

Dairy food for people with lactose intolerance

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What is lactose intolerance?

Lactose is the natural sugar in mammalian milk. It is a disaccharide (two joined sugar molecules) consisting of a glucose unit and a galactose unit. Ordinary cane sugar is mainly sucrose, which is also a disaccharide consisting of a glucose unit and a fructose unit.

Lactose requires an enzyme, lactase, to split the two sugar units before they can be absorbed into the body. The lactase enzyme is on the surface of the mucosa of the human small intestine. Production of the enzyme is vulnerable to conditions affecting the mucosal brush border (like infection), causing secondary lactase deficiency. Primary lactase deficiency in adult life is also known as genetically determined lactase non-persistence (LNP). This is the 'normal' human condition. It's much more common than lactase persistence, where adults have the continuous ability to produce high levels of lactase. Lactase persistence is a result of a number of distinct genetic mutations.¹ The common condition of LNP is the natural decline in intestinal lactase, leaving minimal lactose digestion ability.²

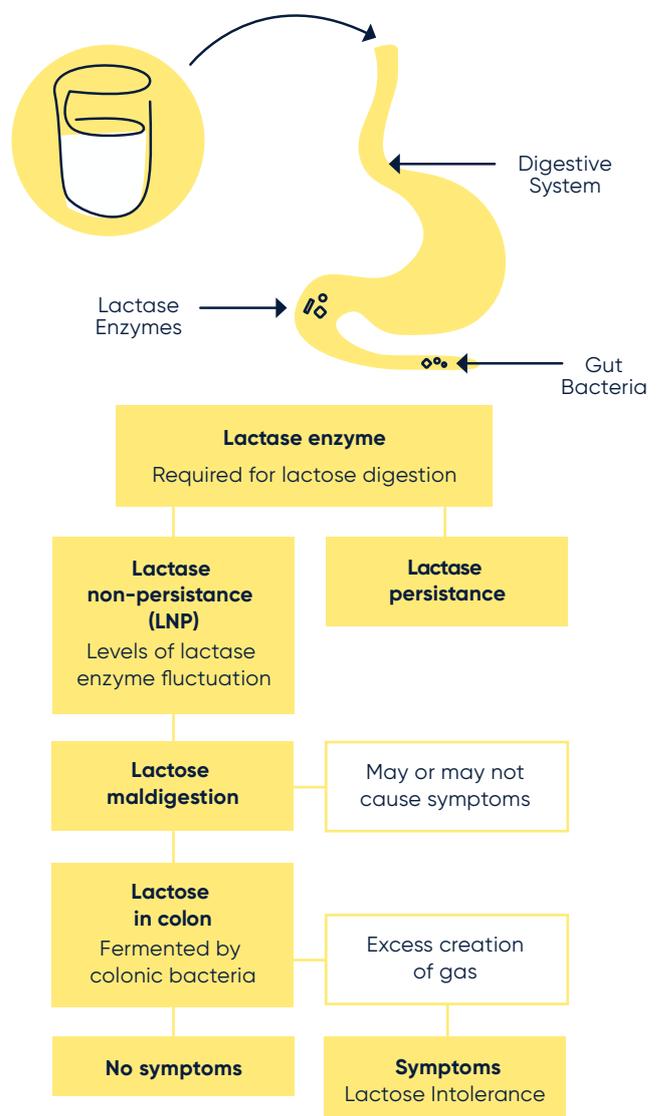
LNP is common, affecting two-thirds of the world's adult population, with regional variations. In Western, Southern and Northern Europe (and people with this heritage), the adult prevalence ranges from 19 per cent to 37 per cent.³

Lactose maldigestion is defined as the inability to digest lactose regardless of cause, resulting in undigested lactose reaching the colon.

Importantly, lactose maldigestion may, or may not, cause symptoms.

Lactose intolerance is characterised by lactose maldigestion, where lactose reaches the colon, however with unpleasant gut symptoms. These symptoms can include flatulence, gas, bloating, cramps, diarrhoea and (rarely) vomiting. For lactose intolerance to be diagnosed, these symptoms must not be present when a placebo is administered instead of lactose.⁴

Lactose maldigestion and intolerance



The symptoms of lactose intolerance occur when undigested lactose reaches the large intestine where it is fermented by colonic bacteria. When this occurs, hydrogen, methane and carbon dioxide gases are produced. When excessively produced, these gases can cause abdominal distension (bloating), excessive flatulence, abdominal pain and gut cramping. The lactose present in the intestine can also create an osmotic load which draws water and electrolytes into the intestine from the body. This can cause loose stools and a rapid transit time (diarrhoea).



The symptoms of lactose intolerance typically occur between 30mins and two hours after consuming a lactose load.

For people who have LNP, there is substantial variation in the symptoms of lactose intolerance. The symptoms of lactose intolerance resulting from LNP rarely appear before the age of five years.⁵ In younger children, lactose intolerance most often has other causes.

Neither having lactose maldigestion nor the perception of lactose intolerance are sufficient to identify people with true lactose intolerance. Many people who self-report that they are lactose intolerant are found not to be so.

Not all people with diagnosed lactose maldigestion respond to lactose doses with gastrointestinal symptoms. Also, some people who are lactose maldigesters and respond to lactose with symptoms, also respond adversely to milk without lactose. This means they are milk intolerant for reasons other than the lactose content of milk⁶. This is relevant because gastrointestinal symptoms after milk consumption aren't always due to lactose intolerance. Similarly, many people who self-diagnose themselves as lactose intolerant are neither lactose intolerant nor lactose maldigesters.

Why is lactose intolerance a problem?

The symptoms of lactose intolerance are very unpleasant, to the extent that most people would want to avoid them. Lactose is found mainly in milk and dairy products, but also in many manufactured foods and medications^{7,8}.

Many people self-diagnose lactose intolerance when this is not the reason for their symptoms.

If they are restricting their dietary behaviour on this basis, they may therefore have the wrong nutrient focus. However, a placebo effect has also been seen^{9,10}. This is where typical lactose intolerance symptoms can occur without malabsorption, possibly due to negative expectations causing real symptoms.

The impact of lactose intolerance, or perceived lactose intolerance, is generally that people avoid dairy foods. This has been identified by the US National Institutes of Health as the main health impact of lactose intolerance⁴.

This type of restricted diet can result in suboptimal nutrition, reduced eating pleasure and may affect social interaction. A recent meta-analysis¹¹ found that postmenopausal women with primary lactase deficiency had lower bone mineral density compared to healthy controls. Z-score of bone mineral density is the accepted measure in clinical practice to assess the risk for bone fracture.

In general, people who suspect they have lactose intolerance should ensure an accurate diagnosis of their condition.

They should be aware of dietary strategies for symptom control that allow them to consume a wide range of foods.

Dietary management of lactose intolerance

Factors relevant for controlling lactose intolerance symptoms include lactose content, gastrointestinal adaptation, gastrointestinal transit factors and consuming yoghurt.

Individual responses to lactose vary due to differences in gastrointestinal transit, gut bacteria, mucosal function, and symptom sensitivity.

People who experienced severe lactose intolerance symptoms may develop a learned aversion, worsening symptoms due to negative expectations. This is also known as a 'nocebo' effect.

Lactose content of foods

Each person has a lactose dose that can overwhelm the lactase system, leading to lactose intolerance symptoms.



250mL of milk may be well tolerated by people with lactose intolerance.

Those with lactose intolerance can tolerate approximately 12g lactose in a single dose, the amount in one cup of milk. Over a full day (in divided doses), it has been stated that approximately 18 g of lactose can be tolerated.^{12,13,14}

Cow's milk is also produced and available that is lactose free, or very low in lactose. Lactose is usually removed by adding lactase. This breaks lactose down into its constituent sugars, resulting in a milk that tastes sweeter. Milk substitutes from non-dairy sources do not usually contain lactose – this sugar is only a natural part of mammalian milks. In dairy foods other than milk, the lactose content varies according to the method of production.



**Hard & matured cheese:
Low lactose content**



**Soft cheese:
Higher lactose content**

Hard and matured cheeses usually have a lower lactose content than softer cheeses. This is because lactose is lost when whey is removed and the maturation process uses up lactose.

The lactose dose ingested depends on the concentration of lactose in the food, and the amount of the food consumed. Table 1 shows typical lactose amounts in foods¹⁴.

Many medications contain lactose as a 'filler'. The amount is insufficient to cause lactose intolerance symptoms, but a higher cumulative dose from multiple medications is possible.

One method of reducing lactose content of milk at the point of production (enzymatic hydrolysis) is also available to consumers. Additionally, lactase preparations can be taken in tablet form at the time of consumption.¹⁵

Gastrointestinal adaptation

Several studies have indicated an improvement in lactose intolerance symptoms following gradual introduction of lactose containing foods. The deficient lactase production cannot be stimulated, and a beneficial effect of colonic bacterial adaptation is proposed^{14,16}.

Changes to colonic microbial species is seen with (for example) a daily of milk. However, the improvement in symptoms could be for other reasons. For example, a placebo effect from becoming more used to measurement procedures, symptom sensitivity reduction, or changed psychological response. The role of colonic adaptation is an area for future research.

Gastrointestinal transit time



Spread dairy intake over the day



Consume dairy foods as part of meals.

Co-ingested foods that slow gastrointestinal transit can reduce lactose intolerance symptoms by extending the time lactose enters the colon.

It is suggested that people with lactose intolerance should consider regular-fat milk and consume milk with meals.

Another important strategy is to avoid consuming milk with foods which may increase gut transit (like caffeine or chili peppers).

Table 1 Lactose content of some food products (from Corgneau et al, 2017)

Food	Lactose (g/100g)	Serving size (g)	Lactose per serving (g)
Whole milk	5.04	244	12.32
Greek yoghurt	2.54	170	4.32
Cheddar	0.18	132	0.24
Mozzarella	0.07	112	0.08
Sour cream	2.91	12	0.35
Multi-grain bread	0.56	28.35	0.16
Chocolate cake	0.46	138	0.63
Energy drink (flavoured)	0.20	30.5	0.06
Cheeseburger (double)	0.39	280	1.09
Salad dressing	1.40	15	0.21
Cheese lasagne	1.00	225	2.27
Vanilla pudding	1.80	28.35	0.51
Chocolate bar	8.21	42	3.45
Fish sticks	0.12	57	0.07

Yoghurt

Yoghurt's lactose is digested efficiently due to its bacteria, aiding digestion more than other dairy sources.¹⁷ The lactase in yoghurt fermenting bacteria survives the acidic conditions of the stomach. This could be because lactase is protected within bacterial cells and aided by yoghurt's buffering capacity. Yoghurt's pH change in the small intestine activates bacterial lactase, digesting lactose sufficiently to prevent symptoms in intolerant people.



Yoghurt contains 'good' bacteria that helps to digest lactose.

Conclusion

Lactose maldigestion in adults is the dominant condition in most parts of the world, arising from LNP.

Many adults with LNP have lactose maldigestion, but are not lactose intolerant.



The main health impact of lactose intolerance is stated to be the negative impact of avoiding milk and dairy foods.

Both people with diagnosed lactose intolerance and perceived lactose intolerance tend to avoid milk and dairy foods.

Most people with lactose intolerance can consume 12g in a single dose with minimal symptoms, or 18g over a day. Regular milk is relatively high in lactose and may be consumed in smaller doses. Other dairy foods, like yoghurt, cheese and lactose-free milk are lower in lactose and can be consumed in higher amounts.

People with lactose intolerance should consume dairy foods in relatively small amounts, spread throughout the day and with other foods.



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