On the whey up

With growing consumer interest in protein and functional health foods, **Hélène Simonin**, director of food, environment and health at the European Dairy Association and European Whey Products Association, discusses the history, value, benefits and future of whey products.

The incredible story of whey began approximately 8,000 years ago with the discovery of milk-clotting enzymes – and who would have thought that the 'residue liquid' of the time would become a precious resource in today's world?

For probably thousands of years, cheese was made and the by-products were either thrown away or, in the best case scenario, left to the animals around the farms. As the world's population grew, so did conscientiousness over resources, and the old residue liquid was given to pigs as a calorie reserve for the winter and to aid survival during the industrial revolution. Since then, the quality of the material has not stopped surprising us; with every new scientific assessment, new outputs become possible. Indeed, today, whey is used for human nutrition and even in pharmaceutical applications.

Thus, whey stands as the core example of a well-functioning circular economy in the limelight of the European Commission's new goals and the global efforts to promote food security and battle climate change.

The value of whey

In essence, whey is simply the liquid that separates from the curd when milk curdles either by acidification or due to cultures. This precipitation was discovered when milk was carried by Bedouins in cows' stomachs; the milk-coagulating enzyme in the stomach helps calves digest their mother's milk.

A product of nature, this off-white liquid retains major valuable elements of the milk, making it an incredible source of nutrition. In addition to the whey proteins, it has lactose, vitamins

and minerals, several of them available in a very digestible way.

As with every natural product, simple whey varies in its make-up, depending on two factors: the composition of the origin milk, influenced, for example, by the cow's breed, feeding or lactation stage; and the type of cheese-making, as coagulation processes depend on the culture used. Today's whey producers standardise these criteria to allow customers to rely on clear and reliable product characteristics and nutritional information for further use.

The approximate composition of whey would be 93.0g of water per litre, 4.5g of lactose, 6.2g of protein and 0.5g of fat. In addition, it contains around 20 different elements present in amounts of milligrams per litre, especially vitamins B5, B2, C and B6, calcium, zinc, iron, iodine, copper, lactoferrin, lactoperoxidase, lysozyme and immunoglobulin-A. With 0.25L of whey, an average adult could meet around 25–30% of their daily needs of vitamin B2 and 17% of the daily needs in calcium.

In the different condensed whey products made of liquid whey, some or all of these components are available in a concentrated form. This multitude of health components is used by the whey-product manufacturers to tailor simpler or more advanced products for the needs and wishes of very different clients and consumers – nearly every nutrient can become the focus of such concentrated or powdered products.

Hélène Simonin
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The easy bioavailability, good digestibility and efficient uptake of the original liquid whey will also be retained. That can be explained by the original 'matrix' of the nutritional composition of milk and whey. Science continuously evolves in explaining the exact chemical reactions that explain these positive effects, but it is already recognised that some nutrients from a dairy source have more beneficial effects than from other sources. A brilliant example of this is the digestibility of whey protein.

The health properties of whey protein

One of the major components of whey, its protein, is highly valuable and of excellent digestible quality for the human body. It is available on the market concentrated in specific 'recipes' prepared for the protein content: WPC35 or 70 would be whey protein concentrate with 35 or 70% protein content. Other typical products would be whey protein isolate or whey protein hydrolysate. As for many whey products, there is an array of more standardised products, but many much highly specific ones, often tailored for certain uses, exist as well.

Protein has a central role in human nutrition as is it the major structural component of all cells in the body. It is essential for growth and tissue repair, and for the production of enzymes essential for the correct functioning of the body. Protein from whey can be more easily and completely absorbed by the human body than protein of plant origin.

Milk and whey are a source of protein of high biological value, providing the human body with all the essential amino acids that it cannot produce by itself. Whey protein comprises part of the milk protein, and is composed predominantly of beta-lactoglobulin and alpha-lactalbumin. Other whey proteins include serum albumin, immunoglobulins (IgA, IgG and IgM), protease peptones, lactoferrin and transferrin. Each of these dairy proteins and peptides have been shown to have unique biological properties, and science is slowly discovering many more.

Today, the important role of milk and whey protein for bone health, heart health, weight maintenance and cancer prevention, and its positive effect on healthy aging and renal health are well established.

The complex and varied matrix of whey protein means a huge variety of products can be formulated with very specific and unique functionalities.

Consumer diets continuously evolve in time, shifting with lifestyles, needs or wishes, and, sometimes, new trends, based on new science or maybe sometimes even simple beliefs. Indeed, the times for whey protein look favourable. Dietary quality is being increasingly recognised, particularly by those taking part in intense physical exercise. The benefits of highly concentrated protein in building up muscle mass was initially recognised among bodybuilders but has now become widespread in the sports world.

Whey powders are highly soluble, making them easy for personal use or further processing. Whey protein concentrate has advantages in its quality, purity and also price. It has been recognised also in helping to recover and regenerate after exercise. It is now often incorporated into many types of sports foods, ranging from concentrated protein powders – with or without added flavours – sports drinks available in gyms and even regular supermarkets to snack bars for active people that can be found in many shops.

Specialised foods for different needs

Whey protein has also found a place in dietetic foods. Many diet replacements use whey proteins as a basis for the protein part of the diet, either for single meal replacements or even for the total intake. The digestibility and availability of the protein from whey is key to the success for these products.

Nutrition for the frail or vulnerable is another very special market in which whey proteins find strong purchase. Nutritional preparations for either premature infants, ill people of all ages, or the elderly with a bodily weakness are more often than not based on whey proteins. These very special foods are produced to adapt to weak organisms under very strict, nearly sterile, conditions. The composition of the ingredients allows the presence of highly valuable nutrients with easy digestibility in a highly concentrated form. These challenges in production are continuously further addressed by specialised whey product producers.

Similar in approach – and still with very strict legislative requirements – is the production of infant and follow-on formulas; here, the whey protein makes up the protein part of the diet appropriate for a baby.

Other applications take advantage of the nutritional quality but also the technical properties of whey protein in terms of high solubility, and easy emulsification and whipping functions in a food application. Thus, whey protein applications have been developed to allow egg replacement in bakery or confectionery; for ingredient use in meat or fish preparations; in prepared meals, soups and sauces; or even as protein base for vegetarian preparations imitating meat products.

Broad appeal

Those who might think whey protein foods are simply a specialised niche for high-resource families may be proven wrong by a new study. It shows that milk and whey protein is not only high quality but also one of the best sources for protein in relation to its price, and they are therefore of interest to support the healthy diets of a broad range of the population.

The array of opportunities for the use of whey would not be complete without mentioning the pharmaceutical products as a basic component of tablets and inhalers, or even drugs' active components. The use in feed materials, specifically for the specialised nutrition of young animals and as a nutrition enhancer, is also an important market for whey product manufacturers.

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Current dietary trends show a tendency towards higher protein content in diets while reducing carbohydrates. This becomes visible in an increasing amount of products on the market that are higher in protein than the 'regular' ones, be it strained yogurt, dairy, or non-dairy foods fortified with extra protein or protein supplements. The non-dairy foods show a wide and creative array of options, from cereal bars to prepared dishes or even ice cream. It is even possible to find recipes for home-made cakes high in protein.

Many people with active lifestyles or that do a lot of travelling recognise the ability of whey protein to allow healthy and natural, but also quick, food – a recent trend is to prepare fruit and vegetable smoothies in a mixer at home, with added protein powders, and thus have a fully balanced meal made in seconds. A connected and faster-moving lifestyle with a desire for simple and natural food will certainly further drive these often urban consumers in such directions.

The whey industry is composed of a good group of different producers of whey, whey powders and whey products, located across all of Europe. They serve local, European and global markets, and have developed different specialisations and products for business-to-business use as well as for direct consumer markets.

The story of whey has really only just begun. Whey has a firm place in today's world where the products fit into sustainable agro-food production and perform highly technical needs all in one.

Increasingly protein-centred diets and whey's very high-quality protein make a long-term trend in nutrition, for a broad population and for many specialised uses. Evolving science, and the whey product manufacturers' product and processing knowledge continually allow more specialised and specific applications – and the whey product producers are certainly willing to take on new challenges of further product developments for the future. ■