Ingredients in Energy Foods

Fast-paced and stressful environment requires energy for survival. Many functional foods are entering the market and they have consumer convenience, good taste, nutrition and energy and so are becoming quite popular. These foods go beyond providing only basic nutrition and provide health benefits for mental well-being, cardiovascular health as well as energy to mind and body.

Functional foods market is expected to grow 39% between 2001 and 2006 posing challenge to food scientists and nutritionist designing and formulating foods. As consumers are becoming aware of benefits and risks of foods, selection of right ingredients including proteins, sweeteners, vitamins, herbs etc. is very critical.

Proteins are generating a lot of discussion because of their success in many protein based diets. It is important for many of our metabolic functions and maintenance. Proteins are made up of amino acids, 20 of which are required by body and diet must supply nine of them as body can not synthesise them. Glutamine, arginine and taurine are often found in energy drinks to enhance performance but science support to such claims is very little.

During exercise, energy is derived using branched chain amino acids (BCAAs) namely, leucine, isoleucine and valine. They help replenish glucose/glycogen deposits in the muscle. Endurance athletes find them valuable. Carnitine, made from lysine and methionine, is useful in utilisation of long-chain fatty acids for energy production. There is literature showing that it enhances athletic performance and delay of the onset of fatigue during exercise, although its effectiveness is still being verified.

Although the recommended dietary allowance may vary from 0.4 to 0.8 g/kg body weight per day for people with a low to average activity level, but this might be even higher. Some experts have suggested the requirements of over 2 g/kg body weight for athletes. There is a wide range of ingredients now available from dairy to soy proteins to be added to energy foods and beverages.

Whey protein ranks among the best sources of proteins with extremely high protein digestibility corrected amino acid score of 1.15. Some studies have shown that whey protein promotes fat loss, while help maintain lean muscle mass. It is rich in branched chain amino acids useful in strenuous exercise preventing muscle breakdown.

Whey Protein:

Whey protein constitutes several proteins, including beta-lactoglobulin, glycomacropeptide (GMP), alpha-lactalbumin, lactoferrin, immunoglobulin, lactoperoxidase, bovine serum albumin (BSA) and lysozyme. Lactoferrin, lactoperxidase, immunoglobulin and lysozyme form a natural defense system. Lactoferrin also binds very strongly with iron, giving it antimicrobial properties.

Whey protein isolate contains approximately 90% to 95% protein, while whey protein concentrate is available in a number of different protein levels, from 25% to 89%. As whey, whey protein and whey protein isolate contribute functionality and nutritional benefits, the product designers should consider while selecting a particular ingredient.

For example, Provon(r), an all-natural whey protein isolate, due to formulation versatility, can be used for a wide range of applications, such as sports-nutrition products, energy beverages and weight-management products. The whey protein isolate is manufactured using cross-flow micro utilization membranes, rendering the product lactose- and fat-free, and thus an excellent choice for energy bars and beverages.

This process results in extremely high levels of undenatured protein, and the ingredient contains high levels of glycomacropeptides. Undenatured whey protein exhibits excellent clarity in acidic beverages, and, since it is fat-free, it can be incorporated in fat-free and low-fat drinks.

Hydrolyzed whey protein breaks the protein down into peptides, which are more easily digested than nonhydrolyzed protein. Biozate(r), a whey protein isolate, is hydrolyzed using a proprietary process that influences the physiological function of whey protein. Studies report that it reduces hypertension.

Soy protein

Soy is gaining widespread popularity as an alternative protein source in the functional-food industry. Soy protein is a complete protein as it provides all of the essential amino acids the body requires. FDA approved its heart health claim in October 1999 according to this diets low in saturated fat and cholesterol that include 25 grams of soy protein a day may reduce the risk of heart disease. In 2000, the U.S. Department of Health & Human Services gave soymilk a status equivalent to cow's milk. (The PDCAAS of soy protein is 0.99, but the USDA only allows up to 1.0 for reporting protein quality.) Nutraingredients.com, in its recently published market analysis, reports a dramatic increase in soy-protein demand, which it predicted would increase 5.4% per year.

A whole soybean contains about 40% protein Formulators uses various ingredients of soybean in energy foods: Soy protein concentrate, made from defatted soy flakes, contains about 70% protein; soy protein isolate, or isolated soy protein (ISP), also from defatted soy flakes, has approximately 90% protein; and textured soy protein (TSP), made from textured soy flour, has 70% protein. After removing the carbohydrates from soybean the product has a more-neutral flavor. Depending on the process used, ISPs can be highly soluble in water, producing solutions with very high viscosities and foaming, emulsification and gel-forming properties.

Soy also has other phytochemicals, such as sterols, lignins, saponins, phytates and protease inhibitors. Isoflavones in functional foods also have health benefits. They can be use to prevent diseases such as osteoporosis and cardiovascular ailments, in post-menopausal women. Only water-washed - not alcohol-washed - ISP contains isoflavones.

Soy protein isolate and soy protein concentrate are available in powdered form. The protein's high moisture-retention capacity enhances mouthfeel and texture of processed foods.

One recent entry into the soy-protein market is PFL(tm), a line of isolated soy protein from ADM's Natural Health and Nutrition Division, Decatur, IL. This agglomerated product consists of ISP, a fiber ingredient and soy lecithin. The soluble dietary fiber as well as the lecithin enhances dispersion in liquids, making the product well suited for instant-powder applications.

Fat:

Like protein, fat is essential for normal body function. However, excessive fat intake is associated with serious consequences, including obesity and cardiovascular disease. Nutritionists and doctors strongly recommend that the public cut its fat intake to maintain a healthy life.

Healthy fats such as medium-chain triglycerides (MCTs) and diacylglycerols (DAGs) are designed by research scientist to meet the dietary needs of consumers.

MCTs:

MCTs, a class of shorter-chain fatty acids, are present in coconut oil, palm-kernel oil and butter, and consist mainly of esters of caproic (C6), caprylic (C8), capric (C10) and lauric (C12) acids. Because of their unique chemical composition, they can be used as an alternative to carbohydrates to provide energy. Foods formulated with MCTs have rapid metabolization, digestion and absorption, and even low caloric value - 6.8 kcal per gram. Clinical studies have reported that MCT increases caloric burning compared with long-chain fatty acids, making it a useful source of energy for people doing vigorous exercise and athletes. But there are insufficient data to support the ingredient's role in weight loss for those on a normal diet.

Stepan Company, Northfield, IL, offers Neobee(r) series MCT, fully saturated coconut oils that have lower viscosities and less susceptibility to oxidation, and, by extension, find utilization in energy bars and other nutritional products. As MCTs are slightly hydrophilic, they have some water solubility and can provide some emulsification properties in beverages.

Derived from the esterification of capric and caprylic fatty acids with glycerin, Neobee M-5 follows a unique metabolic pathway, is metabolized in one-eighth the time of long-chain triglycerides (triacyglycerides) and does not accumulate as fat in the body.

DAGs:

DAG contains only two fatty acids per fat molecule vs. three for standard triglycerides, with a high proportion in the 1,3 position on the molecule. This structure allows the body to metabolize it differently than conventional oils; it is digested and absorbed in the small intestine, making it immediately available for use as energy and making it less likely to be stored as fat. According to ADM Kao LLC, which markets a DAG oil made from soy and canola under the trademark Enova, studies suggest that DAG oil may help reduce body weight and fat mass when included as part of a sensible diet. Enova oil has GRAS status for a number of categories, including nutrition bars and beverages, and bakery products.

Fuel for our body

Though proteins, fats and carbohydrates are all macronutrients and sources of energy, carbohydrates burn quickest, providing fast fuel for the human body. Energy boosters high in sugar can relieve depression caused by low blood sugar. Nutritionists recommend that people who are sedentary should include at least 250 mg of carbohydrates per day in their diet.

High-energy drinks and bars targeting women, the young, the elderly and athletes can use different sugars, including sucrose, fructose, glucose, maltose and galactose, as well as sugar alcohols, as fuel, along with other performance enhancers in the mix. These sugars contribute different degrees of sweetness and caloric contents.

Selecting sweeteners for energy drinks depends on the performance requirements, since glycemic response is important for evaluating the impact that particular carbohydrates have on blood glucose levels. Sport drinks designed for active athletes, such as Gatorade(r), have high concentrations of carbohydrates, with the optimum level at 6% to 8%. The intake level is important in maintaining glycogen levels prior to and during vigorous exercise or sports.

Energy foods and beverages generally contain carbohydrate ingredients that deliver fast energy, such as high-fructose corn and rice syrups, fruit juices, dextrose and maltodextrins. Complex carbohydrates provide sustained energy and help maintain a steady blood-sugar level because it takes longer for the body to metabolize them into glucose, the form required for the energy-producing reaction called glycolysis. Low-glycemic carbohydrates, including sugar alcohols and dietary fibers, are metabolized differently from the quick-energy sugars; therefore, the body stores less glycogen and uses more fat to produce energy.

Micronutrients to fortify

Aside from macronutrients, micronutrients such as minerals and vitamins play a major role in keeping the body healthy. Though they occur naturally in small or trace amounts in food, micronutrients play a key role in enhancing the nutritive value of food.

Minerals have important functions in forming part of the skeleton, enzymes or their cofactors. Minerals participate in the metabolization of glucose to energy by working as enzyme cofactors. These can stabilize enzyme-substrate reactions or become part of the reaction. Zinc is required for enzymes such as carbonic anhydrase, lactate dehydrogenase and superoxide dismutase to work.

Thiamine, riboflavin and niacin (nicotinic acid and nicotinamide) also act as cofactors or precursors of cofactors for enzymes involved in energy metabolism. Pantothenic acid is part of coenzyme A, an important cofactor for enzymes that participate in the Krebs cycle, the reaction that generates energy from glucose. Antioxidants, vitamins C and E, and beta-carotene may fight the effects of exercise stress that produces free radicals, which can harm muscle-cell membranes.

Calcium is needed for muscle-function regulation and to increase bone density, which prevents osteoporosis, making it a popular ingredient in these products. Beverages, especially clear ones, require calcium that is very soluble. Formulators can select the proper ingredient from a variety of GRAS calcium salts, including: calcium carbonate, calcium chloride, calcium citrate, calcium gluconate, calcium hydroxide, calcium lactate, calcium oxide, calcium phosphates and calcium citrate malate. They may also work with dairy calcium, such as TrueCal(r), a whey mineral complex from Glanbia Nutritionals, Inc., is a multifaceted ingredient specially designed to optimize bone health through a balanced combination of 24% calcium and 13% phosphorous, which is very conducive for bone health.

Incorporating vitamins and minerals has always been a formidable task for food formulators due to different degrees of solubility, which impacts appearance, reactivity and flavor. Mineral salts exhibit a solubility profile based on the pH. Encapsulating vitamins and minerals prevents degradation, thus providing long-term stability and potency. This simplifies incorporation of these ingredients in functional foods.

Microencapsulated vitamins, amino acids and other nutraceuticals provide stability and prevent interaction with ingredients. These ingredients can be used in a wide range of functional products, such as bars, textured beverages, infant formulas and supplements.

Herbal energizers

If macro- and micronutrients are required for bodily function, herbal functional ingredients aim to enhance it. Despite regulatory issues, the herbal-product market is expanding. Herbal supplements and herbal-enriched functional foods are gaining in popularity.

Ginkgo biloba, ginseng, and gotu kola are often included in products marketed for enhanced energy. Gingko biloba and ginseng are believed to provide an invigorating mental effect. Gotu kola is thought to have a stimulating effect on the brain that increases focus while relaxing the nervous system. Research is ongoing to support the health benefit claims of these and other botanicals.

Although not an herb itself, caffeine stimulates the central nervous system and can help to decrease fatigue and to increase alertness. It occurs naturally in coffee, tea, cocoa beans, kola nuts, yerba maté and guarana - all natural or herbal compounds frequently included in energy products. Caffeine's effects can last from 0 to 120 minutes. A number of studies show that moderate caffeine levels consumed about 1 hour prior to exercise enhance endurance, or provide a ergogenic effect.

Ephedrine, a central-nervous-system stimulant with a chemical structure similar to amphetamines, occurs naturally in the herbs ma huang (Ephedra sinica) and country mallow (Sida cordifolia). FDA has warned users against the effectiveness and safety of weight-loss, energy and bodybuilding products with ephedra-containing herbs. These potentially cause problems when used alone, but the effects can be compounded when used in combination with other substances.

Spirulina, green-tea extract and Garcinia cambogia (mangosteen, or Malabar tamarind) are also used in weight-loss and energy-enhancement supplements. These herbs are marketed to combat fat by suppressing hunger and supporting the body's defense system, but no direct scientific link has so far been established to weight loss.

Quality control for herbal products is very important. Prior to incorporating herbs into a product, it is critical to evaluate interactions, dosage and a host of other issues.

Herbs are available in the traditional seed, leaf and powder forms, as well as in extracts. Extracts, which are available in liquid, semi-liquid or emulsion form, are more stable and longer lasting for incorporation in foods and beverages.

Careful herb selection and dosage in energy foods and beverages are important to avoid unwanted health problems that, in some cases, may be fatal. Since FDA does not strictly regulate these products, consulting with a specialist in herbal medicine on any potential dangers is essential to avoid adverse side effects.

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