



# The benefits of whey

Researchers at **TEAGASC** are formulating antioxidant beverages based on bovine whey.

Whey is a milk protein prized for its health-promoting benefits. The biological value of whey is higher than egg and meat protein. Bovine whey contains the proteins  $\beta$ -lactoglobulin,  $\alpha$ -lactalbumin, bovine serum albumin, lactoferrin and immunoglobulins. Bovine whey provides a complete protein source, and is rich in sulphur-containing amino acids and branched chain amino acids. Demand for high-quality whey proteins is expected to increase as consumers realise their health benefits beyond the sports nutrition market. For example, food scientists have looked at whey as a potential antioxidant. Dietary antioxidants may help us to live longer in good health by reducing the incidences of neurodegenerative disorders, cancer and liver damage.

Here at Teagasc Food Research Centre Moorepark, we investigated the antioxidant activity of commercial whey products and whether this bioactivity survives gut transit. The ultimate aim of the project was to produce nutritional beverages enriched with whey that are suitable for the ageing consumer.

Of particular interest for the Irish food export market, we have generated powder products from these formulated beverages using spray drying.

## Antioxidant activity of whey after digestion

Commercially available whey products (such as whey protein isolate and whey protein concentrate) were subjected to *in vitro* simulated conditions of stomach and duodenal stages of digestion. We used three different methodologies to determine the antioxidant activity of

native and digested whey samples: oxygen radical absorbance capacity (ORAC); radical cation decolourisation assay (ABTS); and, ferric reducing ability of plasma (FRAP). The results obtained with ORAC assay showed that whey proteins, particularly  $\alpha$ -lactalbumin, exhibited antioxidant activities, which were increased during gut transit (**Figure 1**). These results were confirmed with ABTS and FRAP experiments.

To identify individual protein fragments (peptides), ultra-performance liquid chromatography/electrospray ionisation-high resolution tandem mass spectrometry (UPLC/ESI-HR-MS/MS) was performed. Interestingly, we observed that several known bioactive peptides were released during gut digestion, and these peptides exhibited antioxidant activity. It is, however, important to realise that although whey is antioxidant and this activity is comparable to other proteins, it is not as strong as other well-known compounds such as polyphenols or carotenoids. Although whey can be used in food products at much higher concentrations than these antioxidants, its activity is unlikely to be comparable to these compounds.

## Health benefits of whey peptides

Our studies also looked at which whey peptides and amino acids are transported across the intestinal barrier into the bloodstream to reach target organs like muscle and the liver. To do this, we optimised an *in vitro* model of the intestinal barrier, including enterocytes and mucus-producing cells (Caco-2/HT-29 co-cultures). These co-cultures are a good model to analyse bioavailability of food components. Bioavailability is defined as the portion of the digested food that reaches the blood circulation and is available to downstream target cells. Analysis of whey samples after absorption through the intestinal barrier model revealed not only amino acids but also several peptides. Some of these peptides were already known as bioactives but some were novel. We are now screening these



Elena Arranz and Alberto Corrochano are part of a team hoping to produce whey-enriched beverages that are suitable for the ageing consumer.

novel peptides for health benefits such as muscle repair, nerve health, weight management and cell antioxidant promotion.

### Whey-based beverages formulation

At pilot plant scale, we have also formulated whey-based beverages, suitable as a 200ml single serving for the elderly consumer. To boost antioxidants, we have combined whey in these formulations with plant polyphenols and algae carotenoids. Moreover, and of particular interest for the Irish food export market, we have generated powder products from these formulated beverages using spray drying. At present we are studying the antioxidant shelf life of the beverages and powder products.

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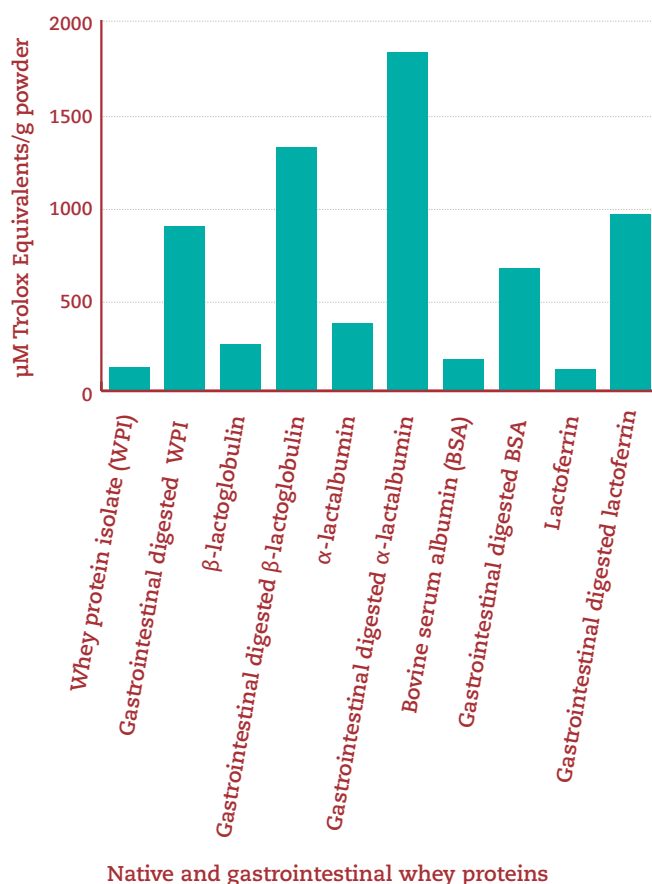
### Related publications

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Native and gastrointestinal whey proteins

FIGURE 1: Antioxidant results (ORAC assay) of native and gastrointestinal digested whey proteins.

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