October 2007 Supplement to *Prepared Foods*

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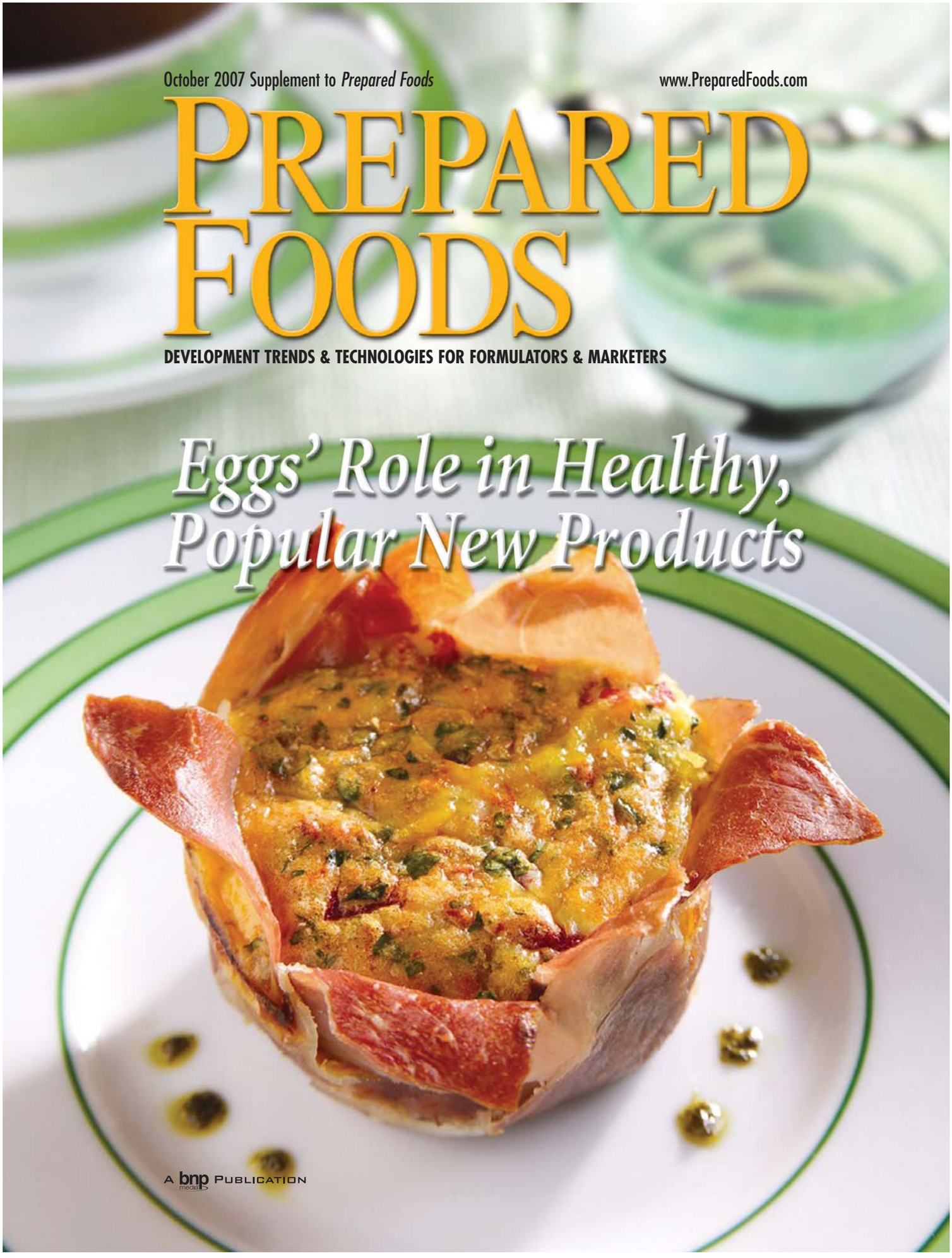

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Eggs' Role in Healthy, Popular New Products

By Ann Przybyla Wilkes

The versatility of eggs, a wholesome ingredient that provides a wide range of benefits in product formulations, has led to their use in a variety of new products, from indulgent foods to sports enhancement products. The American Egg Board (AEB) provides a wealth of information for food manufacturers, product developers and marketers on the benefits, functionality and nutrition of egg products on its website at www.aeb.org/EggProducts.

Egg products perform multiple functions in food products and help keep ingredient statements short and clean. The appeal of eggs as an ingredient is boosted further by the fact that they are virtually trans fat free. Since 100g of eggs have less than 0.5g trans fats, food products incorporating eggs do not have to list trans fats on the ingredient statement, if the other ingredients do not contribute trans fats.

Eggs have a high nutrient density since they provide excellent protein and a wide range of vitamins and minerals in proportion to their calorie level. Protein quality can be measured in a number of ways. Protein Digestibility Corrected Amino Acid Score (PDCAAS) is a method of evaluating the protein quality based on the amino acid requirements of humans. The U.S. Food and Drug Administration (FDA) and the Food and Agricultural Organization of the United Nations/World Health Organization (FAO/WHO) consider PDCAAS the preferred method to determine protein quality in human nutrition. The PDCASS for whey, eggs and casein is 1.0.

Another method used to rate the quality of protein is Amino Acid Score (AAS). This measures the essential amino acids present in a protein and compares the values with a reference protein. The amino acid score reflects the most limiting essential amino acid. Whole eggs have an AAS of 1.21, compared to 1.14 for whey protein, 1.00 for casein, 0.99 for soy protein concentrate, and .94 for beef protein.

Nutritional Benefits From Choline

Newer research about beneficial vitamins, antioxidants and other important nutrients in eggs has further added to their appeal. One of

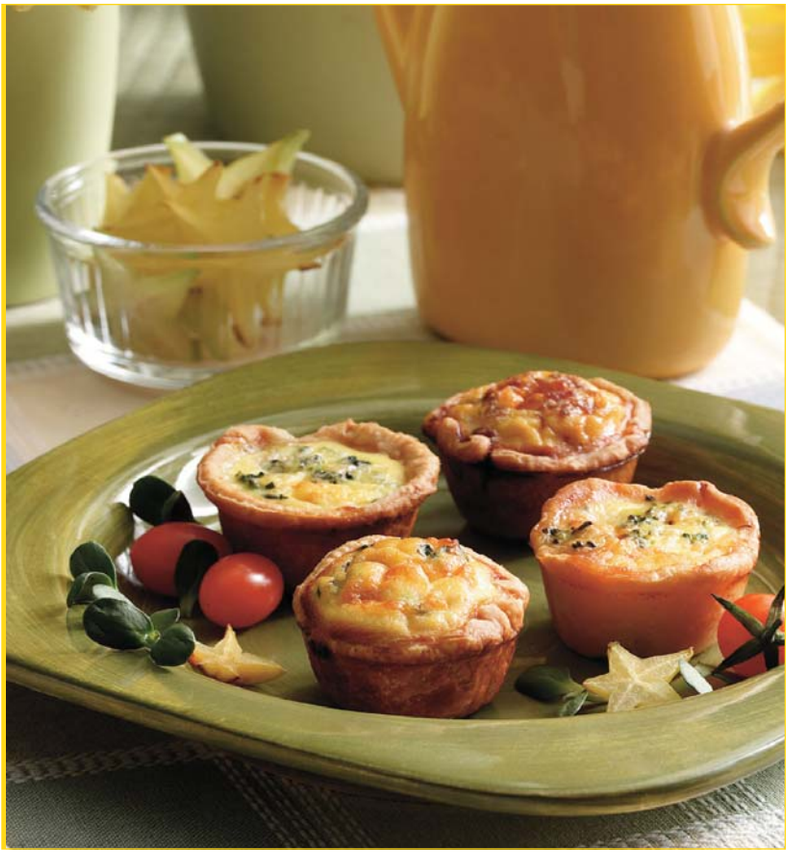
these nutrients is choline—an essential nutrient that provides a range of benefits in human nutrition.

While choline was discovered in 1862, its importance was not recognized until much later and Daily Reference Intakes (DRIs) for choline were not established until 1989. In 2001 the FDA allowed a nutrient content claim for choline. Foods that contain at least 110mg of choline per serving (or 20% of the Daily Value for choline based on 550mg reference) may be labeled as an "excellent source of choline" and foods containing at least 55mg of choline per serving may be labeled as a "good source of choline." A large egg contains approximately 180mg of choline.

The body produces choline, but research is showing that humans need more than the body can synthesize. As a result, a healthy diet needs to include choline, points out Dr. Donald McNamara, Executive Director, Egg Nutrition Center (ENC). The human body converts choline into acetylcholine, which plays a role in skeletal muscle movement, the regulation of smooth and cardiac muscle, and is believed to be involved in learning, memory and mood.

One area of research currently being explored is the role of choline in fetal development. Choline, like folate, has been shown to decrease the incidence of neural tube defects. A further benefit of an adequate choline intake during pregnancy is improved brain function. Animal studies (Albright, CD, et al. 1999. Brain Res Dev Brain Res, 115: 123-9 and Jones JP, et al. 1999. Brain Res Dev Brain Res, 118: 159-67) have shown positive changes in brain function and memory in offspring of female rodents whose diets were supplemented with choline in late pregnancy. These changes continued into adulthood.

"Adequate maternal choline stores are vital to a healthy pregnancy," stresses Jenny Heap, M.S., R.D., ENC. This is due to the high rate of choline transfer from mother to fetus. Human milk is also rich in choline, making it important for lactating mothers to consume the recommended amount of choline.



Due to hectic lifestyles, people are eating smaller and more portable mini-meals. These mini quiches fit into this trend.

Other research has revealed that choline plays key roles in proper nerve signaling, strengthening cell membranes, keeping homocysteine levels in check and preserving brain function in the elderly.

Protecting Vision

The antioxidants lutein and zeaxanthin, found in eggs, play an important role in preventing eye disease. The human eye contains macular pigment, which acts as a filter to protect the eye from photo damage, explains McNamara.

Ultraviolet and blue wavelengths can damage the rods and cones of the eye. The result is blind spots in the middle of a person's vision since this is the area where the eye focuses. The name of this condition is age-related macular degeneration (AMD). AMD is the number one cause of vision loss in older adults in the U.S.

Lutein and zeaxanthin are the only two caroteniods found in the human eye. Specifically, they are found in the macular region of the retina and absorb ultraviolet and blue wavelengths. As lutein and zeaxanthin are oxidized, they absorb ultraviolet waves and blue light. Once oxidized, these antioxidants need to be replaced. Lutein and zeaxanthin cannot be

This hardy fettuccini features noodles that include eggs as an ingredient.

synthesized by the body and, therefore, can only be obtained from dietary sources.

Green vegetables, such as spinach, kale and broccoli, are commonly recommended for promotion of eye health because of their high lutein content. However, research shows that the lutein and zeaxanthin in eggs may have a higher bioavailability because of the egg's lipid matrix. Chung and colleagues (Chung et al., 2004 J Nutr. p 1887-1893) showed that lutein from egg yolk is more effective in raising serum lutein levels than the same amount of lutein from spinach or vitamin supplements.

Lutein and zeaxanthin are also found in blood serum, adipose tissue, breast tissue and breast milk, in addition to the eye. They are considered important antioxidants in the protection of human skin from harmful effects of environmental exposure.

Minimal Impact

Some concern has been expressed about the cholesterol level in eggs; however, extensive research has shown that dietary cholesterol intake has little significant effect on a person's risk for coronary heart disease (CHD). As early as 1982, the Framingham Dietary Study refuted the assumption that egg consumption had a significant impact on blood cholesterol levels.

More recent studies by Greene (Greene CM, et al. 2005. J Nutr, p 2793-8 and Green CM, et al. 2006 Nutr and Metabolism, p 6) showed that healthy men over 60 years old and postmenopausal women who regularly included whole eggs in their diet did not increase their CHD risk profile. Yet according to a survey in Mintel's report, Eggs (published June 2006), 36% of participants aged 55 to 64 and 39% of participants over 65 years old agreed with the statement, "I eat fewer eggs than I like because of my concern about cholesterol." That was in comparison to 30% of all survey participants. The survey was conducted online, with 1,007 people aged 18 and older participating.

"Thanks to accelerating research in the area of genetics, we now understand that, in addition to age, gender, ethnicity, physical activity, and hormonal fluctuations, one's genetic make-up can strongly influence physiological responses to dietary intake," Heap wrote in the Spring 2006 edition of *Nutrition Close-Up* that included several articles on cholesterol studies.

In a Nov. 8, 2006, letter to the editor, nutritionist Dr. David Kritchevsky wrote in response to the Spring 2006 issue of *Nutrition Close-Up*: "Recognition of the importance of the presence of individual compounds such as choline, lutein, zeaxanthin, polyphenols, etc. have made foods, originally shunned because of their fat content, desirable. A life-long dietary pattern appears to be the major factor in the development of diet-related disease."

Role of Eggs in New Products

Nutrient-dense eggs are an ideal ingredient in an expansive array of foods products. Eggs are multifunctional—they are used as foaming agents, emulsifiers, binding agents and as colorants, points out Dr. Glenn Froning, Food Science and Technology Advisor for the American Egg Board and Professor Emeritus, University of Nebraska. One of the benefits of using eggs in these roles is they contribute to a clean label, he adds.

Eggs offer numerous advantages when used as an ingredient, as a result eggs are being incorporated into more new product formulations. According to the Mintel Global New Products Database (GNPD), 384 new foods and beverages in which "egg" or "eggs"

was used in the product description were introduced in 2006 compared to 303 in 2005, 391 in 2004, and 214 in 2003. In 2006, the bakery category saw the most new products with egg or eggs in the product description at 118 products, followed by "meals & meal centers" at 97 new products.

Gluten-Free Products

Eggs can be used as an ingredient in gluten-free foods. People who have celiac disease, a genetic disorder that affects approximately 1.5 to 3 million Americans, are advised to maintain a life-long diet free of gluten. There is no known cure for celiac disease, which causes chronic inflammation of the small intestine

On January 23, 2007, the FDA published a proposed rule defining "gluten free" under the Food Allergen Labeling and Consumer Protection Act (FALCPA). Gluten would be defined as proteins that naturally occur in a prohibited grain and that may cause adverse health effects in persons with celiac disease. Prohibited grains would be defined as wheat, rye and barley, and crossbred hybrids of the three grains. It would not include other grains, which could be marketed as "gluten free" if the finished product contains less than 20ppm gluten.

Eggs can provide a number of functions in gluten-free products and can be used as a binder instead of gluten-rich ingredients in formulations such as crab cakes and meatballs. In 2005, SPINSscan Natural and Conventional channels (Schaumburg, Ill.) reported that there were over 3,150 products with gluten-free label claims on the market, totaling over $696 million in sales.

Two recently introduced products that are promoted as gluten-free are Kineret Macaroni & Cheese and Canton Dijonnaise Fondue and Dipping Sauce. Marketed in Canada by Lassonde Specialties Inc. (Saint-Damase, Quebec, Canada), Canton Dijonnaise Fondue and Dipping Sauce contains no preservatives and is gluten-free. The formulation for this sauce contains egg yolk.

Left:** **Eggs can be featured in a wide variety of breakfast foods, including in the elegant asparagus quiche pictured here.

Right:** **Eggs provide an important role in this ham & cheese braid that includes the appeal of vegetables.

In the U.S., Kineret Macaroni & Cheese, from KFP International Ltd. (Bayonne, N.J.), is made with real cheddar cheese. The product is microwaveable, gluten-free and Kosher certified. The noodles contain egg whites. The egg in the formula helps create a noodle that uses no flour, explains Martin Davidson, Director of Communications for KFP.

Kineret Macaroni & Cheese was introduced in March 2006 in time for Passover. The response was very positive, notes Davidson. "The product tastes very much like regular macaroni and cheese. The noodles taste very much like wheat noodles. Many people were very surprised that it is gluten-free and Kosher for Passover," he adds.

New Product With Eggs

(Number of New Packaged Retail Foods with "Egg" or "Eggs" in their Description)

Category	2006	2007 est.*
Bakery	118	98
Confectionery	40	144
Desserts & Ice Cream	19	8
Meals & Meal Centers	97	148
Processed Fish, Meat & Egg Products	43	28
Sauces & Seasonings	30	8
Side Dishes	22	28
Soup	7	20
Spreads	8	12
Total	384	494

Source: Mintel Global New Products Database (GNPD)
*2007 numbers are estimated

Left: ***The whole eggs in Pepperidge Farm's Tahiti Coconut Cookies provide wholesomeness, add flavor, and increase the brown baked notes. In addition, the protein in the whole egg contributes to the structure of the cookie.***

Right: ***Consumer desire for convenient foods that fit into their busy lifestyles has made convenience breakfast foods a "hot" category. Shown here are Aunt Jemima Sausage, Egg and Cheese Croissant Sandwiches***

Indulgent products

Consumers who want to reward themselves often do so with a culinary treat. In an article on food consumption through 2020, Noel Bliscard, et al., U.S. Department of Agricultural (USDA) Economic Research Services (Food Review, Spring 2002), noted that as the U.S. population continues to become wealthier, older, more educated and more ethnically diverse, they will spend extra discretionary income on quality and convenience, rather than quantity. This will create an even larger demand for convenient, indulgent foods.

Eggs provide important textural characteristics in indulgent products such as sauces, dressings, ice cream, cakes and other products. Pepperidge Farm (Norwalk, Conn.) reintroduced Tahiti Coconut Cookies from its archive into the Distinctive Cookie line in January 2007. The fresh whole eggs in the cookies provide wholesomeness, add flavor, increase the brown baked notes, and the protein in the whole egg contributes to the structure of the cookie, explains Geri Allen, Manager Brand & Corporate Communications, Pepperidge Farm. She adds that overall performance on Tahiti has been strong and feedback from the field has been positive.

Another indulgent product that incorporates eggs is Häagen-Dazs® Light Chocolate Fudge Brownie Ice Cream from Dreyer's Grand Ice Cream Inc. (Oakland, Calif.). It is an all-natural, super-premium light ice cream that the company says has 50% less fat and 16% fewer calories, but with all the taste. The ingredient statement for this products is: Skim milk, corn syrup solids, cream, fudge brownie pieces (sugar, water, wheat flour, natural cocoa powder, butter (cream, salt), eggs, salt, vanilla, baking soda), sugar, cocoa processed with alkali, egg yolks.

Sports Products

The importance of protein for athletics is an active area of research. Melvin H. Williams, Ph.D., Director; Human Performance Laboratory, Old Dominion University (Norfolk, Va.), recommends that for strength-trained athletes attempting to increase muscle mass, "probably the most important nutritional considerations are to obtain sufficient energy and protein." He adds that, "Adequate amounts of both may be obtained simply by increasing the amount of complex carbohydrates and healthful protein sources in the daily diet." (See Gatorade Sports Science Library at www.gssiweb.com/Article_Detail.aspx?articleid=20&level=6&topic=2.)

Amino acids, peptides and proteins have been shown to assist with muscle growth and also repair post-exercise damage. One of the most cost-effective sources of protein is eggs, says Jennifer Cooper, President, Lead Point Solutions—an Orem, Utah-based company that provides product development, market research and regulatory assistance for health and functional foods. As the popularity of protein bars and other high protein foods for athletics increases, eggs (whole, white and yolks in powdered and other forms) can provide high-quality protein for these products.

MET-Rx U.S.A. Inc. (Boca Raton, Fla.) offers Big 100 meal replacement bars. These bars contain a protein blend that includes dried egg white. They are sold under the company's "muscle and strength" category. A 3.52 oz (100g) bar contains 27g of protein.

Convenience Breakfast Foods

Eggs have long been a popular choice for breakfast. Now there is even more reason to eat them since new research is showing added benefits of eating them in the morning. A study by Vander Wal and colleagues (Vander Wal, JS, et al. 2005. JACN, p 510-515) shows that an egg breakfast increases satiety and helps reduce caloric intake the rest of the day.

In the study, 28 overweight women between the ages of 18 and 60 had either two scrambled eggs, two pieces of toast, and one tablespoon of reduced-calorie fruit spread or a bagel, two tablespoons of cream cheese, and three ounces of non-fat

yogurt for breakfast. The women who consumed the egg breakfast consumed fewer calories at lunch and fewer calories throughout the day. The authors concluded that the egg breakfast was more effective than the bagel breakfast in sustaining satiety.

A follow up study examined the effect of an egg breakfast on weight loss. Nikhil Vinod Dhurandhar, of the Biomedical Research Center at the Louisiana State University System, found that eating egg breakfast while on a weight loss diet enhances weight loss, presumably by increasing adherence due to greater satiety.

Speaking at the Experimental Biology Annual Meeting, April 28 – May 2, 2007 in Washington, D.C., Dhurandhar explained that 160 overweight or obese subjects were assigned to egg, egg-diet, bagel, or bagel-diet groups. After eight weeks, the egg-diet group had 65% greater weight loss versus the bagel-diet group. The egg-diet group also reported feeling more energetic than the bagel-diet group. Changes in plasma total- , HDL- and LDL-cholesterol, and triglycerides did not differ significantly between groups.

Despite the importance of breakfast, only 38% of Americans view their breakfast as a complete meal, according to a recently released study on what Americans eat in the morning by The NPD Group Inc. (Port Washington, N.Y.). The report notes that due to hectic lifestyles, people are eating smaller and more portable mini-meals. When people prepare or cook something in the morning, it typically takes under 10 minutes to prepare, and more than half of all breakfast meals are consumed in 10 minutes or less.

Consumer desire for convenient foods that fit into their busy lifestyles has made convenience breakfast foods a "hot" category. One example, Aunt Jemima Sausage, Egg and Cheese Croissant Sandwiches, was introduced in 2005 by Pinnacle Foods Group Inc. (Mountain Lakes, N.J.). Other breakfast sandwiches from the company are: Sausage, Egg and Cheese Biscuit Sandwiches; Sausage, Egg and Cheese French Toast Sandwiches; Sausage, Egg and Cheese Griddlecake Sandwiches; and Ham, Egg and Cheese Griddlecake Sandwiches.

***Left:* Egg products are a good choice for breakfast since studies have shown that eggs increases satiety and helps reduce caloric intake during the day.**

***Right:* In 2006, the bakery category saw the most new products with egg or eggs in the product description, according to the Mintel Global New Products Database. Within the bakery category, date nut bars include eggs into the formulation.**

"Eggs are an important part of any breakfast sandwich," notes Jeff Maloy, Brand manager for Pinnacle Foods. "Their savory taste is a perfect complement to the buttery croissant, sausage and cheese in Aunt Jemima's Croissant Sandwich. In addition, eggs provide protein to start the day," he adds.

Consumer acceptance has been strong. The Croissant Sandwich is one of Aunt Jemima's most popular items. "Given the increasing need for on-the-go breakfast solutions, we expect breakfast sandwiches to continue to grow," explains Maloy.

Another convenient breakfast introduced in 2006 was Jimmy Dean Canadian Bacon & Cheese Whole Grain Muffin Sandwich from Sara Lee Food & Beverage (Downers Grove, Ill.). The company promotes the product as low in cholesterol and a good source of protein. There are nine muffins per package, each containing 4.5g of fat, 0g of trans fat and 5g of whole grains. More recently in 2007, Jimmy Dean announced the launch of Jimmy Dean Breakfast Bowls. Two of them feature eggs: Sausage Breakfast Bowls contain real scrambled eggs, diced russet potatoes, Jimmy Dean sausage and cheddar cheese; and Bacon Breakfast Bowls have bacon instead of the sausage. Each of the breakfast bowls comes in a microwave-ready container that can be prepared in less than three minutes.

"Our Jimmy Dean Breakfast Bowls have everything that you love for breakfast in a quick and convenient package, without any mess or dirty dishes," said Jim Ruehlmann, Vice President of Jimmy Dean, when the product was introduced.

Eggs as ingredients are available in a wide variety of forms, including dried, frozen and refrigerated for a host of applications. They are a nutrient-dense ingredient that contributes to a clean label.

Is page 8 an ad??