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Innovative ways to formulate with whey

It was not long ago cheese makers cringed when they thought about whey, because it was considered a worthless byproduct, one that required extra effort to ensure proper disposal. How things have changed. Today, it is one of the most in-demand ingredients in the food and beverage formulating world.

The milk from cows contains two types of proteins: casein and whey. Casein remains in the curd during cheese-making while whey is washed away in the liquid stream after curd draining. Interestingly, the tables have turned for cheese makers, with many producers

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referring to their business as whey making, as they consider cheese to be the byproduct.

This is because whey proteins are recognized as complete proteins. They contain all of the essential amino acids the human body needs. They also are easy to digest. But most important, whey proteins are one of the best sources of branched-chain amino acids, in particular leucine, which has been shown to stimulate muscle synthesis.

Whey proteins, and the powers they bestow, are on trend with many of today's health and wellness regimes. For those trying to lose or maintain weight, calorie for calorie, research shows whey proteins may help people feel fuller longer than carbohydrates or fats. Further, reduced-calorie, higher-protein diets may improve the

quality of weight loss by helping one lose more fat and maintain more lean muscle.

When exercise is a part of the equation, whey proteins provide additional benefits. For example, consuming whey proteins and performing resistance exercise regularly may help build more lean muscle than resistance

training alone or resistance training combined with carbohydrate consumption. And performance athletes recognize that consuming whey proteins after exercise helps to build and repair muscle. Emerging research also shows older people may be able to reduce the age-related

decline of muscle mass (sarcopenia) by engaging in resistance training and consuming higher than the recommended levels of protein. The fact is most healthy people consume enough dietary protein to prevent nutrient deficiency diseases and conditions. However, additional benefits such as those described

repair and remodeling. But to reap other benefits, one must consider the quality and the quantity of the protein at every meal. This is important at smaller meals, such as breakfast, which often tend to be overloaded with carbohydrates and fat.

For optimum muscle health and function, research suggests that 30 grams of high-quality protein should be consumed at every meal, and preferably the proteins should be high in leucine.

"Scientific evidence supports a diet rich in high-quality protein as an optimal strategy to improve appetite control, satiety and promote body-weight management across the lifespan," said Heather Leidy, assistant professor in the department of Nutrition and Exercise Physiology at the University of Missouri, Columbia.

She agrees research indicates

Research has opened the door to new ways to incorporate whey into food and beverages

may be experienced when protein is consumed above the recommended levels. Donald Layman, professor emeritus of nutrition, University of Illinois at Urbana-Champaign, said data indicate humans need about the same amount of dietary protein every day for basic lean muscle

training alone or resistance training combined with carbohydrate consumption. And performance athletes recognize that consuming whey proteins after exercise helps to build and repair muscle. Emerging research also shows older people may be able to reduce the age-related

decline of muscle mass (sarcopenia) by engaging in resistance training and consuming higher than the recommended levels of protein. The fact is most healthy people consume enough dietary protein to prevent nutrient deficiency diseases and conditions. However, additional benefits such as those described

that 30 grams of high-quality, high-leucine protein at every meal is the magic number for the body to experience the many extras dietary protein has to offer.

"There is a threshold requirement for leucine to initiate muscle protein synthesis," she said. Research shows 2.5 grams of leucine is needed to start building muscles, with muscle health contributing to many of the benefits associated with protein consumption.

Understanding the leucine effect

Why proteins have been shown to provide an anabolic advantage over other proteins in promoting muscle health because of their higher level of leucine. Specifically, whey protein isolate (W.P.I.) is approximately 11% leucine, making it the best source of all protein ingredients. It is no wonder food and beverage formulators are turning to whey protein ingredients to give products an extra edge in the competitive health and wellness market.

Some whey protein suppliers have been able to use advanced technologies to further concentrate the leucine

content of their ingredients. For example, Davisco Foods International Inc., Eden Prairie, Minn., offers W.P.I. BiPRO, which is 13.1% leucine. Since it contains a higher level of leucine, less may be added to product formulations to achieve the 2.5 grams of leucine per serving. This translates to lower usage levels and fewer calories needed to achieve optimal muscle health.

"BiPRO is a high-quality, ultra-pure W.P.I. that delivers all of the essential amino acids needed by the human body, without added carbohydrates and fat," said Phanin Leksrisonpong, director of business development at Davisco. "Made from pasteurized cheese whey by ion exchange technology, it has superior functionality, solubility and clean flavor. BiPRO is ideal for nutrition enhancement of food products and for nutraceutical applications."

At the 2013 Institute of Food Technologists' annual meeting and food exposition, held July 13-16 in Chicago, Davisco exhibited how BiPRO may be added to all types of applications, including

chocolate milk, whole grain extruded puffed cereal, hummus, gluten-free peanut butter chocolate chip cookies and gluten-free pizza.

"BiPRO is a naturally gluten-free ingredient that helps improve the texture, dough handling and baking performance of the gluten-free crust," said Ms. Leksrisonpong.

Also at I.F.T., Glanbia Nutritionals, Fitchburg, Wis., received a 2013 I.F.T. Food Expo Innovation Award for its Optisol 3000 egg replacement system, which is comprised of whey protein concentrate (W.P.C.) and milled flaxseed. The combination provides protein, gum and fiber, which together mimic eggs in baked goods. The ingredient assists with the issue of rising egg prices, as it is a stable-price ingredient system for 100% egg replacement in all types of baked goods, from cakes and muffins to egg rolls and wontons. The ingredient offers nutritional advantages, too, as it is a source of the omega-3 alpha-linolenic acid, protein and natural fiber.



Sensory trials have shown no significant difference in appearance, taste and texture, according to the company.

Advancements have been made to improve the quality of whey protein ingredients in terms of color, flavor and stability. This progress allows for expanded use in food and beverage applications. For example, a number of suppliers are offering whey proteins that have improved heat stability, which is enabling higher usage levels in dairy-based beverages, including meal replacement shakes and recovery drinks.

The U.S. Dairy Export Council, Arlington, Va., funded research on the development and use of whey permeates, also known as whey solids, as a sodium-reduction solution. Research shows whey permeate may help formulators achieve salty flavor characteristics while displacing salt to keep sodium contents down in a number of applications. Permeate also contributes to browning by the Maillard reaction. Browning not only enhances appearance but imparts a pleasant caramelized flavor.

For example, at I.F.T., the U.S. Dairy Export Council sampled a protein-enhanced soft pretzel made with W.P.C., permeate and unsalted butter. The pretzel is a good source of protein (8 grams) and has a 73% reduction in sodium when compared with a traditional pretzel.

The dough used to make an Asian dumpling prototype

The protein-enhanced soft pretzel has 8 grams of protein.





included milk protein concentrate for a boost of protein, while the accompanying dipping sauce used whey permeate to keep sodium content low.

Permeate covers a family of products that have a minimum of 59% lactose and a maximum

of 10% protein and 27% ash.

"The composition of permeate will vary somewhat depending on the starting material," said Kimberlee Burrington, the dairy ingredient applications coordinator at the Wisconsin Center for Dairy Research at the University of Wisconsin in Madison, which is supported in part by the U.S. Dairy Export Council. "Sweet whey and milk are the most common starting materials for permeate production in the United States.

"The lactose in permeate helps baked bread retain its softness for a longer period of time and also helps extend its shelf life. This softness has been attributed to better

emulsification of the fat in the formula and the increase in water-holding capacity.

"Added to pie crusts, permeate can aid in emulsifying the shortening. This allows for a reduction in shortening without sacrificing the tender, flaky texture. Permeate also improves the color and flavor of the baked crust."

Adding whey to beverages

Though whey proteins are separated from cheese curd through a liquid stream, they are typically dried into a powder for use as an ingredient. When using whey protein ingredients in beverage formulations, processors must remember to provide some time for hydration of the powders in water, juice or milk prior to mixing with other ingredients and processing.

A rule of thumb is to allow

for a minimum of 30 minutes of hydration at ambient temperature. Whey protein ingredients should not be hydrated at temperatures above 60°C because it will denature the whey proteins and possibly cause loss in solubility in the finished drink.

Whey proteins remain soluble in low pH conditions, such as in fruit drinks, so difficulties such as turbidity or cloudiness caused by insolubility are eliminated. However, when heat is applied, whey proteins denature. This leads to an insoluble, aggregated protein, resulting in turbidity or a white precipitate. Using a whey protein designed for heat treatment, for example for smoothies, may speed production time through reduced fouling of heat exchangers.

Some new whey protein ingredients, such as those

that are pre-acidified, may be added in substantial amounts to a juice base with minimal effect on flavor, aroma and appearance. In fact, the finished beverage may be clear, much like isotonic beverages.

Red Whey is an example of a clear beverage. The 100% tart cherry juice and whey protein beverage was developed by the University of Wisconsin-Madison Athletic Department in collaboration with the Wisconsin Center for Dairy Research, and a Wisconsin whey processor and cherry processor. It was developed for the university's student-athletes and designed to relieve muscle inflammation (via the cherry juice) and build muscle tissue (via the whey proteins) after a workout. An 8-oz serving of the recovery drink contains 12% whey proteins.

To assist with satiety, Kellogg Co., Battle Creek, Mich., recently introduced Breakfast To Go. With 10 grams of protein and 5 grams of fiber in each 10-oz shelf-stable shake, the company believes the beverage is a great start to the day. The beverage is made with a protein blend based on nonfat milk, W.P.C. and soy protein isolate. It is aseptically packaged in plastic bottles and sold in packs of four in three



flavors: milk chocolate, strawberry and vanilla.

The U.S. Dairy Export Council showed I.F.T. attendees how wake up and power up may be achieved at the same time with its cafe yogurt frappe. Made with yogurt and W.P.C., the chilled coffee beverage combined protein, calcium, riboflavin, phosphorus with freeze-dried coffee and a dash of caffeine to provide the same amount of caffeine in a cup of coffee along with 10 grams of protein.

The export council also developed a W.P.I.-infused, non-alcoholic, mint martini cocktail mix. Whether shaken or stirred, with 10 grams of protein per cocktail, the drink makes for a beneficial happy hour. **FBN**

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