

FOOD DESIGN: TRENDS AND CHANGES

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ABSTRACT

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. The goal of this paper will be to explore the motivation for and consequences of food product design in the highly dynamic, ever changing food industry. Factors that are considered by food industry marketing departments will be characterized as to how the ever present need to provide food products that consumers want is realized. Food product development trends over the past five years will be established to help understand the motivation for new food products. Future trends will be projected. Technological innovations will be highlighted and the impact of food design on nutritional composition will be examined.

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The ensuing is the text of a plenary lecture given at the 21st National Nutrient Databank Conference. The author was asked to provide local color and perspective for this conference that was held in Baton Rouge at the Pennington Biomedical Research Center. Lest one wonder why a Yankee from Pennsylvania be asked to give such a perspective, it is said that "a Yankee can become a Southerner but a Southerner can't become a Yankee --- not that any Southerner would ever want to be a Yankee." In keeping with the charge, the author would like to invoke his honorary status as a Cajun, bestowed on him by the Cajun French Music Association, Baton Rouge Chapter, of which he is a charter member. Cajuns provide an interesting cultural backdrop for such a conference given their renown for creative cuisine and food usage. Although not everyone is enamored with this penchant; for example one disenchanted patron stated that "some of the stuff that stares out of gumbo should not be allowed out except for Halloween... ugly makes Cajuns hungry. The Elephant Man wouldn't last ten minutes in Louisiana... these people eat anything that moves. They don't even bother selling Raid in Louisiana except as a seasoning." Cajuns like to tell jokes on themselves, and of course, there is the famous Cajun Zoo joke with the punch line that the difference between a Regular Zoo and a Cajun Zoo is that in the Cajun Zoo the sign in front of the animal exhibit contains, in addition to all of the normal information like common name, Latin name, habitat, etc., a recipe for how to cook it.

The given topic, i.e. Food Design: Trends and Changes, will be covered relative to terminology, trends, technology and what this author terms the tyranny of data, which of course is the ultimate master of this particular audience.

Terminology

The term Food Design is in this author's view a relatively new description of an old process that food scientists have always called food product development. In this age of art deco, cuisine

nouveau and designer jeans, it is perhaps appropriate that the creation of new food products be designated with more modern terminology. A similarly new term or concept is described as "Designer Foods." Are these concepts the same, similar or related in any way? The 1973 edition of Webster's New Collegiate Dictionary defines design as "to create, fashion, execute, or construct according to a plan," and one definition of designer is "to indicate with a distinctive mark, sign, or name," which was designated as archaic. What was archaic in 1973, however, has now become fashionable. Designer foods have become associated with foods that possess specific nutritional and/or therapeutic properties. These foods have also been referred to as functional foods. Food design may be thought of as an overall concept, with designer foods a component of food design strategies. As a food scientist, this author continues to think of this as food product development.

Trends

Food product development is essential to the stability and growth of any food company. However, the high cost of innovation necessitates a high likelihood of success and a high return on investment. Realization of a new product is normally a lengthy process that involves both marketing and technology components of the company. The number of new products produced in the food industry has grown steadily in recent years, as can be seen from figure 1. Bakery and beverage products have shown the most dramatic increases (figure 2), with processed meats and side dishes showing more modest increases. In light of the importance of new products to the growth and stability of food companies, it is no wonder that some of the largest food manufacturers have been quite active in developing new products (table 1). Other companies, such as Tyson Foods, have made concerted efforts this past year to increase their new product development.

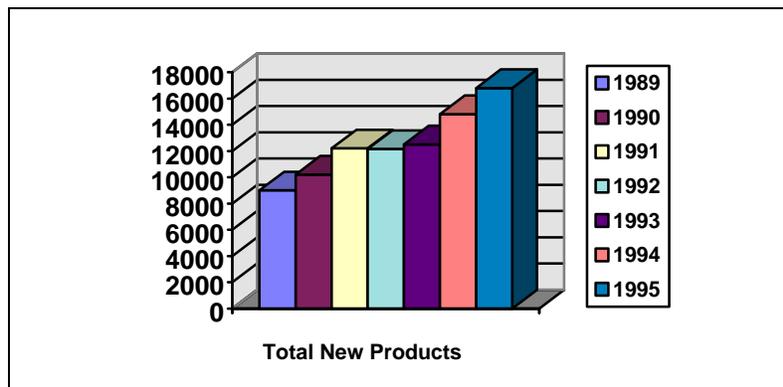


Figure 1. New food products, 1989-1995 (Friedman, 1995)

Mr. William Lynch, President and CEO of Leo Burnett Co., an advertising agency, has stated that "the key drivers of the future of prepared food products won't come as a surprise to anyone. They are found by studying change in the three classic benefits of prepared foods: convenience, nutrition and taste. And, most importantly, by studying changes in the consumer." Recent consumer interest in "designer foods" relative to health and nutritional benefits has increased the emphasis of food manufacturers on the production of new products with health-oriented features. The USDA Economic Research Service issued a report on the increase in sales of 37 nutritionally improved products versus their regular counterpart. They found that the volume of sales increased by a greater percentage between 1989 and 1993 for nutritionally improved foods than for regular products (figure 3). This occurred in spite of the fact that the majority (30 out of 37) of the nutritionally improved versions cost

Table 1. New product development by major food companies.

Company	1994	1995	% Change
1. Sara Lee	93	176	+89
2. Philip Morris	200	169	-16
3. Nestle	164	163	-1
4. ConAgra	99	157	+56
5. Campbell Soup	87	135	+55
10. Hormel Foods	121	89	-26
20. Tyson Foods	10	48	+380

From Friedman, 1995.

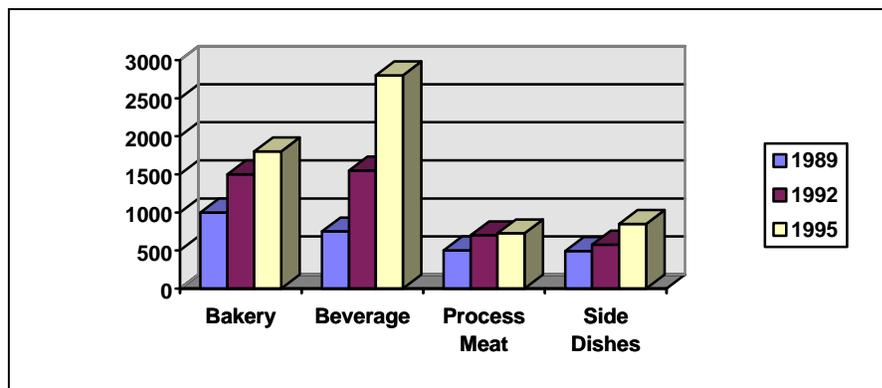
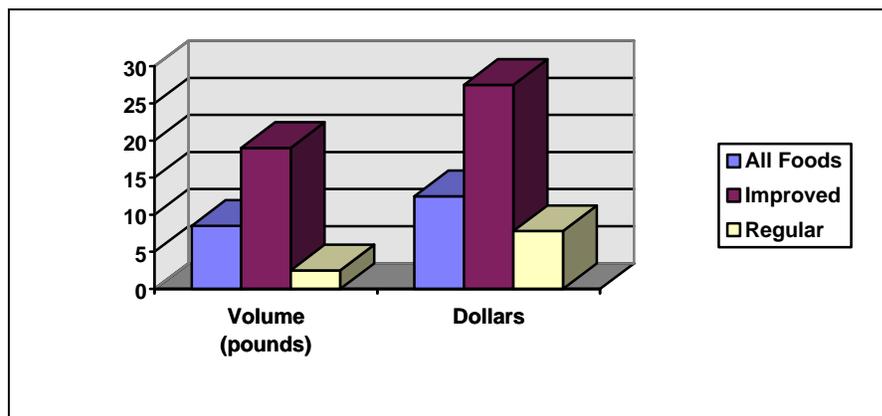


Figure 2. Specific new products (Friedman, 1995)



Economic Research Service, USDA

Figure 3. Percentage increase in sales of 37 food categories, 1989-1993

more than their regular counterparts. A seven-year trend for the development of new food products bearing health claims is depicted in figure 4. Reduced/low calorie and reduced/low fat claims have tended to be among the most often cited claims, especially in 1995. The number of new products

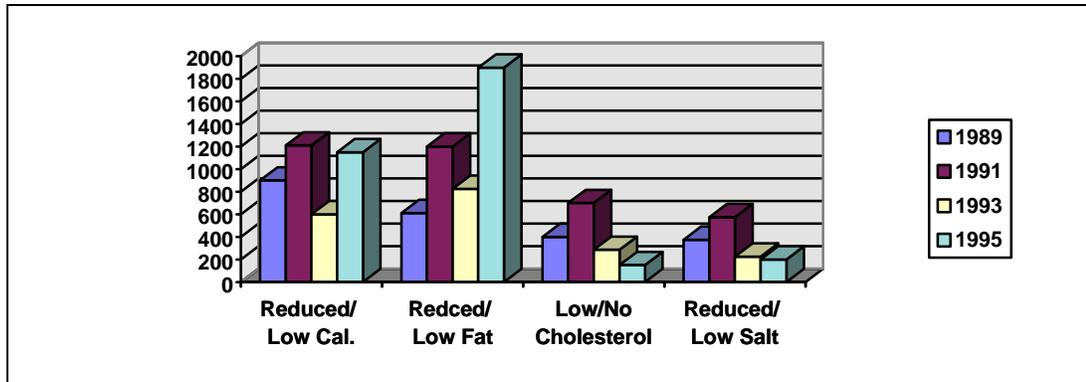


Figure 4. New products bearing health claims (Friedman, 1995)

bearing the claims of low/no cholesterol and reduced/low salt have declined in recent years. David Hettinga, Chief of Technical Services at Land O' Lakes, has stated that technologies that are at the forefront of the food processing industry and/or that are emerging as important new approaches to food processing include "low fat/no fat, functional foods, unique processing, edible films, unusual flavors and biotechnology." Food components that have been associated with health benefits and are therefore viewed as functional foods include thermogenic agents such as chromium picolinate, antioxidants such as tocopherols, phenolics, flavones and fiber.

Trend analysis is certainly an important component of modern day marketing strategy. Dr. Elizabeth Sloan, as a contributing editor for Food Technology, has written two articles on consumer trends and how they may affect the food industry. Her first top ten trends article, which appeared in 1994, listed the following: 1) kitchen cabinet versus medicine cabinet, 2) fresh is best, 3) the "O" (organic) word spells "opportunity," 4) more meatless eating, 5) energy-enhancing foods, 6) beyond speed, 7) microwave magic disappears, 8) an eat-where-you-are society, 9) upgrading the American palate and 10) active cultures to activate consumers. Many of these stated trends are self-explanatory and clearly reflect what appears to be an attitude towards more healthful food choices. In her 1996 update, Sloan indicates that the health orientation of consumer attitudes has been strong. Her new list includes: 1) sense appeal, 2) access and interception, 3) hunting for home meal replacements, 4) horse race for health-promoting ingredients, 5) perishables prevail, 6) lifestyle foods, 7) fruits and veggies flourish, 8) interaction, 9) where's the center of the plate and 10) impulse. Her new list continues to reflect health consciousness but has a much greater emphasis on convenience and taste. She predicts in trend #8, interaction, that consumer fascination, especially amongst younger individuals, with interactive devises will make innovative packaging attractive. This recognition calls attention to the changing demographics of the marketplace.

Today's generation is popularly referred to as the Baby-Boomers. The children of the Baby-Boomers are Generation X, and their children have already received the moniker Generation Next or the Millenials. No matter what you call them, the children of today will be the grocery shoppers of tomorrow, and understanding their likes and dislikes will be essential to food marketers. Selina Guber, President of Children's Market Research, has listed the top ten kid trends as: 1) high tech: computer, multimedia; 2) save the planet; 3) education as a means to an end; 4) family life, alive and well; 5) looking good; 6) sports - let the games begin; 7) money, brands, possessions; 8) race and gender issues; 9) multi-cultural media, advertising and products and 10) fitness and nutrition. On the surface, many of these kid trends do not appear highly related to food choice issues. Obviously, fitness and nutrition would be very much related, but

future marketing strategy will also have to include an awareness that Generation X will be more environmentally and culturally conscious, high tech and sophisticated in their standards.

Technology

Technological developments have fueled the massive increases of new products in recent years. These developments can range from highly sophisticated genetic modification of food commodities to merely repackaging old product types. Many developments have been potentiated through new food additives or components, especially with the movement towards healthier foods. Olestra, as discussed at this conference, is a good example of this. Other approaches to new food products have focused on the manner in which foods are presented to the consumer. For example, fresh cut produce is a new approach to the marketing of fruits and vegetables. In this approach, vegetables and/or fruits are partially prepared, e.g. carrots could be peeled, or lettuce could be chopped, for more convenient incorporation into meals. This approach did not exist 10 years ago but is projected to account for eight billion dollars in sales by the year 2000 (Sloan, 1995). It is primarily salad driven at this time but provides great opportunities for creativity such as fresh produce-based meals.

A similar concept would be "speed scratch," which refers to home-cooked meals with minimal preparation, effort or time (Hollingsworth, 1995). Speed scratch combines premixed, pre-measured, quick cooking components into a meal, nearly ready to eat. It relies on pasta, specialty sauces, salad dressings, prepared soups, pre-cut veggies, pre-cut and seasoned meats, spice and seasoning mixes and frozen components. These items would be co-packed so that the consumer could easily prepare a nearly home-cooked meal.

A technology that is receiving quite a bit of publicity of late is the use of genetic engineering, or modification, to alter certain characteristics of typical food commodities. This technology has conjured up some pretty horrific scenarios in the public eye but has been shown to be quite safe scientifically. The term genetically modified organism is used in the scientific community in reference to plants, animals or microorganisms that have been genetically modified. In the food industry, the modification generally would be related to some aspect of food quality. Genetic material (DNA) from one or more donor organisms is identified, copied and introduced into replicating cells of the target organism. This allows for faster, more precise modification compared with genetic modification that occurs naturally, i.e. by natural selection. The technology of this process was covered in detail at this conference. What effect might genetic modification have on nutritional composition of foods?

The first FDA-approved genetically altered food product was the Flavr SavrTM tomato. The basic principle of the genetic modification in this case was to turn off the production of the enzyme polygalacturonase, which is partially responsible for the softening of the tomato during ripening due to the degradation of pectin. By doing this, it would be possible to allow the fruit to ripen longer on the vine, rather than harvesting in the green state, which is the current practice. The current practice reduces losses due to disease and damage during shipping and handling. Allowing vine ripening increases flavor as the fruit ripens. The problem becomes whether or not other typical characteristics of the tomato are changed through this genetic modification. This would include a concern for changes in nutritional value. The Calgene company, which developed the Flavr SavrTM tomato has published a book through the CRC Press (Redenbaugh et al., 1992) that describes the process that they undertook to obtain FDA approval for this product. In this book, many of the studies that they conducted as part of the approval application are described. A partial comparison of the nutritional analysis of the Flavr SavrTM tomato compared with the normal range is given in table 2. For the most part, the important nutrients all fall into the normal range.

Table 2. Nutritional analysis of the FLAVR SAVR™ tomato compared with the normal range.

Nutrient	Normal Range	Measured Range
	per 100g	
Protein	0.85 g	0.75-1.14 g
Vitamin A	192-1667 IU	330-1600 IU
Thiamin	16-80 :g	38-72 :g
Riboflavin	20-78 :g	24-36 :g
Vitamin B ₆	50-150 :g	86-150 :g
Vitamin C	8.4-59 mg	15.3-29.2 mg
Calcium	4-21 mg	9-13 mg
Iron	0.2-0.95 mg	0.2-0.41 mg

From Redenbaugh et al., 1992

Tyranny of Data

The previous discussion leads nicely into the final component of this presentation, namely the need of this audience for reliable data as the food industry takes different approaches to food product design. A quick review of the literature of recent years revealed that there is not a great deal of data being generated relative to the effect of food processing/development on nutrient composition. Like the Flavr Savr example, much of the data that exists are in the hands of the food manufacturing companies and are of a proprietary nature. This will provide a challenge to the keepers of nutrient databases to obtain reliable data as the nature of food products change.

Several examples of the effect of processing on nutrient composition were published in the last two years. The first is related to the effect of calcium fortification of rice as affected by preparation method (Hettiarachchy et al., 1996). The objective of this research was to evaluate the relative effectiveness of calcium incorporation into rice that would be subsequently washed or exposed to water prior to or during preparation. They found that three percent calcium lactate fortification more than doubled the calcium concentration in the rice and that washing had a relatively minor effect (figure 5). Dialysis of a rice flour slurry against water did reduce the calcium content of the fortified rice, which indicates that the calcium is not tightly bound within the rice protein/starch complexes. However, this type of processing would not be encountered in normal rice preparation. Neither washing nor dialysis affected the calcium concentration of unfortified rice.

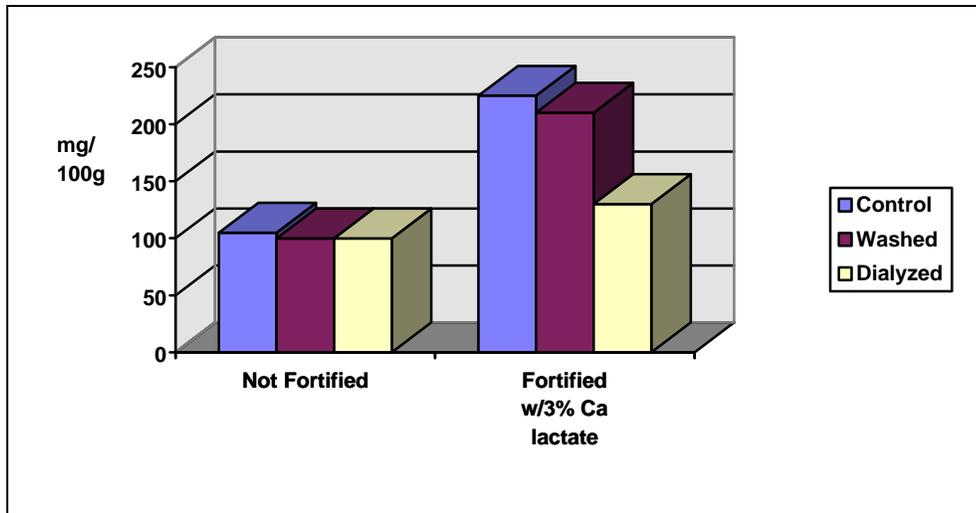


Figure 5. Calcium fortification of rice

Lane et al. (1995) described a study of food products that are processed specifically for use in the U.S. Space Program. They evaluated three different stages of processing vegetables for their effect on folate concentration. As can be seen in figure 6, the effect of processing was highly product specific. Asparagus, which is naturally high in folate, was greatly affected by cooking and freeze-drying after cooking. Broccoli and cheese, on the other hand, which are naturally low in folate, were not affected by these processing procedures.

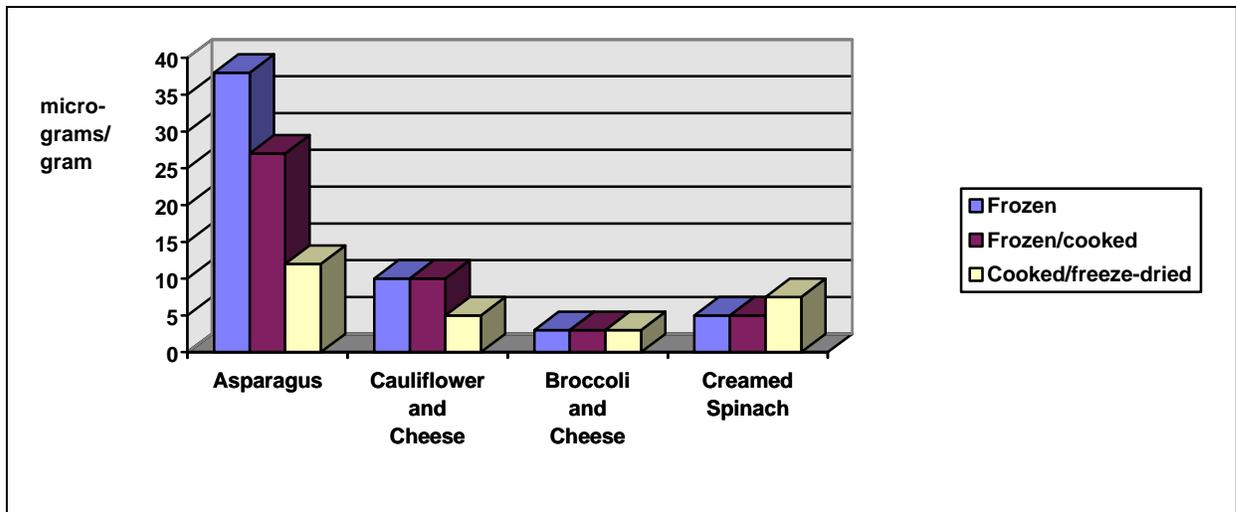


Figure 6. Folate content of vegetables after three stages of processing

A study done in my laboratory as part of an M.S. project (Liu, 1995) evaluated the relative effect of combining rice bran with ground beef on lipid composition. Adding either 5% or 10% rice bran to ground beef dramatically increased vitamin E and oryzanol content (figure 7). Also, the percentage of fatty acids that were saturated decreased and the percentage that were polyunsaturated increased as the percentage rice bran increased in the product.

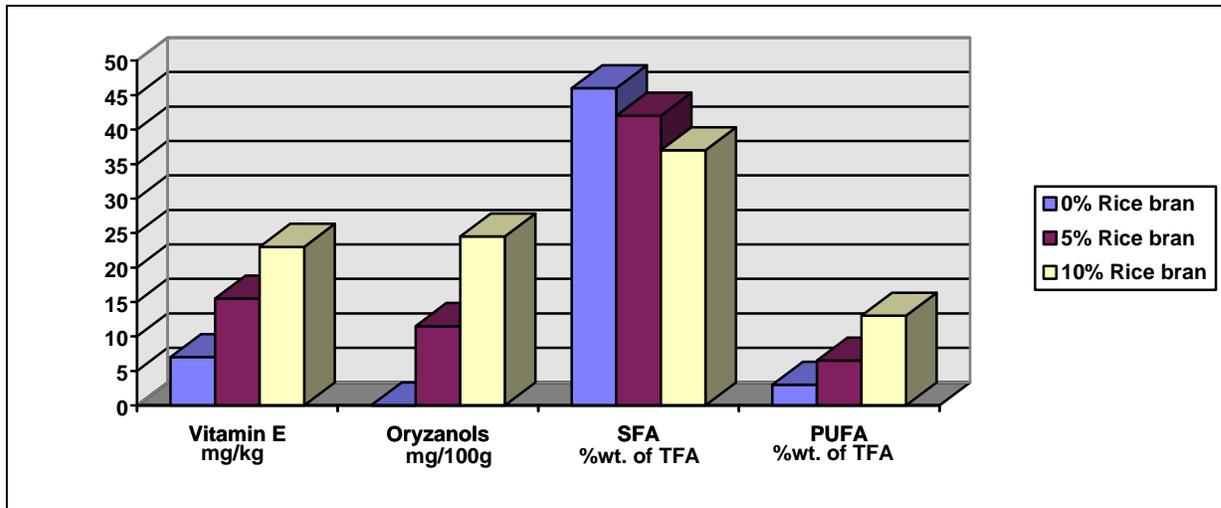


Figure 7. Nutritional modification of beef with rice bran

Each of these studies illustrates the potential effect that product development could have on the nutritional content of food products. Obviously, though, in each of these three studies, one or just a few nutrients was considered, which illustrates the magnitude of research that would be needed to adequately address nutritional composition of new food products. The challenge will be keeping up with the ever-changing food industry and obtaining the information that will satisfy the tyranny of data.

In closing, a couple of quotes may serve to put this topic into perspective. George Bernard Shaw has said, "there is no love sincerer than the love of food." This is, of course, what guarantees many of us our jobs. But perhaps Mark Twain may have been more to the point when he said, "part of the secret of success in life is to eat what you like and let the food fight it out inside." Thank you for your attention, and it is hoped that this presentation has provided sufficient local color and a bit a of useful information as well.

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