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# Lite Food Markets and Ingredients

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## Worldwide Consumer Attitudes Toward Lite Products

It is important to know what happens in the U.S. and Europe on the lite food market and how consumers are enjoying lite foods. Firstly, we will be reviewing a recent U.S. market survey of lite product usage. During 1992-1993, Pfizer contracted with the Calorie Control Council to conduct a similar survey in Europe and Canada. The decision to undertake consumer research in areas outside the U.S. is part of Pfizer's strategy to build a worldwide database on the usage of lite foods and beverages.

The Calorie Control Council has been following the growth of the lite foods industry for 26 years and has conducted the United States lite market survey with support from Pfizer for 15 years. This survey looked at trends and attitudes towards lite foods and beverages in the Western world.

The objectives of the research were:

1. Determine the usage of low-calorie, sugar-free and reduced-fat foods and beverages.
2. Determine specific reasons why consumers eat lite foods and beverages. Analyze the differences and similarities among the U.S., Canada, and Europe.
3. Determine current dieting habits in the U.S. and determine whether consumers are using low-calorie and reduced-fat foods and beverages as part of a healthy dieting and exercise plan, as we have previously found in the U.S.

Qualified respondents in the surveys were males and females age 18 or older. A national random probability samples was used and a total of 1,500 telephone interviews were conducted in each countries.

American consumers are clearly leading the global trend toward healthier eating. Four out of five Americans surveyed consume either low-calorie or reduced-fat foods with 50% of the population using both types of products.

The U.S. is the world's leading market when looking at the percentage of use of lite products on the basis of total population. Incidence of lite product usage is nearly as high as in Canada and the United Kingdom at 74%. A larger percentage of U.S. consumers are more likely to use both low-calorie and reduced-fat products than in any other country surveyed.

Now I would like to adress specific results of the study, beginning with American consumer attitude towards low-calorie products.

Approximately 58% of adult Americans use low-calorie foods and beverages according to this survey. Sixty-three percent of the women surveyed in the U.S. are low-calorie users versus 54% of the men. The German and Canadian markets for low-calorie products are nearly as developed as the U.S. and they are far more developed than the markets in the U.K. and France.

The popularity of low-calorie foods and beverages in the U.S., has more than doubled since 1978. In the last two years, the number of adult Americans consuming low-calorie products increased by eight million people.

The most popular low-calorie products consumed in the U.S. are diet soft drinks, followed by sugar substitutes and sugar-free gum. This holds true among both low-calorie users and the total population. There appear to be opportunities for growth and new product development in many of the categories including sugar-free yogurt, sugar-free frozen desserts and sugar-free cakes and cookies.

Over 50% of low-calorie users in the U.S. consume these products at least daily with an average usage per day of 4.9 products. In general, men are somewhat less likely to be daily users.

Staying in batter overall health is the number one reason for using low-calorie products in the U.S. for 72% of low-calorie users. 60% of low-calorie consumers surveyed stated that they wanted to eat and drink healthier products. Nearly 50% of the low-calorie users chose these products for refreshment of taste.

"Sweets" was the category most often mentioned by respondents where they would like to see new products developed. Within this category, the products most often mentioned were chocolate/candy, ice cream, and cake and pies.

In the U.S., "no-calorie" is the preferred label description among 29% of low-calorie product users. "Lite" is the label preferred by 27% of low-calorie users, followed closely by "reduced-calorie". There is no significant difference between men and women in the preference for "lite". "Diet" was the least-preferred description in the U.S.

## Japanese Lite Foods Market

In the previous section, we reviewed consumer attitudes to lite foods in the Western world. Everyone agrees we Asians are more health conscious and slim because of dieting habits such as eating more fish and less beef compared with the Western people. Let's look at Japanese market as an example how low calorie products are accepted by Japanese consumers.

Nikkei is the leading Economic News papers in Japan for many years. They also provide us key economic indicators such as Nikkei POS (point on sales) data which is a licensee of Information Resource Inc. in the U.S. and the only available online system in Japan to access super market merchandise sales data. This data can provide retail sales data of selling price and sales value of 6,000 foods categories daily, weekly or monthly based on 400 major super market all over Japan.

Let's look at beverage and mayonnaise as an example. The reason for the selection is as we learned Calorie Control Council's survey, both beverage and mayonnaise are quite popular product for lite foods.

In beverage category cola beverage in pet bottle are selected because of Nikkei data is based on super market and pet bottle is more likely choice of consumer than other packages such as cans. Coca Cola's "Regular" is enjoying the dominate market share of 71% followed by "Diet Coke" and "Lite Coke" of 14% and 12% respectively. "Diet Coke" is 100% sweetened by aspartame and "Lite Coke" is sweetened by a fructose and aspartame combination. "Regarding Pepsi Cola, Diet Pepsi" has higher market share than "Regular Pepsi". The total market share of lite cola beverages is 28%. One interesting point should be noted here would be prices. "Diet/Lite" prices are higher than "Regular" in both Coca Cola and Pepsi. This premium price should be a good incentive for food processors to go into lite foods.

A fat content of mayonnaise is extremely high of 70%. Those who understand it high calorie contribution, lite mayonnaise is a good fit for healthy life style. Japanese market of mayonnaise is dictated by two major players; QP and Ajinomoto.

"QP Half" is the first lower calorie mayonnaise marketed in Japan in 1991 and now enjoying 6% of market share. As we found in cola beverage category, price of "QP Half" is a 15% premium over "QP Regular" in 300 g package.

## FDA Regulation on "Lite Foods"

Some of you may have heard that nutrition labeling is now mandatory since May 1994 on processed foods. In the other words, under this regulation named NLEA, the Nutritional Labeling and Education Act, requires to label calorie, fat, cholesterol, dietary fiber, sodium and etc. for each processed foods. This regulation gave a big impact to both American consumer and food industry.

The main three thrusts of the NLEA regulations

are:

1. Nutrient content descriptions are defined
2. Some standard identities for foods are modified
3. Some health claims are allowed on labels

Before we discuss definitions of expressions for lite foods, I would like to address an importance of standard of identity for foods. In the past "no fat ice cream" should be called "fat free frozen dessert" because of the standard of identity for "ice cream" which should contains more than 8% of milk fat and etc. Under the NLEA, this product can be called simply "fat free ice cream". This may happens everywhere because of rapid progress and innovation of food technologies and consumer's interests in new foods. Korea seems not to be an exception that the standard of identity of hard candy requires more than 30% of sucrose. This should be modifies ASAP to include sugarless candies which meet today's health life style of Korean consumers.

Lite food descriptions particularly on "calories" are defined clearly in the NLEA.

"Light or Lite" in calories can be defined by 1/3 less from reference foods for foods with less than 50% of calorie from fat. If foods with more than 50% of calorie from fat, 50% fat should be reduced too.

"Reduced or less" should be reduction of 25%.

"Low" should be for foods less than 40 kcal/serving. Thus these low calorie foods would be likely beverages.

These clear definitions allow consumer to understand what they should select and what they are eating for healthy life style.

## Lite Food Ingredients

Replacement of sucrose became an area of heavy concentration in the late 1970's, in the U.S. with the release, in 1977, of "Dietary Goals for the United States," which proposed reduction of sugar consumption by 40% to result in 15% of total calories(Bollenback, 1981). This was the start of a series of reports from the USDA, the Surgeon General's Office, and the FTC, that implicated sucrose in tooth decay, development of obesity, coronary heart disease, high blood pressure, the development of diabetes, etc. The Sugar Association and a number of other food industry professionals mounted an educational campaign to counter the anti-sugar movement as a result of this, the emphasis on sugar has changed in the eyes of the consumer. Need for product development toward "Lite/Sugarless" now is directed more toward calorie reduction, taste, flavor or foods of diabetics.

This section can be summarized to generally characterize what we might consider as an acceptable sugar replacers; non-nutritive sweetener (high intense sweeteners) and reduced calorie bulking agent—in many ways, this problem is similar to the search for the ideal fat replacer. No one ingredient can fulfill all of the requirements, so the best products will come from a systems approach.

Aspartame is by far the most accepted non-nutritive sweetener in the world because of its good taste and availability. One major setback is stability in acidity and heat condition. Industry sources report more than 10,000 tons of aspartame are used in 1993.

Acesulfame K is one of the most widely accepted non-nutritive sweetener in Europe because of its very good stability. This product is usually used in combination with aspartame for synergy of sweetness and stability particularly in beverage. Acesulfame K has not been approved yet in some Asian counties such as Japan and Korea.

Steviocides is a natural non-nutritive sweetener extracted from plant. Because of bitter nature of sweetness, applications were limited. There are rapid improvements of sweetness quality by extraction technology, selection of plant and enzyme modification.

Sucralose and alitame are newly developed non-nutritive sweeteners to overcome setbacks discussed currently available products.

The group of mono- and disaccharide sugar alcohols has been loosely termed "the polyols", and

the group has many similarities, but each ingredient has unique features which favor it in some applications, but exclude its use in others. Some factors to consider are caloric content, laxation potential, cost, solubility, heat of solution (cooling effect), regulatory status, relative sweetness, and stability. The products which fall into this category are sorbitol, mannitol, palatinit, lactitol, xylitol, maltitol, and the related hydrogenated starch hydrolysates (HSH). All reproduced by the hydrogenation of closely related sugars. Although polyols are in general considered fully caloric (4 kcal/g) in the U.S. at this moment, the EC for a directive on nutrition labeling has a caloric value of 10 kj/g, equal to 2.4 kcal/g for all polyols. Japanese regulation does not specify each calorie value to reduced calorie bulking agent but set an analytical method which determines 1.5~2.4 kcal/g. At request of the FDA, Federation of American Societies for Experimental Biology (FASEB) is reviewing calorie value of each polyol in the U.S.

Sorbitol and mannitol are stereoisomer that differ from each other only in the position of the hydroxyl group on the #2 carbon.

Sorbitol is produced by the catalytic hydrogenation of glucose, and mannitol by the catalytic hydrogenation for fructose－source materials can be the pure sugars or starch, sucrose, or invert syrup. Both compounds have the same molecular weight, the same sweetness level relative sucrose (0.6x), and very similar heats of solution. Both have a negative heat of solution, resulting in a cooling effect. Both products are non-reducing, and are not reactive in Maillard browning. Both are resistant to fermentation by oral microorganisms (non-cariogenic). Some striking dissimilarities are solubility in water, hygroscopicity, laxative potential, and claimed caloric content. Mannitol is used in pharmaceutical applications as an excipient or as a freeze-drying carrier, or in foods as a sweetener in sugar-free confectionery, or as an anti-crystallizing agent in chewing gums. Sorbitol is used extensively as a tablet excipient, as a bodying agent, and as a humectant in pharmaceutical, and in foods as a non-cariogenic sugar-free bulking agent in confectionery, gums, baked goods, jams and jellies, etc. It is also used as a humectant in baked goods, confectioneries, and meat-based products, and can be used to lower the freezing point of ice creams.

Palatinit (isomalt) is formed by the hydrogenation of palatinose in aqueous solution using a Raney nickel catalyst. Palatinose is formed by the transglucosidation of sucrose, using enzyme. Palatinit is an equimolar mixture of alpha-D-glucopyuranosyl-1,1-D-mannitol (GMP) and alpha-D-glucopyranosyl-1,6-D-sorbitol(GPS). The sweetness of palatinit is 0.45~0.6x the sweetness of sucrose, with a comparable heat of solution (less cooling effect than other polyols).

Palatinit is non-cariogenic, has a low water solubility (25% at 20℃), and has atendency to crystallize. Compared to other polyols, Palatinit is less hygroscopic. Palatinit is approved in several countries, and is being marketed in the US on an assumed-GRAS status. While caloric contribution is 2.4 kcal/g in the EC, it is assumed at 1.5 kcal/g in Japan.

Maltitol is a crystalline polyol produced by the enzyme hydrolysis of starch to maltose syrup, then hydrogenation of maltose. The product was first developed in Japan, and has been in use there since the 1960s. It was regarded as a low calorie sugar replacer in Japan. Purity of maltitol is dependent on supplier and % of maltitol can vary from 88.5~99.0. Maltitol is about 0.8x as sweet as sucrose, and water solubility, heat of solution, effect on water activity, and effect on freezing point depression are close to sucrose values. In the U.S., a GRAS, petition was submitted 12/23/86, and is still under consideration by the FDA. For the US, maltitol is regarded currently at 4.0 kcal/g (EC proposal 2.4 kcal/g). Typical uses are confections, granola bars, baked goods.

The hydrogenated starch hydrolysate (HSH) and the hydrogenated glucose syrups (maltitol syrup) are non-crystallizing hydrogenated syrups defined in general by their maltitol content (DP-2), and further defined by DP-1 (sorbitol) and DP-3 (maltot-

riol). It has been suggested that HSHs with a maltitol content >50% be termed "maltitol syrups" or "hydrogenated glucose syrups", and those <50% be termed "HSH". Primary use is in sugar-free confections, such as caramels, gummy bears, chewing gum, jelly beans, etc. As stated for maltitol, GRAS petitions have been filed, and are under consideration by the FDA.

Xylitol is a five-carbon sugar alcohol which also is found in nature, both as a constituent of fruits and vegetables, and as a normal product of human metabolism.

It is produced by the catalytic hydrogenation of D-xylose, which is extracted from the xylanhemiscellulose portion of birch trees. Xylitol has a sweetness equivalent to that of sucrose, with an extreme cooling effect (heat of solution= −36.6 kcal/g) 40% higher than that of sorbitol. Xylitol has been established by its non-cariogenic status, and it is insulin independent. Sugarless chewing gums, mints and lozenges are its major use. Lactitol, or 4-0-(Beta-D-galactopyranosyl)-D-glucitol, is produced by the hydrogenation of a 30~40% lactose solution at about 100℃ with a Raney nickel catalyst.

Lactitol is, as a result, a hydrogenated disaccharide with a higher MW than the products described above− its effect on water activity and freezing point depression are similar to sucrose. Solubility in water is lower than sorbitol or xylitol (55% at 20℃), but now low enough to affect most applications. Sweetness is 0.3~0.4x the sweetness of sucrose, and lactitol has a slight cooling effect (heat of solution= −13 kcal/g). The EC has proposed 2.4 kcal/g.

Polydextrose, a randomly-bonded melt condensation polymer of glucose, was developed at Pfizer Inc. Specifically as a soluble dietary fiber widely used for fiber beverage in Japan and Korea, and has a proven caloric content of 1 cal/g all over the world. The reaction materials are dextrose, sorbitol, and citric acid in an 89 : 10 : 1 ratio, resulting in a weakly acidic, non-sweet, extremely water-soluble polymer with slight residuals of bound sorbitol and citric acid. Recent improvements, the Litesse I, II and III products, offer much cleaner-tasting products with markedly lower titratable acidity. The MW of polydextrose is controlled to <20,000, with almost 90% <5,000 MW. The result is a polymer which is extremely water soluble (80% at 25℃), which enables one to build soluble solids with little caloric contribution. Solutions of polydextrose are slightly more viscous than sucrose solutions, which plays an important role in partial fat replacement in some food systems. Polydextrose also will lower freeze-point without further contributing to sweetness. Polydextrose is fairly hygroscopic, and has been used in some applications, primarily baked goods, as a humectant.

Polydextrose is extremely stable to processing, and is non-cariogenic. Thus it is used many kind of lite confections such as hard candy, soft candy, chocolate and ice cream.