS, Cleary LJ (2005) The potential use of cereal (103) (104)-b-D-glucans as functional food ingredients. J Cereal Sci 42: 113.

55. Pins JI, Kaur H (2006) A review of the effects of barley b-glucan on cardiovascular and diabetic risk. Cereal Foods World 51: 811.

56. Wood P (2010) Oat and rye b-glucan: properties and function. Cereal Chem 87: 315S-30.

57. Izypornycky MS, McMillan T, Bazin S, Kletke J, Dushnicky L (2014) Milling of Canadian oats and barley for functional food ingredients: Oat bran and barley fibre-rich fractions. Can J Plant Sci 94: 573-586.

58. Bhatty RS (1999) The potential of hull-less barley. Cereal Chem 76: 589-599.

59. Behall KM, Scholfield DJ, Hallfrisch JG (2002) Fasting glucose and insulin and measures of insulin resistance of men after consumption of whole wheat/brown rice or barley. J Am Coll Nutr 21: 486.

60. Amri A, Ouammou L, Nassif F (2005) Barley-Based Food in Southern Morocco. In: Grando S and Gomezmacpherson H (eds.), Food Barley: Importance, Uses, and Local Knowledge. ICARDA, Aleppo.

61. Null MJ (2009) Rich nutrition from the poorest-cereal fermentations in Africa and Asia. Food Microbiol 26: 685-692.

62. Lemaerts V, Moussa I, Dumoulin Y, Mebsout F, Chouinard F, et al. (1998) Cross-linked high amylose starch for controlled release of drugs: recent advances. J Control Release 53: 225-234.

63. Autamashih M, Isah AB, Allagh TS, Ibrahim MA (2011) Effects of selected diluents and maize starch mucilage binder on the tablets formulation of the crude aqueous extract of Vernonia galamensis. Int J Pharm 375: 2746-2756.
galactomannan without chemical fragmentation. Carbohydrate Polymers 45: 69-77.

106. Blank I (1996) The flavor principle of fenugreek. Nestlé research center. 211th ACS Symposium, New Orleans.

107. Senthil A, Mamatha BS, Vishwanath P, Bhat KK, Ravishankar GA (2011) Studies on development and storage stability of instant spice adjunct mix from seaweed (Eucheuma). J Food Sci Technol 48: 712-717.

108. Singhal PC, Gupta RK, Joshi LD (1982) Hypcholesterolemic effect of seeds. Current Science 51: 136-137.

109. Basch E, Ulbricht C, Kuo G, Szapary P, Smith M (2003) Therapeutic applications of fenugreek. Altern Med Rev 8: 20-27.

110. Uemura T, Goto T, Kang MS, Mizoguchi N, Hirai S, et al. (2011) J Nutr Food Sci 45: 69-77.

111. Kumar P, Kale RK, McLean P, Baquer NZ (2012) Antidiabetic and Sangeetha MK, ShriShri Mal N, Atmaja K, Sali VK, Vasanthi HR (2013) ISSN:2155-9600 JNFS, an open access journal J Nutr Food Sci

112. Roberts KT (2011) Mol Cell Biochem 396: 161-174.

113. Singh V, Garg AN (2006) Availability of essential trace elements in Indian Thomas Blank I (1996).

114. Grover JK, Yadav S, Vats V (2002) Medicinal plants of India with anti-Tolachev ON, Zhuchenko AA Jr (2000) Biologically active substances of atherogenic reduction. J Nutr 141: 514-521.

115. Uemura T, Goto T, Kang MS, Mizoguchi N, Hirai S, et al. (2011) J Nutr Food Sci 45: 69-77.

116. Methwold M, Gowwami TK (2012) A Review on the Functional Properties, Nutritional Content, Medicinal Utilization and Potential Application of Fenugreek. J Food Process Technol 3: 9.

117. Leela NK, Shafeekh KM (2008) Fenugreek, Chemistry of Spices. CAB International, Pondicherry, India.

118. Li SP, Zhang GH, Zeng Q, Huang ZG, Wang YT, et al. (2006) Hypoglycemic activity of polysaccharide, with antioxidation, isolated from cultured Cordyceps mycelia. Phytomedicine 13: 428-433.

119. Yue K, Ye M, Zhou Z, Sun W, Lin X (2013) The genus Cordyceps: a chemical and pharmacological review. J Pharm Pharmacol 65: 474-493.

120. Tuli HS, Sharma AK, Sandhu SS, Kashyap D (2013) Cordycepin: a bioactive metabolite with therapeutic potential. Life Sci 93: 863-869.

121. Paterson RR (2008) Cordyceps: a traditional Chinese medicine and another fungal therapeutic biofactory? Phytochemistry 69: 1469-1495.

122. Han ES, Oh JY, Park HJ (2011) Cordyceps militaris extract suppresses dextran sodium sulfate-induced acute colitis in mice and production of inflammatory mediators from macrophages and mast cells. J Ethnopharmacology 134: 703-710.

123. Zhu HJ, Liu C (1992) Modulating effects of extractum semen Pisciae and cultivated Cordyceps hypae in immuno-dysfunction of inpatients with posthepatitic cirrhosis. Zhanqiu Zhong Xi Yi Jie He Za Zhi 12: 207-209.

124. Park DK, Choi WS, Park HJ (2012) Antiallergic activity of novel isoflavone methylglycosides from Cordyceps militaris grown on germinated soybeans in antigen-stimulated mast cells. Journal of Agricultural and Food Chemistry 60: 2309-2315.

125. Nakamura K, Shinozuka K, Yoshikawa N (2015) Anticancer and antitumestatic effects of cordycepin, an active component of Cordyceps sinensis. J Pharmocol Sci 127: 53-56.

126. Reis FS, Barros L, Calhelha RC, Cric’A, Van Griensven LJLD, et al. (2013) The methanolic extract of Cordyceps militaris (L) Link fruiting body shows antioxidant, antibacterial, antifungal and anti-human tumor cell lines properties. Food Chemical and Toxicology 62: 91-98.

127. Tolkachev ON, Zhuchenko AA Jr (2000) Biologically active substances of flax: medicinal and nutritional properties (a review). Pharmaceutical Chemistry Journal 34: 360-367.

128. Singh KK, Midrula D, Relah J, Barnwal P (2011) Flaxseed: a potential source of food, feed and fiber. Crit Rev Food Sci Nutri 51: 210-222.

129. Oomah BD, Maaza G (1998) Compositional changes during commercial processing of flaxseed. Ind Crop Prod 9: 29-37.

130. Oomah BD (2001) Flaxseed as a functional food source. J Sci Food Agric 81: 889-894.

131. Thompson LU, Robb P, Serraino M, Cheung F (1991) Mammalian lignan production from several foods. Nutr Cancer 16: 43-52.

132. Kamal-Eldin A, Peerlkamp N, Johnsson P, Andersson R, Andersson RE, Li SP, Zhang GH, Zeng Q, Huang ZG, Wang YT, et al. (2006) Studies on development and storage stability of instant spice adjunct mix from seaweed (Eucheuma). J Food Sci Technol 48: 712-717.

133. Kamal-Eldin A, Peerlkamp N, Johnsson P, Andersson R, Andersson RE, Kamal-Eldin A, Peerlkamp N, Johnsson P, Andersson R, Andersson RE, et al. (2001) An oligomer from flaxseed composed of secoisolariciresinolidegugulose and 3-hydroxy-3-methyl glutaric acid residues. Phytochemistry 58: 587-590.

134. Maggio M, Artoni A, Lauretani F, Borghi L, Nouvenne A, et al. (2009) Reducing atherogenic effects of flax: medicinal and nutritional properties (a review). Pharmaceutical Chemistry Journal 34: 360-367.

135. Singh KK, Midrula D, Relah J, Barnwal P (2011) Flaxseed: a potential source of food, feed and fiber. Crit Rev Food Sci Nutri 51: 210-222.

136. Oomah BD, Maaza G (1998) Compositional changes during commercial processing of flaxseed. Ind Crop Prod 9: 29-37.

137. Oomah BD (2001) Flaxseed as a functional food source. J Sci Food Agric 81: 889-894.

138. Thompson LU, Robb P, Serraino M, Cheung F (1991) Mammalian lignan production from several foods. Nutr Cancer 16: 43-52.

139. Kamal-Eldin A, Peerlkamp N, Johnsson P, Andersson R, Andersson RE, et al. (2001) An oligomer from flaxseed composed of secoisolariciresinolidegugulose and 3-hydroxy-3-methyl glutaric acid residues. Phytochemistry 58: 587-590.

134. Maggio M, Artoni A, Lauretani F, Borghi L, Nouvenne A, et al. (2009) Reducing atherogenic effects of flax: medicinal and nutritional properties (a review). Pharmaceutical Chemistry Journal 34: 360-367.

135. Singh KK, Midrula D, Relah J, Barnwal P (2011) Flaxseed: a potential source of food, feed and fiber. Crit Rev Food Sci Nutri 51: 210-222.

136. Oomah BD, Maaza G (1998) Compositional changes during commercial processing of flaxseed. Ind Crop Prod 9: 29-37.

137. Oomah BD (2001) Flaxseed as a functional food source. J Sci Food Agric 81: 889-894.

138. Thompson LU, Robb P, Serraino M, Cheung F (1991) Mammalian lignan production from several foods. Nutr Cancer 16: 43-52.

139. Kamal-Eldin A, Peerlkamp N, Johnsson P, Andersson R, Andersson RE, et al. (2001) An oligomer from flaxseed composed of secoisolariciresinolidegugulose and 3-hydroxy-3-methyl glutaric acid residues. Phytochemistry 58: 587-590.

140. Maggio M, Artoni A, Lauretani F, Borghi L, Nouvenne A, et al. (2009) Reducing atherogenic effects of flax: medicinal and nutritional properties (a review). Pharmaceutical Chemistry Journal 34: 360-367.

141. Oomah BD, Maaza G (1998) Compositional changes during commercial processing of flaxseed. Ind Crop Prod 9: 29-37.
149. Setchell KD, Lawson AM, Mitchell FL, Adlercreutz H, Kirk DN, et al. (1980) Lignans in man and in animal species. Nature 287: 740-742.

150. Setchell KD, Lawson AM, Borriello SP, Harkness R, Gordon H, et al. (1981) Lignan formation in man--microbial involvement and possible roles in relation to cancer. Lancet 2: 4-7.

151. Adlercreutz H, Fotsis T, Bannwart C, Hämäläinen E, Blioug S, et al. (1986) Urinary estrogen profile determination in young Finnish vegetarian and omnivorous women. J Steroid Biochem 24: 289-296.

152. Adlercreutz H (1988) Lignans and phytoestrogens. Possible preventative role in cancer. In: Frontiers of Gastrointestinal Research, Rozen P, Karger, Basel.

153. Adlercreutz H (1990) Western diet and Western diseases: some hormonal and biochemical mechanisms and associations. Scand J Clin Lab Invest Suppl 201: 3-23.

154. Adlercreutz H, Honjo H, Higashi A, Fotsis T, Hämäläinen E, et al. (1991) Urinary excretion of lignans and isoflavonoid phytoestrogens in Japanese men and women consuming a traditional Japanese diet. American Journal of Clinical Nutrition 54: 1093-1100.

155. Serraino M, Thompson LU (1992) The effect of flaxseed supplementation on the initiation and promotional stages of mammary tumorigenesis. Nutr Cancer 17: 153-159.

156. Kashtan H, Stern HS, Jenkins DJ, Jenkins AL, Thompson LU, et al. (1992) Colonic fermentation and markers of colorectal-cancer risk. Am J Clin Nutr 55: 723-728.

157. Mousavi Y, Adlercreutz H (1992) Enterolectone and estradiol inhibit each other's proliferative effect on MCF-7 breast cancer cells in culture. Journal of Steroid Biochemistry and Molecular Biology 41: 615-619.

158. Sathyamoorthy N, Wang TT, P pang JM (1994) Stimulation of p53 expression by diet-derived compounds. Cancer Res 54: 957-961.

159. Adlercreutz H (1995) Phytoestrogens: epidemiology and a possible role in cancer protection. Environ Health Perspect 103: 103-112.

160. Westcott ND, Muir AD (1996) Variation in the concentration of Linuurn spp. In: Flax, The Genus Linuurn Muir, AD and Westcott, Taylor and Francis, London.

161. Thompson LU (1995) In: Flaxseed in Human Nutrition. Cunnane SC and Thompson LU (eds.), Champaign, IL: AOCS Press.

162. Thompson LU, Rickard SE, Cheung F, Kenashko E, Obermeyer WR (1997) Variability in anticancer lignan levels in flaxseed. Nutr Cancer 27: 26-30.

163. Piskirinen SL, Pajari AM, Salminen I, Heimonen SM, Adlercreutz H, et al. (2005) Effects of a flaxseed mixture and plant oils rich in alpha-linolenic acid on the adenosine formation in multiple intestinal neoplasia (Min) mice. Br J Nutr 94: 510-518.

164. Bommareddy A, Arasala BD, Matthes DP, Dwivedi C (2006) Chemopreventive effects of dietary flaxseed on colon tumor development. Nutr Cancer 54: 216-222.

165. Bommareddy A, Zhang X, Schrader D, Kaushik RS, Zeman D, et al. (2009) Effects of dietary flaxseed on intestinal tumorigenesis in Apo(M) mice. Nutr Cancer 61: 276-283.

166. Yan L, Yee JA, Li D, McGuire MH, Thompson LU (1998) Dietary flaxseed supplementation and experimental metastasis of melanoma cells in mice. Cancer Lett 124: 181-186.

167. Bergman JM, Thompson LU, Dabrosin C (2007) Flaxseed and its lignans inhibit estradiol-induced growth, angiogenesis, and secretion of vascular endothelial growth factor in human breast cancer xenografts in vivo. Clin Cancer Res 13: 1061-1067.

168. Mason JK, Thompson LU (2014) Flaxseed and its lignan and oil components: can they play a role in reducing the risk of and improving the treatment of breast cancer? Appl Physiol Nutr Metab 39: 663-678.

169. Lin X, Gingrich JR, Bao W, Li J, Haroon ZA, et al. (2002) Effect of flaxseed supplementation on prostatic carcinoma in transgenic mice. Urology 60: 919-924.

170. Boccardo F, Lunardi G, Guglielmini P, Paroditi M, Murialdo R, et al. (2004) Serum enterolectone levels and the risk of breast cancer in women with palpable cysts. Eur J Cancer 40: 84-89.

171. Demark-Wahnefried W, Polascik TJ, George SL, Switzer BR, Madden JI, et al. (2008) Flaxseed supplementation (not dietary fat restriction) reduces prostate cancer proliferation rates in men pre-surgery. Cancer Epidemiol Biomarkers Prev 17: 3577-3587.

172. Phipps WR, Martini MC, Lampe J, Slavin JL, Kurzer MS (1993) Effect of flax seed ingestion on the menstrual cycle. J Clin Endocrinol Metab 77: 1215-1219.

173. Hendawi MY, Alam RT, Abdellatief SA (2016) Ameliorative effect of flaxseed oil against thiacloprid-induced toxicity in rats: hematological, biochemical, and histopathological study. Environ Sci Pollut Res Int 23: 11855-11863.

174. Carotenuto F, Costa A, Albertini MC, Luigi Rocchi MB, Rudov A, et al. (2016) Dietary flaxseed mitigates impaired skeletal muscle regeneration: in vivo, in vitro and in silico Studies. International Journal of Medical Sciences 13: 206-219.

175. Gerster H (1997) The potential role of lycopene for human health. J Am Coll Nutr 16: 109-126.

176. Santos-Sánchez NF, Valadez-Blanco R, Salas-Coronado R (2013) Factors affecting the antioxidant content of fresh tomatoes and their processed products. In: Tomatoes: Cultivation, Varieties and Nutrition, Higashide T, Nova Science Publishers, Hauppauge, NY, USA.

177. Luna-Guevara ML, Hernández-Carranza P, Luna-Guevara JJ, Flores-Sánchez R, Ochoa-Velasco CE, et al. (2015) Effect of sonication and blanching postharvest treatments on physicochemical characteristics and antioxidant compounds of tomatoes: Fresh and refrigerated. Academia Journal of Agricultural Research 3: 127-131.

178. Takagi K, Toyoda M, Shimizu M, Satoh T, Saito Y (1994) Determination of tomatine in foods by liquid chromatography after derivatization. J Chromatogr A 659: 127-131.
190. Leonardi C, Ambrosino P, Esposito F, Fogliano V (2000) Antioxidative activity and carotenoid and tomatine contents in different typologies of fresh consumption tomatoes. J Agric Food Chem 48: 4723-4727.

191. Friedman M (2002) Tomato glycoalkaloids: role in the plant and in the diet. J Agric Food Chem 50: 5751-5780.

192. Giovanelli G, Paradiso A (2002) Stability of dried and intermediate moisture tomato pulp during storage. J Agric Food Chem 50: 7277-7281.

193. George B, Kaur C, Khurdiya DS, Kapoor HC (2004) Antioxidants in tomato (Lycopersicum esculentum) as a function of genotype. Food Chem 84: 45-51.

194. Toot RK, Savage GP (2005) Antioxidant activity in different fractions of tomatoes. Food Res Int 38: 487-494.

195. Canene-Adams K, Campbell JK, Zaripeh S, Jeffery EH, Erdman JW Jr (2005) The tomato as a functional food. J Nutr 135: 1226-1230.

196. Juroszek P, Lumpkin HM, Yang RY, Ledesma DR, Ma CH (2009) Fruit quality and bioactive compounds with antioxidant activity of tomatoes grown on-farm: comparison of organic and conventional management systems. J Agric Food Chem 57: 1186-1194.

197. Slimestad R, Verheul M (2009) Review of flavonoids and other phenolics from fruits of different tomato (Lycopersicon esculentum MILL.) cultivars. J Sci Food Agric 89: 1255-1270.

198. Giovannucci E, Ascherio A, Rimm EB, Stampfer MJ, Colditz GA, et al. (1995) Intake of carotenoids and retinol in relation to risk of prostate cancer. J Natl Cancer Inst 87: 1767-1776.

199. Graff RE, Pettersson A, Lis RT, Pettersson A, Lis RT, Erdman JW Jr (2001) Dietary lycopene intake and risk of prostate cancer defined by ERG protein expression. Am J Clin Nutr 103: 851-860.

200. Clinton SK (1998) Lycopene: chemistry, biology, and implications for human health and disease. Nutr Rev 56: 35-51.

201. Weisburger JH (1998) International Symposium on Lycopene and Tomato Products in Disease Prevention: an introduction. Proc Soc Exp Biol Med 218: 93-94.

202. Böhm F, Tinkler JH, Truscott TG (1995) Carotenoids protect against cell membrane damage by the nitrogen dioxide radical. Nat Med 1: 98-99.

203. Woodall AA, Lee SW, Weesie RJ, Jackson MJ, Britton G (1997) Oxidation of carotenoids by free radicals: relationship between structure and reactivity. Biochim Biophys Acta 1336: 33-42.

204. Di Maccio P, Kaiser S, Sies H (1989) Lycopene as the most efficient biological carotenoid singlet oxygen quencher. Arch Biochem Biophys 274: 532-538.

205. Chang KJ, Cheong SH (2007) The effect of fermented milk supplement with tomato (Lycopersicon esculentum) on blood lipid profiles in ovariectomy-induced hyperlipidemic female rats. FASEB J 21: 1086.

206. Hsu YM, Lai CH, Chang CY, Fan CT, Chen CT, et al. (2008) Characterizing the lipid-lowering effects and antioxidant mechanisms of tomato paste. Biosci Biotechnol Biochem 72: 677-685.

207. Friedman M (2013) Anticarcinogenic, cardioprotective, and other health benefits of tomato compounds lycopene, a-tomatine, and tomatidine in different tomato (Lycopersicon esculentum Mill.) cultivars. J Agric Food Chem 61: 9534-9550.

208. Lee LC, Wei L, Huang WC, Husi YJ, Chen YM, et al. (2015) Hypolipidemic Effect of Tomato Juice in Hamsters in High Cholesterol Diet-Induced Hyperlipidemia. Nutrients 7: 10525-10537.

209. Das D, Vimala R, Das N (2010) Functional foods in Natural Origin-An Overview. Indian Journal Natural Products Resources 1: 136-142.

210. Satyavati GV, Raina MK, Sharma M (1976) Medicinal Plants of India. New Delhi: 201-206.

211. Bradley PR (1992) British Herbal Compendium. British Herbal Medicine Association, Bournemouth, Dorset, UK.

212. Chonoko UG, Rufai AB (2011) Phytochemical screening and antibacterial activity of Cucurbita pepo(Pumpkin) against Staphylococcus aureus and Salmonella typhi. Bayero Journal of Pure and Applied Sciences 4: 145-147.

213. Caili F, Huan S, QuanHong L (2006) A review on pharmacological activities and utilization technologies of pumpkin. Plant Foods Hum Nutr 61: 73-80.

214. Eynard AR, Cajas V, Silva R, Quiroga P, Muñoz S (1992) Histopathology of essential fatty acid-deficient mice. Nutrition 8: 37-40.

215. Murkovic M, Hillebrand A, Winkler J, Pfannhauser W (1996) Variability of vitamin E content in pumpkin seeds (Cucurbita pepo L.). Eur Food Res Technol 202: 275-278.

216. Liu HW (2001) Determination of 4-aminoatuburic acid in pumpkin powder by high performance liquid chromatography. Se Pu 19: 532-533.

217. Lovejoy JC (2002) The influence of dietary fats in insulin resistance. Curr Diab Rep 2: 430-440.

218. Stevenson DG, Eller FJ, Wang L, Jane JL, Wang T, et al. (2007) Oil and tocopherol content and composition of pumpkin seed oil in 12 cultivars. J Agric Food Chem 55: 4005-4013.

219. Kulatiene J, Jariene E, Danilcenko H (2007) Oil pumpskins seeds and their quality. Pol J Nutr Sci 57: 349-352.

220. Gossell-Williams M, Lyttle K, Clarke T, Gardner M, Simon O (2008) Supplementation with pumpkin seed oil improves plasma lipid profile and cardiovascular outcomes of female nonovariectomized and ovariectomized Sprague-Dawley rats. Phytotherapy Res 22: 873-877.

221. Ardabili G, Farhoosh R, Khodaparast MH (2011) Chemical composition and physicochemical properties of pumpkin seeds (Cucurbita pepo Subsp. pepo Var. Styriaka) grown in Iran. J Agric Sci Tech 13: 1053-1063.

222. Sribnina M, Hrabovski N, Rafajlovska V, Fiser S (2012) Characterization of the seed and seed extracts of the Pumpkins Cucurbita maxima and Cucurbita pepo L from Macedonia. Macedonian Journal of Chemistry and Chemical Engineering 31: 65-78.

223. Smith BD (1997) The initial domestication of Cucurbita pepo in the Americas 10,000 years ago. Sci 276: 932-934.

224. Wang XL, Liu J, Chen ZH, Gao E, Liu JX, et al. (2001) Preliminary study on pharmacologically effect of Cucurbita pepo cv Dayanggua. J Trad Chin Vet Med 6: 2-9.

225. Park SC, Lee JR, Kim YJ, Hwang I, Nah JW, et al. (2010) Pr-1, a novel antifungal protein from pumpkin rinds. Biotechnol Lett 32: 125-130.

226. Gill NS, Bali M (2011) Isolation of anti ulcer cucurbitecine type triterpenoid from the seeds of Cucurbita pepo. Research Journal of Phytochemistry 5: 70-79.

227. Shrivastava A, Gupta VB (2012) Various treatment options for benign prostatic hyperplasia: A current update. J Midlife Health 3: 10-19.

228. Rathinavelu A, Levy A, Sivanesan D, Gossell-Williams M (2013) Cytotoxic effect of Cucurbita (pumpkin) seed extracts in LN1CA prostate cancer cells is mediated through apoptosis. Current Topics in Nutraceutical Research 11: 137.

229. Tomar PB, Kumar N, Singh A, Selvukumar P, Roy P (2014) Characterization of anticancer, DNase and antifungal activity of pumpkin 2S albumin. Biochemical and Biophysical Research Communications 448: 349-354.

230. Vorobyova OA, Bolshakova AE, Pegova RA, Kolchik OV, Klubukova IN, et al. (2014) Analysis of the components of pumpkin seed oil in suppositories and the possibility of its use in pharmaceuticals. Journal of Chemical and Pharmaceutical Research 6: 1106-1116.

231. Sedighi A, Jamal MS, Mahbubeh S, Somayeh K, Mahmoud RK, et al. (2011) Hypoglycaemic and hypolipidemic effects of pumpkin (Cucurbita pepo L.) on alloxan-induced diabetic rats. African Journal of Pharmacy and Pharmacology 5: 2620-2626.

232. Jia W, Gao W, Tang L (2003) Antidiabetic herbal drugs and other related effects of pumpkin rinds. Biotechnol Lett 25: 125-130.

233. Shrivastava A, Gupta VB (2012) Various treatment options for benign prostatic hyperplasia: A current update. J Midlife Health 3: 10-19.
234. Xia T, Wang Q (2007) Hypoglycaemic role of Cucurbita ficifolia (Cucurbitaceae) fruit extract in streptozotocin induced diabetic rats. J Sci Food Agric 87: 1753-1757.

235. Jian Z, Du Q (2011) Glucose-lowering activity of novel tetrasaccharide glyceroglycolipids from the fruits of Cucurbita moschata. Bioorg Med Chem Lett 21: 1001-1003.

236. Diaz-Flores M, Angeles-Mejia S, Baiza-Gutman LA, Medina-Navarro R, Hernández-Saavedra D, et al. (2012) Effect of an aqueous extract of Cucurbita ficifolia Bouche on the glutathione redox cycle in mice with STZ-induced diabetes. J Ethnopharmacol 144: 101-108.

237. Jin H, Zhang YJ, Jiang JX, Zhu LY, Chen P, et al. (2013) Studies on the extraction of pumpkin components and their biological effects on blood glucose of diabetic mice. Journal of food and drug analysis 21: 184-189.

238. Teugwa CM, Boudjeko T, Tchinda BT, Mejiato PC, Zofou D (2013) Anti-hyperglycaemic globulins from selected Cucurbitaceae seeds used as antidiabetic medicinal plants in Africa. BMC Complement Altern Med 13: 63.

239. Bharti SK, Kumar A, Sharma NK, Prakash BO, Kumar S, et al. (2013) Tocopherol from seeds of Cucurbita pepo against diabetes: Validation by in vivo experiments supported by computational docking. J Formosan Med Assoc 112: 676-690.

240. Gutierrez RMP (2016) Review of Cucurbita pepo (Pumpkin) its phytochemistry and pharmacology. Med Chem 6: 12-21.

241. Acosta-Patino JL, Jiménez-Balderas E, Juárez-Orpeza MA, Díaz-Zagoya JC (2001) Hypoglycemic action of Cucurbita ficifolia on Type 2 diabetic patients with moderately high blood glucose levels. J Ethnopharmacol 77: 99-101.

242. Bharti SK, Kumar A, Sharma NK, Prakash BO, Kumar S, et al. (2013) Tocopherol from seeds of Cucurbita pepo against diabetes: Validation by in vivo experiments supported by computational docking. J Formosan Med Assoc 112: 676-690.

243. Makni M, Fetoui H, Gargouri NK, Garoui el M, Jaber H, et al. (2008) Effect of dietary garlic on the serum lipids of fructose-fed rats. J Nutr Metab 2011: 475216.

244. Islamsohn JL, Moser M, Stein EA, Dudley K, Davey JA, et al. (1998) Garlic and other alliums: the lore and the science. Royal Society Chemistry.

245. Block E (2009) Garlic and other alliums: the lore and the science. Royal Society Chemistry.

246. [No authors listed] (1996) Book review. Platelets 7: 367-370.

247. Slagciy C, Neil A (1994) Garlic as a lipid lowering agent—a meta-analysis. J R Coll Physicians Lond 28: 39-45.

248. Vincent C, Furnham A (2001) Complementary medicine—A research prospective. John Wiley and Sons.

249. Isaacsohn JL, Moser M, Stein EA, Dudley K, Davey JA, et al. (1998) Garlic powder and plasma lipids and lipoproteins: a multicenter, randomized, placebo-controlled trial. Arch Intern Med 158: 1189-1194.

250. Canogullari S, Baylan M, Erdogan Z (2010) The effects of dietary garlic powder on performance, egg yolk and serum cholesterol concentrations in laying quails. Czech J Anim Sci 55: 286-293.

251. You WC, Blot WJ, Chang YS, Ershow AG, Yang ZT, et al. (1988) Diet and high risk of stomach cancer in Shandong, China. Cancer Res 48: 638-642.

252. Uchida Y, Takahashi T, Sato N (1975) [The characteristics of the antibacterial activity of garlic (author's transl)]. Jpn J Antibi 28: 638-642.

253. Cellini L, Di Campli E, Masulli M, Di Bartolomeo S, Allocati N (1996) Inhibition of Helicobacter pylori by garlic extract (Allium sativum). FEBS Immunol Med Microbiol 13: 273-277.
277. Sivam GP, Lampe JW, Uness B, Swanzay SR, Potter JD (1997) Helicobacter pylori in vitro susceptibility to garlic (Allium sativum) extract. Nutr Cancer 27: 118-121.

278. Jain RC (1998) Anti tubercular activity of garlic oil. Indian J Pathol Microbiol 41: 131.

279. Ankri S, Mirelman D (1999) Antimicrobial properties of alliin from garlic. Microbes Infect 1: 125-129.

280. Ross ZM, O’Gara EA, Hill DJ, Sleightholme HV, Maslin DJ (2001) Antimicrobial properties of garlic oil against human enteric bacteria: evaluation of methodologies and comparisons with garlic oil sultides and garlic powder. Appl Environ Microbiol 67: 475-480.

281. Taso SM, Yin MC (2001) In vitro antimicrobial activity of four diallyl sulphides occurring naturally in garlic and Chinese leek oil. J Med Microbiol 50: 646-649.

282. Martin KW, Ernst E (2003) Herbal medicines for treatment of bacterial infections: a review of controlled clinical trials. J Antimicrob Chemother 51: 241-246.

283. Shuford JA, Steckelberg JM, Patel R (2005) The anti-infective and anti-inflammatory effects of garlic (Allium sativum) on Staphylococcus. Pak J Biol Sci 8: 158-159.

284. Low CE, Chong PP, Lim CS, Ahmad Z, et al. (2008) Inhibition of hyphal formation and SIR2 expression in Candida albicans treated with fresh Allium sativum (garlic) extract. J Appl Microbiol 105: 2169-2177.

285. Mozaffari Nejad AS, Shabani S, Bayat M, Hosseini SE (2014) Antibacterial Effect of Garlic Aqueous Extract on Staphylococcus aureus in Hamburger. Jundishapur J Microbiol 7: e13134.

286. Li G, Ma X, Deng L, Zhao X, Wei Y, et al. (2015) Fresh Garlic Extract Enhances the Antimicrobial Activities of Antibiotics on Resistant Strains in Vitro. Jundishapur J Microbiol 8: e14814.

287. Gheni AI, Noori MY, Shekhany AI, Small HO (2016) Inhibitory Effects of Aqueous Garlic Extract (AGE) against multidrug resistant from Staphylococcus aureus and Escherichia coli. International Journal of Advanced Research 4: 928-933.

288. Saha S, Saha SK, Hossain MA, Paul SK, Gomes RR, et al. (2016) Anti-Bacterial effect of Aqueous Garlic Extract (AGE) determined by DisC Diffusion Method against Escherichia coli. MymsenSingh Med J 25: 23-26.

289. Vswathanan V, Phadatate AG, Mukne A (2014) Antimycobacterial and Antibacterial Activity of Allium sativum Bulbs. Indian J Pharm Sci 76: 256-261.

290. Patrick-Iwuanyanwu KC, Wegwu MO, Ayalogu EO (2007) Prevention of V iswanathan V, Phadatare AG, Mukne A (2014) Antimycobacterial and Antibacterial Activity of Allium sativum Bulbs. Indian J Pharm Sci 76: 256-261.

291. Shin JH, Lee CW, Oh SJ, Yun J, Kang MR, et al. (2014) Hepatoprotective effect of aged black garlic extract in rodents. Toxicol Res 30: 49-54.

292. Nasiru A, Hafsat IG, Sabo AA (2012) Effect of anti-tuberculosis drugs co-administered with garlic homogenate on rat liver enzymes. International Conference on Biological and Life Sciences 40: 96-99.

293. Rao RR, Rao SS (1946) Inhibition of Mycobacterium tuberculosis by garlic extract. Nature 157: 441.

294. Houshmand B, Mahjouf D, Dianat O (2013) Antibacterial effect of different concentrations of garlic (Allium sativum) extract on dental plaque bacteria. Indian J Dent Res 24: 71-75.

295. Vattem DA, Ghaedian R, Shetty K (2005) Enhancing health benefits of berries through phenolic antioxidant enrichment: focus on cranberry. Asia Pac J Clin Nutr 14: 120-130.

296. Pedersen CB, Kyle J, Jenkinson AM, Gardner PT, McPhail DB, et al. (2000) Effects of blueberry and cranberry juice consumption on the plasma antioxidant capacity of healthy female volunteers. Eur J Clin Nutr 54: 405-408.

297. Chu YF, Liu RH (2005) Cranberries inhibit LDL oxidation and induce LDL receptor expression in hepatocytes. Life Sci 77: 1892-1901.

298. Skrovad DJ, Sumczyński D, Mlecz K, Jurikova T, Sochor J (2015) Bioactive Compounds and Antioxidant Activity in Different Types of Berries. Int J Mol Sci 16: 24673-24706.

299. Blatherwick NR (1914) The specific role of foods in relation to the composition of the urine. Arch Int Med 14: 409-450.

300. Schmidt DR, Sobota AE (1988) An examination of the anti-adherence activity of cranberry juice on urinary and nonurinary bacterial isolates. Microbios 55: 173-181.

301. Griffiths P (2003) The role of cranberry juice in the treatment of urinary tract infections. Br J Community Nurs 8: 557-561.

302. Ermel G, Georgeault S, Inisan C, Besnard M (2012) Inhibition of adhesion of uropathogenic Escherichia coli bacteria to uroepithelial cells by extracts from cranberry. J Med Food 15: 126-134.

303. Sun J, Marais JP, Khoo C, LaPlante K, Vejborg RM, et al. (2015) Cranberry (Vaccinium macrocarpon) oligosaccharides decrease biofilm formation by uropathogenic Escherichia coli. J Funct Foods 17: 235-242.

304. McKay DL, Blumberg JB (2007) Cranberries (Vaccinium macrocarpon) and cardiovascular disease risk factors. Nutr Rev 65: 490-502.

305. Novotny JA, Baer DJ, Khoo C, Gebauer SK, Charron CS (2015) Cranberry juice consumption lowers markers of cardiometabolic risk, including blood pressure and circulating C-reactive protein, triglyceride, and glucose concentrations in adults. J Nutr 145: 1185-1193.

306. Bomser J, Madhavi DL, Singletary K, Smith MA (1996) In vitro anticaner activity of fruit extracts from Vaccinium species. Planta Med 62: 212-216.

307. Krueger CG, Porter ML, Welbe DA, Cunningham DG, Reed JD (2000) Potential of cranberry flavonoids in the prevention of copper-induced LDL oxidation. Polyphenols Communications 2: 447-448.

308. Seearm NP, Adams LS, Hardy ML, Heber D (2004) Total cranberry extract versus its phytochemical constituents: Antiproliferative and synergistic effects against human tumor cell lines. J Agric Food Chem 52: 2512-2517.

309. Sun J, Hai Liu R (2006) Cranberry phytochemical extracts induce cell cycle arrest and apoptosis in human MCF-7 breast cancer cells. Cancer Lett 241: 124-134.

310. Vattem DA, Jang HD, Levin R, Shetty K (2006) Synergism of cranberry phenolics with ellagic acid and rosmarinic acid for antimutagenic and DNA protection functions. J Food Biochem 30: 98-116.

311. Vu KD, Carletti H, Bouver J, Côté J, Doyon G, et al. (2012) Effect of different cranberry extracts and juices during cranberry juice processing on the antiproliferative activity against two colon cancer cell lines. Food Chem 132: 939-967.

312. Baharum Z, Akim AM, Hin TY, Hamid RA, Kasran R (2016) Theobroma cacao: Review of the Extraction, Isolation, and Bioassay of Its Potential Anti-cancer Compounds. Trop Life Sci Res 27: 21-42.

313. Corti R, Flammer AJ, Hollenberg NK, Lüscher TF (2009) Cocoa and cardiovascular health. Circulation 119: 1433-1441.

314. Khan N, Khymenets O, Uripsi-Sarda M, Tü lipani S, García-Aloy M, et al. (2014) Cocoa polyphenols and inflammatory markers of cardiovascular disease. Nutrients 6: 844-880.

315. Kumar R, Bhataya K, Kapoor S (2015b) The Role of Functional Foods for Healthy Life: Current Prospectives. Int J Pharm Bio Sci 6: 429-443.

316. Cooper KA, Donovan JL, Waterhouse AL, Williamson G (2008) Cocoa and health: a decade of research. Br J Nutr 99: 1-11.

317. Dillinger TL, Barriga P, Escárcega S, Jimenez M, Salazar Lowe D, et al. (2000) Food of the gods: cure for humanity? A cultural history of the medicinal and ritual use of chocolate. J Nutr 130: 2057S-72S.

318. Pearson DA, Paglieroni TG, Reid D, Wun T, Schramm DD, et al. (2002) The effects of flavanol-rich cocoa and aspirin on ex vivo platelet function. Thromb Res 106: 191-197.

319. Othman A, Ismail A, Abdul Ghani N, Adenan I (2007) Antioxidant capacity and phenolic content of cocoa beans. Food Chemistry 100: 1523-1530.
325. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds of cacao: a review of the epidemiologic evidence. Nutr Cancer 61: 573-579.

326. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

327. Erdman JW Jr, Carson L, Kwik-Uribe C, Evans EM, Allen RR (2008) Effects of cocoa flavanols on risk factors for cardiovascular disease. Asia Pac J Clin Nutr 17: 284-287.

328. Maskarinec G (2009) Cancer protective properties of cocoa: a review. ISRNI:2155-9600 JNFS, an open access journal 11: 51-56.

329. Meyers KJ, Watkins CB, Pritts MP, Liu RH (2003) Antioxidant and anti-inflammatory activities of strawberries. J Agric Food Chem 51: 6887-6892.

330. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

331. Ried K, Sullivan TR, Fakler P, Frank OR, Stocks NP (2012) Effect of cocoa on blood pressure. Cochrane Database Syst Rev.

332. Meyer AS, Heinonen M, Frankel EN (1998) Antioxidant interactions of catechin, cyanidin, caffeic acid, quercetin, and ellagic acid on human LDL oxidation. Food Chem 61: 71-75.

333. Maskarinec G (2009) Cancer protective properties of cocoa: a review of the epidemiologic evidence. Nutr Cancer 61: 573-579.

334. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

335. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

336. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

337. Meyer AS, Heinonen M, Frankel EN (1998) Antioxidant interactions of catechin, cyanidin, caffeic acid, quercetin, and ellagic acid on human LDL oxidation. Food Chem 61: 71-75.

338. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

339. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

340. Ried K, Sullivan TR, Fakler P, Frank OR, Stocks NP (2012) Effect of cocoa on blood pressure. Cochrane Database Syst Rev.

341. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

342. Burton-Freeman B (2010) Postprandial metabolic events and fruit consumption is associated with increased antioxidant capacity in serum. J Nutr 140: 2272S-2276S.

343. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

344. Meghji SJ, Salve AR, Chauhan S (2016) Peanuts as functional food: a review. J Food Technol 53: 31-41.

345. Wang SY, Feng R, Lu Y, Bowman L, Ding M (2005) Inhibitory effect on activator protein-1, nuclear factor-kappab, and cell transformation by extracts of strawberries (Fragaria x ananassa Duch.). J Agric Food Chem 53: 4187-4193.

346. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

347. Meyer AS, Heinonen M, Frankel EN (1998) Antioxidant interactions of catechin, cyanidin, caffeic acid, quercetin, and ellagic acid on human LDL oxidation. Food Chem 61: 71-75.

348. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

349. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

350. Zhang Y, Seeram NP, Lee R, Feng L, Heber D (2008) Isolation and identification of strawberry phenolics with antioxidant and human cancer cell antiproliferative properties. J Agric Food Chem 56: 670-675.

351. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

352. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

353. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

354. Wang SY, Feng R, Lu Y, Bowman L, Ding M (2005) Inhibitory effect on activator protein-1, nuclear factor-kappab, and cell transformation by extracts of strawberries (Fragaria x ananassa Duch.). J Agric Food Chem 53: 4187-4193.

355. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

356. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

357. Meyer AS, Heinonen M, Frankel EN (1998) Antioxidant interactions of catechin, cyanidin, caffeic acid, quercetin, and ellagic acid on human LDL oxidation. Food Chem 61: 71-75.

358. Aaby K, Ekeberg D, Skrede G (2007) Characterization of phenolic compounds in strawberry (Fragaria × ananassa) fruits by different hplc detectors and contribution of individual compounds to total antioxidant capacity. J Agric Food Chem 55: 4395-4406.

359. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.

360. Buijsse B, Weikert C, Drogan D, Bergmann M, Boeing H (2010) Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. Eur Heart J 31: 1616-1623.
Quality of Life in Patients With Chronic Heart Failure. Circ Heart Fail 8: 1077-1087.

366. Kutner NG, Clow PW, Zhang R, Aviles X (2002) Association of fish intake and survival in a cohort of incident dialysis patients. Am J Kidney Dis 39: 1018-1024.

367. Pase MP, Grim N, Cockerell R, Stough C, Scholey A, et al. (2015) The effects of long-chain omega-3 fish oils and multivitamins on cognitive and cardiovascular function: a randomized, controlled clinical trial. J Am Coll Nutr 34: 21-31.

368. Fuller R (1994) History and development of probiotics. In: R. Fuller (ed.), Probiotics, Chapman and Hall, NY, USA.

369. Pandey KR, Naik SR, Vakil BV (2015) Probiotics, prebiotics and synbiotics—a review. J Food Sci Technol 52: 7577-7587.

370. Gerritsen J, Smidt H, Rijkers GT, de Vos WM (2011) Intestinal microbiota in human health and disease: the impact of probiotics. Genes Nutr 6: 209-240.

371. Fontana L, Bermudez-Brito M, Plaza-Diaz J, Muñoz-Quezada S, Gil A (2013) Sources, isolation, characterisation and evaluation of probiotics. Br J Nutr 109: 535-550.

372. Zhang YJ, Li S, Gan RY, Zhou T, Xu DP, et al. (2015) Impacts of gut bacteria on human health and diseases. Int J Mol Sci 16: 7493-7519.

373. Liong MT (2008) Roles of probiotics and prebiotics in colon cancer prevention: Postulated mechanisms and in-vivo evidence. Int J Mol Sci 9: 854-863.

374. Pearson JR, Gill CI, Rowland JR (2009) Diet, fecal water, and colon cancer—development of a biomarker. Nutr Rev 67: 509-526.

375. Wollowski I, Rechkemmer G, Pool-Zobel BL (2001) Protective role of probiotics and prebiotics in colon cancer. Am J Clin Nutr 73: 451S-455S.

376. Uccello M, Malaguarnera G, Basile F, D’agata V, Malaguarnera M, et al. (2015) Potential role of probiotics on colorectal cancer prevention: Postulated mechanisms and in-vivo evidence. Int J Mol Sci 9: 720-739.

377. Gibson GR, Roberfroid MB (1995) Dietary modulation of the human colonic microbiota: introducing the concept of prebiotics. J Nutr 125: 1401-1412.

378. Gibso GR, Saavedra JM, Macfarlane S (1996) Probiotics and intestinal infection. In (Fuller R ed.), Probiotics: Therapeutic and Other Beneficial Effects, Chapman and Hall, London.

379. Tomomatsu H (1994) Health effects of oligosaccharides. Food Technol 48: 61-65.

380. Florowska A, Krygier K, Florowski T, Dluzewska E (2016) Prebiotics as functional food ingredients preventing diet-related diseases. Food Funct 7: 2147-2155.

381. Das R, Trafadar B, Das P, Kar S, Mitra S, et al. (2015b) Anti-Inflammatory and Regenerative Potential of Probiotics to Combat Inflammatory Bowel Disease (IBD). J Biotechnol Biomater 5: 181.

382. Pighin D, Pazos A, Chamorro V, Paschetta F, Cunzolo S, et al. (2016) A Contribution of Beef to Human Health: A Review of the Role of the Animal Production Systems. ScientificWorldJournal 2016: 8681491.

383. Thomas C, Scollan N, Moran D (2014) A road map for the beef industry to meet the challenge of climate change—a discussion document. Animal Frontiers 1: 6-9.

384. Kim JH, Kim Y, Kim YJ, Park Y (2016) Conjugated Linoleic Acid: Potential Health Benefits as a Functional Food Ingredient. Annu Rev Food Sci Technol 7: 221-244.

385. Ip C, Scimeca JA (1997) Conjugated linoleic acid and linoleic acid are distinctive modulators of mammary carcinogenesis. Nutr Cancer 27: 131-135.

386. Kelly ML, Berry JR, Dwyer DA, Grinarni JM, Chouinard PY, et al. (1998) Dietary fatty acid sources affect conjugated linoleic acid concentrations in milk from lactating dairy cows. J Nutr 128: 881-885.

387. Maslak E, Buczek E, Szumn A, Szczepnski W, Francyck-Zarow M, et al. (2015) Individual CLA isomers, c9t11 and t10c12, prevent excess liver glycogen storage and inhibit lipogenic genes expression induced by high-fructose diet in rats. Biomed Res Int.

388. Zhou GH, Xu XL, Liu Y (2010) Preservation technologies for fresh meat—a review. Meat Sci 86: 119-128.

389. Giovannini M, Agostoni C, Safari PC (1991) Is carnitine essential in children? Int Med Res 19: 88-102.

390. Overvad K, Diamanti B, Holm L, Holmer G, Mortensen SA, et al. (1999) Coenzyme Q10 in health and disease. Eur J Clin Nutr 53: 764-770.

391. Packer L, Witt EH, Tritschler HJ (1995) alpha-Lipoic acid as a biological antioxidant. Free Radic Biol Med 19: 227-250.

392. Sharma M (2013) Functional Foods: Marketing ‘Health’ To Modern India. International Journal of Innovative Research and Development 2: 720-739.

393. Ayyagari R, Grover V, Purvis R (2011) Technostress: Technological Antecedents and Implications. MIS Quarterly 35: 831-858.

394. Popkin BM (2004) The nutrition transition: an overview of world patterns of change. Nutr Rev 62: S140-S143.

395. Banerjee A, Banerjee B (2000) Effective retail promotion management: use of point of sales information resources. Vikalpa 25: 52-59.