



Nutritional benefits of lactose and lactose derived products

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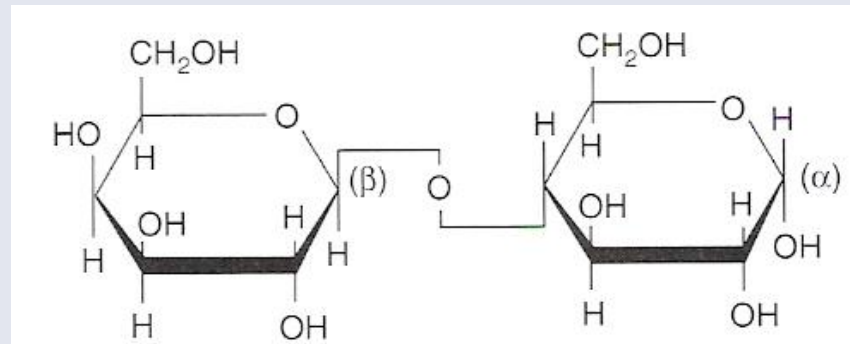


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Lactose in milk, yogurt and whey



Alpha lactose (4-O- β -D-galactosylpyranosyl- α -D-glucose)

Human milk	7	g/100 ml
Cow milk	4.6	
Yogurt	3.0	
Cheese whey	4.8	



Lactose digestion and metabolism

- 1. Break down into galactose and glucose by lactase (β -galactosidase).**
- 2. Active intestinal transport of glucose and galactose.**
- 3. Conversion of galactose into glucose in the liver (Leloir pathway).**

E1: galacto kinase

E2: galacto-1phospho-uridylyltransferase

E3: uridine-diphospho- 4-epimerase



Lactose intolerance

- | **Gastro intestinal symptoms (cramps, bloating, flatulence, diarrhea) upon the ingestion of lactose.**

- | **Depend on:**
 - è **Dose**
 - è **Lactase activity**
 - è **Type of food (solid vs. fluid)**



Terms related to lactose intolerance

- | Lactose malabsorption**
 - | Primary adult lactase deficiency**
 - | Primary adult lactase non persistence**
 - | Secondary lactase deficiency**
 - | Congenital lactose intolerance**
 - | Congenital lactase deficiency**
 - | Milk intolerance**
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Prevalence of adult primary lactase non-persistence (% adult population)

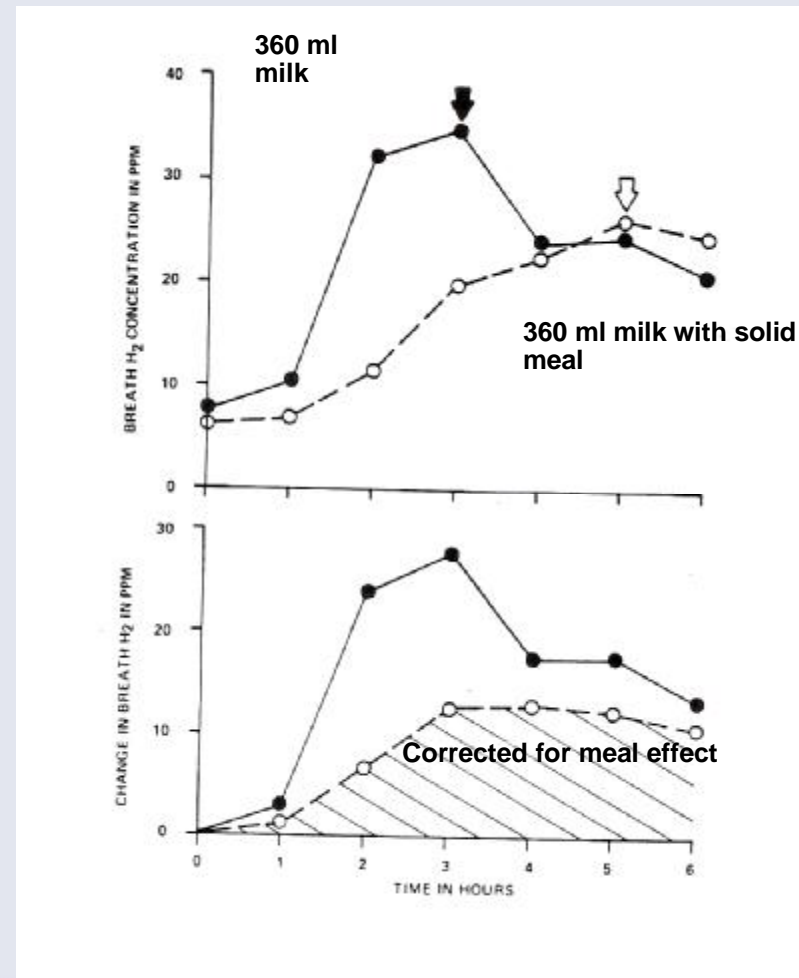
Table 2. Prevalence of adult primary lactase deficiency

France	30-40	India	60-65
Germany	15-20	Jordan	20-25
Russia	20-30	Israel	70-80
Finland	15-20	Israel, Jemenites	40-50
Sweden	< 5	North Am., Whites	10-15
Greece	70-80	North Am., Blacks	65-70
Ethiopia	80-90	North Am., Indians	85-90
Nigeria	80-90	Mexico	50-60
Nomadic Fulani	<10	Uruguay	60-65
Sudan	60-65	South Am., Indians	90-100
China	90-100	Greenland Eskimos	85-90
Japan	95-100	Australia, Aborigines	80-85

Data taken from Alm (2002)



Breath H₂ in lactose intolerant subjects





Impact of lactose intolerance

I Lactase deficient subjects can consume without adverse effects 10-15 g of lactose per day, if the lactose is:

è distributed over the day

è taken with solid meals



Nutritional benefits of lactose are in:

- | Sweetness**
 - | Cariogenicity**
 - | Glycemic index**
 - | Calorific value**
 - | Fiber-like and prebiotic activities**
 - | Mineral absorption**
-



Sweetness

Sweetness of some sugars, relative to sucrose =1

Sucrose	1
Glucose	0.6-0.7
Maltose	0.4-0.5
Sorbose	0.4
Xylose	0.6-0.7
Lactose	0.2-0.4
Fructose	1.3
Galactose	0.5-0.7

From Schaafsma (2002)



Cariogenicity

- | Less cariogenic than sucrose
- | Slower acid production
- | Buffering capacity of milk



Glycemic index

The glycemic Index of selected sugars and foods

Glucose (reference)	100
Fructose	19
Lactose	46
Sucrose	68
Boiled white rice	83
Maltose	105
Baked potato	85
French fries	75
French baquette	95

From: Foster-Powel et al (2002), International Table of Glycemic Index (GI) and Glycemic Load (GL) values.



Calorific value

- | **Between 2-4 kcal/g, depending on digestion in the small intestine**



Fiber-like and prebiotic activities

- | **Comparable to non-digestible oligosaccharides, depending on digestion in small intestine**



Mineral absorption

- | **Enhances colonic (passive) absorption of calcium and magnesium**



Lactose-derived products

- | **Lactitol** (β -D-galactosyl-sorbitol)
- | **Lactulose** (β -D-galactosyl-D-fructose)
- | **Galacto-oligosaccharides** (GOS: gal-(gal) n -glu)
- | **Lactobionic acid** (β -D-galactosyl-gluconic acid)
- | **Tagatose**

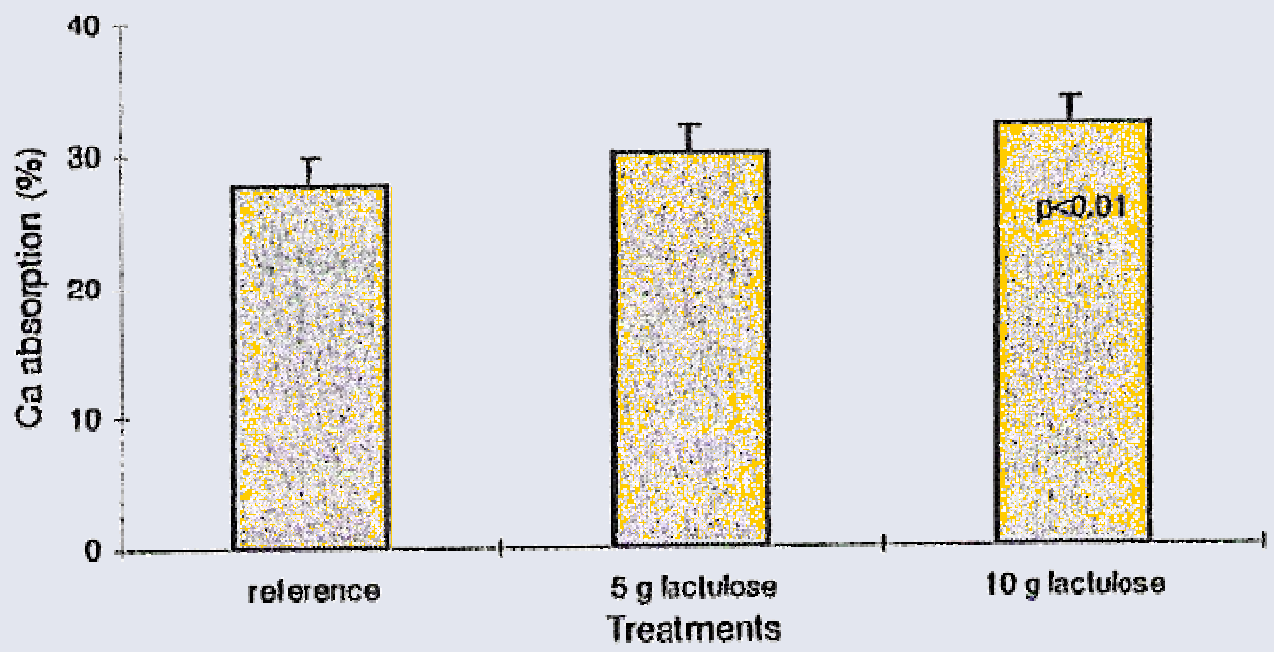


Nutritional benefits of lactose-derived products

- | Gut health promotion (prebiotic effects; anti-constipation)**
 - | Low calorific value (approx. 2 kcal/g)**
 - | Dental health**
 - | Enhancement of mineral absorption**
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Lactulose and Ca-absorption in post-menopausal women



Taken from van den Heuvel et al (1999).



Conclusions

- 1. Lactase deficient subjects can consume without side effects 10-15 g of lactose per day.**
- 2. Lactose malabsorption results in prebiotic effects and reduction of calorific value.**
- 3. Lactose derived products promote gut health.**