

Functional Foods: Sources, Safety Concern and Future Prospective

Nilakshi Chauhan

Department of Food Science, Nutrition and Technology, College of Community Science, CSK HPKV, Palampur- 176062 (H.P., India)

Corresponding Email: nilakshi.sharma9@gmail.com

Introduction

All foods have taste, aroma and nutritive value and also provide an energy source and are therefore considered functional. However, foods are currently being thoroughly studied for additional physiological benefits that could improve health or lower the risk of chronic illness. The concept of functional foods was first developed in Japan in 1980s, when the Ministry of Health and Welfare set up a regulatory system to approve certain foods with proven health benefits in order to lower the country's rising health care costs and improve the health of its aging population. There is no such regulatory identity for functional foods in the United States. However, many organizations have proposed definitions for this new category of food. Functional foods were described as "any modified food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains" by the Food and Nutrition Board of the National Academy of Sciences in 1994. The International Life Sciences Institute define as, food that, by virtue of its physiologically active component(s), provides a health benefit beyond the benefits provided by basic nutrition." According to the Functional Food Centre (FFC), "Functional Food" are natural or processed foods that contain active compounds either known or unknown that have the capacity to help prevent, manage or treat chronic disease by providing documented and

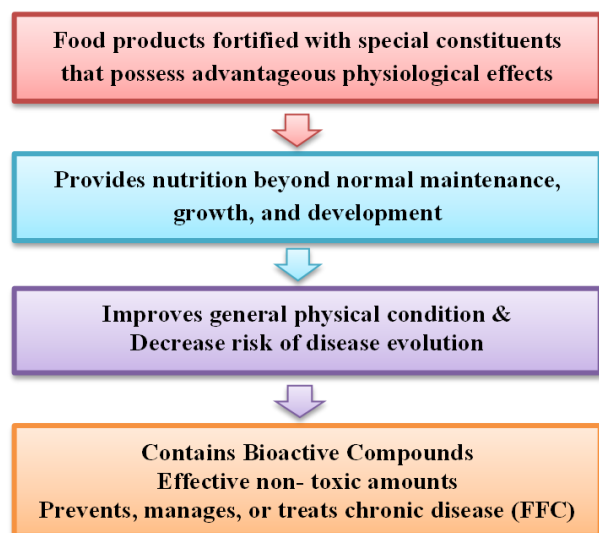


Figure 1.1 Development of "functional food definition"

clinically-proven benefits, within defined limits of effectiveness and toxicity. This definition is unique due to its recognition of "bioactive compounds," or biochemical molecules providing health benefits through physiological mechanisms.

Functional foods are not pills or capsules but rather are products that would be consumed as part of a normal diet. The functional food comprises of:

- Conventional foods containing naturally occurring bioactive substances (e.g., dietary fibre).
- Food enriched with bioactive substances (e.g., probiotics, antioxidants).
- Synthesized food ingredients introduced to traditional foods (e.g., prebiotics).

Functional Foods from Plant Sources

- **Soy:** Soy has received considerable attention during the 1990s. Not only is soy a good source of high-quality protein according to FDA's "Protein Digestibility Corrected Amino Acid Score" method, but soy also appears to offer therapeutic and preventative benefits for CVD and cancer, as well as osteoporosis, and can help to reduce menopausal symptoms. The primary and best-known benefit of soy on the human body is its cholesterol-lowering effect. In a 1995 meta-analysis that included 38 separate studies (involving 743 subjects), found that soy protein consumption leads to a significant reduction in total cholesterol (9.3%), LDL cholesterol (12.9%), and triglycerides (10.5%), although there was a relatively small, but not statistically significant, increase (2.4%) in the cholesterol-lowering effects of soy, recent attention has focused on the isoflavones.
- **Flaxseed:** Flaxseed oil is the highest source of alpha-linolenic acid (omega-3), which accounts for 57% of the oil. Recent research, has focused on compounds found in high fiber foods that are lignans. The two main types of lignans produced by mammals are enterodiol and its oxidised product, enterolactone; these two compounds are formed from plant precursors by the action of bacteria that live in the intestines (Setchell et al., 1981). Flaxseed provides good amount of mammalian lignan precursors (Thompson et al., 1991). Enterodiol & enterolactone are structurally similar to estrogens & have weak estrogenic & anti-estrogenic qualities, so may reduce risk of estrogens in breast cancer. However, there is no epidemiological study data nor sufficient animal research support for this hypothesis.
- **Garlic.** Garlic (*Allium sativum*) is probably the herb most frequently cited in the literature as possessing medicinal properties. Garlic exhibits health promoting benefits, including cancer chemo preventive, antibiotic, antihypertensive, and

cholesterol-lowering properties (Srivastava et al., 1995). The flavor and pungent aroma of garlic are produced by oil and water-soluble sulfur compounds, which are most probably responsible for many of the pharmacological properties attributed to garlic.

- **Broccoli and other Cruciferous Vegetables:** According to epidemiological evidence, regular consumption of cruciferous vegetables may reduce the risk of cancer. Cabbage, broccoli, cauliflower, and Brussels sprouts consumption were found to be inversely associated with cancer risk in 70, 56, 67, and 29% of case-control studies, respectively. According to Verhoeven et al. (1997), cruciferous vegetables comparatively high glucosinolate content is responsible for their anticarcinogenic qualities.
- **Citrus Fruits:** Various epidemiological studies demonstrate a protective effect of citrus fruit against human cancers. While oranges, lemons, limes and grapefruits are a main source of essential nutrients including vitamin C, folate and fiber.
- **Cranberry.** Cranberry juice has been shown to be effective in treating urinary tract infections; this benzoic acid-rich fruit caused acidification of the urine. Recent studies have concentrated on cranberry juice's capacity to prevent *Escherichia coli* from adhering to uroepithelial cells. Two compounds have been implicated in this phenomenon: fructose and a nondialyzable polymeric compound. The other compounds, which have since been isolated from cranberry and blueberry juices, were shown to inhibit adhesins present on the pili of the surface of certain pathogenic *E. coli*.

Functional Foods from Animal Sources

- **Fish:** Fish oil is a good source of Omega-3 (n-3) fatty acids which belong to a group of essential polyunsaturated fatty acids (PUFAs). Although eating good amount of fish may reduce the risk of cardiovascular disease in healthy men, and consuming 35 g or more of fish daily has been shown to reduce the risk of death from non-sudden myocardial infarction, while one serving of fish per week significantly reduced the risk of total cardiovascular mortality.
- **Dairy Products:** Dairy products are good source of calcium—a key nutrient which helps to prevent osteoporosis and colon cancer. As a result, the National Academy of Sciences has recently increased its recommendations on calcium intake for different age groups. However, recent studies also focused on other compounds in dairy products, particularly fermented dairy products called Probiotics. The word Probiotic refers to “live microbial feed supplements

which beneficially affect the host animal by improving its intestinal microbial balance”.

- **Beef:** Conjugated Linoleic Acid (CLA) is an anticarcinogenic fatty acid was first isolated from grilled beef in 1987. The term "CLA" refers to a mixture of geometric and positional isomers of linoleic acid (18:2 n-6) where the double bonds are conjugated rather than in the usual methylene interrupted form. The amount of CLA present in beef fat is 3.1 to 8.5 mg CLA/g fat with 9-*cis* and 11-*trans* isomers contributing 57-85% of the total CLA. CLA can suppress tumor formation in the forestomach of mice, aberrant colonic crypt foci in rats, and mammary carcinogenesis in rats.

Safety considerations

Although there is evidence that some functional foods have a role in health promotion as well as disease prevention. As such, all safety issues regarding these products should be of primary concern. Recently, safety concerns have been raised, particularly with regard to the addition of botanicals to foods. There is a large amount of products as "functional" - Bars, drinks, cereals, and soups enhanced with botanicals, some of which may represent a potential risk to some consumers. Herbal products have many safety concerns, and there is increasing attention to the potential for herb-drug interactions. The GAO has made specific recommendations related to the safety of functional foods:

- Develop and promulgate regulations or other guidance for industry on the evidence needed to document the safety of new dietary ingredients in dietary supplements.
- Develop and promulgate regulations or other guidance for industry on the safety-related information required on labels for dietary supplements and functional foods.
- Develop an enhanced system to record and analyze reports of health problems associated with functional foods and dietary supplements.

Future of functional foods

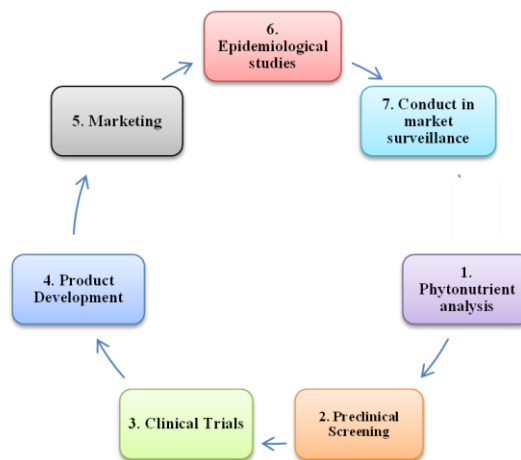


Figure 1.2 Steps for bringing functional foods to markets (FFC)

Functional foods are fortified with nutrients and/or functional ingredients to help combat chronic disease, therefore reducing health care costs and improving the quality of life. Nutrigenomics is an emerging field that will have a significant impact on future functional foods research which investigate the interaction between diet and development of disease based on individual's genetic profile. Biotechnology will play an increasingly important role in the future of functional foods. An example of a crop developed using biotechnology is "golden rice" and "iron-enriched rice", which can improve the health of millions worldwide.

Conclusion

Although many functional foods have shown great promise for public health, there are concerns that the promotion of functional foods and structure/function claims may not rest on sufficiently strong scientific evidence. Any health benefits attributed to functional foods should be based

on sound and accurate scientific criteria, including rigorous studies of safety and efficacy. Interactions with other dietary components and potential adverse interactions with pharmaceutical agents must be clearly imparted. Consumers must realize that these food products are not a "magic bullets" or panacea for poor health habits. There are not good and bad "foods," only good and bad dietary patterns. Thus, they should be wary of many of the promoted or implied benefits of these foods, and must realize that there is no consistent regulation or enforcement of existing regulations in the functional foods area. A healthy diet should include regular exercise and an avoidance habit with smoke and tobacco products, stress control, healthy and appropriate weight maintenance, as well as healthy practices. Only then will there be an overall strategy incorporating these additional aspects towards optimizing optimum health and chances against disease.
