



Lactose-free dairy for special diets

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Dairy products including milk, cheese, and yoghurts made from cow, sheep, goat or buffalo milk can represent a key part of a balanced healthy diet. Dairy foods are rich in protein, calcium and vitamins, which our bodies need to grow and stay strong. Milk-based drinks and foods taste great on their own, and dairy ingredients are found in many of our favorite savory and sweet recipes, from Mac`N`Cheese to ice cream. Dairy-based nutritional formulas are also important sources of nourishment for infants, while powdered and liquid supplements represent a convenient boost for athletes or individuals of any age with special dietary requirements.

Most of us don't think twice about reaching for a thirst-quenching glass of cold milk or a pot of our favorite yoghurt snack. However, for some people consuming dairy products causes unpleasant abdominal symptoms, such as bloating, nausea, gas and diarrhea. This is because they can't digest lactose, which is the main carbohydrate in milk.

Lack of lactase

Lactose makes up about a third of the dry composition of milk, but it can't be directly absorbed by the digestive system. The carbohydrate is a disaccharide, which means it is composed of two component sugars, glucose and galactose. The digestive enzyme lactase produced in the small intestine has the job of breaking dietary lactose into glucose and galactose, which can then be absorbed by the intestine. People who don't produce enough lactase and so can't break down all the lactose they consume may suffer the unpleasant abdominal symptoms when they eat or drink lactose-containing dairy foods.

The food pyramid



A healthy diet should include a wide variety of food types

Lactose intolerance in adults most often occurs because our bodies naturally start to produce less lactase after infancy, when our bodies rely less on milk as a primary food source. In some cases, injury or disease can also temporarily stop lactase being produced by the small intestine. And in very rare cases infants are born with defective lactase gene, so they don't produce any lactase and need lactose-free nutritional formulas from birth.

It's important to understand that lactose intolerance isn't the same as a milk allergy, which is an immune response to cow's milk protein. And while the symptoms of lactose intolerance cause considerable discomfort, they aren't dangerous. Many people with some degree of lactose intolerance still produce a small amount of lactase and so can continue to consume a limited amount of dairy products without suffering. Nevertheless, they might avoid consuming dairy products completely, which means they may be missing out on an important source of nutrition.

Estimates suggest that about two thirds of people in the world have a reduced ability to digest lactose after infancy¹. There are trends tied to ethnicity, with lactose intolerance most often occurring in populations that traditionally do not consume a lot of dairy foods. On the other hand, lactose intolerance is less common in populations that have relatively dairy-rich diets¹. U.S. National

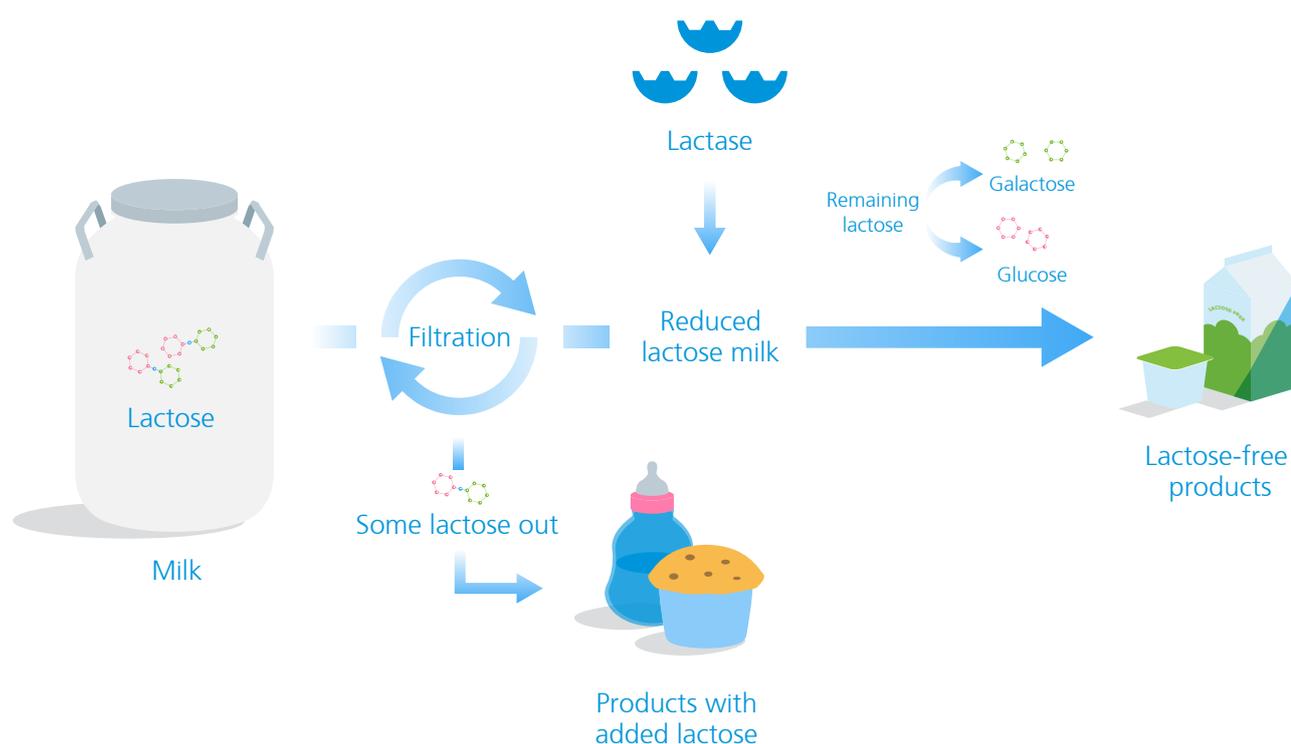
Institutes of Health figures¹ suggest that only about 5% of people in Northern Europe are lactose intolerant, for example, whereas the condition may affect upwards of 90% of adults in some East Asian communities.

Making lactose-free dairy, naturally

The dairy industry now produces a wide range of lactose-free milks, dairy-based nutritional powders, yoghurts, butter, creams and ice creams, so that people of every age who have some degree of lactose intolerance can still consume their favorite products and have access to an important nutritional food group. It's a diverse and expanding global market, which industry commentators estimate could be worth US\$ 17.8 billion by the end of 2027².

So how do manufacturers produce lactose-free versions of our favorite dairy products? The simplest way is to add the enzyme lactase to milk so that the lactose is split into glucose and galactose before we eat or drink it. However, leaving all the lactose in the milk and just adding lactase results in products that we perceive as sweeter tasting, because the galactose and glucose components taste sweeter than lactose itself. Getting the flavor right is one of the major challenges for producers of low-lactose or lactose-free milk and dairy products.

Production of lactose free products



Today's modern plants remove some of the lactose from milk before adding the lactase. This results in a final product that has a perceived sweetness that more closely mirrors that of lactose-containing products. Consumers may not be able to distinguish any difference in the taste of lactose-free milk and dairy products compared with those made with lactose-containing milk.

The process involves skimming and pasteurizing the milk, and then passing it through filtration plants to remove a proportion of the lactose. A variety of different filtration methods can be used, including microfiltration, nanofiltration, ultrafiltration and reverse osmosis. GEA has specialist expertise in milk processing and works with milk producers and dairy manufacturers worldwide to configure reliable separation and filtration systems. Our solutions can be tailored for efficient fractionation of milk components, which are used in products such as drinking milk, yoghurt and dairy ingredients.

Smart solutions for lactose-free products

We have developed a wide range of processing equipment for manufacturing reduced lactose or lactose-free milk and dairy products. Our portfolio includes a versatile microfiltration, ultrafiltration, nanofiltration and reverse osmosis systems, which are the most commonly used filtration systems for the process of removing lactose. The liquid milk passed through the filtration membranes, which capture the proteins and the majority of other components, but let the lactose pass through.

Filtration and separation processes can, however, also capture some of the calcium. Another big challenge for manufacturers is ensuring that the balance of calcium in the final product remains as close as possible to that of whole milk, so GEA is partnering with industry to develop processes with minimum impact on the calcium and mineral balance in lactose-free milk-based foods.

We also design and install technologies for producing lactose-free, extended shelf-life (ESL) milk, which has a shelf-life of up to 40 days under refrigerated conditions, and UHT milk that can be stored without refrigeration. These products can potentially represent a lifeline for infants, children and adults in regions where access to lactose-free dairy foods is infrequent, or where refrigerated transport and storage is problematic.

The development of state-of-the-art processing technologies and solutions is helping industry to manufacture high quality, nutritious dairy foods for a global population that has special dietary needs. At GEA we are working hard to stay at the forefront of technology innovation, so that our components, equipment and processes can help to ensure efficient, sustainable manufacturing for this and future generations.

1. <http://ghr.nlm.nih.gov/condition/lactose-intolerance#statistics>

2. <http://globenewswire.com/news-release/2018/04/26/1487975/0/en/Lactose-Free-Dairy-Products-Market-will-reach-at-a-CAGR-of-5-3-from-2017-to-2027-Future-Market-Insights.html>