

Casein and caseinates: new dynamics for an "old-school" product

Casein: an old-school product?

Caseins have been around for some time and became in many applications unrivalled and difficult to substitute. There are simply no other ingredients - dairy or from other origins - that can match the nutritional characteristics as well as the functional characteristics - sensory, emulsification, pH & heat stability for instance - of casein. They continue to grow and have become an invaluable ingredient for the food and nutrition industries worldwide.

The global casein and caseinates category traditionally used to be dominated by just a few players and new capacity mostly comes in the form of line extensions rather than new entrants into the market. Furthermore, market developments used to be overall gradual rather than dynamic but this can only be an assumption rather than a fact as public data about the product category are scarce. However, over the last decade a couple of new market developments have injected new life into this versatile product category:

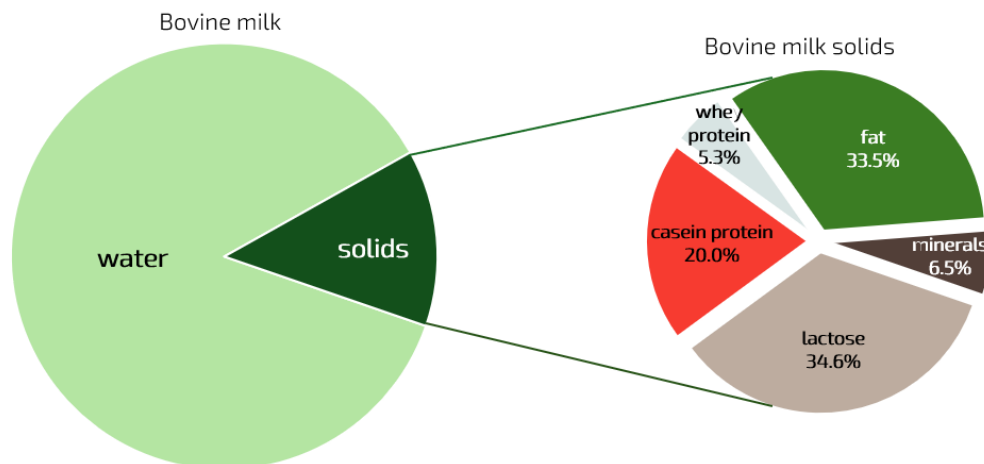
- China is quickly becoming a significant importer of both casein and caseinates;
- Casein became a popular alternative destination for skimmed milk when the changing dairy trade balance between New Zealand and China created a global surplus in SMP;
- Milk Specialties Global became the first major producer of casein in the US;
- Micellar casein is quickly gaining popularity as an ingredient of sport nutrition.

If all of this doesn't already provide enough interesting developments, recently Leprino Foods announced to have signed an exclusive agreement with Rotterdam-based Fooditive Group to commercialize non-animal casein worldwide. However, we will stick to dairy in this Dairyntel Insight and briefly touch upon the new dynamics in the global casein and caseinates category.

But first, a bit of technological background on casein and caseinates

Casein proteins are the most abundant proteins in milk representing about 80% of all the proteins.

Figure 1. Average composition of bovine milk



Commercially available products in the casein category are; Rennet Casein, Acid Casein, Caseinates, and Micellar Casein Isolate (MCI):

- **Rennet casein** is manufactured by the renneting of skim milk and is in effect non-fat dried cheese solids. It is used widely in the manufacture of imitation and processed cheese as well as for the fortification of milk in cheese making.
- **Acid casein** results from the coagulation of skim milk using a pH adjustment. Acid casein is used in processed cheese, but also widely applied in fat emulsifications such as coffee creamers and whipped toppings. Acid Casein is insoluble and is often converted to a soluble form known as Caseinate. The most common caseinates are Sodium Caseinate and Calcium Caseinate. Caseinates are prized for their solubility, stability, functionality (gelling, water-binding etc), and nutritional properties and consequently they are used in a wide variety of nutrition and food applications including medical nutrition, processed meats, yogurt stabilizers etc.
- **Micellar Casein Concentrate/Isolate (MCC/MCI)** are relatively newly developed products resulting not from the coagulation of skim milk but from the use of membrane technology to separate the various components of skim milk. This gives MCC/MCI some unique functional and nutritional properties. MCC can be used to enrich milk prior to cheese making or to improve structure in cream cheese products. MCI is used in liquid medical nutrition products where it facilitates a very high protein/serving level.

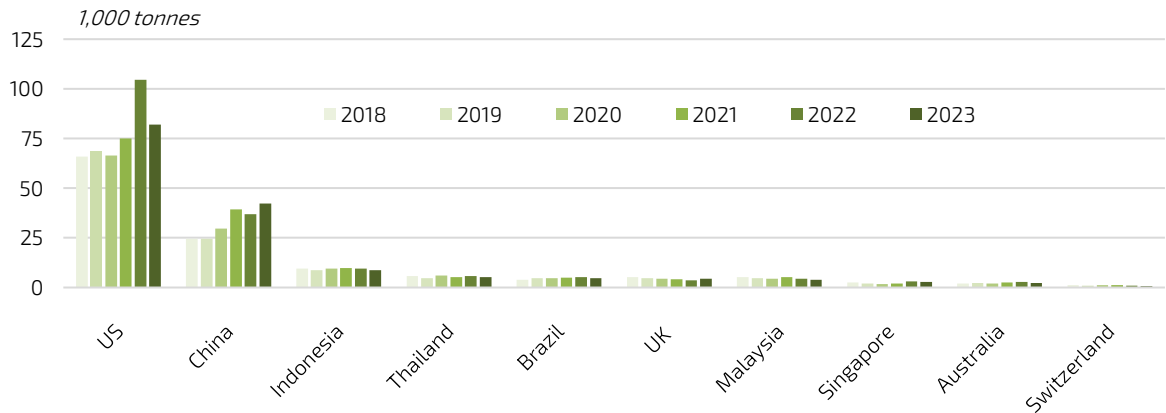
Caseins/caseinates are a very versatile product group with many non-food applications as well, such as high-quality paper and specialty cements for stucco work for instance. It is important to note that as with any dairy fractionation process the nature and value of the by-products is a critical aspect of any successful casein manufacturing operation. The whey from rennet casein is equivalent to sweet whey from cheese manufacture and as such can be processed with the cheese whey. However, the whey from acid casein, caseinates, and MCC/MCI is quite different in composition and functionality and should be processed separately and marketed in other markets.

China may soon overtake the US as the number 1 importer

As a result of China's increasing level of dairy technology and application expertise the country is changing its import profile from mainly dried whole milk to single ingredients. The country's rapid progress in terms of using single dairy ingredients for all kind of food – and some non-food – applications has caused a strong increase in the imports of casein and caseinates.

In 2023 China was already the second biggest importer after the US and import data of the January- May 2024 period indicate another 50% increase to 23 thousand tonnes in these 5 months alone. If this trend continues China could overtake the USA as the number 1 importer of casein and caseinates in about three years. Also because the US now also has its first major domestic manufacturer as we will see later in this article.

Figure 2. Import volumes of casein and caseinates in the top-10 import countries



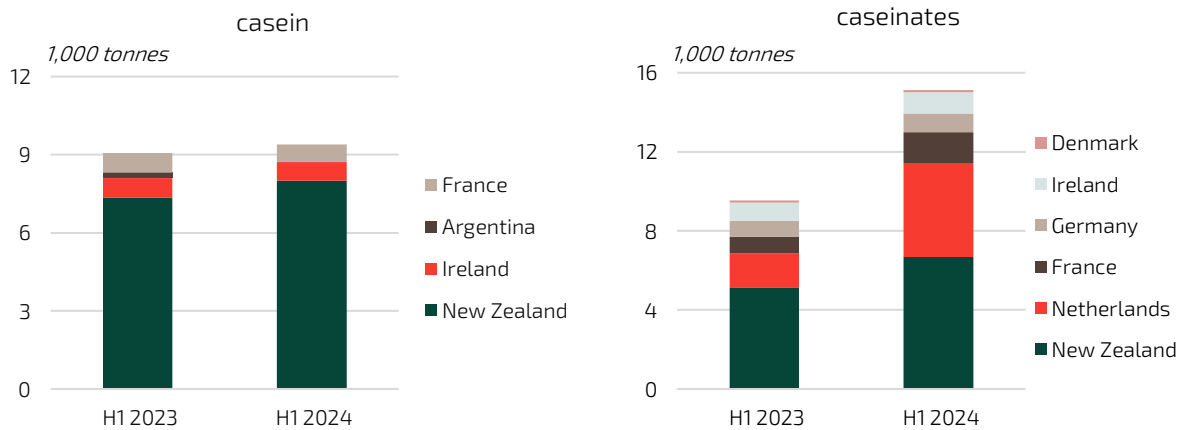
Source: Dairyntel analysis, 2024

Global milk protein surplus turns casein into an attractive alternative

After 2021 China's imports of whole milk powder (WMP) deteriorated rapidly, which freed up about 400 thousand tonnes of WMP for alternative destinations. This caused China's main trading partners to start looking for alternative outlets for those volumes of milk fats and proteins. It turned out that finding alternative destinations for milk fats was a relatively easy job. Even to this day the global market for butter and butteroil is remarkably tight and every additional volume is welcomed at elevated prices. Finding alternative destinations for the skimmed milk residue turned out a much harder job. Producing casein and caseinates from these surplus skimmed milk volumes was a welcome alternative to the very competitive and crowded SMP market. As a result the casein market ended up out of balance in 2023 with elevated stocks and low prices. Things have improved somewhat in 2024, but the market remains oversupplied to this day.

If we look at the first half year of 2024 compared to H1 of 2023 then figure 2 clearly indicates that China's growing demand for casein and particularly caseinates caused countries like New Zealand, the Netherlands and France to divert skimmed milk volumes away from their SMP-dryers towards their casein and caseinates lines.

Figure 3. China's import volumes of casein and caseinates by origins



Source: Dairyntel analysis, 2024

A new entrant in the US

Milk Specialties Global (MSG) who have been an established manufacturer of dairy based ingredients for the food industry announced the completion of its new casein and caseinates production facility in Jerome in August 2023, "providing North American customers with an domestic alternative to their imported casein and caseinates" in the company's own words. MSG's new Jerome facility will process 2.5 million pounds of milk per day from its partner Magic Valley Quality Milk, a raw-milk cooperative that will supply the skimmed milk. Apart from the growing demand for casein and caseinates in the global market and Asia in particular, the business model appears to make perfect sense due to a couple of characteristics of the US market:

- The US have always been a major destination of both casein and caseinates coming from New Zealand, Ireland, France and the Netherlands mostly. MSG is probably right when it states that North American customers will appreciate an alternative local source, although it may take the company some time to build to quality standards of the US' long term suppliers in New Zealand and the EU
- The US have always been a net surplus market for skimmed milk so sourcing the required volumes of skimmed milk at favorable prices should not be a major challenge in the US market

New technological developments

MSG is one of a growing number of processors that use microfiltration to extract micellar casein and whey directly from fresh milk. With the growing demand for bespoke application-oriented protein formulations in performance nutrition comes the desire to create more flexibility in the conversion of milk into single proteins, fats and lactose. The traditional processing routines that focus on cheese making and butter manufacturing do not always guarantee the required quality standards for performance nutrition applications. Extracting single proteins straight from the milk source is obviously a very interesting technological development, also in a country like China where the demand for whey proteins outpaces its cheese making capabilities.

All in all, it seems like quite an understatement to call casein an old-school product these days. Casein and caseinates seem to be right at the heart of a number of dynamic developments that are reshaping priorities in milk processing as well as the valorization of the different components of milk.

If you are interested in our in-depth market insights or data underlying this analysis, please feel free to [contact us](#).