

# DAIRY FOOD FOR PEOPLE WITH LACTOSE INTOLERANCE

Dr Malcolm Riley & Dr Jane Bowen

## WHAT IS LACTOSE INTOLERANCE?

Lactose is the natural sugar in mammalian milk. It is a disaccharide (2 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 (the lactase enzyme) 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 therefore vulnerable to conditions impacting on the mucosal brush border (such as severe infection) resulting in secondary lactase deficiency. Primary lactase deficiency in adult life, or genetically determined lactase non-persistence (LNP) is the 'normal' human condition, and much more common than lactase persistence (where adults have the continuous ability to produce high levels of lactase throughout adult life) which results from a number of distinct genetic mutations<sup>1</sup>. The common condition of LNP is therefore the natural decline in intestinal lactase to a low level which leaves adults with minimal ability to digest lactose<sup>2</sup>.

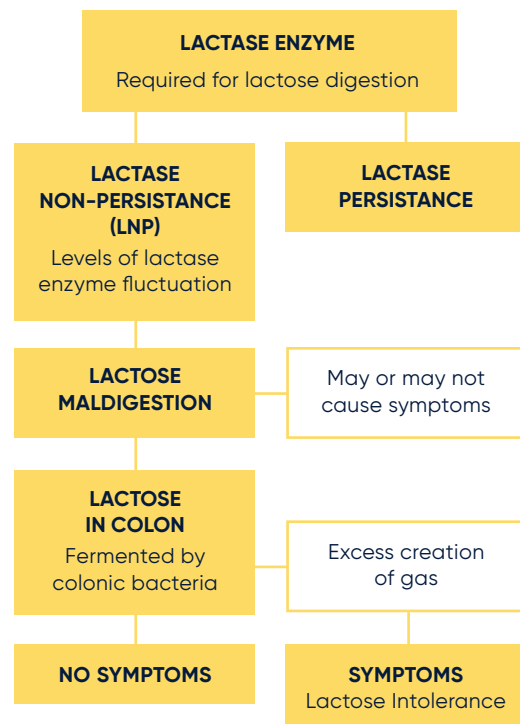
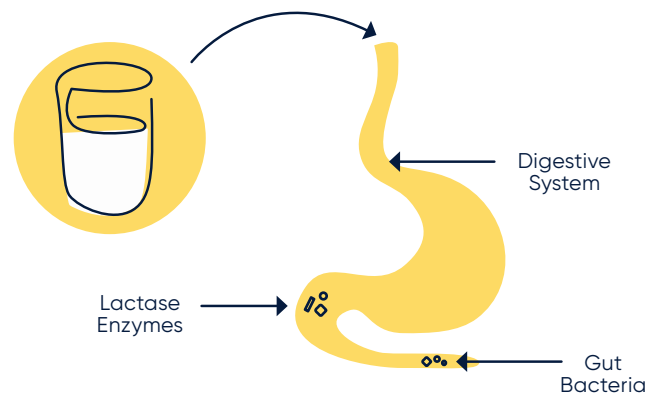
LNP is common, with an overall prevalence of two thirds of the world's adult population, but with a wide variation between regions. In Western, Southern and Northern Europe (and people with this heritage), the adult prevalence ranges from 19% to 37%<sup>3</sup>.

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 (LI) is characterised by symptoms resulting from the ingestion of lactose including flatus, gas, bloating, cramps, diarrhoea and (rarely) vomiting. For lactose intolerance to be positively diagnosed, these symptoms must not be present when an inert placebo is exchanged for lactose<sup>4</sup>.

## LACTOSE MALDIGESTION AND INTOLERANCE



The symptoms of lactose intolerance occur when undigested lactose reaches the large intestine where it is fermented by colonic bacteria with the production of gases such as hydrogen, methane and carbon dioxide. 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, and causes a loose stool and rapid transit time (diarrhoea).



## THE SYMPTOMS OF LACTOSE INTOLERANCE TYPICALLY OCCUR BETWEEN 30MINS AND 2HRS 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 5 years<sup>5</sup> – in younger children lactose intolerance most often has other causes.

Neither the fact of 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 shown to be lactose maldigesters and respond to a lactose dose with symptoms, also respond adversely to milk without lactose (i.e. they are milk intolerant for reasons other than the lactose content of milk)<sup>6</sup>. The relevance of this is firstly that the development of gastrointestinal symptoms after consumption of milk is not necessarily due to lactose intolerance (and therefore removal of lactose alone will not necessarily mitigate symptoms), and secondly many people who consider themselves 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<sup>7,8</sup>.

**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 nocebo effect has also been seen<sup>9,10</sup>. This is where typical lactose intolerance symptoms are experienced in the apparent absence of lactose malabsorption and thought to relate to the expectation of negative effects resulting in real symptoms.

The impact of lactose intolerance, or perceived lactose intolerance, is generally that people avoid dairy foods. In fact, this has been identified by the US National Institutes of Health as the main health impact of lactose intolerance<sup>4</sup>. This type of restricted diet may impact on eating pleasure and social interaction as well as raise health risks through suboptimal nutrition. For example, in a recent meta-analysis<sup>11</sup>, postmenopausal women with primary lactase deficiency were seen to have lower z-scores for bone mineral density at multiple sites, 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 also be aware of the dietary choices they have to control their symptoms while allowing consumption of a wide range of foods.

## DIETARY MANAGEMENT OF LACTOSE INTOLERANCE

Factors that are relevant for the control of symptoms of lactose intolerance are the lactose content of foods, the possibility of gastrointestinal adaptation, factors influencing gastrointestinal transit, and the special case of yoghurt. There is considerable individual variation in response to lactose containing foods because of individual differences in gastrointestinal transit, differences in the bacterial content of the gut, different gut mucosal function, and different sensitivity to the symptoms of lactose maldigestion. People who have previously suffered severe symptoms of lactose intolerance when consuming a food may have a 'learned aversion' to the same food where the expectation of a negative outcome may worsen any symptoms (also known as a nocebo effect).

## LACTOSE CONTENT OF FOODS

For every person, there is some lactose dose that will overwhelm the ability of the lactase system to digest the sugars with lactose intolerance symptoms resulting.



## 250ML OF MILK MAY BE WELL TOLERATED BY PEOPLE WITH LACTOSE INTOLERANCE.

For those with lactose intolerance, it has been concluded that 12g of lactose in single dose can be tolerated by the majority of people with lactose intolerance – this is approximately the amount of lactose in one cup (250ml) of regular milk. Over a full day (in divided doses), it has been stated that approximately 18 g of lactose can be tolerated.<sup>12,13,14</sup>

Cow's milk is also produced and available that is lactose free, or very low in lactose. Depending on how the lactose is removed, the milk may be sweeter than regular milk (when lactose is broken down into its constituent sugars, for example). 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 AND MATURED CHEESES:  
LOW LACTOSE CONTENT**



**SOFT CHEESES:  
HIGHER LACTOSE CONTENT**

Hard and matured cheeses usually have a lower lactose content than softer cheese 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 foods<sup>14</sup>.

Many medications contain lactose as a 'filler' however the amount is considered insufficient to cause symptoms to people with lactose intolerance, although higher cumulative doses through multiple medications are possible<sup>9</sup>.

One method of reducing the lactose content of cows milk at the point of production (i.e. enzymatic hydrolysis) is also available to consumers to use immediately prior to consumption, or taken in tablet form at the time of consumption<sup>15</sup>.

## 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<sup>14,16</sup>. While a change in colonic microbial species is seen with the introduction of (for example) a daily amount of 1 cup of milk per day, the apparent improvement observed could be due to other reasons – for example, a placebo effect from becoming more accustomed to the measurement procedures with time, a moderation in the sensitivity of individuals to adverse symptoms, or a changed psychological response to the food. 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.**

It has been suggested that co-ingested foods (which slow the gastrointestinal transit time) decrease lactose intolerance symptoms by reducing the amount of undigested lactose reaching the large bowel at any one time (i.e. extending the total time over which the lactose dose enters the colon). In this regard, it is suggested that people with lactose intolerance consume whole milk rather than fat reduced milk, preferably consume milk with meals, and avoid consuming milk with foods which might increase gastrointestinal transit (such as 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

The lactose in yoghurt is digested more efficiently than other dairy sources of lactose because the bacteria inherent in yoghurt assist with its digestion<sup>17</sup>. The lactase within the yoghurt fermenting bacteria survives the acidic conditions of the stomach, apparently because it is physically protected within the bacterial cells and is facilitated by the buffering capacity of yoghurt. The change in pH as the yoghurt enters the small intestine and a slower gastrointestinal transit time allows the bacterial lactase to be active, digesting the lactose in the yoghurt sufficiently to prevent symptoms in lactose intolerant people.

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.**



**YOGHURT CONTAINS 'GOOD' BACTERIA THAT HELPS TO DIGEST LACTOSE**

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

The majority of people with lactose intolerance are considered to be able to consume 12 grams of lactose in a single dose with only minimal symptoms, and up to 18 grams of lactose over a day. While regular milk is a relatively rich source of lactose and may be consumed in large doses, many dairy foods are much less concentrated and are consumed in small amounts.

## CONCLUSIONS

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

People with lactose intolerance are advised to consume dairy foods in relatively small amounts, spread throughout the day and preferably consumed with other food.



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