

FUNCTIONAL FOODS

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Abstract

As we are moving into the 21st century, the world's demand for food is becoming ever greater. In the poorest nations, the lack of availability of food supply leading to micronutrient deficiencies. In contrast, in developed countries, people enjoy a greater varieties and quantity of foods leading to the effect of overnutrition (obesity, heart disease, and cancer).

In response, the concept of food is changing from an emphasis on health maintenance to promoting better health by helping to prevent chronic illness. Functional foods are design to help people to reduce their risks of some diseases (by preventing) through readily available, good-tasting diets rather than through the use of curative measures only. The distribution of potential ingredients in functional foods are dietary fiber (40%), calcium (20%), oligosaccharides (20%), lactic acid bacteria (10%) and other (10%).

The perspective of Western and Eastern, somehow, are not totally competent. People living in the Eastern hemisphere believe that certain food had a therapeutic benefit. Whereas those living in Western are considered to be more conscious in their health.

The food industries and government agencies have the agreement to establish definition and substantiation for functional food. This aims to protect the consumer and build consumer confidence.

INTRODUCTION

Terminology

The Food and Drug Administration defines foods as "articles used primarily for taste, aroma or nutritive value. Functional foods are foods that provide an additional physiological benefit that may prevent disease or promote health (Hasler, 1996). *Designer foods* was coined in 1989 to describe foods that naturally contain or are enriched with non nutritive, biologically active chemical components of plants (e.g. phytochemicals) that are effective in reducing cancer risk. *Nutraceuticals* has been popularized by the Foundation for Innovation in Medicine and refers to "any substance that may be considered a food or part of a food and provides medical or health benefits, including the prevention and treatment of disease."

More recently the Institute of Medicine of the U.S. National Academy of Sciences has defined *functional foods* as those that "encompass potentially healthful products" including "any modified food or food ingredients that may provide a health benefit beyond the traditional nutrients it contains". The common terms used include *medical foods*, *nutraceuticals*, *functional foods*, and *nutritional foods*.

The Application of Functional Foods

There are a wide range of the major use of functional foods :

1. *Prevent disease*; the role of functional foods in fighting against diseases will be further discussed.
2. *Prevent aging*; functional foods approaches to slowing down the aging process by tonifying the kidneys and spleen, nourishing essential materials of the body, and roving the disease-causing factors.

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3. *Maintain and improve appearance*; functional foods improve the luster of facial skin, reducing facial wrinkles, removing facial pigments and improving facial skin edema, enrich blood and to strengthen the function of the spleen and lung.
4. *Control body weight*; functional foods has the ability to remove excessive body fat and reducing body weight by removing dampness and facilitate diuresis.

Overall, the functionality of foods are applied for variety applications throughout health maintenance and medication, aging prevention, and cosmetological purposes.

Market Drivers

A number of factors have been recognised to be the driver of the marketing and development of functional foods; (1) scientific advances, (2) consumer demand, (3) aging population, (4) health care costs, (5) technical advance in food industry, (6) mission of medicine, and (7) nutritional labelling (Hasler, 1996) (Goldberg, 1994)

1. *Scientific advances* ; the expansion of scientific and clinical knowledge support the vital role in diet in health and well-being. Six of ten leading diseases (cancer, coronary heart disease, stroke, diabetes, arteriosclerosis and liver disease) in United States are believed to relate to diet.
2. *Consumer demand* ; Consumer nowadays demand foods to function not only as mean of providing sustenance but also as a self medication and disease prevention. According to a survey led by *Healthfocus Trend Report*, 42% of the respondents agreed that foods can be used to reduce their use of drugs and other medical therapy. On the other hand, the media (i.e. radio, television) provides the information of health, diet and nutrition to encourage a feedback from consumer response.
3. *Aging population* ; the incidence of degenerative diseases of the aged such as cancer would be a burden on the health care system. Nearly 60% of new cancer cases in 1990 occurred in people over the age of 65. Thus, the older consumers are more conscious and interested in

functional foods than the younger generation to improve the life expectancy.

4. *Health care cost* ; the costs are rocketing in most countries. For example, in U.S. the health care costs exceeded \$1 trillion in 1995 and if the cost could be allocated towards disease prevention, the cost for health care would certainly decrease.
5. *Technical advances in the food industry* ; the focus in food industry now is moving from "taking out the bad stuff (fat, cholesterol, sodium, and calories)" to "putting back the good stuff (phytochemicals, dietary fibre, flavonoids etc)
6. *Mission of medicine* ; physicians and healthcare clinics give an emphasis in educate the consumers towards a healthy diet.
7. *Nutritional labelling* ; the labelling system in the packaging of foods which provide the information effectively attract the consumers as they are more health-conscious.

The Western and Eastern Perspective

As it has been reported by Malaspina (1996), there seemed to be gap between Western and Eastern perspective on functional food. People living in Western are considered to be more aware of "health consciousness". Scientific and clinical advances are made, health food industries are increasing (offering promises on "self-medicine" foods), media of communication (i.e. radio and television) provides a wide range of information on diet, health and medicinal information, health care cost is skyrocketing hence all these make people more conscious of their health maintenance and on the other hand, encourage educational (school of medicine and food) and health care agencies (physicians, clinics) to have a mission in educating people to have a healthier life in order to obtain longer life expectancy. This case become more popular amongst the Western people as reported by *Food Technology the July 1994 issue* that highlighted 10 trends to watch and to work on, it is identified as "the increasing role of food and food ingredients and self medication and disease prevention"

However, in Eastern hemisphere, people believe that food has therapeutic benefits. This

beliefs are primarily anecdotal, based on centuries of tradition and largely undocumented by solid scientific research. Functional food is known as "Traditional Chinese Medicine" (TCM) which has important role in human physiology and health. TCM maintain and improve health status, prevent disease, help in treating disease, and facilitate rehabilitation. In TCM food and medicine are of equal importance (Weng, 1996). According to TCM, like medicine, each item of food has its own taste (sour, bitter, sweet, spicy and salty) and properties (cool, cold, warm, hot and plain). So, when it is used properly, food could regulate Yin, Yang, Qi, and blood (a comprehensive material in the body that represents all internal organs).

HEALTH FUNCTIONS OF FOOD VS DISEASES

The four major diseases (cardiovascular disease, cancer, hypertension and obesity) are believed to be related to human's diet. The recent investigation of role of functional foods in preventing cardiovascular disease and cancer are described as follows.

Cardiovascular Disease (CVD)

It is reported that each year in the U.K., 170,000 people die from myocardial infarction and CVD-related disorders. The research from biochemical, epidemiological, and cell culture studies reveal that this illness is caused by inadequate intakes of micronutrient with antioxidant activity such as vitamin E, C and beta-carotene.

It is found that the high level consumption of saturated fat increases blood cholesterol concentration which leading to mortality. And free radical-mediated oxidation of cholesterol is a key step in atherogenesis. The production of free radicals can initiate damage to biological material. Hence a complex antioxidant system is needed to retard the damaging reaction by protecting the mammalian cells and cholesterol from the injurious effects of free radicals.

Some essential antioxidant are provided in foods; (1) vitamin E, a lipid-soluble antioxidant that is able to break the chain of free radical-mediated lipid peroxidation of polyunsaturated fatty

acid, (2) carotenoid and beta-carotene is considered to have similar functionality as vitamin E, (3) vitamin C is water-soluble that scavenges free radicals. Ubiquinone (a lipophilic quinone in mitochondria) and flavonoid (food polyphenols) found in foods are claimed to be novel antioxidants. A protective action suggested is to consume fruit and vegetable as these foods contain nutrients that can protect LDL from oxidative modification to an atherogenic form (Goldberg, 1994).

Cancer

The report from *National Academy of Sciences Report on Diet and Health* (1989) revealed that 60% of cancers in woman and more than 40% in men are related to food habits and 35% of all cancer deaths may related to diet (Goldberg, 1994).

The exposure to N-nitroso compounds, a class of potential carcinogens, and their precursor found in foods and beverages to human body is leading to carcinogenic result as the human liver has the ability to metabolize N-nitrosoamines to compounds that are known to produce DNA damage in animal and possible carcinogens in human.

The in vivo formation of N-nitroso compounds is accelerated in the presence of bacteria in human gastrointestinal and urinary tracks. Diet can modify the total number and types of microorganisms. Vitamin C is one of the dietary factor in modifying the microbial-mediated formation of N-nitroso compounds. Sulphur compounds in garlic and associated plants are also reported to be effective. Ohigashi (1996) reported that dietary plants from tropical southeast Asia with important cancer-prevention is potential to inhibit tumor promotion. The anti-tumor compounds were isolated from the rhizome of *Languas galanga* (Zingiberaceae). Other examples of potential anti-carcinogenic foods and the possible mechanisms of their action is provided in Table 1.

REGULATORY AND LEGAL ASPECTS

Definition

The issue of definition has particular relevance not only to the biomedical disciplines but also to industry, consumers, and regulatory au-

thorities. Approaches to definition have been described in detail elsewhere, such as in Australian National Food Authority's working document (Head et.al., 1996). Functional foods are :

- a class of foods that have strong putative metabolic and regulatory (physiological) roles over and above that seen in a wide range of common foods;
- a class of foods that achieve a defines endpoint that can be monitored (e.g. reduction in blood pressure, reduction in plasma-borne risk markers); and
- products referred to as special dietary foods.

By these definitions, functional foods could be naturally occurring, nutrient-enriched or ingredient-enriched foods.

Substantiation and Safety

Some related issues include the need for and extent of substantiation, labelling, the activity of functional foods in the context of overall diet, monitoring and evaluating public health and safety impacts, and the role of nutrition education (Preston, 1996). There is a relationship between substantiation and the acceptance of functional foods by both consumers and regulatory authorities. The relationship between the development of functional foods and the substantiation is complex and has taken many forms. Studies on digestibility, bioavailability, nutrient interaction, and physiological and pharmacological effects as well as mechanisms of action.

As for safety towards future direction, it is necessary to apply the concept of pharmacokinetics to the measurement of the bioavailability of the key ingredients in foods with health potential so as to permit an estimate of appropriate intakes in human. However, attempt has been made to define the health potential of particular products by using in vitro techniques (in animal and in human) to examine the toxic effect, biomarker and kinetic / dynamics, in vivo animal studies and clinical studies. This aims to assess and confirm the risk of human hazard. In particular, specific safety assessment strategies are required to address functional foods which are, or which contain, the following: (a) dietary macrocomponents, (b) new protein sources (potential food allergens), (c) viable microorganisms (Huggett, 1996).

The Regulatory and Legal Aspects; The Australian Perspective

In Australia, current regulations are very clear that health claims to food are prohibited (Preston, 1996). However, the *Australian Food Standards Code* is undergoing a substantial policy review and the current prohibition on health claims are being reexamined. In anticipation of the possibility that foods may be developed that could legitimately warrant certain claims, the *Australia New Zeland Food Authorities* is preparing a pre-emptive analysis and draft of a conceptual frame-

Table1. Examples of potential anticarcinogenic foods and possible mechanisms of action (Goldberg, 1993)

Mechanisms	Food
I. Drug detoxification	Cucumber, squash, parsley, carrots, lemon oil Peaches, apples, cranberry, garlic, onion, Leeks, strawberry, broccoli, beets
II. Cell proliferation	Grains, fish, carrots, squash, sweet potato, Cucumber, soybean, citrus fruit, apples
III. Anti-hormone function	Soybean, fennel, anise, carrots

work that sets out the position of functional foods and health claims in the continuum of the relationship between food and health. The purpose is to enable the food industry to position its future research and development activities while protecting public health and safety (Preston, 1996).

MARKETING AND FUTURE PROSPECTS

At the moment, Japan is regarded as the world pioneer and leader in the developments of functional foods. The support from the government towards this project and the confidence among the Japanese market opportunists in considering functional food as a major new product challenge for food industries are believed to be the success industries and development in this field.

The first project started in 1984 as the Ministry of Education, Science and Culture sponsored a project on "A statistical analysis and an outlook on food nutrition" and in 1986, it is concluded that functional foods concept has three function in the body : (1) food nutritive value, (2) sensory appeal or organoleptic properties, (3) physiological aspects (i.e. neutralizing harmful effect, regulation of body function and physical conditions, preventing disease etc.) The Ministry of Health and Welfare is currently considering 12 different classes of health-enhancing ingredients for use in foods for specific health, including dietary fiber, oligosaccharides, sugar alcohol, peptides and proteins, glycosides, alcohols, vitamins, cholines, lactic acid bacteria, minerals, fatty acid and miscellaneous collection of unclassified ingredients (i.e. phytochemicals and antioxidant).

Functional food products have been launched in areas soft drinks, ready meals, breakfast cereals, biscuits, confectionery, milk products, ice cream and salad dressing. The value of Japanese market is up to \$3billion and is expected to reach a level of \$7 billion (PA Consulting Gorup, 1990 in Goldberg, 1994). The products in the market include :

- Nissin Food Products Co. and Toshoku Ltd. Manufacture a yoghurt drink.

- Takeda Chemical Industries Ltd. Is expanding through health food and beverages and is developing more specialized functional foods and beverages (vitamin-based health drink) targeted as soft drinks for general public.
- Hayashibara Biochemicals Laboratories Inc is the manufacturer of water soluble rutin (an ingredient for functional food), a flavonol glycoside and a natural yellow pigment found in bean families. They are reported to have the ability to protect tissue from damage against oxidation and u.v. radiation, to be used as vitamin P to strengthen the damage capillaries, prevent and treat cerebral thrombosis and lung hemorrhage etc.
- Asahi Chemical Industry Co. has developed "Fibermix 391" which is a wafer cookie with a high (39%) fiber content and is being marketed as a constipation preventive. Another product from this company is "Hemace" which is an iron supplement candy containing heme purified from animal blood.
- Yakult, a fermented milk and Bifiel, a fermented yoghurt produced by Yakult Company. Yakult drink contains lactic acid bacteria as its key active ingredients. Its health benefits may result from modifying the microflora in the human gut. Yakult is sold in 50ml bottle at the rate of 1 million a day in Japan.

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