



DESIGNER FOODS-THEIR ROLE IN PREVENTING LIFESTYLE DISORDERS

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ABSTRACT

Designer foods are the processed foods that are supplemented with food ingredients naturally rich in disease preventing substances. Food design, designer foods, functional foods, nutritionally modified foods and genetically modified foods are some of the myriad terms that appear in the popular scientific food nutrition press. (Samuel Godber, 2007). Development of designer foods has mainly based on the technical approaches like product formulation, novel processing and modification of raw materials. Lifestyle diseases also known as non communicable diseases are conditions associated with the way people live and behave. According to World Health Organization (WHO) fact sheets, lifestyle diseases like cardiovascular diseases, diabetes, obesity, cancer, osteoporosis, respiratory diseases and gastro intestinal diseases account for 59 percent of the 56.5 million deaths annually and 45.9 percent of the global burden of disease (WHO, 2009). In this review, we introduce the beneficial effects/role of Designer foods and functional ingredients that can help prevent the diseases associated with changing lifestyle.

KEY WORDS: Functional Foods, Genetically modified foods, Non Communicable diseases, and WHO,

INTRODUCTION

Designer foods are the processed foods that are supplemented with food ingredients naturally rich in disease preventing substances (this may involve genetic modification of food). During the last decades, knowledge of the dietary influence on health and well being has highly increased and often related to specific food components. Based on this new knowledge we are know in better position to design new and healthier foods reducing the several chronic or infectious diseases. The food thus designed are called designer foods which are traditional foods modified in such a way that they have health benefits compared to the non modified products. According to some market surveys, the global market of these designer foods is very large and growing rapidly. Thus the global market estimate has been up to 73 billion € and or annular growth rate of 8 – 16 percent (Finn Holm, 2003)

Food design, or designer foods, or functional foods, or nutritionally modified foods, or genetically modified foods are some of the myriad of terms that appear in the popular and scientific food and nutrition press. The similarities and differences in the meanings of these terms, and the implications for nutritional composition are not always clear (Samuel Godber. 2007). Designer foods or functional foods are the foods similar in appearance to conventional food consumed as a part of the usual diet which contains biologically active components with demonstrated physiological benefits and offers to potentials of reducing the risk of chronic disease beyond basic nutritional functions (FAO, 2004)

Potential Benefits

With prevalent poverty and high rates of malnutrition and escalating rates of diet-related diseases in developing countries, growing functional food markets provide opportunities for developing countries through improvements in public health, and for generating employment and income in the development of functional foods and their supply chains.

At present, demand for designer foods or functional foods is concentrated in developed countries and high-income groups in developing countries. Functional foods are still considered expensive, although research has been carried out to cover issues of affordability and access, especially by the poor. Moreover, there is growing research on the potential of biotechnology in the development of functional foods for improved health effects of the staple foods in developing countries including high-iron rice, high vitamin A rice, improved oil content in legumes, improved protein content in legumes and soybean and orange fleshed sweet potato (Niba, 2003). A few developing countries have been considering functional foods as part of their plan to tackle malnutrition. For example, in China, the Center for Public Nutrition and Development has proposed that essential consumables such as salt, flour, edible oils, baby foods and soy be fortified to help reduce malnutrition especially in poverty-stricken regions. In India's rural areas, food companies have introduced specific products with high vitamin A at affordable prices (Japan Development Institute, 2006).

Approaches to Design Functional Foods

In the past, improved knowledge of the health benefits associated with different elements of the diet was used as the basis of dietary advice (to eat less fat, more fruit and vegetables, etc.). These days however, such knowledge is increasingly also being used to produce functional foods, using a number of different technical approaches-

Product Formulation – This includes incorporation of functional ingredients into foods (e.g. fortification, reformulation to increase levels of ingredients such as bran or fibre and adding novel ingredients such as probiotics, phytochemicals, etc.), as well as reformulating foods to contain lower levels of potentially harmful components (e.g. reducing fat).

Novel Processing - Enhancing the functionality of foods by fermentation by heat or enzyme processes or by novel processing to increase the availability to the body of components already present in the food.

Modification of Raw Materials - Until recently, this involved using conventional breeding/selection techniques to enhance the properties of plants and animals. More recently, the advent of genetic engineering has led to the development of a wide range of genetically modified (GM) foods, and crops with enhanced functional components (altered fatty acid profiles, isoflavone content, etc.) are a major priority of current research.

DEMAND OF FUNCTIONAL FOODS

Global Market

The global functional foods sector has experienced phenomenal growth over the past years. Since the late 1990s, the rapid expansion (approximately 50 percent to 60 percent growth in value sales over a five year period) is expected to continue only at a slightly slower pace over the next five years (Datamonitor, 2004). The indicated growth rates are significantly higher compared with the approximately two percent growths annually for the food sector as a whole (Menrad, 2003). Growth forecast for main emerging markets as a group (Hungary, Poland, Russia, Mexico, Brazil, China, and South Korea) is similar to the global forecast (Benkouider, 2005). Globally, dairy products represent the highest value sales (39 percent to 56 percent of total in 2003, depending on the source) functional confectionery, soft drinks and bakery and/or cereal groups (not in order) follow in popularity (Benkouider, 2004).

Indian Market

India's health foods history dates back centuries. Developments of the last few decades, have taken the traditions of ancient medicines and natural health foods to a new stage. With its strong tradition of healthful eating, India ranks among the top ten nations in buying functional foods (Watson, 2006). India's nutrition industry is generating US\$6.8 billion in annual revenue, and that number is expected to nearly double in the next five years (Ismail, 2005). The functional food industry in India is strong and growing with the aims of becoming a major force in the international health foods market (Japan Development Institute, 2006). The government is working hard and fast at shoring up its intellectual property rights law and food legislations, productivity is growing and investment in research and development infrastructure

continues to increase year-over-year (Ismail, 2005). This ambitious state of affairs is due to cooperation at all levels. Unanimity of purpose exists between major companies and in the government, where both ministers and the substantial state research organization are behind the idea (Shrimpton, 2004).

Safety of Designer Foods

Since the functional ingredient will be added to food, it must first be approved for use in food either via a food additive petition or obtaining GRAS (Generally Recognized As Safe) status. However, functional ingredients are biologically active and may therefore produce a range of outcomes in the body at various levels of intake, from suboptimal physiologic action to therapeutic effect to frank toxicity. Understanding the mechanisms for pharmacologic activity as well as for toxicological potential is important to predict the consequences of exposure at different dose levels. The intended use and potential exposure to a functional ingredient must be compared to its determined safe level of ingestion; depending upon the compound, historical exposure and/or scientific studies (animal toxicology, absorption, distribution, metabolism and excretion (ADME), clinical trials) may be used to determine that safe level. This point is important since the margin of safety between the intended level of ingestion and a potentially toxic level may be very small.

Life Style Disorders

Lifestyle diseases also known as non communicable diseases are conditions associated with the way people live and behave. (As opposed to infectious diseases). Lifestyle and diet are major factors thought to influence susceptibility to many diseases. Drug abuse, tobacco smoking and alcohol drinking as well as lack of exercise may also increase the risk of developing certain diseases especially in latter life. Lifestyle diseases are different from other diseases because they are potentially preventable and can lowered with change in diet, lifestyle and environment. According to WHO fact sheets lifestyle diseases like cardiovascular diseases, diabetes, obesity, cancer, osteoporosis, respiratory diseases and Gastrointestinal diseases account for 59 percent of the 56.5 million deaths annually and 45.9 percent of the global burden of disease.

Changes in lifestyle and the increase of chronic diseases, increased affluence and urbanization is also linked to a lifestyle. For much of its history, nutrition science has focused on the role of essential nutrients in preventing deficiencies. However, there is a need to ensure unaltered levels of key nutrients or functional components in the context of declining energy expenditures.

Role of Designer Foods in Addressing Life-Style Disorders

The emergence of dietary compounds with health benefits offers an excellent opportunity to improve public health and thus, this category of compounds has received much attention in recent years from the scientific community, consumers and food manufacturers. The list of dietary active compounds (vitamins, probiotics, bioactive peptides, antioxidants.) is endless, and scientific evidence to support the concept of health promoting food ingredients is growing steadily (Wildman, 2006).

Countries world wide are going through a nutritional transition and are now affected by double burden of nutritional problems. Under nutrition and specific nutrient deficiencies continue to present a problem and simultaneously in balanced diets and lifestyle diseases are becoming alarmingly common.

Health and healing foods have a long history in different cultures of the world. The tenet “Let food be thy medicine and medicine be thy food,” espoused Hippocrates about 2500 years ago, is receiving renewed interest. The foods are designated to promote health, growth and development and also to prevent/treat various diseases and disorders from time immemorial. There has been an explosion of consumer concern in the health enhancing role of specific foods or physiologically active food components – phytochemicals which provide health benefits beyond basic nutrition. Whole grains rich in dietary fiber, starch, fat, antioxidant nutrients, minerals, vitamins, lignans, and phenolic compounds have been linked to the reduced risk of obesity, insulin resistance, dyslipidemia, type 2 diabetes, heart diseases, hypertension, cancer, and other chronic diseases.

Several foods and their components are emerging as factors capable of modifying growth, development, performance and disease resistance. Overwhelming evidence from epidemiological, in vivo, in vitro and clinical trial data indicate that a wide variety of foods prevent and prolong the risk/onset of diseases, protect health and extend longevity. The advances in medical care, technological progress and socioeconomic empowerment have extended the longevity, often with poor health status. The modern fast food culture, stressful living and sedentary life style have elevated the demand for nutraceutical foods.

Obesity is a major public health and economic problem of global significance. Prevalence rates are increasing in all parts of the world, both in affluent Western countries and in poorer nations. Men, women and children are affected. Indeed, overweight, obesity and health problems associated with them are now so common that they are replacing the more traditional public health concerns such as undernutrition and infectious disease as the most significant contributors to global ill health (WHO, 1998). Functional foods for obesity should be able to influence the energy balance equation regulated by the control of energy intake or of energy dissipated as heat (thermogenesis). The basis for functional food development for body weight control should be the knowledge of the body weight control system, including the key genes involved in energy balance and the potential effects of nutrients or food components on gene regulation and function, as well as inter-individual variations based on genetic and acquired particularities in the responses to nutrients. Considering functional foods for body weight control, the following main strategies can be outlined as i) inhibition of food intake, by inhibiting orexigenic signals or enhancing anorexigenic signals, by limiting the bioavailability of macronutrients ii) decrease in the caloric content of foods, by substituting sugar or fat by less caloric or less digestible substances iii) stimulation of energy expenditure (thermogenesis) and iv) regulation of

nutrient partition between tissues and not favouring the efficiency of fat deposition processes. Functional foods for obesity may also include foods that affect the glucose-insulin homeostasis and ameliorates the risk factors for collateral illness such as diabetes and/or cardiovascular disease. (Palou et al, 2007)

Cardiovascular disease remains the principle cause of death in both developed and developing countries, accounting for roughly 20% of all worldwide deaths per year. Lifestyle factors including a diet high in saturated fat, in energy and in cholesterol- have an important role in the CVD risk. Epidemiological studies examining CVD risks in different populations have observed a positive correlation between elevated levels of low density lipoprotein (LDL) cholesterol and development of CVD as well as low levels of high density lipoprotein (HDL) cholesterol and CVD. Consuming a diet rich in natural antioxidants has been associated with prevention from and/or treatment of CVD. Bioactive components of food, which are of special interest, include the Vitamins E and C, polyphenols, carotenoids mainly lycopene and β -carotene, and coenzyme Q10, featured by antioxidant properties. (Kaliora, et al, Lovegrove et al, 2000).

Dietary factors are thought to account for about 30% of cancers in western countries and thus, diet is second only to tobacco as a potentially preventable cause of cancer. The contribution of diet to risk of cancer in developing countries is lower around 20 %. The interactions between diet and the biological processes leading to the development of cancer are extremely complex. However, over the past decades a large body of epidemiological evidence in favour of a protective effect of biologically active food components has appeared and become generally accepted by nutritionists and regulatory bodies. Dietary antimutagens which may provide a means of slowing progression toward cancer have been identified such as certain types of dietary fibres, certain probiotics or small molecule dietary antioxidants including ascorbic acid, vitamin E, glutathione, various polyphenols, carotenoids and selenium have been suggested to be important antimutagen agents. These last ones possibly through their ability to scavenge free radicals, and prevent their interactions with cellular DNA. Many fruits and vegetables contain compounds that will protect against mutation and cancer by several mechanisms. For example, kiwifruit has antioxidant effects and may also affect DNA repair enzymes. Dietary folate may be a key factor in maintenance of methylation status, while enhanced overall levels of vitamins and minerals may retard the development of genomic instability. The combination of each of these factors could provide a sustainable intervention that might usefully delay the development of cancer. Although there are a range of potentially antimutagenic fruits, vegetables and cereals available, current intake is generally below the level necessary to protect from dietary or endogenous mutagens. Functional foods development could be provide an alternative approach.

Immune function throughout life can be influenced by nutrition. Possible ingredients for the development of functional foods that could contribute to optimal immune

response include the antioxidant vitamins, trace elements (e.g. zinc, copper and manganese), n-3 and n-6 PUFAs, l-arginine, nucleotides and nucleosides, probiotics, prebiotics and synbiotics.

The GI target functions which are associated with a balanced microflora together with an optimal gut associated lymphoid tissue are relevant to the state of well-being and health and to the reduction of the risk of diseases. Probiotics (e.g. lactobacilli or bifidobacteria) and prebiotic (like inulin and its hydrolysate oligofructose) are recent concepts in nutrition that have already and will in the future be used to support the development of functional foods targeted towards gut function. However, colonic functional foods will not be treated in this report since they have been the object of a recent report of a joint FAO/WHO expert committee (FAO, 2006).

Osteoporosis is a growing concern of the aging population. Governments develop health campaigns related to the prevention of osteoporosis in order to reduce its impact on public health costs. Once food components are discovered which may help to prevent the risks of osteoporosis it is required that solid evidence is obtained on the efficacy of these components when taken daily. Promising in this respect are vitamin K, phyto-estrogens and non-digestible carbohydrates, in addition to the well established key-nutrients calcium and vitamin D (Pérez-López, 2007).

Considerable progress has been made in scientific knowledge leading to identification and characterization of the functional effects of foods. Good health is closely linked to a healthy lifestyle, specifically to good dietary habits that conform to food guidelines, the established dietary recommendations and the latest nutritional science. Indeed the optimisation of body functions and the development of well-being and good health through a varied diet and the reduction of the risk of developing certain diet-related disorders by means of suitable food choices are major priorities for many interested parties. These include scientists, consumers, governments and food manufacturers.

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