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FUNCTIONAL FOOD – NEED OF AN HOUR? A NUTRITIONIST PERSPECTIVE

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ABSTRACT

We live in the age of information technology; an age in which we are literally being inundated with information of all kinds. However, incorrect and inadequate knowledge about the food intake can be dangerous. This is particularly true in relation to health and chronic degenerative diseases as far as functional foods are concerned. The population consuming these foods on face value can be dangerous rather than advantages from such foods. An attempt has been made to give scientific and reliable information about functional foods with respect to levels of intake, safety and adverse effects on the human health. The study also aimed for evaluate the nutritional quality of some selected food.

KEYWORDS :

INTRODUCTION

Food is made up of chemical compounds called nutrients. The six basic nutrients include proteins, carbohydrates, fats, vitamins, minerals and water. Different foods contain different amounts of nutrients. Most foods contain all three energy provider carbohydrates, fats and proteins as well as vitamins, minerals (body regulators), water and other substances. The amount of energy a food provides depends on how much carbohydrate, fat and protein it contains. Food and nutrition play a great role in maintaining and improving overall health. Healthy and balanced nutrition develop immune system to prevent illnesses and contributes to the health of all parts of body. The benefits of good nutrition can be found in physical and mental health because a healthy diet provides adequate energy, promotes good sleep and prevents illness. All food is essentially functional as it provides energy and nutrients. Different foods have different sensory function. Functional foods perform specific 'physiological function.'1-2

Defining Functional Foods

Functional food is a food given an additional function related to health-promotion or disease prevention by adding new ingredients or more of existing ingredients. The term may also apply to traits purposely bred into existing edible plants, such as purple or gold potatoes having enriched anthocyanin or carotenoid contents, respectively. Functional foods are designed to have physiological benefits and/or reduce the risk of chronic disease beyond basic nutritional functions, and similar in appearance to conventional food and consumed as part of a regular diet. All foods are functional, as they provide taste, aroma, or nutritive value.

To date, Japan is the only country that has formulated a specific regulatory approval process for functional foods known as Foods for Specified Health Use (FOSHU). Health-conscious baby boomers have made functional foods the leading trend in the food industry. More significant, perhaps, is the potential of functional foods to mitigate disease, promote health, and reduce health care costs.

DISCUSSION

Functional Foods from Plant Sources

Overwhelming evidence from epidemiological and clinical trial data indicates that a plant-based diet can reduce the risk of chronic disease. A review showed that cancer risk in people consuming diets high in fruits and vegetables was only one-half that in those consuming few of these foods. It is now clear that there are components in a plant-based diet other than traditional nutrients that can reduce cancer risk. Steinmetz and Potter identified more than a dozen classes of these biologically active plant chemicals, now known as "phytochemicals."

Oats: Oat products are a widely studied as dietary source of the cholesterol-lowering soluble fiber glucan. There is now significant scientific agreement that consumption of this particular plant food can reduce total and low density lipoprotein (LDL) cholesterol, thereby reducing the risk of coronary heart disease (CHD). The majority of these studies revealed significant reductions in total and LDL-cholesterol in hypercholesterolemic subjects consuming either a typical a low fat diet. The daily amount of oat bran or oatmeal consumed ranged from 34 g to 123 g. Quaker Oats determined that 3 g of glucan would be required to achieve a 5% reduction in serum cholesterol, an amount equivalent to approximately 60 g of oatmeal or 40 g of oat bran (dry weight). Thus, a food bearing the health claim must contain 13 g of oat bran or 20 g oatmeal, and provide, without fortification, at least 1.0 g of glucan per serving.

Soybean: Soybean is a high quality protein provider3. It plays preventive and therapeutic roles in cardiovascular disease (CVD), cancer, osteoporosis, and the alleviation of menopausal symptoms. The cholesterol-lowering effect of soybean is the well-documented physiological effect. Linear regression analysis indicated that the threshold level of soybean intake at which the effects on blood lipids became significant was 25g. Regarding the specific component responsible for the cholesterol-lowering effect of soybean is the isoflavones4. The exact mechanism by which soybean exerts its hypocholesterolemic effect has not been fully elucidated. Based on an effective daily level of 25g soybean protein, PTI proposed that the amount of soybean protein required to qualify an individual food to bear the health claim is 6.25g with a minimum of 12.5mg of total isoflavones per reference amount customarily consumed.

Several classes of anticarcinogens have been identified in soybeans, including protease inhibitors, phytosterols, saponins, phenolic acids, phytic acid, and isoflavones These isoflavones, genistein and daidzein are the only significant dietary source of these compounds. Isoflavones are heterocyclic phenols structurally similar to the estrogenic steroids. Because they are weak estrogens, isoflavones may act as antiestrogens by competing with the more potent, naturally-occurring endogenous estrogens for binding to the estrogen receptor. This may explain why populations that consume significant amounts of soybean have reduced risk of estrogen-dependent cancer. To date, there are no published clinical intervention trials investigating the role of soybean in reducing cancer risk. Soybean may benefit bone health. It is found that 40g isolated soybean protein (ISP) per day containing 90mg total isoflavones significantly increases both bone mineral content and density in the lumbar spine after 6 months. The soybean may alleviate menopausal symptoms and significantly lowers of hot flushes[5].

Flaxseed: Among the major seed oils, flaxseed oil contains the 57% of the omega-3 fatty acid, linolenic acid6,7. The two primary mammalian lignans, enterodiol and its oxidation product, enterolactone, are formed in the intestinal tract by bacterial action on plant lignan precursors. Flaxseed is the richest source of mammalian lignan precursors. Both these possess weakly estrogenic and anti-estrogenic activities helps in prevention of

estrogen-dependent cancers. Fewer studies have evaluated the effects of flaxseed feeding on risk markers for cancer in humans. The ingestion of 10g of flaxseed per day elicited several hormonal changes associated with reduced breast cancer risk. The urinary lignan excretion was significantly lower in postmenopausal breast cancer patients compared to controls eating a normal mixed or a lactovegetarian diet8-9. Consumption of flaxseed can reduce LDL cholesterol as well as platelet aggregation.

Tomatoes: Tomatoes contains lycopene, the primary carotenoid and play its role in cancer risk reduction10-11. More consumption of tomato products decreases the risk of developing advanced prostate cancer. Other cancers whose risk has been inversely associated with serum or tissue levels of lycopene include breast, digestive tract, cervix, bladder, and skin. Proposed mechanisms by which lycopene could influence cancer risk are related to its antioxidant function. Lycopene is the most efficient quencher of singlet oxygen in biological systems.

Garlic: Garlic is the herb widely quoted in the literature for medicinal properties. The purported health benefits of garlic are numerous, including cancer chemopreventive, antibiotic, anti-hypertensive, and cholesterol-lowering properties. The characteristic flavor and pungency of garlic are due to oil and water-soluble, sulfur-containing elements, which are responsible for the various medicinal effects ascribed to this plant. However, undisturbed bulbs of garlic contain only a few medicinally active components. The intact garlic bulb contains an odourless amino acid, alliin, which is converted enzymatically by allinase into allicin when the garlic cloves are crushed. This latter compound is responsible for the characteristic odor of fresh garlic. Allicin decomposes to form numerous sulfur-containing compounds, some of which have been investigated for their chemopreventive activity[12-13].

Garlic can inhibit tumorigenesis. Garlic may be effective in reducing human cancer risk. A strong inverse relationship between stomach cancer risk and increasing allium intake exists. Garlic consumption is associated with 50% reduction in colon cancer risk. Garlic has been advocated for the prevention of CVD, possibly through antihypertensive properties14-15. The cardio-protective effects are more likely due to its cholesterol-lowering effect. Consumption of 900mg garlic/day can decrease total serum cholesterol levels by 9%. Cruciferous Vegetables: Epidemiological evidence has associated the frequent consumption of cruciferous vegetables with decreased cancer risk. The inverse association between consumption of cabbage, broccoli, cauliflower, Brussels sprouts and cancer risk is 70, 56, 67, and 29%, respectively16. The anticarcinogenic properties of cruciferous vegetables are due to their relatively high content of glucosinolates. Glucosinolates are a group of glycosides stored within cell vacuoles of all cruciferous vegetables. Myrosinase, an enzyme found in plant cells, catalyzes these compounds to a variety of hydrolysis products, including isothiocyanates and indoles. The C-16 and C-2 hydroxylations of estrogens involve competing cytochrome P-450-dependent pathways, each sharing a common estrogen substrate pool. The increased formation of 2-hydroxylated (catechol) estrogen metabolites relative to 16-hydroxylated forms, may protect against cancer. Although a wide variety of naturally occurring and synthetic isothiocyanates have been shown to prevent cancer in animals, Isothiocyanate isolated from broccoli, known as sulforaphane. are the principal inducer of quinone reductase.

Citrus Fruits: Citrus fruits are protective against a variety of human cancers. Oranges, lemons, limes and grapefruits are a major source of important nutrients like vitamin C, folate, and fiber. Citrus fruits are high in a class of phytochemicals limonoids. Limonoid is effective against both spontaneous and chemically induced tumors.

Cranberry: Cranberry juice has efficacious in the treatment of urinary tract infections due to benzoic acid-rich fruit caused acidification of the urine. Cranberry juice can inhibit the adherence of Escherichia coli to uroepithelial cells17. This phenomenon has been attributed to two compounds: fructose and a nondialyzable polymeric compound. The cranberry and blueberry juices, can inhibit adhesins present on the pili of the surface of certain pathogenic E. coli. Consumption of 300mL cranberry beverage per day had significantly reduced incidence of bacteriuria prevailing beliefs about the benefits of cranberry juice on the urinary.

Tea. Tea is second only to water as the most widely consumed beverage in India. Polyphenolic constituents of tea comprise up to 30% of the total dry weight of fresh tea leaves. Catechins are the predominant and most significant of all tea polyphenols18-20. The four major green tea catechins are epigallocatechin-3-gallate, epigallocatechin, epicatechin-3-gallate, and epicatechin. Health benefit of tea is focused on its cancer chemopreventive effects. There is evidence that tea consumption may reduce the risk of CVD. Intake of flavonoids significantly inversely associated with mortality from CHD.

Wine and Grapes: Red wine can reduce the risk of CVD. The link between wine intake and CVD found a strong negative correlation between wine intake and death from ischemic heart disease France in particular has a relatively low rate of CVD despite diets high in dairy fat. The alcohol has ability to increase HDL cholesterol. The non-alcohol components of wine, the flavonoids, high phenolic content of red wine, is due to the incorporation of the grape skins into the fermenting grape juice during production. Black seedless grapes and red wines contain high concentrations of phenolics about 1800 and 3200mg/L, respectively, while green grapes contain only 260 mg/kg phenolics21. The positive benefits of red wine to the ability of phenolic substances to prevent the oxidation of LDL a critical event in the process of atherogenesis21-22. The commercial grape juice is effective in inhibiting the oxidation of LDL isolated from human subjects. Red wine is a significant source of trans-resveratrol, a phytoalexin found in grape skins. Resveratrol has been shown to have estrogenic properties which explains the cardiovascular benefits of wine drinking and inhibition of carcinogenesis.

Functional Foods from Animal Sources

Although the large number of naturally occurring health-enhancing substances are of plant origin, there are a number of physiologically-active components in animal products that deserve attention for their potential role in optimal health.

Fish. Omega-3 (n-3) fatty acids are an essential class of polyunsaturated fatty acids (PUFAs) derived primarily from fish oil23-24. It has been suggested that the Western-type diet is currently deficient in n-3 fatty acids, which is reflected in the current estimated n-6 to n-3 dietary ratio of 20:25-1, compared to the 1:1 ratio on which humans evolved. This has prompted researchers to examine the role of n-3 fatty acids in a number of diseases like cancer and CVD.

Dairy Products: Dairy products are functional foods and are one of the best sources of calcium, an essential nutrient which can prevent osteoporosis and possibly colon cancer25-26. In view of the former, the National Academy of Sciences recently increased recommendations for this nutrient for most age groups. In addition to calcium, however, recent research has focused specifically on other components in dairy products, particularly fermented dairy products known as probiotics. It is estimated that over 400 species of bacteria, separated into two broad categories, inhabit the human gastrointestinal tract. The categories are: those considered to be beneficial (Bifidobacterium and Lactobacillus and those considered detrimental (Enterobacteriaceae and Clostridium spp.). Of the beneficial microorganisms traditionally used in food fermentation, lactic acid bacteria have attracted the most attention. Although a variety of health benefits have been attributed to probiotics27-28, their anticarcinogenic, hypocholesterolemic and antagonistic actions against enteric pathogens and other intestinal organisms have received the most attention

Beef: An anticarcinogenic fatty acid known as conjugated linoleic acid (CLA) was first isolated from grilled beef is a mixture of positional and geometric isomers of linoleic acid (18:2 n-6). Nine different isomers of CLA have been reported as occurring naturally in food. CLA is unique in that it is found in highest concentrations in fat from ruminant animals (beef, dairy, and lamb). Beef fat contains 3.1 to 8.5mg CLA/g fat with the 9-cis and 11-trans isomers contributing 57- 85% of the total CLA. CLA increases in foods that are cooked and/or otherwise processed. Many mutagens and carcinogens have been identified in cooked meats. CLA is an effective anticarcinogen in the range of 0.1-1% in the diet, which is higher than the estimated consumption of approximately 1 g CLA/person/day.

Safety Issues

Although "increasing the availability of healthful foods, including functional foods, in the American diet is critical to ensuring a healthier population" (ADA, 1995), safety is a critical issue. The optimal levels of the majority of the biologically active components currently under investigation have yet to be determined. In addition, a number of animal studies show that some of the phytochemicals (allyl isothiocyanate) have been shown to be carcinogenic at high concentrations Thus, Paracelsus' 15th century doctrine that "All substances are poisons the right dose differentiates a poison from a remedy" is even more pertinent today given the proclivity for dietary supplements.

The benefits and risks to individuals and populations as a whole must be weighed carefully when considering the widespread use of physiologically-active functional foods. For example, what are the risks of recommending the increased intake of compounds (isoflavones) that may modulate estrogen metabolism? Soybean phytoestrogens may represent a "double-edged sword" because of reports that genistein may actually promote certain types of tumors in animals. Knowledge of toxicity of functional food components is crucial to decrease the risk: benefit ratio.

CONCLUSION

Mounting evidence supports the observation that functional foods containing physiologically-active components, either from plant or animal sources, may enhance health. It should be stressed, however, that functional foods are not a magic bullet or universal panacea for poor health habits. There are no "good" or "bad" foods, but there are good or bad diets. Emphasis must be placed on over-all dietary pattern Moreover, diet is only one component of an overall lifestyle that can have an impact on health; other components include smoking, physical activity, and stress. Health-conscious consumers are increasingly seeking functional foods in an effort to control their own health and well-being. The field of functional foods, however, is in its infancy. A number of factors complicate the establishment of a strong scientific foundation, however. These factors include the complexity of the food substance, effects on the food, compensatory metabolic changes that may occur with dietary changes, and, lack of surrogate markers of disease development. Additional research is necessary to substantiate the potential health benefits of those foods for which the diet-health relationships are not sufficiently scientifically validated.

Research into functional foods will not advance public health unless the benefits of the foods are effectively communicated to the consumer. Finally, those foods whose health benefits are supported by sufficient scientific substantiation have the potential to be an increasingly important component of a healthy lifestyle and to be beneficial to the public and the food industry.

Functional foods are the foods which provide health benefits beyond basic nutrition

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