

Functional Foods with Protective Benefits

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“The concept that foods can have a third function in addition to a primary role in providing essential nutrients and a secondary need for desirable organoleptic qualities has become well established .This third property or function of food is its role in the prevention of human health”.

Consumers worldwide are becoming increasingly sophisticated in their food choices, & are routinely demanding more from foods than a calorie quota and a balance of protein, carbohydrate and fats .In Particular, educated consumers now demand extra health related benefits from their foods. This increased awareness of the physiological activities of food components, and their role in our well-being has heralded the introduction of a large number of health foods; for the past five years, approximately 10% of all new foods introduced have made reference to health. Examples include cholesterol lowering margarines, hypoallergenic rice, low phosphorus milk and probiotic fermented milk. However, in addition to these new healthier functional foods, there has also been increased interest in the potential health benefits associated with ordinary every day food items. In this short article, a selection of potential protective effects of food is presented, & some of the chemical components in these foods, which have particular health related physiological activities, are described.

In the table below (Table I), foods with protective benefits are listed along side the disease or diseases against which they are effective.

Table I: Foods with protective effects against disease(s).

Disease	Foods
Cancer	Garlic, Rosemary, Fish oils, Brussels sprouts, Tomatoes & Processed tomato products, Soybeans & Processed soy products, Turmeric, Bilberries, Mustard oil, Yoghurt, Citrus fruits, Green tea, Carrot, Spinach.
Hypertension	Milk protein hydrolysates, Cocoa beans, Squid protein hydrolysates, Fermented dairy products, Wine.
Stroke	Garlic, Fruits & Vegetables, Green tea, Lemon peel extracts, Fish
Depression	Fish oils, Carbohydrate based foods.
Hyperlipidaemia	Aubergines, Green tea, Wine, Coriander, <i>Allium</i> species, shiitake mushrooms, Fish oils, Carbohydrate based foods.
Arthritis	Fish oils & other fish products, Shiitake mushrooms, Fermented plant foods, Kombucha(a fermented tea beverage).
Osteoporosis	Soybeans & processed soy products, Dairy products, Xylitol.
Cardiovascular diseases	Milk & other dairy products, Turmeric, Tomatoes & Processed tomato products, Citrus fruits, Red wine, Black tea, Oily fish, Fruits & vegetables.

NB: A few words of caution must be introduced to accompany the above table. Many of the associations between foods & health are either preliminary findings, or have been proven in animal or cell culture studies, but not in humans. Additionally, foods can confer risks as well as benefits, and excessive consumption of given category of foods is not recommended.

Physiological activity of specific food components.

Phytoestrogens.

Isoflavone phytoestrogens, which protect against atherosclerosis & cancer, are found principally in soybeans & processed soy products; the major Isoflavones are Genistein & Diadzein. Examples of Phytoestrogen - containing soy products include soy sauce, tofu, soy milk, soy based textured vegetable protein. Phytoestrogens are thought to act by modulating Oestrogen metabolism, binding to Oestrogen receptors but without stimulating cell division. In this manner, they are acting as anti-Oestrogen, possibly in similar fashion to the drug tamoxifen. Cardio protective effects of Phytoestrogens have been linked to increased production of low density lipoprotein (LDL) receptors in liver, thereby lowering rates of LDL oxidation. Soybean Isoflavones also have anti-oxidant activities which may contribute to the protective effects of Soy foods by protecting against oxidative damage implicated in many diseased states. Unfortunately, Phytoestrogen may also cause infertility in some animals, & their influence on reproductive hormones in infants has been questioned.

Glucosinolates.

Brussels sprouts and other members of Brassica family (Cabbage, Broccoli, Cauliflower) are thought to act as preventive agents against degenerative diseases such as Cancer & Coronary Heart Disease(CHD).Two important mechanisms by which these vegetables exert their effects as anti carcinogens may be anti oxidant potential and altered biotransformation capacity; these protective mechanism were investigated in humans in

short term intervention studies. Results suggested that detoxification enzymes were introduced and a decrease in the rate of oxidative DNA damage occurred upon consumption of Brussels sprouts. These effects were attributed to the presence of Glucosinolates.

FLAVONOIDS

Flavonoids, a group of polyphenolic compounds common in plants, are believed to protect against cancer and cardiovascular diseases. The major types of Flavonoids (Flavonols, Flavones, Flavanones) are found in fruits & vegetables, and Catechins are found in green & black teas .The main dietary source of flavonoids are tea, onions, apple & wine. The protective effect of Flavonoids are thought to be due to inhibition of LDL oxidation although the mechanism of this inhibitory effect is unclear , Flavonoids may be acting as free radical scavengers, metal chelators or protectants which inhibit oxidation of endogenous vitamin E.

Carotenoids.

Atleast epidemiological studies correlate a high intake of beta-carotene rich foods with reduced risk of developing cancer, particularly lung cancer. Other carotenoids have also been shown to reduce cancer risks, including Canthaxanthin, which can induce apoptosis in tumour cells; Astaxanthin in enriched egg yolk, which can have anti-carcinogenic effect; and Lycopene, a major carotenoid in tomatoes & processed tomato products, which is associated with reduced risk of several forms of cancer .Carotenoids have antioxidant activities ; Lycopene & beta carotene also have hypocholesterolaemic activities.

ACE inhibitors.

Angioensin converting enzymes (ACE; EC 3.4.15.1) is a controlling factor for blood pressure, being involved in vasoconstriction of peripheral blood system. ACE inhibitors are therefore antihypertensives. Their physiological action leads to decrease in blood pressure. ACE inhibitors are mainly peptides, formed during hydrolysis of proteinaceous foods such as milk, fermented whey beverages & other dairy products, squid and some cereals and legumes. Cocoa beans, polyphenols & tea tannins also have ACE inhibitor effects

Organosulphur compounds.

Organic sulphur compounds are present in Garlic and other *Allium* species such as onions, & leaks. These flavour compounds also have anti-carcinogenic properties. One possible mechanism through which these sulphur compounds act is via induction of detoxifying enzymes such as NAD(P)H: quinine oxidoreductase & Glutathione transferase. In combination with mustard oil, garlic has also been reported to have anticlastogenic effects; this was attributed to the fatty acids in mustard oil, in combination with the organic sulphur compounds in garlic, which together acted as strong radical scavengers. Other physiological activities attributed to *Allium* organosulphur compounds include their ability to lower blood lipid & cholesterol levels, induced anti platelet aggregation & fibrinolytic activities, & act as immunostimulants, enhancing leukocyte, Lymphocyte & macrophage levels & natural killer cell functions.
