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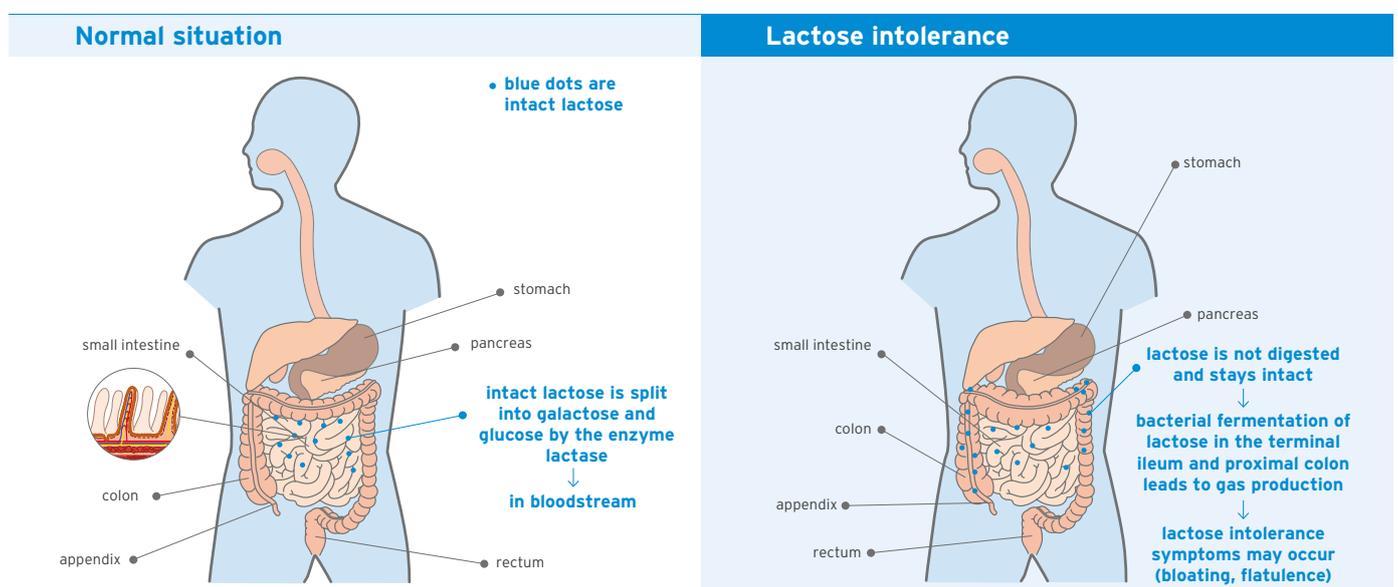
## Lactose intolerance

Many Europeans and some populations in Africa, the Middle East and Southeast Asia can digest lactose throughout life thanks to the presence of the enzyme lactase in the small intestine. This is called lactase persistence. Most people who cannot digest lactose can tolerate 12 grams of lactose per moment of consumption and 24 grams when spread throughout the day and taken with other foods (Bayless et al., 2017; EFSA, 2010; Wahlqvist, 2015). This is equal to a large glass (about 250 ml) of milk. Yoghurt contains less compared to milk and semi-hard cheeses hardly contain any lactose.

### Lactose intolerance

At birth, almost every infant produces enough lactase to digest the lactose in breast milk. The production of lactase decreases gradually after the age of 3 years. Lactose, a disaccharide, is split into 2 monosaccharides - glucose and galactose - by lactase in the small intestine. When lactase is not sufficiently produced, lactose will not be split or taken up in the small intestine. Instead, it ends up in the lower part of the small intestine, and the beginning of the colon. Residing bacteria ferment the lactose, resulting in gas formation which can cause symptoms such as bloating and flatulence after lactose ingestion (Malik et al., 2024; Misselwitz, 2019). A part of the world's population is able to tolerate lactose as they have a genetic variation that ensures they continue to produce sufficient quantities of the enzyme lactase after childhood (Fabre et al., 2023; Heyman, 2006; Malik et al., 2024; Schaafsma, 2008; Storhaug, 2017).

**FIGURE 1** Normal situation and presentation in people with lactose intolerance



## Types of lactose intolerance

A distinction is made between three forms of lactose intolerance: primary, secondary and congenital. Primary lactose intolerance is the most common form (Heyman, 2006; Szilagyi, 2019).

### Primary lactose intolerance

Virtually every baby is born with the ability to produce sufficient lactase to digest the lactose in breast milk. Following the introduction of other foods, this lactase production gradually decreases in people with this form of lactose intolerance. It decreases so strongly that a lactase deficiency eventually occurs. The decreasing lactase production is caused by hereditary factors and - depending on ethnicity - takes place between the ages of 2 to 20 years and does not always result in symptoms. A person is said to suffer from primary lactose intolerance if symptoms develop with dairy consumption of 1 to 3 glasses of milk per day (Heyman, 2006; Schaafsma, 2008).

### Secondary lactose intolerance

Secondary or acquired lactose intolerance means that the person has a shortage of lactase due to damage to the intestinal mucosa. This damage can have various causes, namely:

- Infections such as gastro-enteritis, following radiotherapy or intestinal surgery, untreated coeliac disease, intestinal parasites or a virus (such as rotavirus)
- Bacterial overgrowth in the small intestine following a resection of the small intestine or a stenosis
- A period of malnourishment
- The damaging effect of medication (such as antibiotics) or alcohol on the intestinal mucosa.

The digestion of other disaccharides may also be affected in the presence of secondary lactose intolerance. In the case of damage to the intestinal wall, the lactase activity is the first to be affected and the last to recover. The lactase activity is usually fully or partially restored during recovery of the intestinal mucosa (Heyman, 2006; Usai-Satta, 2022).

### Rare congenital form

Thirdly, there is also a rare congenital form of lactose intolerance (congenital lactase deficiency). In this case, lactase is absent from birth. The condition persists for life and occurs mainly in Finland. These people have a lactase activity of 0-2% at birth, meaning that they also do not tolerate breast milk. This condition can be fatal without correct management (Szilagyi, 2019).

### Prevalence

Approximately two thirds of the world's population suffers from lactose maldigestion or lactose malabsorption. The actual



prevalence of lactose intolerance is lower, but difficult to determine due to the absence of an objective measurement method. In Europe, 25% of the population struggles to digest lactose in the intestines (Kranen, 2013). Most Caucasians have the unique characteristic of maintaining lactase activity throughout their lives. People from other ethnic backgrounds are genetically programmed to decrease or stop producing lactase after they have been weaned (Schaafsma, 2008).

### Diagnosis

Symptoms of lactose intolerance can include abdominal pain, feeling bloated, nausea, diarrhoea or flatulence caused by the amount of undigested lactose in the intestines. The diagnosis of lactose intolerance is usually determined using a hydrogen breath test. In people with a mild form of lactose intolerance, this is a good method that is non-invasive. You can also opt for a diagnostic lactose-restricted diet. If a positive effect is observed, the recommendation is to introduce lactose into the diet again in order to rule out the placebo effect of a lactose-free diet and to confirm the diagnosis (Catanzaro, 2021; Heyman, 2006). A meta-analysis reveals that clinical symptoms (abdominal pain, diarrhoea) or self-reporting are not reliable indices for the diagnosis of lactose intolerance (Jellema et al., 2010).

### Dietary advice

A lactose-restricted or lactose-free diet forms the basis of management for lactose intolerance. The degree of restriction depends on the quantity of lactose that a person can tolerate (Lomer, 2007; Montalto, 2006). Most people do not need to stop consuming milk or dairy products altogether, since the majority are able to tolerate 12 grams of lactose as a single dose (EFSA, 2010; Heyman, 2006; Janssen-Duijghuijsen et al., 2024; Shaukat et

al., 2010; Ugidos-Rodrigues, 2018). This equates to approximately one large glass (250 ml) of milk. According to the European Food Safety Authority, it is important to be certain that a person is lactose intolerant before recommending a 'low-lactose' diet by elimination of milk and dairy products. It also states that avoidance of dairy products, without a proper supplementation strategy or other dietary adjustments, may result in low intakes of calcium, vitamin D and riboflavin (vitamin B2) (EFSA, 2010). Milk naturally contains essential nutrients that the body needs: proteins, vitamins B2 and B12 and minerals such as calcium. Fermented dairy products such as yoghurt, buttermilk and low-fat soft cheese often contain less lactose than milk. This is due to the fact that the lactic acid bacteria in these products have already broken down some of

the lactose (Heyman, 2006). Lactase-producing lactic acid bacteria are required for the production of yoghurt; they break down some of the lactose in the milk. Hard cheeses - such as Edam, Gouda, Maasdam or Cheddar - contain virtually no lactose (Schaafsma, 2008). Lactose-free dairy drinks are also an option. These drinks are available in most supermarkets and contain in general less than 0.1% lactose. If a diet including these products does not provide all the required nutrients, then nutrient-enriched products (including soy drinks) or supplements can be used to ensure a balanced diet. Studies have shown that pre- and probiotics may have a positive effect on lactose tolerance (Ahn et al., 2023; Angima et al., 2024; Catanzaro et al., 2021; Ibrahim et al., 2021; Leis et al., 2020; Mysore et al., 2023; Oak et al., 2018; Saleem et al., 2024).

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## Important note

Breastfeeding is the best nutrition for healthy growth and development of babies. Exclusive breastfeeding for six months is the optimal way of feeding infants. Thereafter infants should receive complementary foods with continued breastfeeding up to two years or beyond. Mothers should receive guidance on proper maternal nutrition in order to help sustain an adequate supply and quality of breast milk. Unnecessary introduction of bottle-feeding, partially or fully, or of other complementary foods and drinks may have a negative impact on breastfeeding, which may be irreversible. Mothers should consult their doctor and consider the social and financial implications before deciding to use breast milk substitutes or if they have difficulty breastfeeding. Usage, preparation and storage instructions of breast milk substitutes or of other complementary foods and drinks should be followed carefully as improper or unnecessary use may pose a health hazard.

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