Approaches to Feel-good Confections

Formulating confections with added nutrients so that people feel good about consuming them will help the market grow.

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WE ALL HAVE OUR OPINIONS about nutraceuticals, but one thing is for sure—our industry is changing, and changing rapidly. Nutraceuticals have grown to be a major category. They are directing changes in our confectionery and snack food products. I have always heard that change is the only constant and society's relationship to candy and treats is not an exception.

Candy has been and will always be a feel-good treat. Today, confectionery is still an acceptable indulgence but many times not without guilt. To maintain sales and growth, the confectionery and snack industries have changed to meet the evolving needs and desires of this market and our society. New approaches for products that make consumers feel good about buying and/or consuming them will be instrumental in contributing to the continuing growth of our industry. Let me offer here a short overview on how this relationship of the consumer and the confectionery industry is changing, highlight a few areas of opportunity and offer a general guide or approach that will allow companies to capitalize on this growing feel-good confectionery market. I will also discuss several formulation approaches to fortified confections using protein, calcium and fiber. You will see that development here uses many common-sense approaches that we use every day, except with a different twist.

The increase in sales of the confectionery portion of nutraceutical or functional foods is hard to quantify. However, seeing that this portion is about 15 percent of what was a $58 billion industry globally in 2006 gives us a better idea of its size (Figures 1 and 2). The latest figures state that nutritional snacks and trail mixes, for instance, are up in the United States by 18.7 percent over the last year. On the other hand, many trackers of trends say that consumers are now looking for permission or maybe justification to partake in typical sweets or to buy them for their families.

The obesity epidemic and other health-related factors are of major concern to our consumers as well as legislators. Many of the nutraceutical products made to address such concerns do not meet the expectation of a treat to the common consumer. However, there are many approaches to making products that people can buy with less guilt but which are still true confections. These involve marketing as well as ingredient approaches. We have products such as those using natural and organic ingredients, 100-calorie packs (portion control), supporting charitable causes and even environmentally green. We also have sugarfree, reduced-sugar and low- ➤

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glycemic ingredients, which are all quite doable and popular. I will offer some unique approaches to adding extra nutritional value to your confectionery treats. I'm not referring to products that are meal replacers or megadoses of nutrients, such as supplements in candy form, but to confections that have a competitive edge, maybe qualifying for a *contains* statement or even *a good source of* statement for a certain nutrient or logical combination of nutrients (like Sport Beans). You could even include ingredients associated with certain nutrients (e.g., blueberries associated with high antioxidant level). These products may actually fall along a continuum of products, starting with the original fruit juice gummies with added vitamin C to those that provide higher levels of nutrients. Feel-good confections that have some added nutrition are a natural fit for the current market and not as difficult to develop as one might think when keeping in mind a few key considerations.

FORMULATION APPROACH

In developing these feel-good confections with added nutrients, the determining factors to set your approach include choosing the right nutrients, the right form and amount of ingredients, selecting the right confection type and, lastly, identifying the right method of incorporation into the formulation. I'll discuss each one briefly and then provide a few specific examples.

Before we consider these one by one, we have to touch on the most important attribute, taste. When asked what was the most important attribute of a new product, 96.9 percent said "good taste," followed by 88.7 percent saying "good nutrition." Experts agree that taste rules supreme but many suggest that most consumers are willing to accept a nutritious product that is not quite as good as their favorite candy without added nutrition. This probably is true for current purchasers of many of the nutrition or sports bar products currently

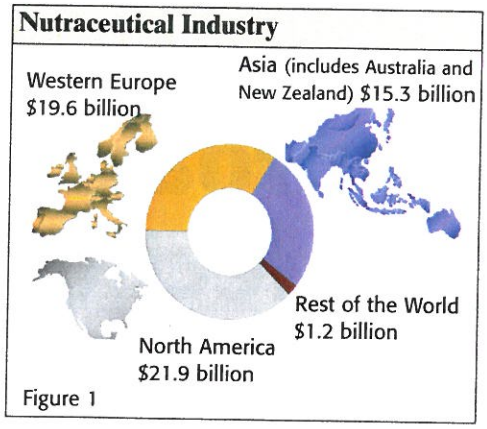

Figure 1

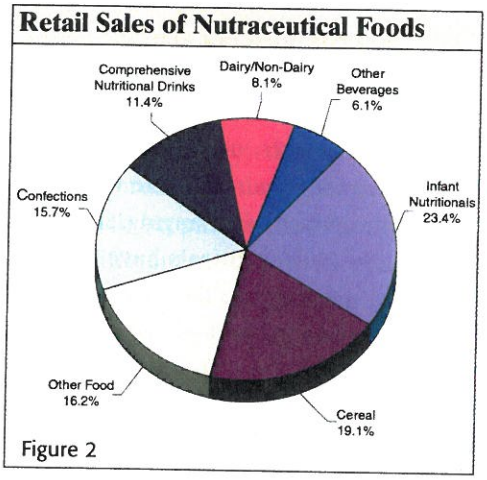

Figure 2

on the market but more research needs to be done to see what the current candy consumer would be willing to settle for to get additional nutrition. As an avid candy consumer I would not be willing to accept anything that does not taste good. Please keep in mind that it is critical to get it right the first time since there is truth in the adage, "once bitten, twice shy." However, with continuing improvements in nutrient-additive ingredients, flavor-masking technology and more logical ways of approaching formulation, good-tasting products with higher nutritional values will continue to be easier to develop and will meet the expectations of even the most finicky consumer.

Choosing the Right Nutrient

Now that we are keeping taste in mind, choosing the correct nutrient seems like the first logical decision but tends to be ➤

more complicated than one would think. Going with popular, familiar or "in" nutrients or ingredients makes more sense than introducing candies with ingredients that are strange, perceived questionable in quality or of unknown value to consumers. To complicate things even further, there seems to be a disconnect between the nutrients people need versus what they think they need. One method is to choose those which seem to get good press or have proven track records. Unfortunately, this approach leaves developers always playing catch-up.

Many of us have seen the way trends travel around the world. Seeing what is popular in other areas, especially in Europe or Asia, can give product development a head start. A perfect example is the phenomenom of green tea—an ingredient/flavor that has been very popular for years in parts of Asia as healthy. It became an additive to products and it quickly became an ingredient in many U.S. beverages, gums, mints and candies. There are services that gather this information but other sources include ingredient suppliers, trade magazines and even the internet. Trends also move from segment to segment. What is popular can be a very fast-moving target, not only what is considered good for you but also the debunking of popularly held "healthy" eating trends (e.g., butter versus margarine).

Certain nutrients or ingredients allow the use of health claims, which can strengthen positioning, but there are limited health claims and many of those have certain stipulations for use. Sometimes it seems easier to capitalize on public information and generally suggestive marketing campaigns, but there are many grey areas regarding statements made. Regulatory departments or, for smaller companies, legal counsel need to be involved. Again, content claims seem safer and just as effective even when using a combination of ingredients/nutrients that would appeal to a certain health issue.

Nutrient Form and Amount

Now that you have identified the active ingredient, one needs to consider form. Most nutrients are found in differing chemical forms (calcium from calcium phosphate, calcium citrate or calcium carbonate); differing sources (protein from soybeans and other vegetable sources versus milk or other animal); and in modifications to make ingredients friendlier to use (for example, heat-stabilized whey protein that is less likely to coagulate under higher heat). Bioavailability is in the press and many tout the benefits of natural sources. Also, marketing will undoubtedly want an input on how these ingredients or nutrients appear on the label. To make things even more complicated, not all sources of certain nutrients are approved ingredients in all countries, so regulatory needs to also get involved. All of these factors make it important to investigate multiple sources of ingredients. Many of these are newly available or newly improved ingredient sources and it is wise to capitalize on the knowledge base of your suppliers and their application departments.

As for amount, to make these good-tasting products, using enough nutrients for a *contains* or a *good source* claim could provide the competitive edge some products may need. The amount to use is based on which nutrient is being used. Herbs or other micronutrients that do not have recommended daily values for the most part cannot have the *good source of* content claim. To use this statement on your product, there needs to be 10 percent or more of the recommended daily value in one serving size.

Confection Form and Method of Incorporation

In regard to picking the confection form and method of incorporation, these are almost impossible to discuss separately but are probably even more important than the other considerations mentioned. One ➤

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Inclusions can be a great component for carrying nutrients, especially when embedded in chocolate, caramel or other candy matrices.

suggestion is compounding the same nutrient or logical combination of nutrients to improve chances of success. There are many nutrients or good-for-you compounds found in confections naturally, from the protein in milk or gelatin to the natural fiber in fruit, nuts or pectin. A good resource for information on this topic is the paper from the 2007 PMCA Production Conference by Debra Miller, *Nutrition in Confections.* Combination examples are already on the market and are as simple as protein found in high-milk caramel with nuts, or antioxidants found in dark chocolate with certain dried fruits. These nutrients will add up to higher total contents and also make it an easier story to tell when it comes to marketing.

Many nutritional ingredients can still impart less than optimum textural and flavor attributes to finished products. The next suggestion is to try a multiple component or multilayered approach when possible to help hide these defects. This also results in a multitextural product that has added interest and complexity in its eating quality, which appeals to many consumers. Inclusions can be a great component for carrying nutrients, especially when embedded in chocolate, caramel or other candy matrices. Even if the texture or flavor of the inclusion is not completely acceptable alone, it can be used in candies with great results. These more complex products can result in better-tasting feel-good confections. If that doesn't work, remember that flavor- and bitter-masking agents have come a long way, so check with your flavor suppliers.

When incorporating different ingredients into these products, additional formulation or processing changes may be required. Beware of ingredient interactions. Remember, it is not as easy as just adding an inert ingredient. Again, using your supplier's application department for suggestions on which changes are required for a particular nutrient or ingredient is the best assurance of success. These requirements may also in turn determine logical places to use certain ingredients. For instance, if you have chosen pomegranate as a source of antioxidants, don't choose a starch gel or other vehicle that is sensitive to the high acid that is normally associated with that fruit concentrate.

SPECIFIC NUTRIENTS

Following are some examples of specific nutrients and what you need to consider when using them in a product. I have chosen three to cover.

Protein

Why pick protein, given that according to the USDA study, 83.3 percent of people in the United States get the recommended level? Simply, there is a lot of information linking protein and satiety, especially as opposed to the consumption of carbohydrates. With obesity as an issue and with protein and carbohydrates contributing the same calories to the diet, it would seem that added protein would be a good idea for even less-active individuals. For active people, the evidence is even more compelling. There are many sources of protein available for use in confections. They include hydrolyzed gelatin, whey proteins, soy isolates and vegetable protein, to name just a few.

In this example, whey protein concentrate was chosen. There are many different forms of whey protein concentrates available. Whey protein has also had good press and is a complete protein containing all the amino acids required for human health. Beyond that, whey protein is digested over a longer distance of the digestive tract. This allows a greater absorption of amino acids and peptides, which then can be available for use in the body. Lastly, whey protein contains other bioactive components that have been indicated in fighting viruses and infections, notably ➤

lactoferrin and glycomacropeptide, indicated in antithrombotic activity (thrombosis is the type of clotting that is a leading cause of cardiovascular disease). Whey protein also tends to provide a mild, creamy flavor as opposed to some of the other protein sources.

The drawback to whey protein is mainly the price, which tends to fluctuate more than some of the other protein sources. Availability of some of the specialty forms may not always be guaranteed. Also, it does need to be labeled and handled as a milk allergen.

Some people are quick to mention lactose intolerance or intolerance to certain amino acids found in milk. The levels that would be added in these feel-good confections would not be high enough to cause intolerance reactions in most of the population (even those with tolerance issues). Natural places to use proteins include caramels, chocolate, fat-based fillings, aerated layers and inclusions like protein crisps. Other sources of protein can also be used in these applications.

The first thing to remember about proteins is that the control of hydration of proteins is critical. An oversimplification is that you either need to hydrate them fully or not hydrate them at all. Being refined into chocolate, confectionery coating or a fat-based filling would be the main examples of not hydrating at all. Where there is moisture present in the system, as in caramels, hydration is critical. Your protein supplier can give you specifics on how much water and what type of mixing will be needed to properly hydrate. Without proper hydration in a water-based system, protein can cause textural defects like dryness, mealiness or gumminess.

The second thing to remember is that many typical ingredients found in candy products provide the other components that are needed to react with protein for the Maillard reaction (nonenzymatic browning) to occur. Even where the resulting reaction (browning) is desired, as in caramel, the higher the protein concentration the faster the reaction occurs. Native proteins tend to also increase viscosity and can be subject to coagulation during heating processes. Just as in making high-milk caramels, homogenization or the use of stabilizers like di-sodium phosphate or others can help prevent this from happening. There are heat-stabilized forms of protein also available in the market.

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The last consideration is that with added protein there can be some interactions with certain flavor components, so as with any planned added nutrient, providing that information to your flavor supplier can prevent issues down the road.

A good example of a product containing whey protein is a cereal bar. The product is also a good example of the multilayered approach, with a granola bottom layer topped with a high-protein caramel layer and enrobed in chocolate. There is protein added to the syrup matrix that binds the granola, with protein crisps also in that layer, and a layer of high-protein caramel. Coating with a high-protein confectionery coating can raise the protein level further. Refer to the formulation and nutritional profile (Figures 3, 4 and 5). This product also contains calcium fortification since it seems a natural fit with the milk component, which leads me to the next example.

Calcium

Another popular additive is calcium. For over 20 years we have known that calcium is important for bone and teeth health. Newer evidence links proper intake of calcium to reduction of hypertension and even appetite suppression (if in bioavailable form). Calcium has been added to children's confections in Europe and parts of Asia for years. According to the USDA Agricultural Research Service, only 44.1 percent of Americans over 1 year old get an adequate ➤

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intake of calcium, so there is a documented need for increasing calcium in our diets. Calcium carbonate is probably the most common form used to fortify foods since it is the most economical. Natural places to use calcium are also where milk is used—caramel, milk chocolate, yogurt coatings or white chocolate coatings.

Calcium can become involved in the cross-linking and gelling of some hydrocolloids. Using a carrageenan or a low-methoxyl pectin that is known to set with calcium is fine, but too high of a calcium level in these products can cause too tight of a gel that cannot hold enough moisture to result in the desired texture. This could result in a more brittle gel and syneresis of water. Also, as a pectin supplier once reminded me, even the high-methoxyl pectin is a mixture and has some sites that will react with calcium, especially when other setting mechanisms like pH or solids are not optimum. This can definitely cause pregelling, which results in a weak final texture. Also, many candies contain acid that can liberate carbon dioxide from calcium carbonate, which can cause foaming.

There have been many improvements in sources of precipitated calcium carbonate. Some of these modified calcium carbonates have to a degree overcome the typical chalkiness and abrasiveness that is associated with this form of calcium. With certain densities of calcium carbonate,

Cereal Bars Nutritional Panel

Nutrition Facts

Serving Size (30g)
Servings Per Container

Amount Per Serving

Calories 120	Calories from Fat 30
	% Daily Value*
Total Fat 3.5g	**5%**
Saturated Fat 1g	**4%**
Trans Fat 1g	
Cholesterol 0mg	**0%**
Sodium 55mg	**2%**
Total Carbohydrate 19g	**6%**
Dietary Fiber 1g	**4%**
Sugars 8g	
Protein 5g	

Vitamin A 4%	• Vitamin C 0%
Calcium 8%	• Iron 2%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300 mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

Figure 3

Cereal Bar Formula

Chewy granola layer	53.85%
High-protein caramel	23.08%
Milk chocolate	23.08%
Chewy Granola Layer	
Lowfat granola cereal without raisins	33.05%
Dried coconut–unsweetened	0.77%
Dry whole roasted almonds	2.52%
Whey crisps	17.16%
Corn syrup solids–25 DE	2.42%
62 DE corn syrup	9.30%
Invert sugar syrup	5.05%
High maltose rice syrup (42 DE)	6.24%
Nonfat dry milk	0.77%
Sorbitol solution (70%)	2.22%
Honey	1.01%
Salt	0.15%
Water	2.02%
2X bourbon vanilla extract	0.10%
Partially hydrogenated vegetable oil (soybean, cottonseed)	5.05%
Semisweet chocolate chips	6.58%
Calcium carbonate	0.82%
Whey protein isolate	4.77%

Combine cereal, coconut, almonds, whey crisps. Combine remaining ingredients except vanilla and chocolate chips. Freeze chocolate chips so they will melt less when mixed into granola layer. Heat syrup to 190°F. Add cooked syrup to the dries in mixer until uniform. Add vanilla and chocolate chips, mixing just until incorporated. Compress 1,420 g into a sheet 9/16" thick, 12" x 18", and cool. Apply caramel to granola base at 23 percent (formula, Figure 5). Cut to desired size, 1¼" x 4", should be 50 g. Enrobe in milk chocolate of 65 g.

Figure 4 *Formulations courtesy DMI/USDEC*

keeping it suspended during processing may be a concern. Also, calcium carbonate adds opacity and lightens the color, which may be fine unless a transparent or dark color is actually desired. Just as in the case of protein, there are various sources of calcium available. There has been conflicting press about bioavailability of some forms of mineral supplements and this is true of calcium as well. Dairy calcium is very complex but is predominantly calcium phosphate. Dairy calcium is not normally protein free so it would be considered a milk allergen, but it has a good reputation for bioavailability.

A good example of using calcium is in a yogurt-coated raisin, where the calcium is added to the coating and then applied in a typical chocolate-coating system. In this case, a ladle or spray system may yield superior results to a drip system, which may require quite a bit of added fat to apply a calcium-fortified coating. This product could be easily made with dairy calcium or calcium carbonate. See formulation and nutritional information in Figure 6.

Fiber

Lastly, let me touch on fiber. Fiber is the only macronutrient that Americans on the average do not eat the recommended amount of according to the USDA (only 21.4% of Americans over 1 year old). Fiber has been shown to improve digestion, improve glucose tolerance, increase satiety, and reduce hypertension and other coronary heart disease. With the new sources of fiber and improvements in some older sources, there are quite a few more options to provide fiber fortification in confections. Fiber can come in insoluble and soluble forms. Sources of fiber are varied as well as the cost, ease of incorporation and content of actual fiber. Whole grains, fruit, pectin and nuts are all natural sources of fiber.

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High-protein Caramel

Whey protein concentrate	5.98%
Water	18.51%
42 DE corn syrup	30.67%
Lightly salted butter	6.16%
Sugar (granulated)	24.90%
Soya lecithin	0.50%
Salt	0.40%
Vanillin	0.05%
Water	6.40%
Caramel flavor	0.20%
Dairy flavor	0.08%
Calcium carbonate (or dairy calcium)	6.15%

Mix whey powder in water and hydrate for at least 25 minutes. Mix sugar, fat, lecithin, salt, water and ¼ of the whey mixture. Mix together several minutes to emulsify. Bring to a boil. Stir in the remainder of the protein mixture. Cook until 240°F while stirring constantly (83° Brix). Add vanillin, calcium and flavor and mix well. Apply to granola slab at 23 percent.

Figure 5

Yogurt-coated Raisins with Calcium

Yogurt coating	47.6%
Raisins, seedless	51.2%
Dairy calcium	1.2%

Nutrition Facts

Serving Size (40g)
Servings Per Container

Amount Per Serving	
Calories 160	Calories from Fat 50
	% Daily Value*
Total Fat 6g	9%
Saturated Fat 6g	28%
Sodium 20mg	1%
Total Carbohydrate 28g	9%
Dietary Fiber 1g	3%
Sugars 25g	
Protein 1g	
Calcium 15% • Iron 2%	

Not a significant source of trans fat, cholesterol, vitamin A and vitamin C.

*Percent Daily Values are based on a 2,000 calorie diet.

INGREDIENTS: Yogurt confectionery coating [sugar, partially hydrogenated palm kernel oil, nonfat milk powder, yogurt powder (cultured whey and nonfat milk), artificial color (titanium dioxide), lactic acid, soy lecithin (emulsifier) and vanillin (an artificial flavor)], raisins, dairy calcium (milk), gum arabic and confectioner's glaze

Contains: Milk, soy.

Calcium: good source of calcium

Figure 6 *Source: Knechtel, Inc.*

If we can formulate confectionery products that make people feel better about consuming them, then we can continue to grow our market.

There are many soluble forms of fiber that can be easily added to gels, chews, fruit snacks or almost anywhere corn syrup is used. Like protein, there are many inclusions, such as crisps or other nuggets, that can add fiber to composite-type confections. In normal confections, resistant starches/maltodextrins, inulin, gum arabic or fructo-oligosaccharides are some of the easiest-to-use sources of fiber. Like protein, hydration of fiber is critical. Your supplier of fiber ingredients can let you know the best way to hydrate. Since these different types of fiber have different contributions to viscosity and body in the end confection or during processing, other modifications to the confectionery formula may be necessary. Some newer forms of fiber can replace all of the corn syrup on a solids basis, whereas others will need to be added at a lower percentage. If corn syrup is replaced there may need to be some intense sweetener added to compensate for the reduction in sweetness. Since fiber tends to be lower glycemic, and may require an intense sweetener, consider using it in a sugarfree formula, especially one where the additional body imparted (from the fiber) could also be helpful in making an acceptable finished product.

Insoluble fiber can be trickier to use and can have a tendency to significantly raise hot viscosity and develop scorched particles in many cooking processes. Depending on the source of fiber, off-flavors or reduction of added flavor impact can occur. See the example of a starch gel where the corn syrup is replaced with soluble corn fiber (Figure 7).

Starch Jellies with Soluble Corn Fiber

Ingredients	Percent
Soluble corn fiber	31.6%
Granulated sugar	31.6%
Water	23.0%
Thin-boiling cornstarch	12.7%
Citric acid	0.5%
Flavor (to suit)	0.5%
Color (to suit	0.1%

Procedure:

Pour water into premix vessel and start applying heat.

Add soluble corn fiber and sugar. Dissolve completely while stirring. Add starch and heat solution to 80°C (176°F).

Cook using a jet cooker at 130°C (266°F) to a solids content of 76 to 77 percent.

Add citric acid, color and flavor.

Deposit into starch and dry to a finished solids of 85 percent.

Figure 7

CONCLUSION

There are many ways to formulate new feel-good confections. Additional news hits the press every day regarding new beneficial additives or new benefits of known nutrients and minerals. Capitalizing on the knowledge of suppliers and other experts can allow formulators to bypass some common pitfalls. If we can formulate confectionery products that make people feel better about consuming them or purchasing them for their families, then we can continue to grow our market even as more and more consumers look for healthy snacking options. □

REFERENCES

Boutin, Robert. Nutraceuticals—Once Again. *Kennedy's Confection,* March 2005.

Boutin, Robert. Lactose, the Forgotten Sugar. *Kennedy's Confection,* December 2005.

Cribbs PhD, Paul. The Role of Whey Proteins in Sports and Exercise Nutrition. American College of Sports Medicine's Annual Convention, 2003.

Dietary Guidelines for Americans. U.S. Department of Health & Human Services. U.S. Department of Agriculture, 2005.

The Great Tastes of America. *Virginia Dare National Consumer Insights Survey Marketing Department Bulletin 081007,* 2007.

Hoffman, Jay R. et al. Protein—Which is Best? *Journal of Sports Science and Medicine,* 3:118–131, 2004.

Miller, Debra. Nutrition in Confections. *The Manufacturing Confectioner,* 87 (10):67, 2007.

Sanchez, A., et al. Nutritive Value of Selected Proteins and Protein Combinations. *American Journal of Clinical Nutrition,* 13 (4):243, 1963.

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