FROM LACTOSE INTOLERANCE TO LACTOSE NUTRITION

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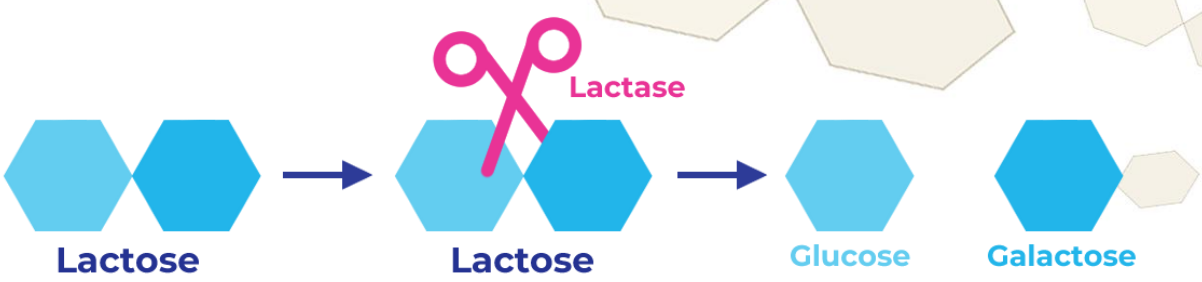
Widjaja Lukito MD, PhD
Safarina G Malik DVM, MS, PhD
Ingrid S Surono MSc, PhD
Mark L Wahlqvist MD, FRACP, FAFPHM, FAIFST FTSE

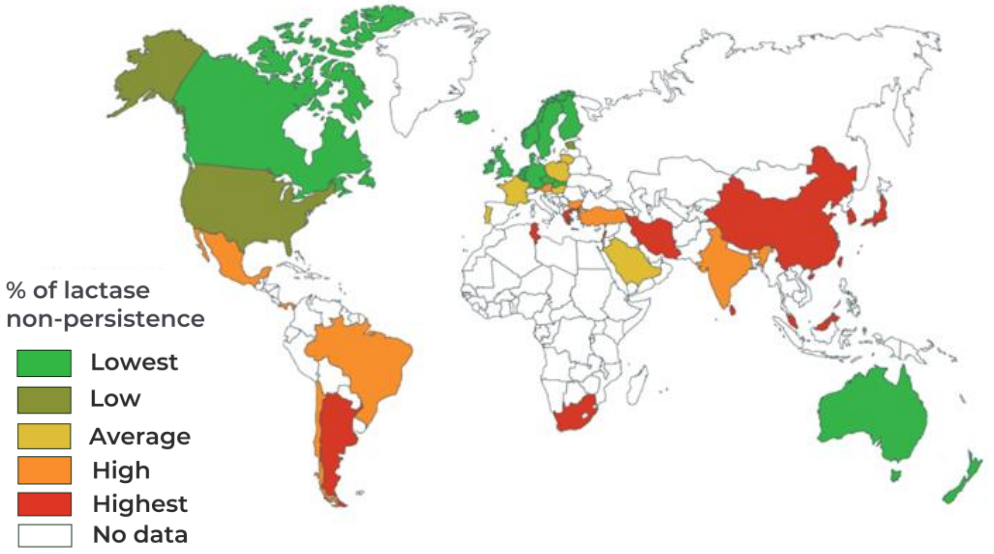
Figure 1. Lactose Digestion in the Intestine



Source of figure: Yogurt in Nutrition Initiative for a Balanced Diet and World Gastroenterology Organisation. Nama et al. Yogurt White Book: A convenient food for all, including lactose maldigesters and intolerants, 2017.

- Lactose is the principal sugar present in dairy products. During infancy, lactose accounts for most of the dietary carbohydrates. It is the principal breastmilk carbohydrate at 7 g% with oligosaccharides of various types providing another 1.3 g%, a total of 8 g%, almost double than of cow's milk at about 4.8 g%.
- In order to be digested and absorbed, lactose requires the presence of lactase in the small intestinal brush border. Lactose digestion in the premature neonate may be incomplete in the small intestine but partially salvaged from the colon.

Figure 2. World Map of Lactase Non-Persistence



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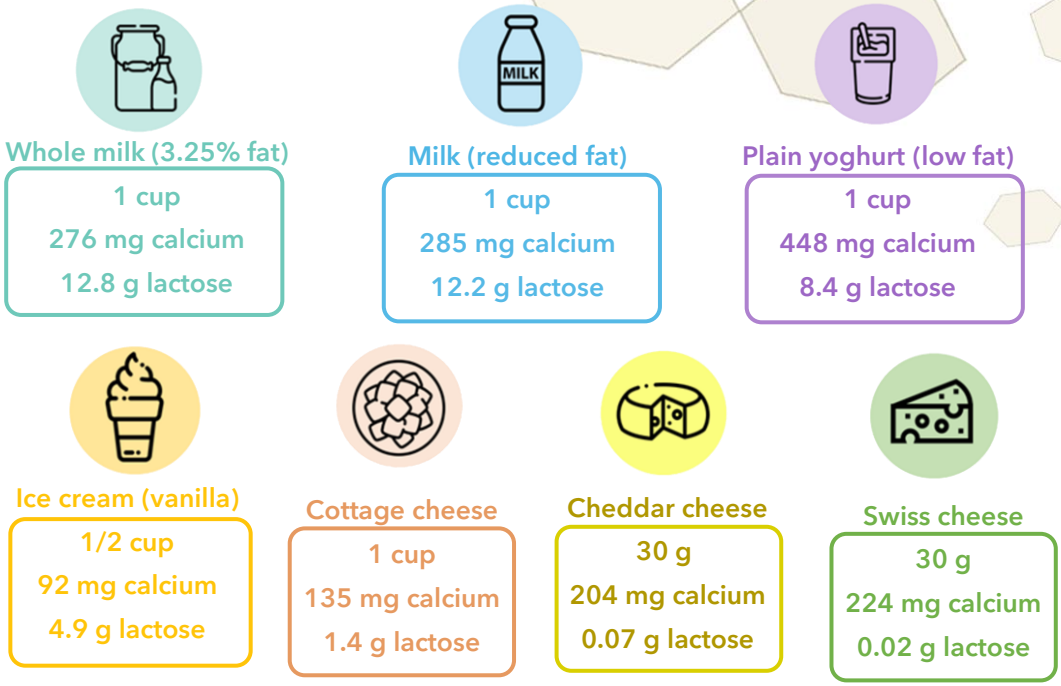
- Lactase levels decline from a peak at birth to less than 10% of the pre-weaning infantile level in childhood. This normal decline is called **lactase non-persistence**. It is more common in Asian, African, South American, Southern European, as well as Australian Aboriginal heritage.

- In most of Northern Europe, Western Europe, and the USA region, lactase activity may persist in some populations where dairy products are consumed into adulthood. The advent of dairying culture following the agricultural revolution 10,000 years ago, whether through migration, settlement, food shortage or local climatic conditions, was considered to be a key driver for **lactase persistence** (LP) beyond weaning.

Figure 3. Lactose and Calcium Content of Common Foods (Gerbault et al, 2013)



- Lactase activity varies among geographical locations and populations worldwide. The frequency of lactase persistence is **100% in the Dutch** population and **99% in the Swedish** population. By contrast, the frequency of lactase non-persistence is **80%-100% in some Asian and African countries**, particularly **60% in Pakistan, 90% in Thailand**, and **90% in China**, whereas it is merely **4% in Denmark** and **16%-23% in Russia**.
- For most of the current global population, **lactase non-persistence** (LNP) is the norm and **most of these people tolerate ≤9-12 g** of lactose (equivalent to **200 mL or 1 glass of milk**).

Table 1. Definitions of Lactose-related Gut Health Terms (Szilagy, 2015)

Term	Abbreviation	Interpretation
Lactase persistent	LP	The dominant genetic trait in adults with continuous ability to digest lactose throughout adulthood
Lactase non persistent	LNP	The natural decline in intestinal lactase to <10 u/g of tissue which leaves adults with minimal ability to digest lactose
Lactase deficiency	LD	Reduction of intestinal enzyme from either genetic (LNP) or any secondary causes due to diseases of the proximal small bowel mucosa
Lactose maldigestion (malabsorption)	LM	Inability to digest lactose due to primary (LNP) or secondary causes resulting in undigested lactose reaching the colon
Lactose intolerance	LI	Symptoms resulting from the ingestion of lactose including flatus, gas, bloating, cramps, diarrhoea and rarely vomiting
Lactose sensitivity		Symptoms (with or without symptoms of LI) with systemic features like depression, headache, fatigue
Dairy food tolerance	DFT	Assessment of milk or dairy product containing lactose rather than lactose alone

LACTOSE AS A NUTRIENT

- Breast-fed infants derive a major part of their energy intake from lactose, which may also play a role in innate immunity and contribute galactose to neurometabolism.

- Lactose may be consumed as a dairy food component in modest amounts, up to 12-24 g per day, preferably in small amounts across the day, in those whom lactase persistence is not physiological, without clinical symptoms.

- Lactose may enhance divalent cation absorption.

- Lactose may favourably alter the colonic microbiota if it is not digested in the small intestine. It enhances the fermentation of lactic acid bacteria like bifidobacteria.

- Lactose may enhance innate gut immunity not only in early, but also later life through synergistic action with other carbohydrates or short chain fatty acids (SCFA) such as acetate, propionate, and butyrate.

- Lactose avoidance may result in unnecessary dairy food avoidance in those who would be advantaged by a regular intake of small quantities (less than 1 serve per day).

LACTOSE AND THE HUMAN MICROBIOME (1)

- The combined genomes and gene products of resident human microbes constitute the human microbiome. The human genome encodes not more than 20 enzymes for carbohydrate digestion, mostly sucrose, oligosaccharides, starch and lactose. However, to this must be added the metabolic capacity of the gut microbiome, particularly that in the large intestine, and especially when considering LNP people.

- The LP allele appeared as a selective advantage. People with the mutation would have had a more fertile offspring than those who lacked it and that the degree of selection was “among the strongest yet seen for any gene in the genome.” Over many generations, the advantage could have helped a population become dominant if the population had a supply of fresh milk and was dairying. (Bersaglieri et al, 2004)

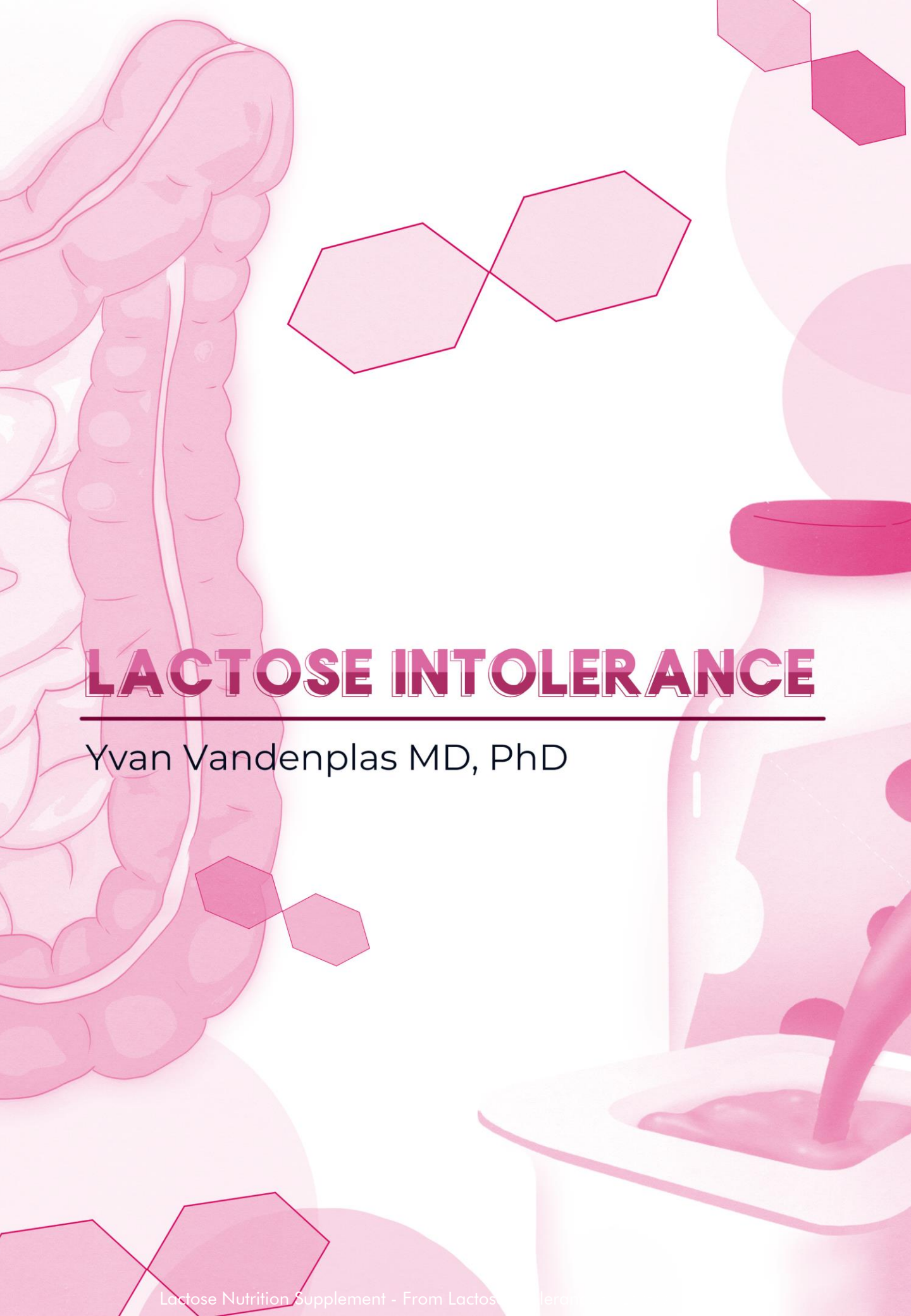
LACTOSE AND THE HUMAN MICROBIOME (2)

- Frequency and degree of lactose malabsorption is higher in southern than in northern India populations because of genetic differences in these populations as shown by the lactose tolerance test, lactose hydrogen breath test, and identification of lactase gene c/T-13910. (Babu et al, 2010)

- 15 g lactose/d given to Japanese lactose malabsorbers increased the amounts of lactobacilli, enterococci, and short-chain fatty acids and decreased clostridia and bacteroides in feces within 6 d. In addition, bacterial β-galactosidase is abundant in the colon. **Altogether, this suggests adaptive capacity for dietary lactose.** (He et al, 2005; Ito et al, 1993)

DAIRY FOOD TOLERANCE TESTS

Since LNP is poorly associated with 'lactose intolerance', and that amounts of lactose up to 12-24 g on a single occasion are tolerable by almost all people whatever their lactase status, and that pure lactose is never virtually ingested, a 'lactose tolerance tests' is not what is required for present public health or clinical purposes. The questions that actually have to be addressed are whether, which and how much dairy product is tolerable. For this we need a 'dairy food tolerance tests' which could have acute (several hours, perhaps as long as 24 hours) symptom evaluation and breath hydrogen as the end points. The breath test is much more preferable to diagnose lactose intolerance.

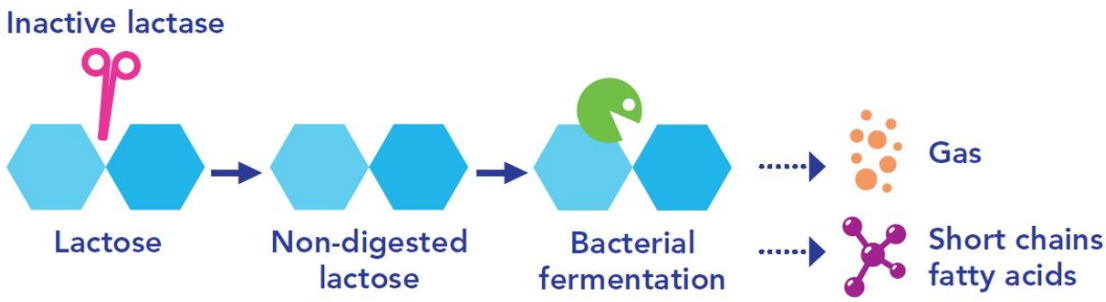


LACTOSE INTOLERANCE

Yvan Vandenplas MD, PhD

METABOLISM OF LACTOSE (1)

Figure 4. Lactose maldigestion process



Source of figure: Yogurt in Nutrition Initiative for a Balanced Diet and World Gastroenterology Organisation. Yogurt White Book: A convenient food for all, including lactose maldigesters and intolerants, 2017.

- Young children almost universally produce lactase and can digest the lactose in their mother's milk. But as they mature, most switch off the lactase gene expression, as children are weaned. **Only about 35% of the human population can digest lactose beyond the age of about 7 or 8**.
- Lactose intolerance has been a way of **distinguishing the use and risks of dairy foods by people of different ethnicities** for many years and considered to be a health problem if not a disease.
- Reduced lactase activity may lead to undigested lactose which is known as **lactose maldigestion**. Non-digested lactose enters the colon and is digested by the resident microbiota. Most of the people show few or no symptoms.

METABOLISM OF LACTOSE (2)

- Nevertheless, some individuals also show symptoms. Symptoms are in general related to the amount of ingested lactose. Non-absorbed lactose is fermented by the gastrointestinal microbiota resulting in the increasing gut transit time and intracolonic pressure, as well as production of metabolites such as short chains fatty acid (SCFA), mainly acetate, propionate, and butyrate, and gasses (hydrogen, carbon dioxide and methane).[1,2,3] The production of gas in the pathophysiologic mechanism causing symptoms such as abdominal pain, cramps, borborygmi, bloating and flatulence, watery and acid diarrhoea, nausea and vomiting. When this happens, this is called **lactose intolerance**.

- However, these symptoms are not specific to lactose intolerance and may also occur for other reasons. For example, those symptoms can be found in Gastrointestinal (GI) dysfunction such as irritable bowel syndrome, inflammatory bowel disease (Chrohn's disease and ulcerative colitis), intolerance to FODMAP (Fermentable, Oligo-, Di-, Mono-saccharides and Polyos), as well as psychological factors such as somatic anxiety, stress and depression.

TYPES OF LACTOSE INTOLERANCE (1)

According to Vandenplas, the most common type of carbohydrate maldigestion and malabsorption is caused by intestinal lactase deficiency. Lactose malabsorption or hypolactasia is a common condition caused by a low lactase activity. Lactose intolerance occurs when the malabsorption causes symptoms. Lactase deficiency has been described in three different conditions:

1. Congenital lactase deficiency
2. Primary late onset hypolactasia
3. Secondary hypolactasia

TYPES OF LACTOSE INTOLERANCE (2)

Congenital lactase deficiency

- Symptoms occur short after birth. In the first year of life, a number of infants may display partial malabsorption of dietary carbohydrate present in human milk or formula.
- This phenomenon of physiological malabsorption due to enzyme insufficiency may be cause colic (enzyme insufficiency generally resolves at approximately three months of age which coincides with when colicky behaviour usually subsides)

Primary late onset hypolactasia

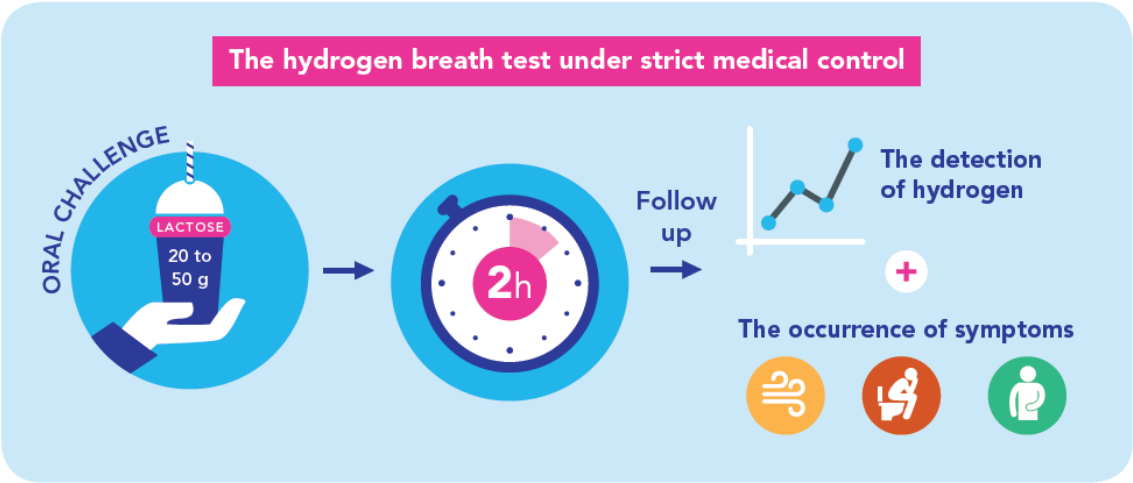
- Autosomic recessive condition characterized by a gradual reduction of lactase activity, but does not occur before the age of two years. It is the normal condition for most humans. However, the occurrence may differ for each racial group.
- Mutation of a regulatory gene for lactase has been postulated to explain the delayed onset of hypolactasia. Continued exposure to milk can to some extend affect the expression of the regulatory gene.

Secondary hypolactasia

- Is due to gastrointestinal disease causing (partial) atrophy of the small bowel villi such as gastroenteritis, celiac disease or inflammatory bowel disease (Crohn's disease).
- Recovery may take months. The presence of lactose in the colon is responsible for fluid shifts that result in osmotic diarrhoea. Fermentation of a carbohydrate causes bloating and cramps.
- Clinically, lactase deficiency occurs after small bowel injury, such as viral and parasitic infections. Whether it makes sense to decrease the lactose intake in infants with a severe gastroenteritis for a limited period of time (1 to 3 weeks) is heavily debated.

Relation Between Expired Hydrogen and Methane During Lactose Breath Test

Figure 5. The diagnosis of lactose intolerance



Source of figure: Yogurt in Nutrition Initiative for a Balanced Diet and World Gastroenterology Organisation. Yogurt White Book: A convenient food for all, including lactose maldigesters and intolerants, 2017.

Figure 6. Relation between expired hydrogen and methane during lactose breath test

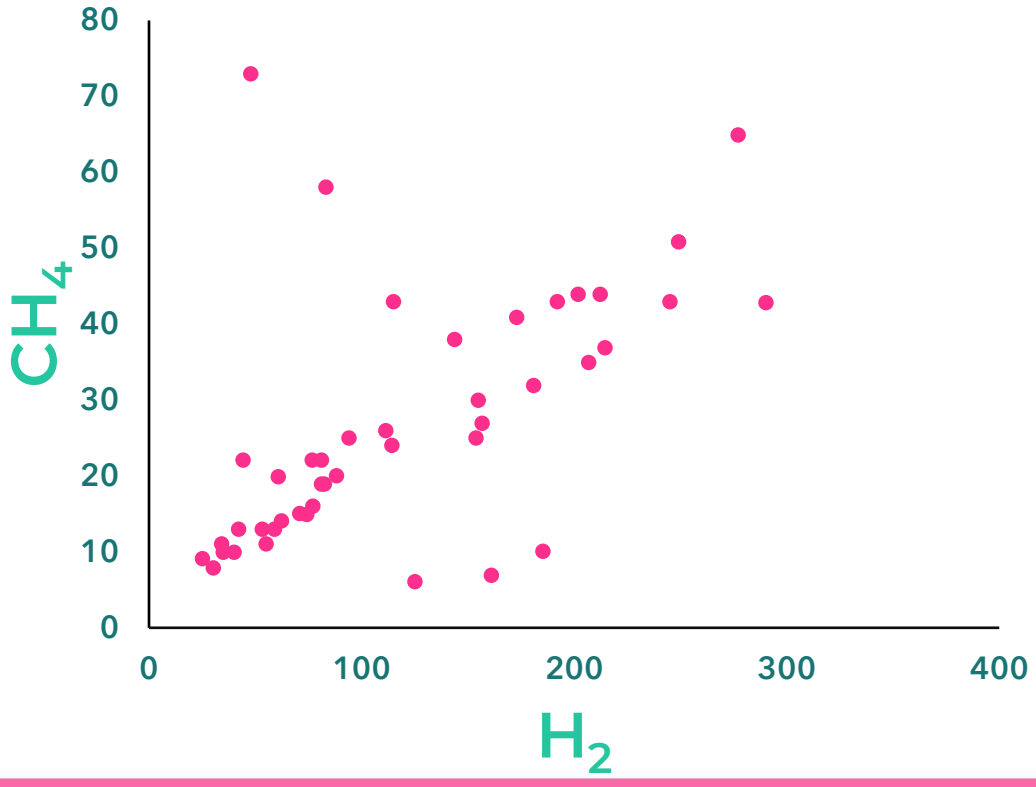


Table 2. Diagnosis of lactose intolerance: LTT and LBT

Lactose Tolerance Test (LTT)	Lactose Breath Test (LBT)
It is considered to be less sensitive than the lactose breath test.	It is a rapid, non-invasive test that allows measuring the content of hydrogen in the expired air.
Method: the lactose tolerance blood test measures the evolution of glucose levels in blood after a challenge with lactose. Glucose is created when lactose breaks down.	Method: the duration of the breath test should be three hours in pediatric patients, with a sample interval of at least 30 minutes, after a fasting of at least 3 hours in the youngest up to at least six hours in older children. Sensitivity and specificity of hydrogen measuring LBT is evaluated at around 70-100% and 100%, respectively.
(-): several blood samples need to be taken after the intake of a liquid containing lactose; a poor correlation was found between lactase activity, lactose tolerance test and lactose hydrogen breath test in children suffering from chronic diarrhea.	False-negative results are reported to range between 2.5% and 15% of all lactose malabsorbers. False negative results are mainly due to a lack of gastro-intestinal microbiota able to produce hydrogen.; The lactose breath test does not reliably predict tolerance toward lactose in infants recovering from diarrhoea (due to after antibiotic treatment because of a strongly reduced microbiota or because of an increased production of methane by intestinal bacteria).
Similarity: lactose tolerance and hydrogen breath test must be performed after a 6 hour fast beyond infancy	

INTOLERANCE ≠ ALLERGY

≠

Lactose intolerance is not to be confused with cow's milk protein allergy. In cow's milk allergy, the immune system overreacts to one or more proteins contained in the milk such as caseins and whey proteins. Symptoms include hives, swelling, nausea, and wheezing and can last up to 72 hours after consuming cow's milk.

TREATMENT (1)

1. Lactose-free or poor lactose diet can be done to treat lactose intolerance. However, Lactose free is only needed in the rare infants with congenital lactase deficiency. In all the other clinical situations, some lactase activity will persist and thus small amounts of lactose are tolerated. Most lactose malabsorbers will tolerate small amount of lactose. Amounts of 0.5 to 0.7 g lactose have been shown to not cause symptoms. Some malabsorbers have been shown to even tolerate 240 and up to 500 ml of milk per day.

2. Lactase can be administered as an **"enzymatic supplement"** in many countries.

3. Fermented dairy products such as **yoghurt** are in general better tolerated as the lactose is fermented by the probiotic strains added.

TREATMENT (2)

4. Primary lactose intolerance is almost non-existent before the age of 5-6 years. If symptomatic lactose malabsorption occurs before that age, it is likely to be secondary to another disease. In the latter situation, **treatment of the etiology results in recovery of the lactase activity**.

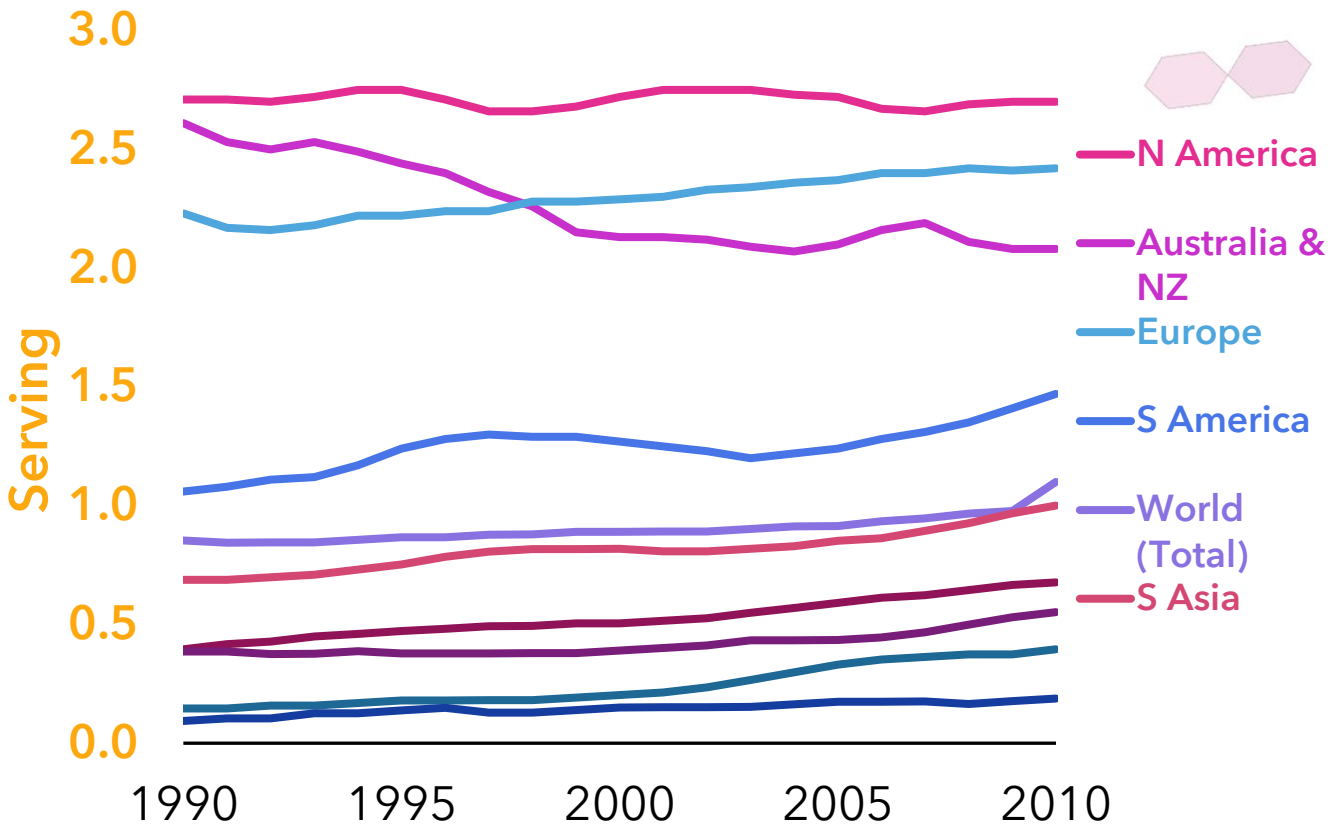
5. Slow maturation of lactase after birth may cause infantile crying and colic, but this is no reason to stop breastfeeding. In this case, the lactose has a prebiotic bifidogenic effect. Late onset lactose intolerance requires a **reduced lactose intake**.

DAIRY FOODS AND HEALTH IN ASIANS: TAIWANESE CONSIDERATIONS

Meei-Shyuan Lee DrPH
Mark L Wahlqvist MD, FRACP, FAFPHM
Cheau-Jane Peng MS, MPH

TRENDS IN DAIRY FOOD CONSUMPTION (1)

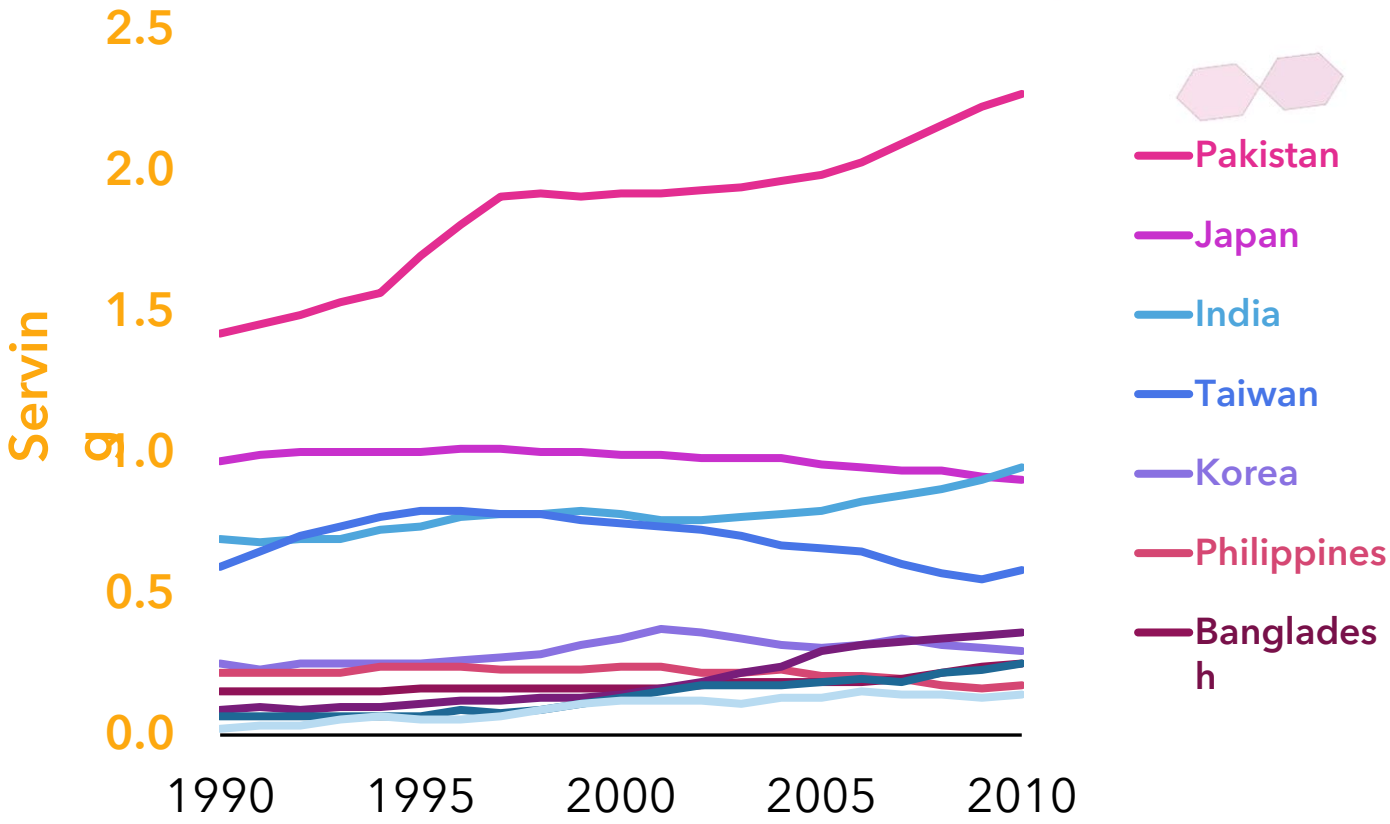
Figure 7. Global and continental daily dairy food availability for the period 1991 to 2010



The highest dairy consumptions are to be found in countries with major European populations, although declining in Australia. The global average consumption is less than one serving per day.

TRENDS IN DAIRY FOOD CONSUMPTION (2)

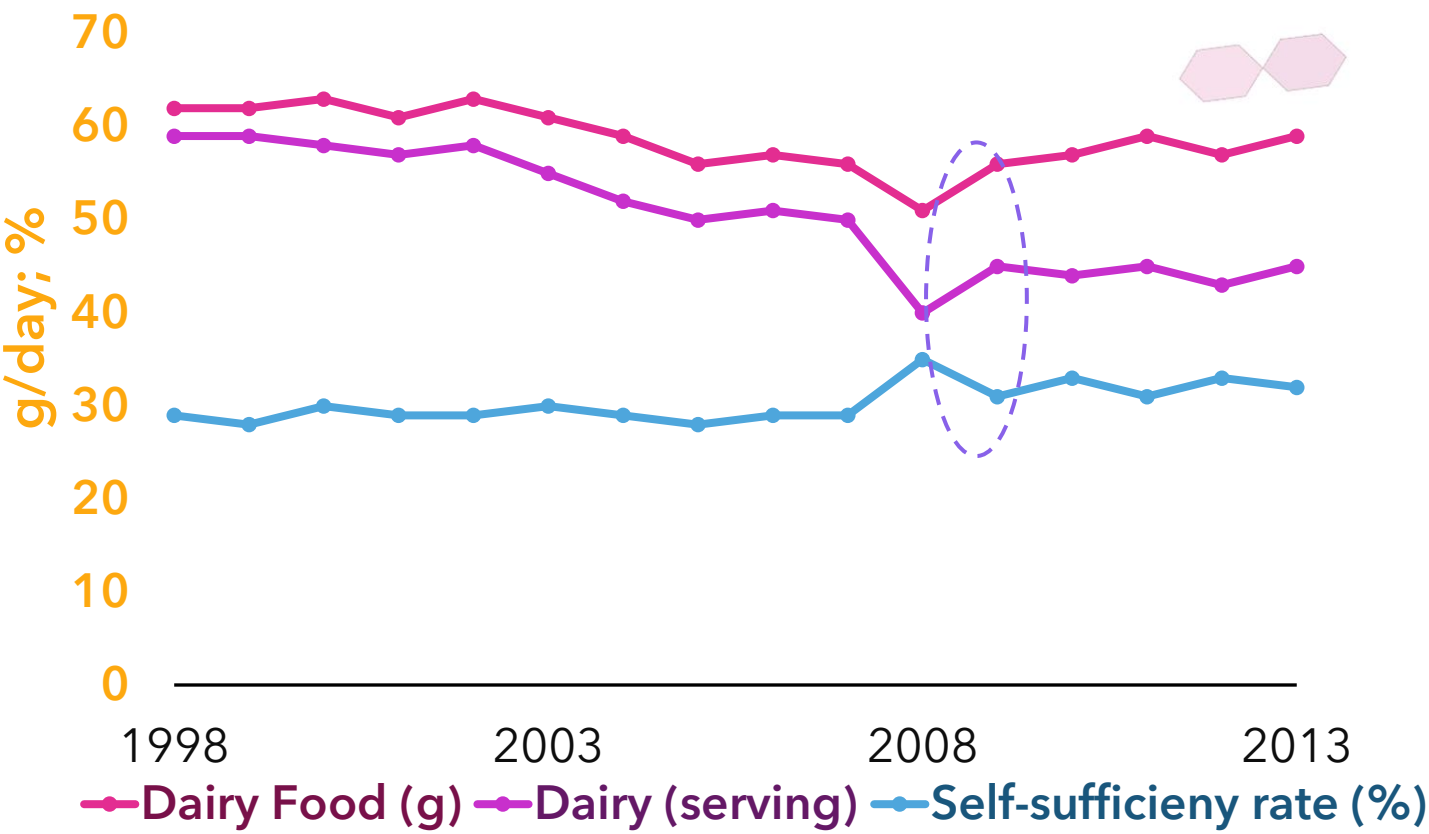
Figure 8. Daily dairy food availability in Asian countries for the period 1991 to 2010



The highest dairy consumptions in Asia are in South Asia, climbing most steeply in Pakistan. For NE Asia, where lactase non-persistence is prevalent, the highest consumption is in Japan, followed by Taiwan.

TRENDS IN DAIRY FOOD CONSUMPTION (3)

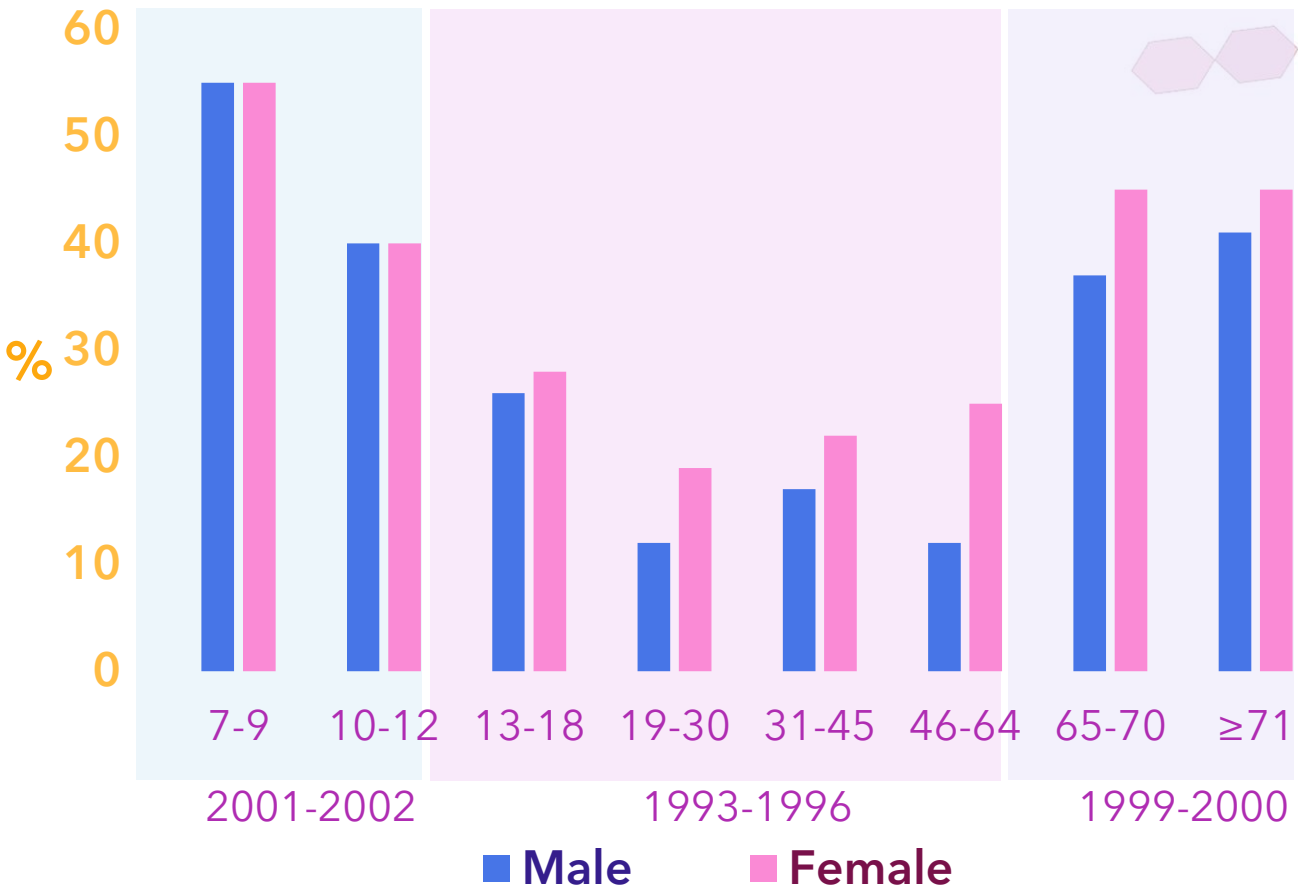
Figure 9. Dairy food self-sufficiency and servings, Taiwan 1998-2013



But the intakes seem capped at less than 1 serving per day, suggesting barriers. The dairy consumption in Taiwan went down markedly in 2008-2009 at the time of the melamine adulteration fiasco and has since not fully recovered.

Taiwan: Availability, Self-sufficiency & Servings

Figure 10. Age-gender-specific dairy consumption prevalences, 3 NAHSITs.

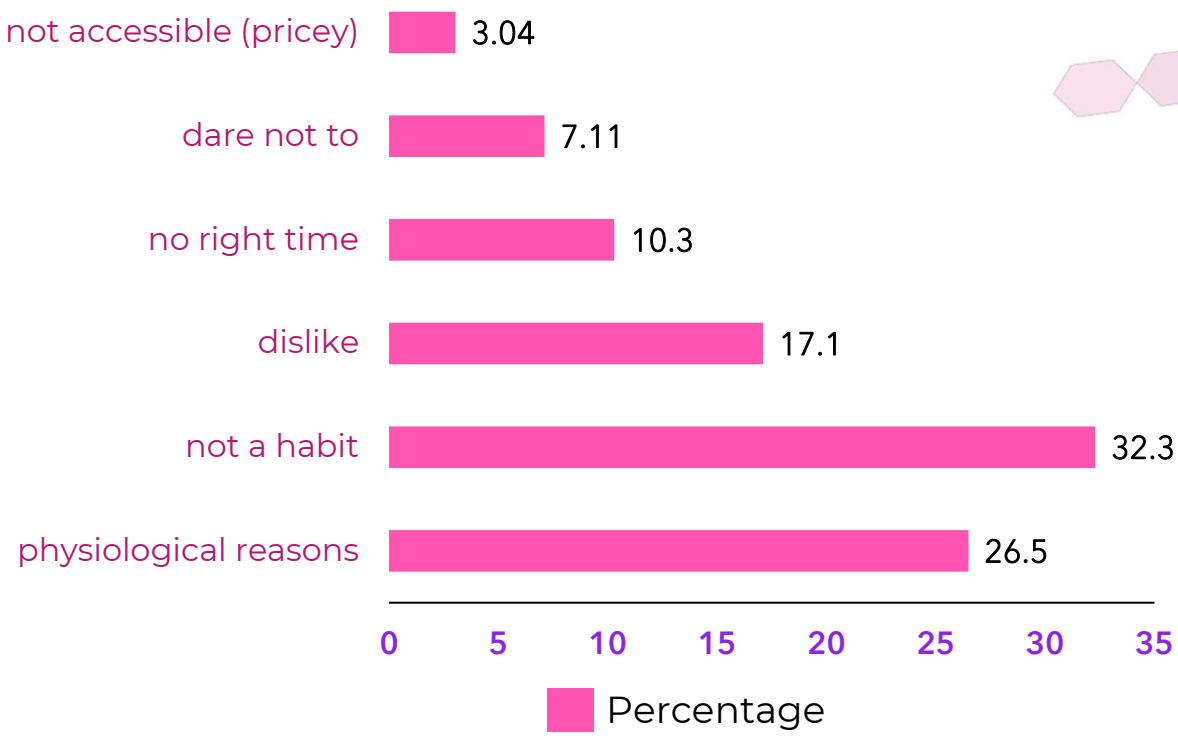


NAHSIT : Nutrition and Health Surveys in Taiwan

In Taiwan, the most prevalent dairy consumptions are to be found among children and the elderly. Barriers to consumption are therefore more likely in adolescence and adulthood. Even though lactose digestion may decline with age, it may be asymptomatic. This may account for the relative acceptability of dairy products among the aged at a time when the benefit may also be considerable in terms of CVD.

Limits to Dairy Intake in Asia

Figure 11. The NAHSIT study of 2005-2008 on non-use dairy foods



NAHSIT : Nutrition and Health Surveys in Taiwan

More than a quarter (26,5%) of participants claimed this was for physiological reasons. Two thirds (66.7%) of participants claimed that dairy was not part of their diet, including those with “no such habit” (32.2%), “dislike” (17.1%), “no right time” (10.3%) and “dare not to” (7.11%). There were 4.81% for whom dairy was not accessible usually because the price was too high (3.04%), especially for the Eastern region and Indigenous people.

Projections that dairy consumption in Asia will continue to rise are based on income and population growth and not necessarily on individual consumption. However, it is also argued that technological advances in Asia may reduce world dairy price.

LACTOSE INTOLERANCE IN LACTOSE NONPERSISTERS

Mark L Wahlqvist MD, FRACP, FAFPHM, FAIFST, FTSE

LACTOSE NUTRITION IN LACTASE NON-PERSISTERS (1)

- Lactase non-persisters are generally regarded as ‘abnormal’ when gut symptoms appear at higher doses which are mostly reported with single intakes ≥25 g/day. It is generally understood that lactose is bifidogenic, but its potential ongoing role to provide this function in lactase non-persisters is usually neglected.

- It is likely that, in lactase non-persisters, adaptation to at least low intakes of lactose also takes place, dependent on the prevailing food culture and the place of dairy foods in it. For example, in Northeast Asia, where dairy has not been a traditional part of the diet, exposures have increased in recent times and some adaptation may have occurred.
    - Post World War 2 Taiwan and Japan: dairy intakes were encouraged during food shortage, reconstruction and economic recovery

LACTOSE NUTRITION IN LACTASE NON-PERSISTERS (2)

Limited lactose absorption as physiology

- Considerable attention has been given to the consequences of lactose-free diets by way of restricted dairy food consumption and associated nutrient deficiencies. Nevertheless, high dairy consumers in northern Europe have higher fracture rates than the lower dairy consumers in southern Europe. Lactase nonpersisters in Asia have generally lower fracture rates than lactase persistent Europeans.

- **The question in relation to health advantage is whether lactose which survives the small intestine may have physiological relevance in the colon**. There are at least 2 ways in which this may be important:
    - First, is that lactose may enhance divalent cation like calcium uptake.
    - Second, is as an immune-stimulant through its role as a substrate for a favourable gut microbiome and its direct cellular (colonocyte and phagocyte) effects on the generation of anti-microbial peptides.

HEALTH IMPLICATIONS (1)

Potential Health Implications

Cardiovascular Disease (CVD)

Diabetes

Immune function

Bone health

Enteropathies e.g. coeliac disease

Inflammatory bowel disease

Body compositional e.g. obesity, sarcopenia

Central system health

Uterine fibroids

There are several potential health implications for lactose nutrition although these may be more to do with it as an indicator for dairy intake or as a nutritional factor in synergy with other food intake and behavioural factors.

Most of the health focus of lactase non-persistence has been on the problems of either gastrointestinal symptoms or the potential adverse consequences of lower calcium intakes with dairy avoidance. It is now clear that the gastrointestinal symptoms are partly dose-dependent and can be minimised by the consumption of small dairy servings and the overall dietary pattern. They are also related to colonic fermentation.

HEALTH IMPLICATIONS (2)

Several cohort studies in Asians and Europeans which have examined the associations of dairy intakes with health outcomes

- Reduced risk of cardiovascular (CDV) mortality is a consistent finding irrespective of location. Of particular note, because of its high incidence in NE Asia, a modest dairy intake of 3-7 servings per week is associated with a major risk reduction in adult Taiwanese. In support of the CDV mortality findings, dairy food intake is associated with less risk of myocardial infarction in women, although not with all products, cheese (a good source of vitamin K-2) being the protective item. Likewise, higher dairy intakes are associated with less arterial stiffness and hypertension.

- In Taiwan, there is no apparent association with total cancer mortality, but in North America there is. A protective association is seen for colorectal cancer in North America and Sweden, but not for breast cancer.

- Less than one serving per day also reduces the risk of type 2 diabetes in Chinese.
  Lactase non-persistence, which maintains the availability of absorbable galactose (toxic to ooxytes) has been of particular interest as protective against galactosemia which may be a risk factor for ovarian cancer beyond infancy.

TRADITIONAL INDONESIAN DAIRY FOODS

Ingrid S Surono Msc, PhD

INTRODUCTION

Buffaloes have been domesticated in large numbers in Indonesia. Hence, some areas in Indonesia use buffalo milk for preparing traditional dairy products, such as *minyak samin* (ghee) in Aceh, Northern Sumatra; *dali* or *bagot ni horbo* in North Sumatra; *Dadih* in West Sumatra; *dangke* in South Sulawesi; and *litsusu* and *colonganti* in East and West Nusa Tenggara, indicating that Indonesia has long used milk as a food ingredient.

Rural buffaloes maintained by small farmers in Indonesia can potentially contribute to the development of the Indonesian dairy industry.

Various manufacturing methods for traditional dairy foods in Indonesia play considerable roles in preserving milk and improving nutritional value and diversification.

MINYAK SAMIN (GHEE)

Texture

A type of butter oil, is white, highly viscous, and contains 99%-99.5% milk fat and <0.05% water.

Process

Manufactured by storing fresh buffalo milk in an earthenware jar exposed to the sun for 1 hour to separate the cream from the milk serum. *Solanum aculeatissimum* is added to coagulate the milk and *Pandanus amarylifolius* to obtain the desired smell. The milk allowed to stand another 24-48 hours at room temperature, and the cream layer is collected and heated until the fat on the top layer becomes separable. The fat is collected into a glass bottle or can and allowed to crystalize.

Fact

The process involves an enzymatic reaction catalyzed by a proteolytic enzyme from S. aculeatissimum. Bacterial fermentation might also occur during the preparation given the incubation period.

Origin: **Aceh**

DADIH (1)

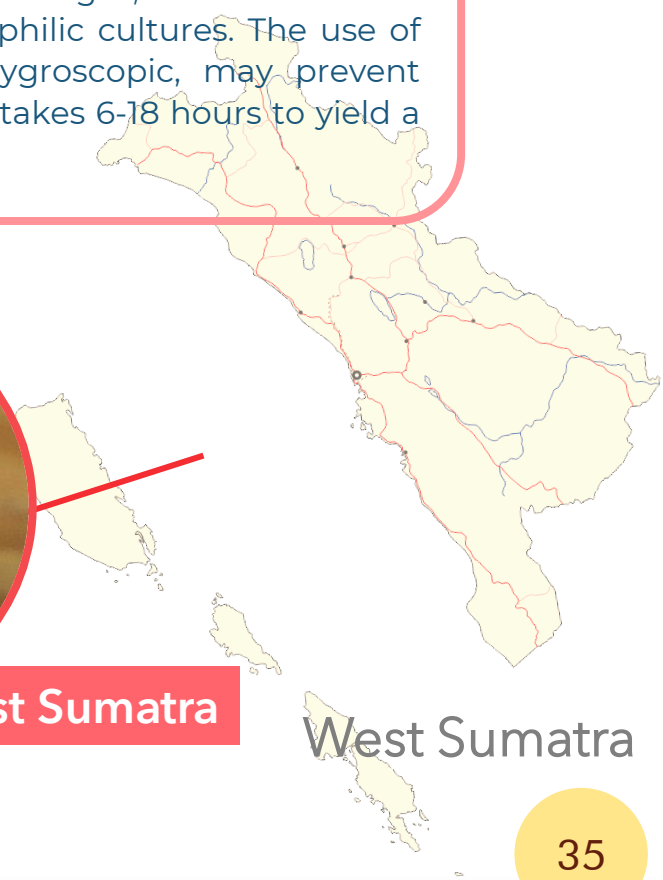
Texture

Yoghurt-like, thick consistency, smooth texture.

Process

Dadih is prepared at home by using a traditional method involving the milk of water buffaloes. The milk is neither boiled nor inoculated with any starter culture. The fresh unheated milk is placed in bamboo tubes covered with banana leaves, incubated at ambient temperature (25° C–30° C) overnight, and allowed to naturally ferment using mesophilic cultures. The use of bamboo tubes, which are hygroscopic, may prevent whey syneresis. Fermentation takes 6-18 hours to yield a thick consistency.

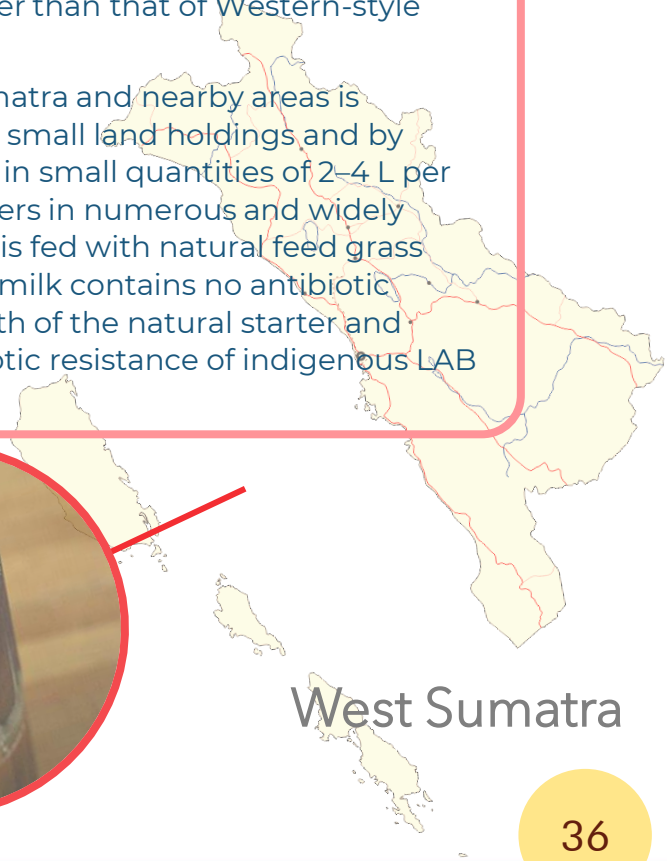
Origin: **West Sumatra**



DADIH (2)

Facts

- Various indigenous lactic acid bacteria (LAB) are involved in dadih fermentation, which may vary depending on the time and place of dadih preparation (natural fermentation). The microbial isolates of dadih have been reported to exhibit probiotic properties.
- The process of dadih preparation does not involve good hygiene practices; however, no incidence of product failure or food poisoning has been reported. Lactose fermentation for forming lactic acid is crucial means for preventing or limiting milk spoilage due to the growth of contaminating bacteria and their enzyme activity.
- Dadih is easily digestible because of the amino acids produced during fermentation. The general chemical composition of dadih is characterized by a higher protein and fat content than that of Western-style yogurt, whereas the carbohydrate and moisture content of dadih is considerably lower than that of Western-style yogurt.
- Most of the buffalo milk in West Sumatra and nearby areas is produced in villages by farmers with small land holdings and by landless agricultural laborers mostly in small quantities of 2–4 L per day and by small and marginal farmers in numerous and widely scattered villages. The water buffalo is fed with natural feed grass free from antibiotics. Hence, buffalo milk contains no antibiotic residue, which may inhibit the growth of the natural starter and cause product failure, and no antibiotic resistance of indigenous LAB occurs.



DALI / BAGOT NI HORBO

Texture

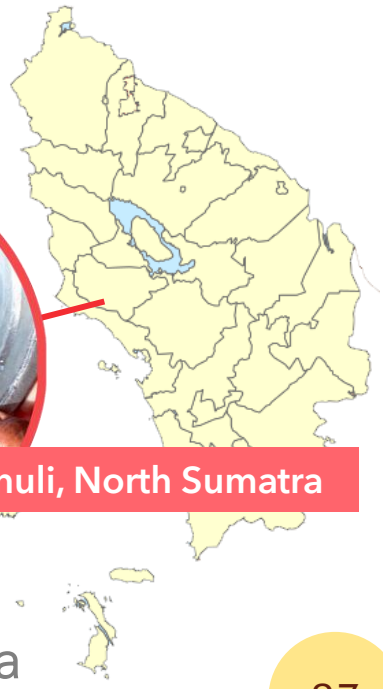
Cheese-like, yellowish white appearance, tofu-like texture, and milky flavour.

Process

Fresh buffalo milk is slowly boiled in a pan, with continuous stirring, and a certain amount (approximately 5.0%-6.0%, v/v) of fresh pineapple juice or papaya leaf juice is added to the boiled milk and continuously stirred until the milk is coagulated. The whey is then removed. The moisture content of dali is high because after milk coagulation, a pressing procedure is not performed.

Fact

Milk may coagulate because of both the action of proteolytic enzymes of pineapple juice and acidity of the unripe pineapple.



Origin: **Tapanuli, North Sumatra**

North Sumatra

DANGKE (1)

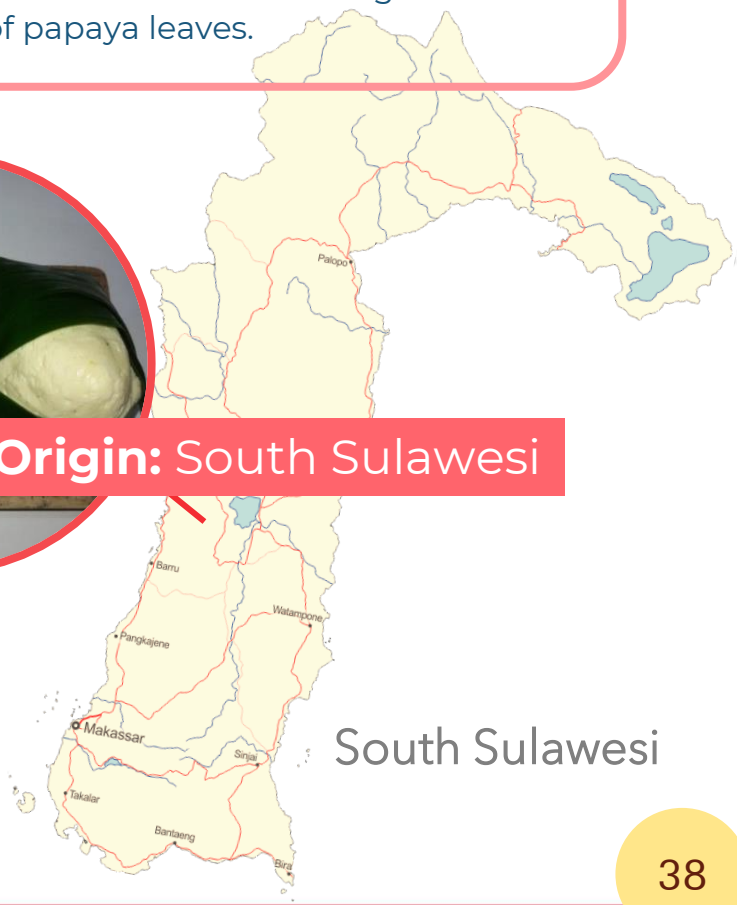
Texture

Cheese-like, white and has an elastic texture (fresh)

Process

Freshly drawn buffalo milk is heated in a small fire until it boils. A certain amount of sliced leaves, stems, or unripe papaya is then added; the mixture is stirred for 15 minutes until it the clot is formed. The clot is kept in a mold made of a coconut shell and pressed to separate the liquid. To increase the shelf-life and sensory quality, dangke is soaked in a brine solution overnight before being wrapped with banana leaves for masking the bitter taste caused by the addition of papaya leaves.

Origin: South Sulawesi



South Sulawesi

DANGKE (2)

Facts

- Because dangke is manufactured at 90 ° C, at which the proteolytic activity which produce small peptide is relatively low and the milk clotting activity which promote coagulation is at the maximum, it does not develop a strong bitter taste, on the addition of an appropriate amount of papaya leaves.
- To increase the curd yield, tapioca, rice, or wheat flour is added, resulting in pale yellow dangke with no elastic texture.

South Sulawesi

COLOGANTI AND LITSUSU

Texture

Cheese-like

Process

Cologanti is made using various coagulants from tropical plants, such as papaya leaves, unripe pineapple juice, Ficus sp, latex from *Calotropis gigantea* (rembega), bark from *Calotropis mangkas* (ridi tree), latex from *Planconella axinela* (jeliti tree), *Solanum melongena* extract, *Solanum torvum* juice, and *Mimosa pudica* leaf extract. Natives of East Nusa Tenggara observed that the bark of *Wrightiana calysina*, called pohon litsusu (the litsusu tree), produces ample latex and effectively coagulates milk. The bark of pohon litsusu is added to 2–3 L of milk in bamboo tubes at less than 40° C and allowed to stand for 2–3 hours. After milk coagulation, the whey is removed by squeezing the curd with the fingers. The curd is then molded into a hemispherical shape and dried in the sun for 1 hour. The dried curd is called litsusu.1

Fact

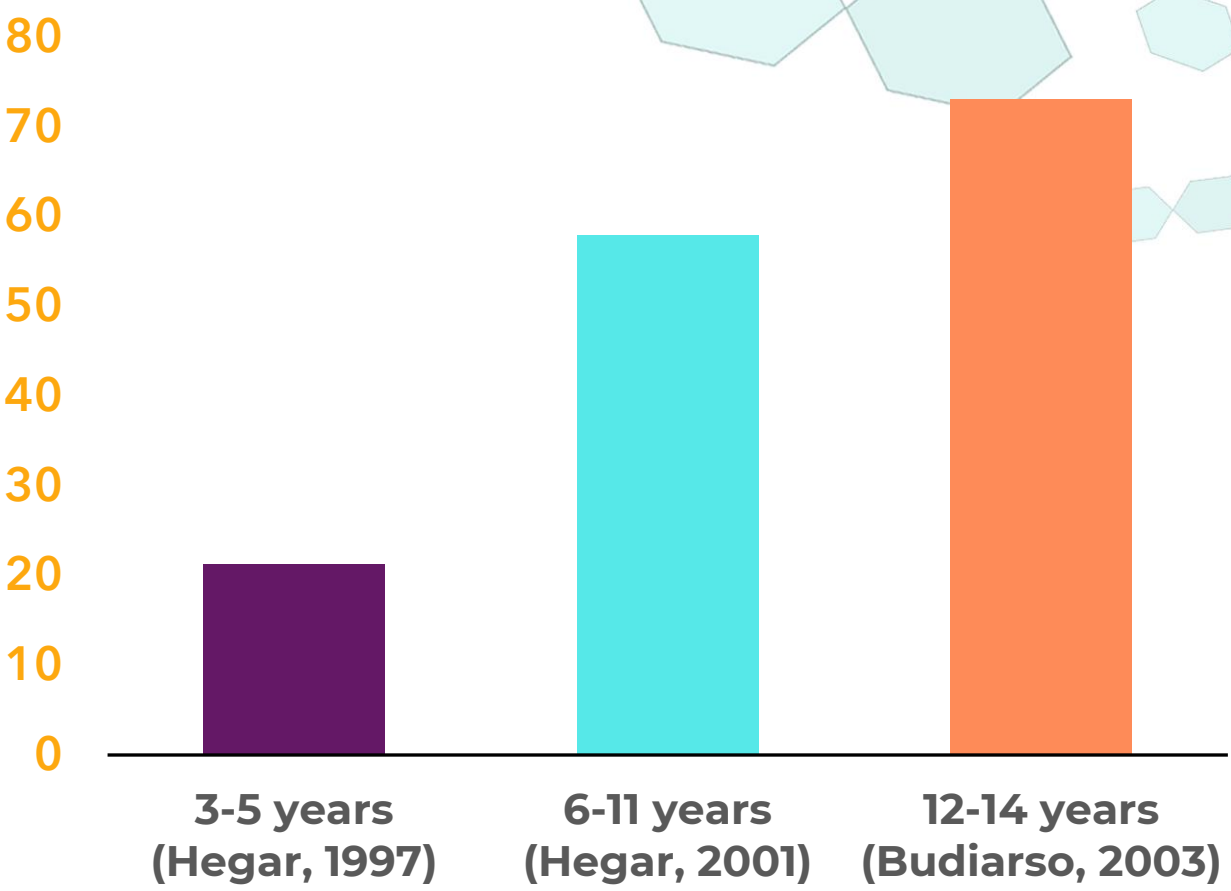
In West Nusa Tenggara, cattle is more extensively bred than it is in other districts because of the severe tropical climate and for combating dryness throughout the year. Therefore, manufacturing litsusu is a daily task and extremely crucial for providing a proteinous food source for the natives.

Origin: **East and West Nusa Tenggara**

LACTOSE INTOLERANCE IN INDONESIAN CHILDREN

Badriul Hegas MD, PhD
Ariani Widodo MD

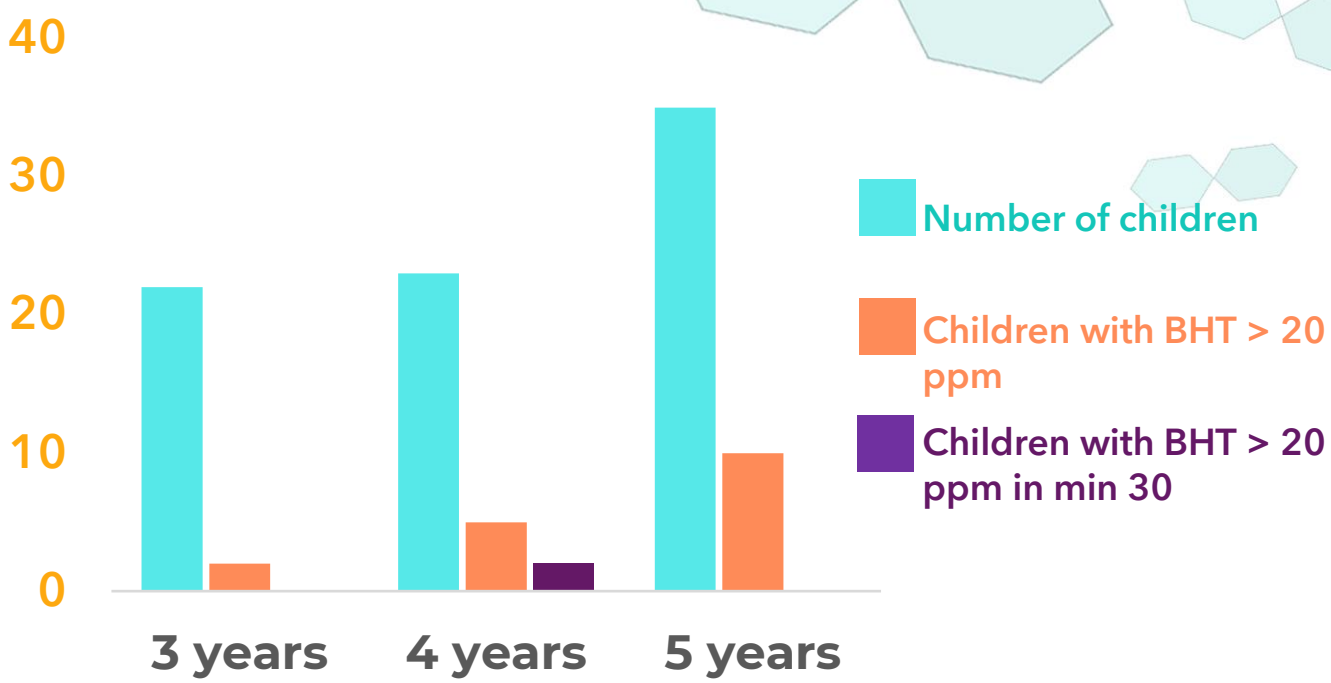
Figure 12. Lactose Malabsorption in Indonesian Children



Primary lactase deficiency or lactase non-persistence is the downregulation of lactase activity; it is genetically determined and considered as a developmental phenomenon. The breath hydrogen test (BHT) is the primary procedure for determining the presence of lactose malabsorption in Indonesia. Several studies have examined lactose malabsorption and intolerance in Indonesian children.

Data on the Indonesian population show the prevalence of lactose malabsorption in **pre-elementary school (age, 3-5 years), elementary school (age, 6-11 years),** and **junior high school (age, 12-14 years) children** to be **21.3%, 57.8%,** and **73%** respectively.

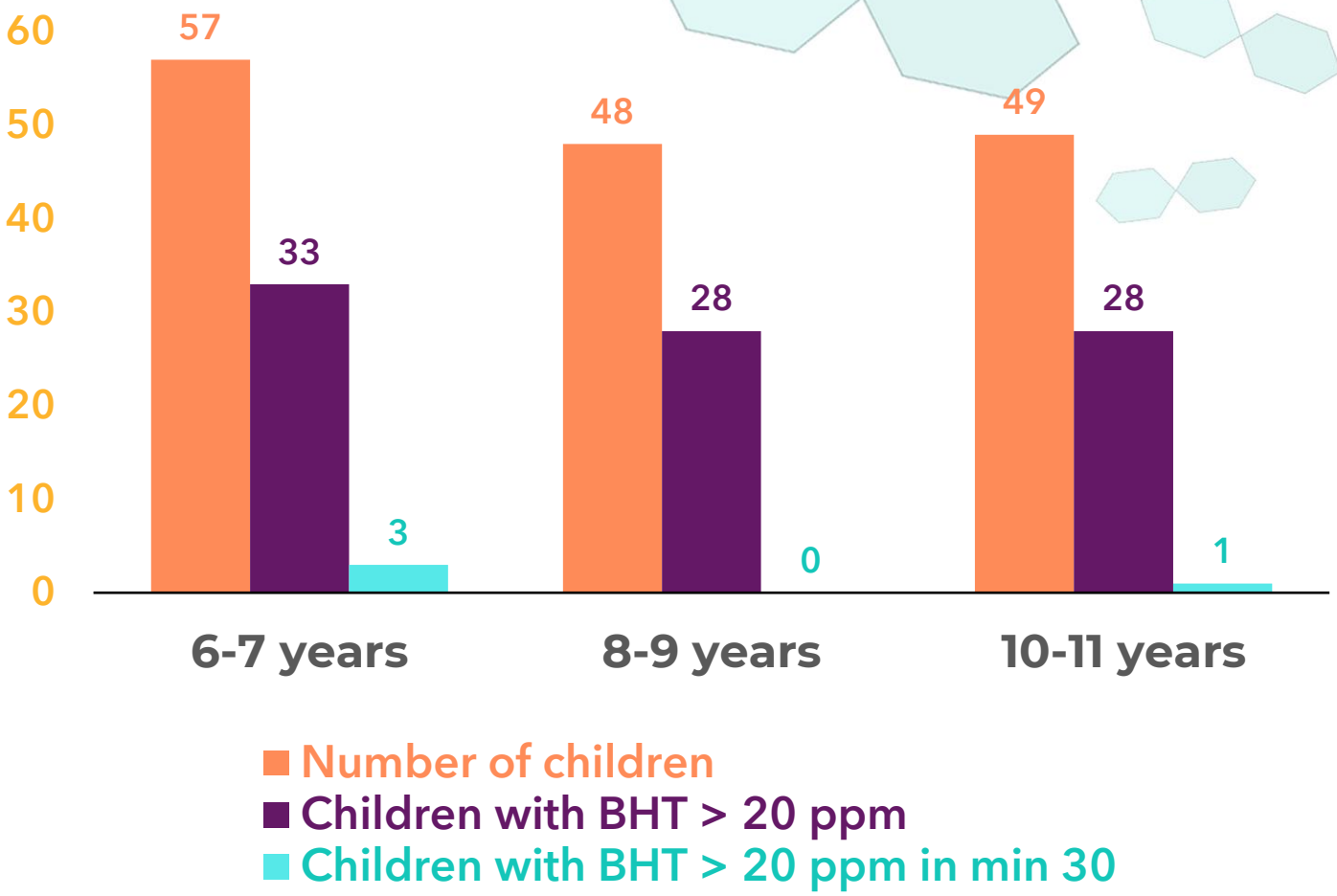
Figure 13. Prevalence of Lactose Malabsorption in Pre-elementary Children (age 3-5 year) (Hegar et al., 1997)



BHT : Breath Hydrogen Test

A thorough analysis of each subgroup shows an increasing trend in the prevalence of lactose malabsorption in pre-elementary school children (age, 3–5 years). The prevalence was only 9.1% at 3 years of age and constantly increased to 28.6% at 5 years of age.

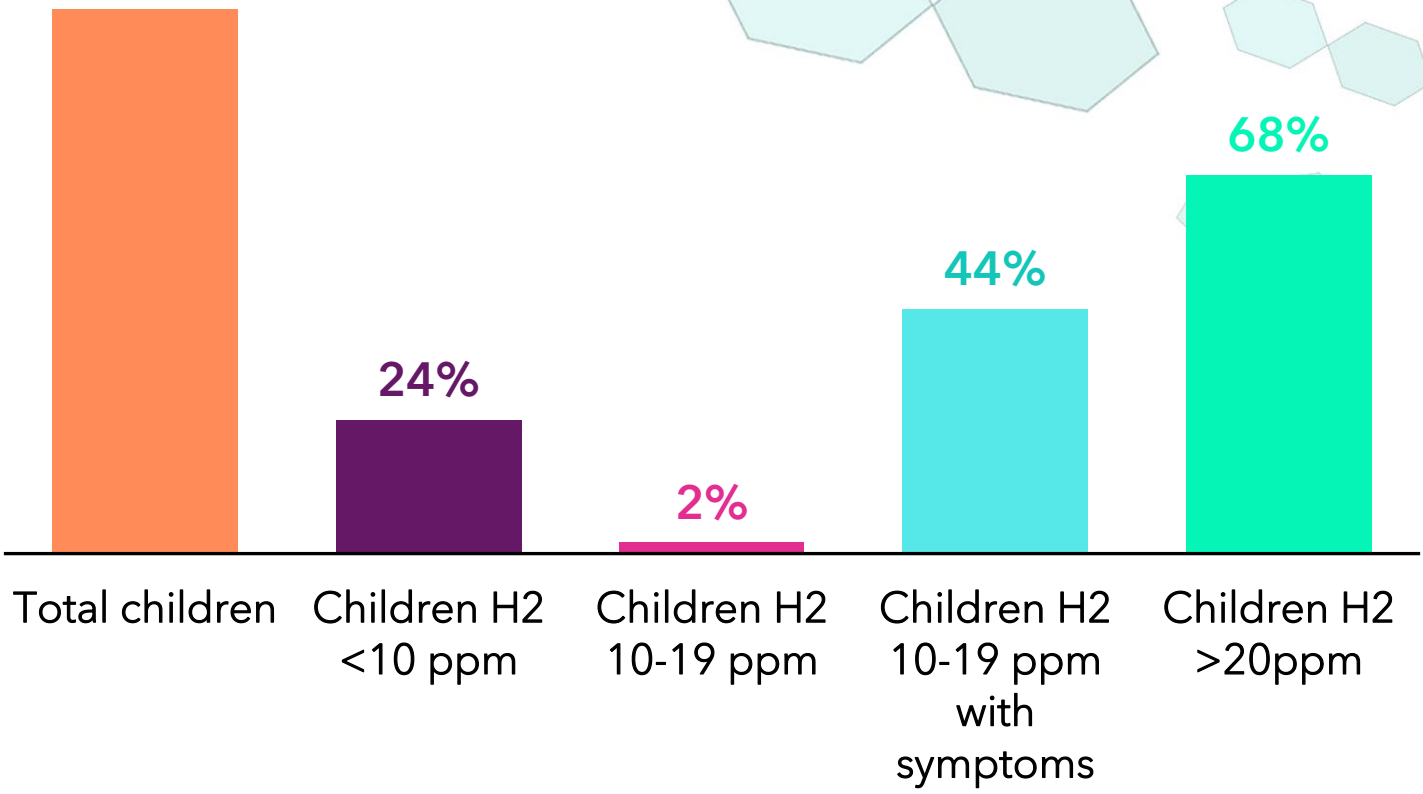
Figure 14. Prevalence of Lactose Malabsorption in Elementary School Children (age 6-11 years)



BHT : Breath Hydrogen Test

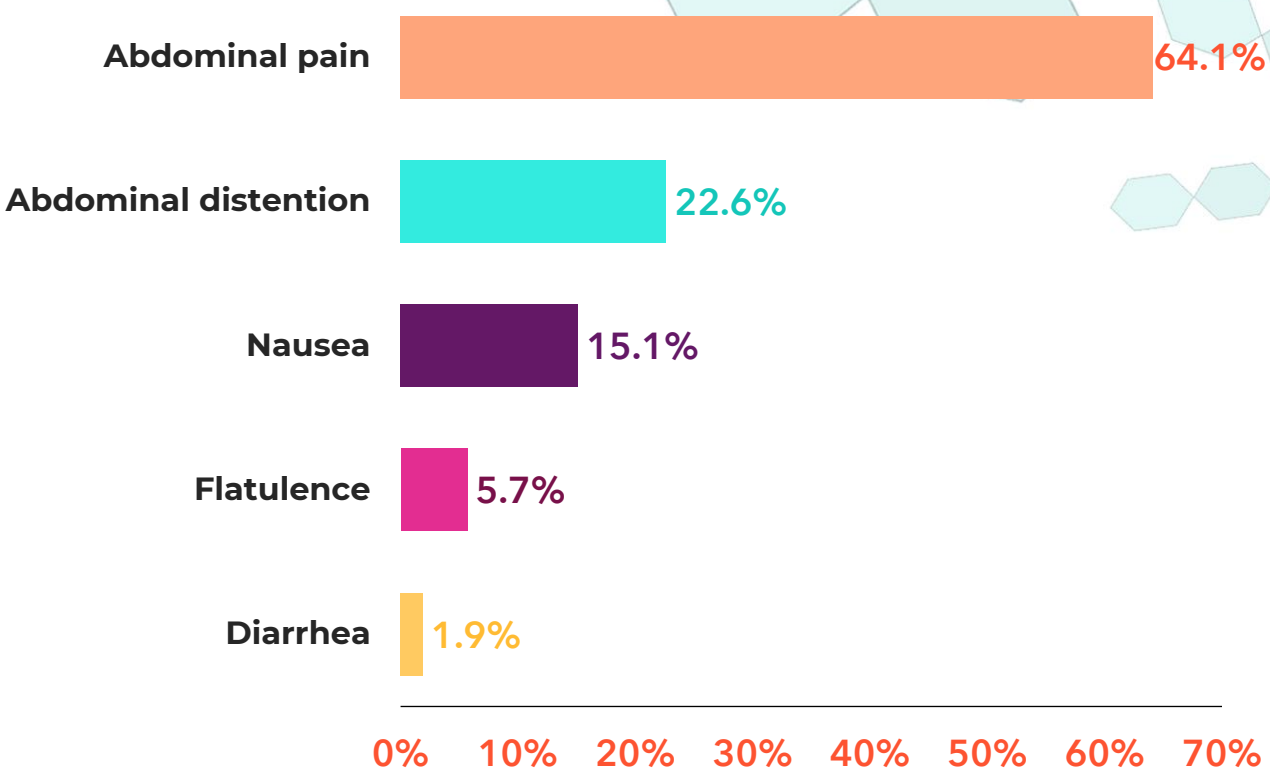
In elementary school children (age, 6–11 years), no significant difference in the incidence rate of lactose malabsorption was observed among all age groups. An incidence rate is reported to be ranging between 57.1% and 58.3%.

Figure 15. Prevalence of Lactose Malabsorption in Junior High School Children (age 12-14 years) (Hegar et al., 2001)



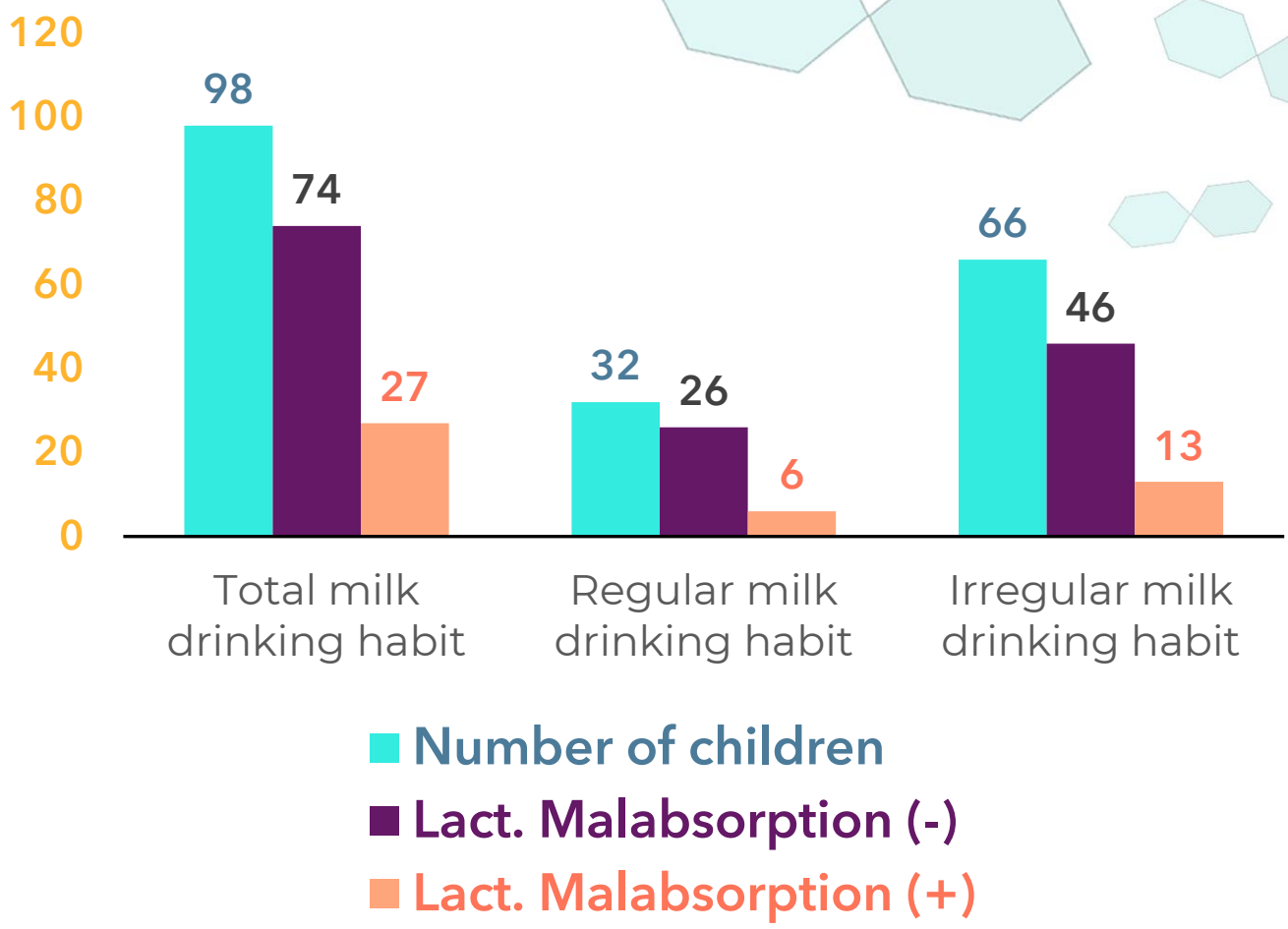
The incidence rate of lactose malabsorption increased in junior high school children, with 69% of the population showing the hydrogen concentration in the breath to be >20 ppm.

Figure 16. Symptoms after Ingestion of Lactose Solution in 98 Junior High School Children (Hegar et al., 2001)



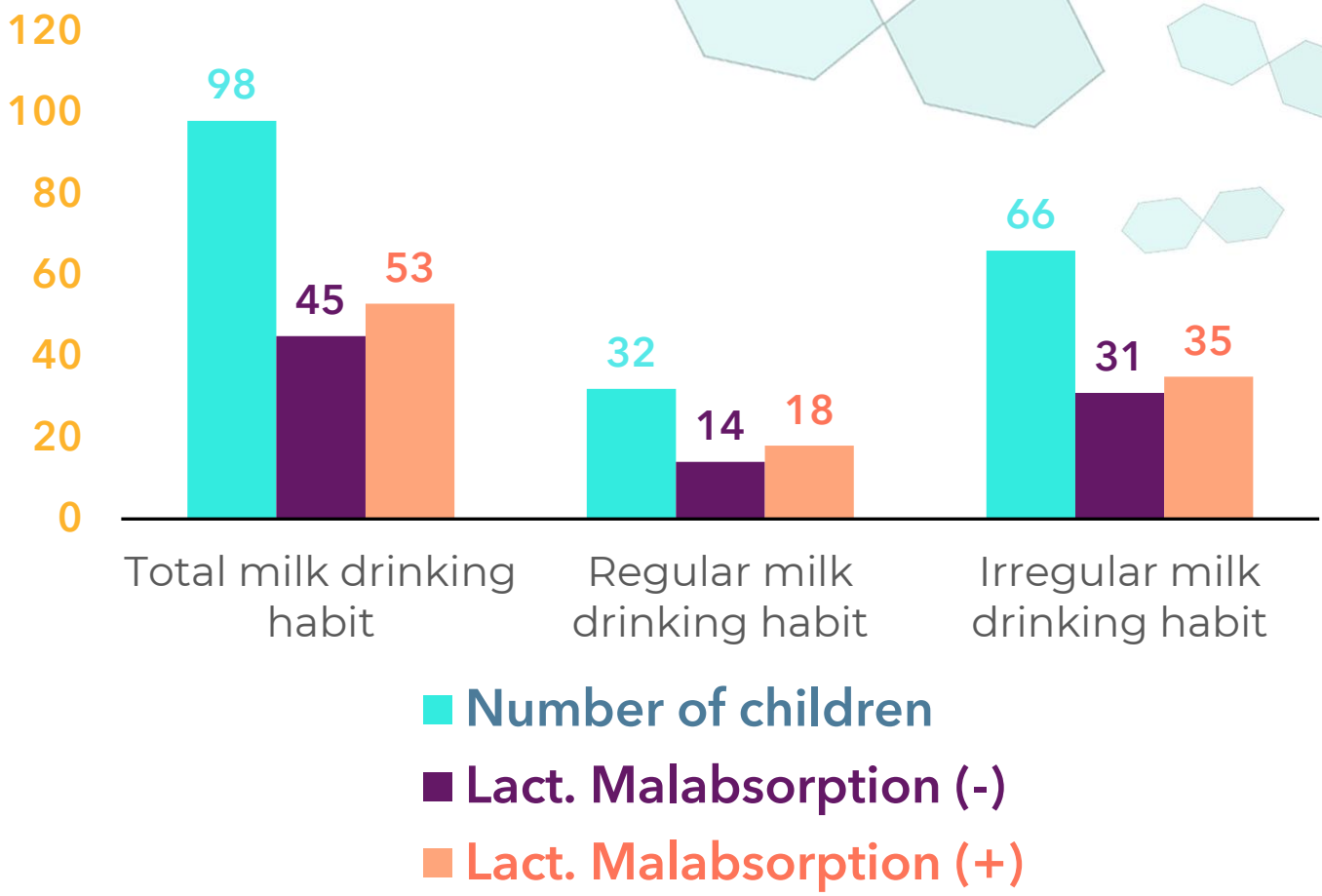
It is reported that lactose intolerance occurred in 53 of 98 children (54%) aged 12–14 years, and the most frequent symptom was abdominal pain (64.1%), followed by abdominal distention (22.6%), nausea (15.1%), flatulence (5.7%), and diarrhea (1.9%). Five children exhibited two symptoms. The symptoms of lactose intolerance mainly occurred 1 hour after ingestion of a test dose of a lactose solution. Only diarrhea occurred within 2 hours. Lactose malabsorption was not always followed by the symptoms of lactose intolerance.

Figure 17. Lactose Malabsorption in Junior High School Children Related to Milk Drinking Habit (Hegar et al., 2001)



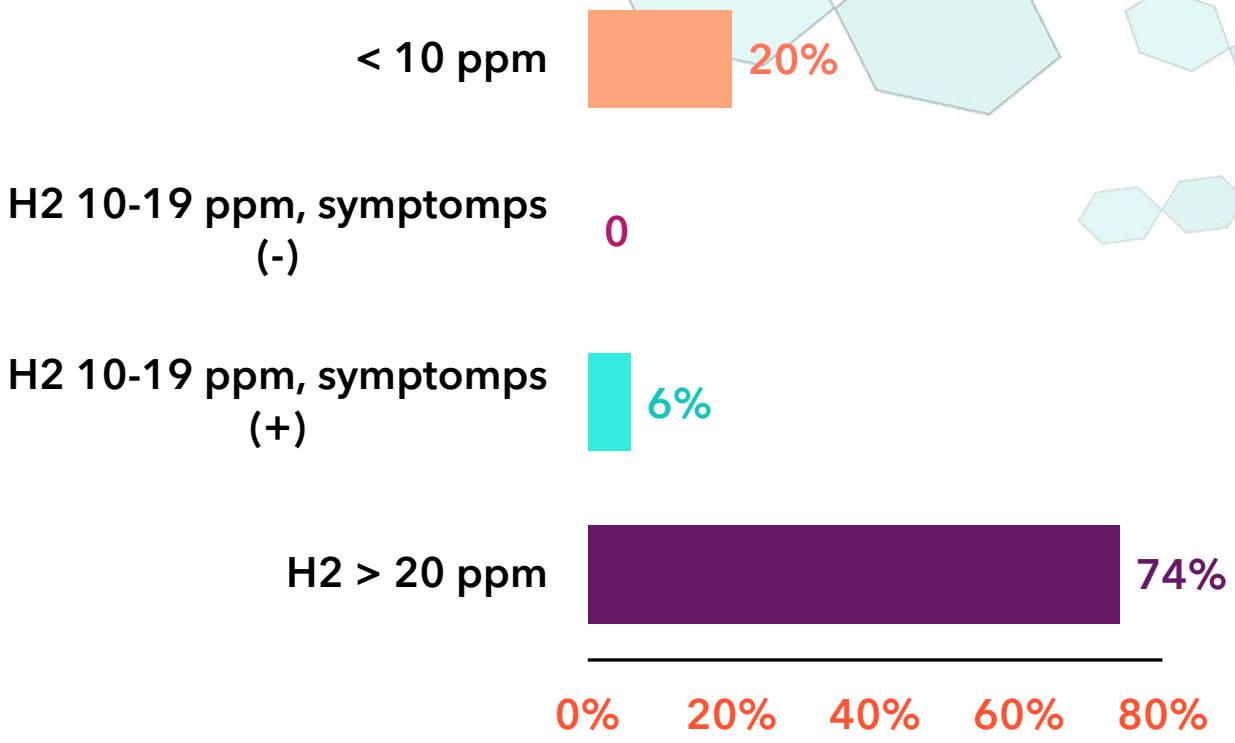
A regular milk-drinking habit was reported in 33% of junior high school children. Lactose malabsorption occurred in 81.2% children of this age group with a regular milk-drinking habit and 69.6% children of this age group with an irregular milk-drinking habit.

Figure 18. Lactose Intolerance in Junior High School Children Related to Milk Drinking Habit (Hegar et al., 2001)



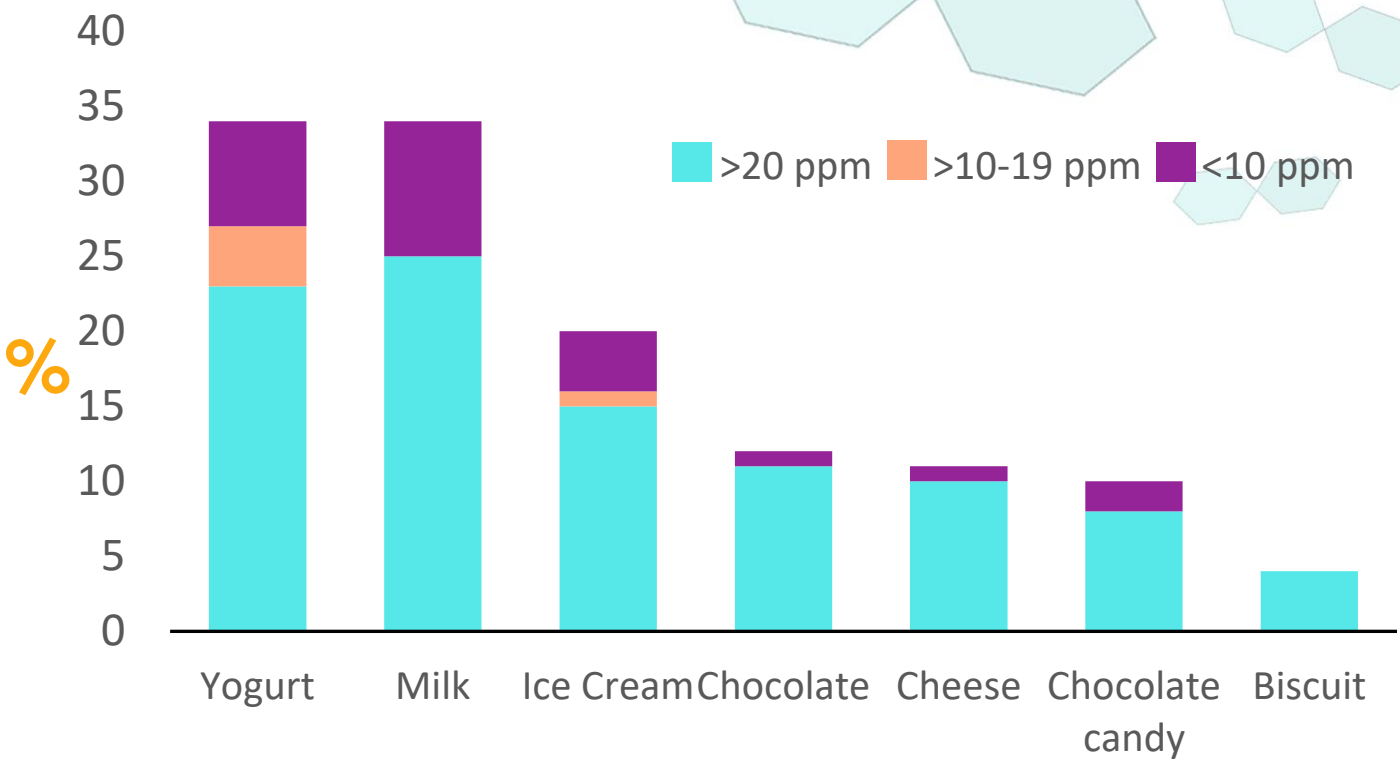
Furthermore, lactose intolerance was observed in 56.2% of junior high school children with a regular milk-drinking habit and 52.1% of those with an irregular milk-drinking habit.

Figure 19. Lactose Malabsorption in Indonesian Children with Recurrent Abdominal Pain (Yohmi et al., 2004)



Lactose malabsorption as a contributing factor for RAP in children was studied in 85 Indonesian children aged 12–14 years by using the BHT, and the prevalence of lactose malabsorption was found to be 80%. Four children exhibited a hydrogen concentration in the breath >20 ppm within the first 30 minutes after lactose ingestion (Figure 18), probably because of the overgrowth of bacteria.

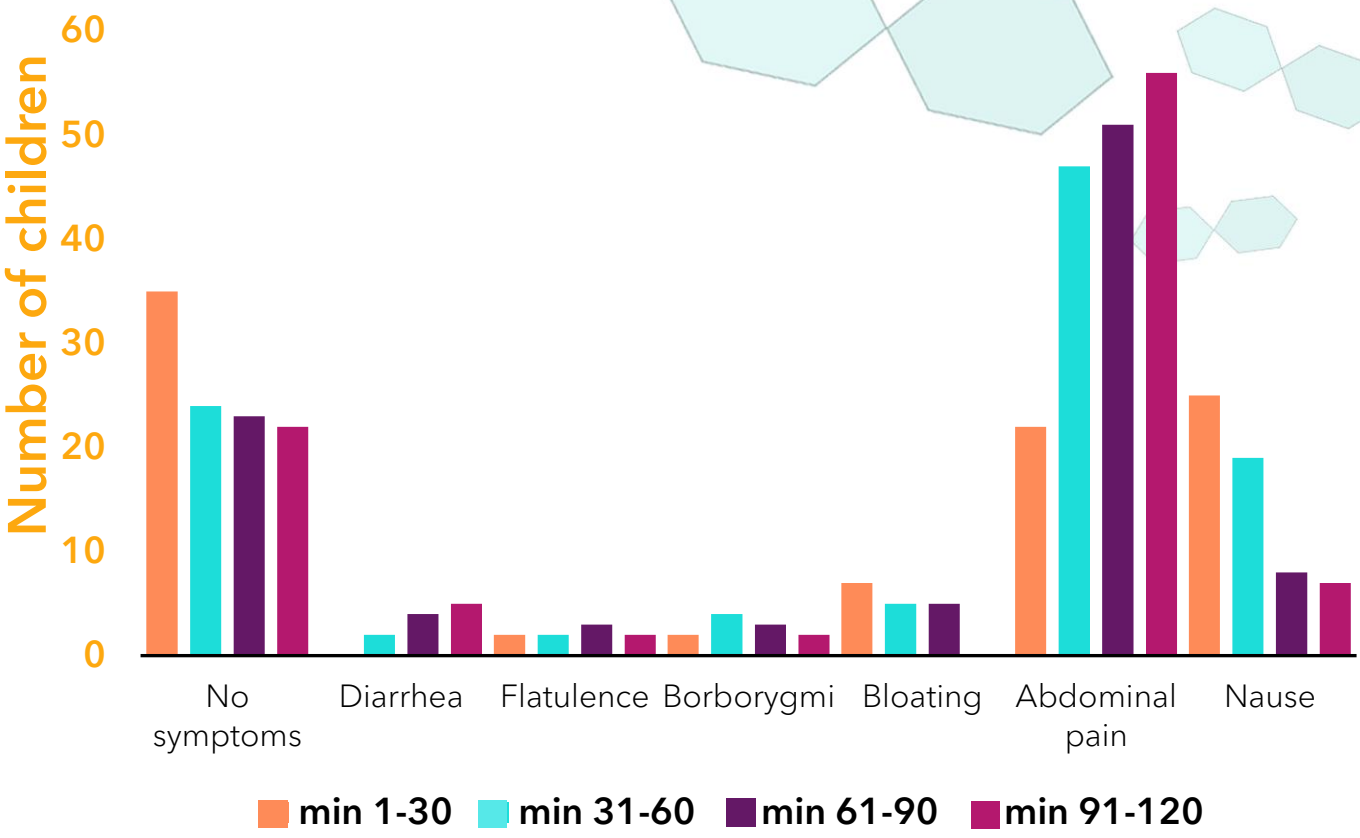
Figure 20. Breath Hydrogen Concentration in Children with Recurrent Abdominal Pain: Relation to Food-associated Symptoms (Yohmi et al., 2004)



RAP : Recurrent Abdominal Pain

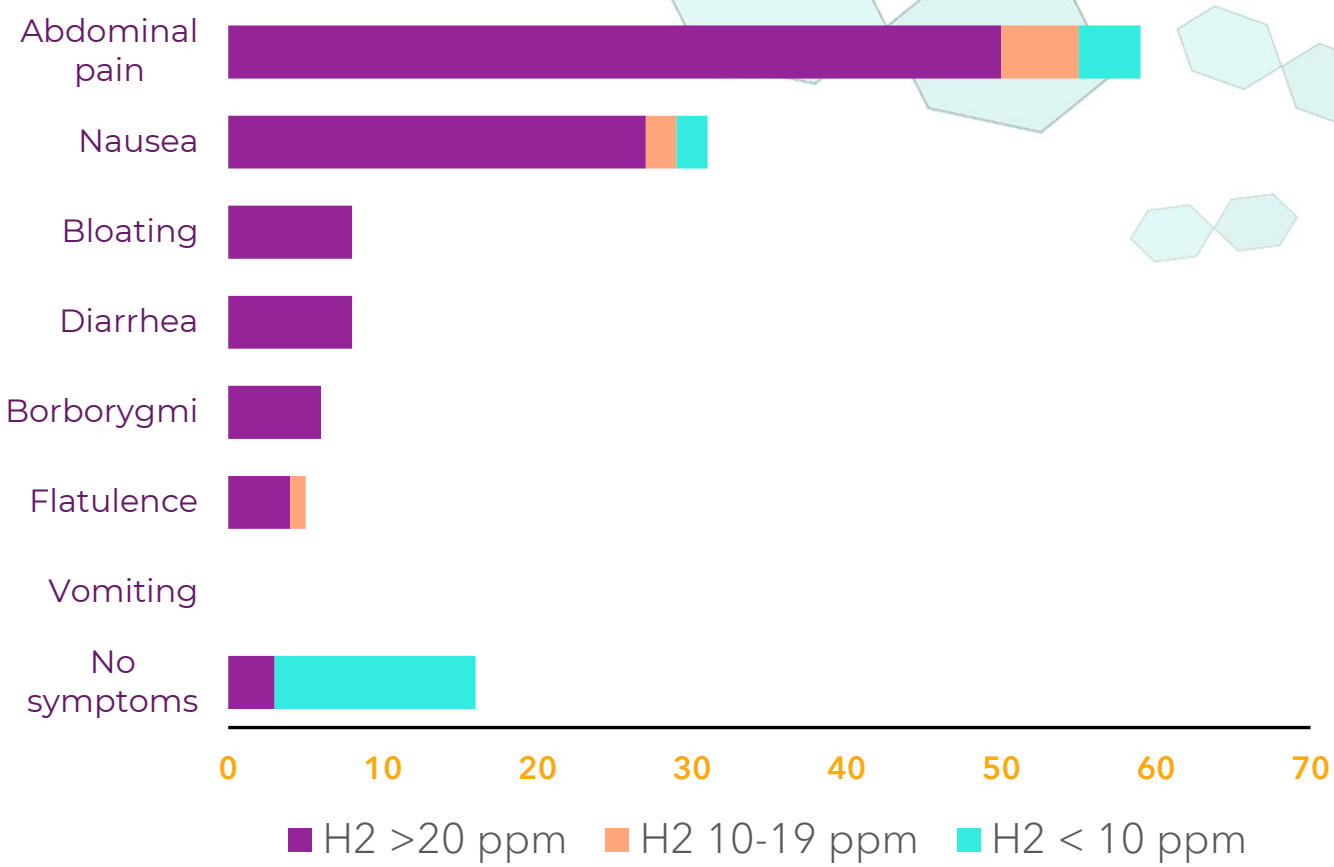
The dairy products most frequently reported as the cause of RAP are milk and yoghurt, followed by ice cream, chocolate, cheese, and biscuits. In one study, most children with a history of RAP thought to be associated with dairy product consumption were lactose malabsorbers.

Figure 21. Food-related Recurrent Abdominal Pain Symptoms in Children with and without Lactose Malabsorption (Yohmi et al., 2004)



The progression of lactose intolerance after lactose ingestion varies in each individual. Lactose intolerance during BHT was reported in 81% of children. The most frequent symptom was abdominal pain (56 children), followed by nausea, bloating, diarrhoea, borborygmi, and flatulence. Several symptoms began to appear 30 minutes after lactose ingestion, particularly nausea, bloating, and abdominal pain.

Figure 22. Breath Hydrogen Concentration in Children with Recurrent Abdominal Pain Based on Lactose Intolerance Symptoms (Yohmi et al., 2004)



The symptoms of lactose intolerance, such as abdominal pain, nausea, bloating, and borborygmi, were frequently observed in children with an increased hydrogen concentration in the breath (>20 ppm). More lactose intolerance symptoms were observed in children with lactose malabsorption than in those with no lactose malabsorption.

CONCLUSION

Are Lactose-free Foods Necessary?

It is liquid or reconstituted powdered milk which presents the greatest lactose load beyond the period of breast feeding. Mostly, milk is fermented before consumption and ingested as yogurt, cheese or similar commodities which have less lactose. School milk and food aid programs in the 20th century increased liquid milk consumption. This may be evolving further with the greater consumption of liquid meals and milk-based beverages like sugary drinks, milk teas and coffees like latte.

There is a case to be made for and against lactose-free foods

Cons	Pros
Lactase non-persistence is physiological	Lactose may be consumed in modest amounts, up to 12-24 g/day preferably in small amounts across the day, in those in whom lactase persistence is not physiological, without clinical symptoms.
It should be possible to minimise GI symptoms by attention to possible predisposing risk factors (e.g.. maternal, birth, antibiotic usage), food & product type, dietary pattern, dose and spacing.	Lactose may favourably alter the colonic microbiome if it is not digested in the small intestine.
There may be health disadvantage in a lactose free diet (e.g.. immune dysfunction, colonic health)	Lactose may enhance innate gut immunity in early (and possible later) life through synergistic action with other carbohydrates or SCFA (e.g. butyrate)

Public Health and Clinical Practice Policy for Lactose Nutrition

1. Avoid terminology implying lactase non-persistence is a disorder or disease.
2. Encourage all people to consume dairy products in small amounts and in conjunction with other nutritious foods.
3. Provide information which would allow the recognition and mitigation of GI symptoms possibly attributable to lactose, but not to preclude other explanations.
4. Develop a greater interest in the potential health advantages of lactose nutrition.