

Lactose Intolerance: Dietary Management and a2 Milk™



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Outline

- Lactase non-persistence and maldigestion
- Milk avoidance
- Dietary management to prevent intolerance
- A1 vs. A2 beta-casein



Loss of Lactase Activity

- Lactase non-persistence (primary acquired): Genetically programmed loss of lactase post-weaning after weaning (ages 3-5 years).
- Secondary acquired: Temporary loss due to illness, medication, radiation or other factors.
- Congenital lactase deficiency: Complete absence of lactase at birth (rare).

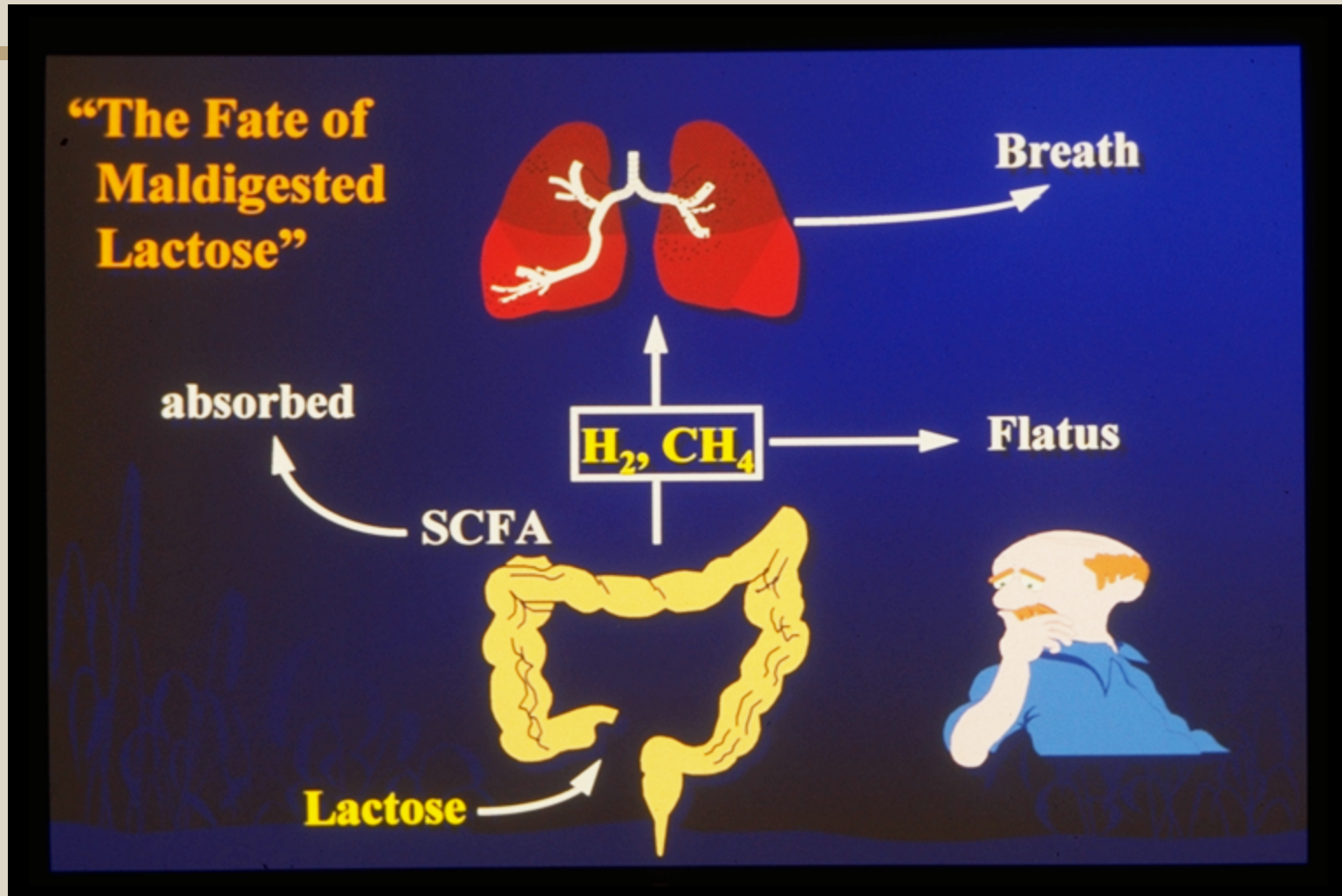


Prevalence of Lactase Non-persistence

<i>Ethnic Group</i>	<i>% of Adults</i>
Northern European	1-5
Middle European (English, Russian)	10-20
Mexican-American	50-80
Mediterranean (Greek, Italian)	60-90
Most African and African-American	70-100
Native American	80-100
Asian and Asian-American	80-100

Adapted from: Savaiano, DA and Levitt MD. Milk intolerance and microbe-containing dairy foods. J Dairy Sci 1987; 70: 397-406





The traditional dogma:

- Lactose maldigesters are lactose intolerant
- They need to avoid milk
- Use digestive aids
- Take supplements
- Eat low lactose alternatives
- Don't worry about lower calcium intakes and poor bone health



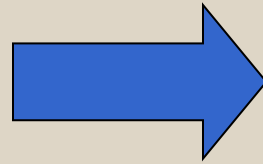
Psychological Barriers to Calcium Consumption

- Lactose Intolerance
 - Widely publicised
 - Highly marketed products

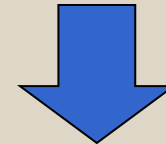


Scientific reality

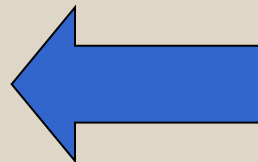
**Lactose Intolerance
(real or perceived)
5 - 40%
of maldigesters**



**Low Calcium
intake
-200 to -300 mg/day**



**Increased fracture
rate**



Low BMD

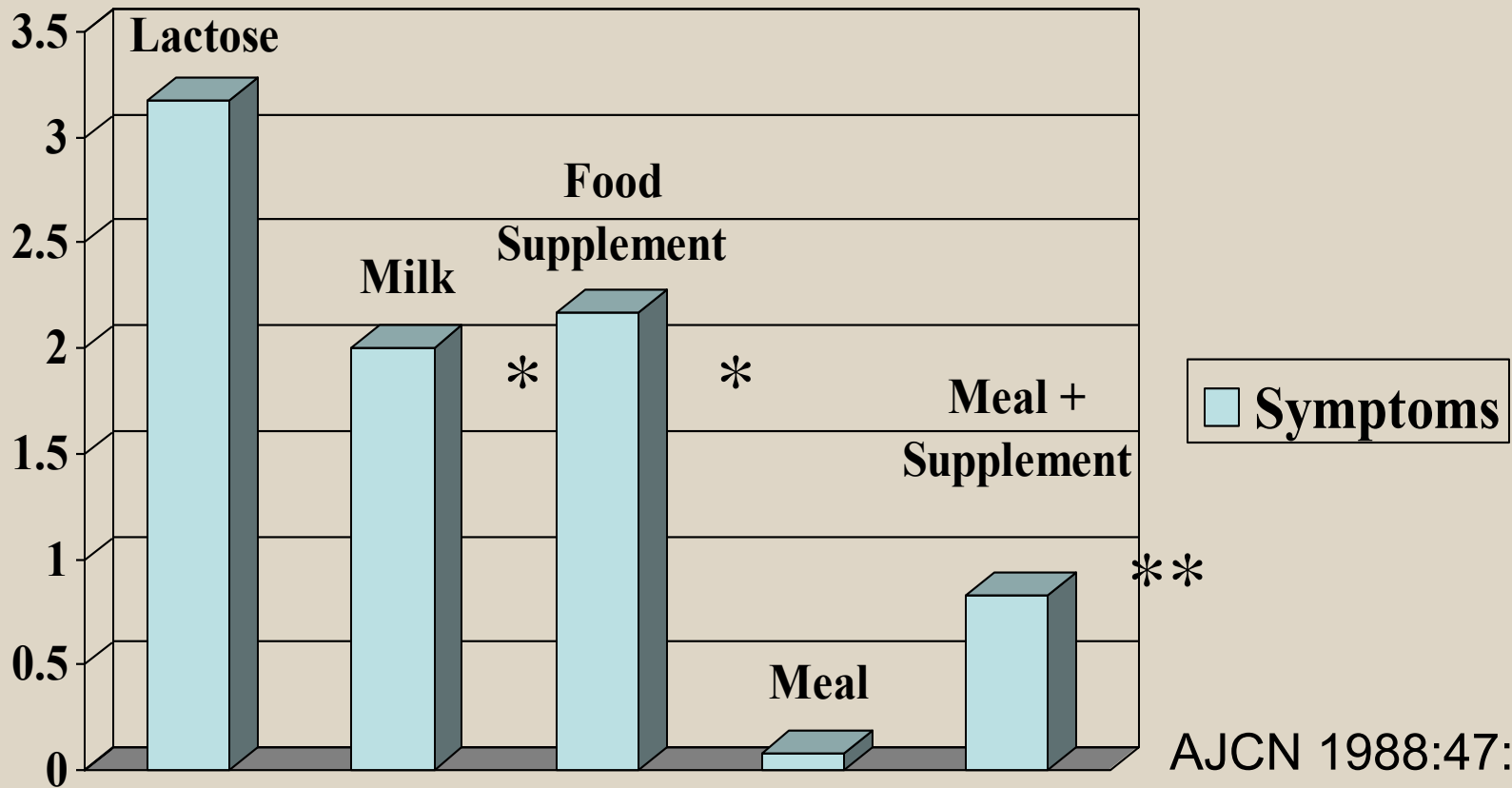


Managing lactose tolerance

- Dose and timing
- Colon adaptation
- Residual mammalian lactase
- Food sources vary in lactose
- Meal feeding
- Beta-casein



Lactose intolerance following lactose consumed with a meal



Lactose in Foods

(grams per serving)

Milk (8 oz)	11-13
Yogurts (plain, 8 oz)	11-17
Cheeses	
Cottage (4 oz)	2-3
Processed (1 oz)	2-3
Hard Cheeses (1 oz)	0.3-1
Sour cream (4 oz)	4-5
Cultured milk (8 oz)	9-13
Acidophilus milk (8 oz)	11-13
Ice cream (8 oz)	6-7
Whey (8 oz fluid)	13
(1Tbsp=2.9g dry)	2.1

Tolerance from Lactose, Skim Milk and Whole Milk

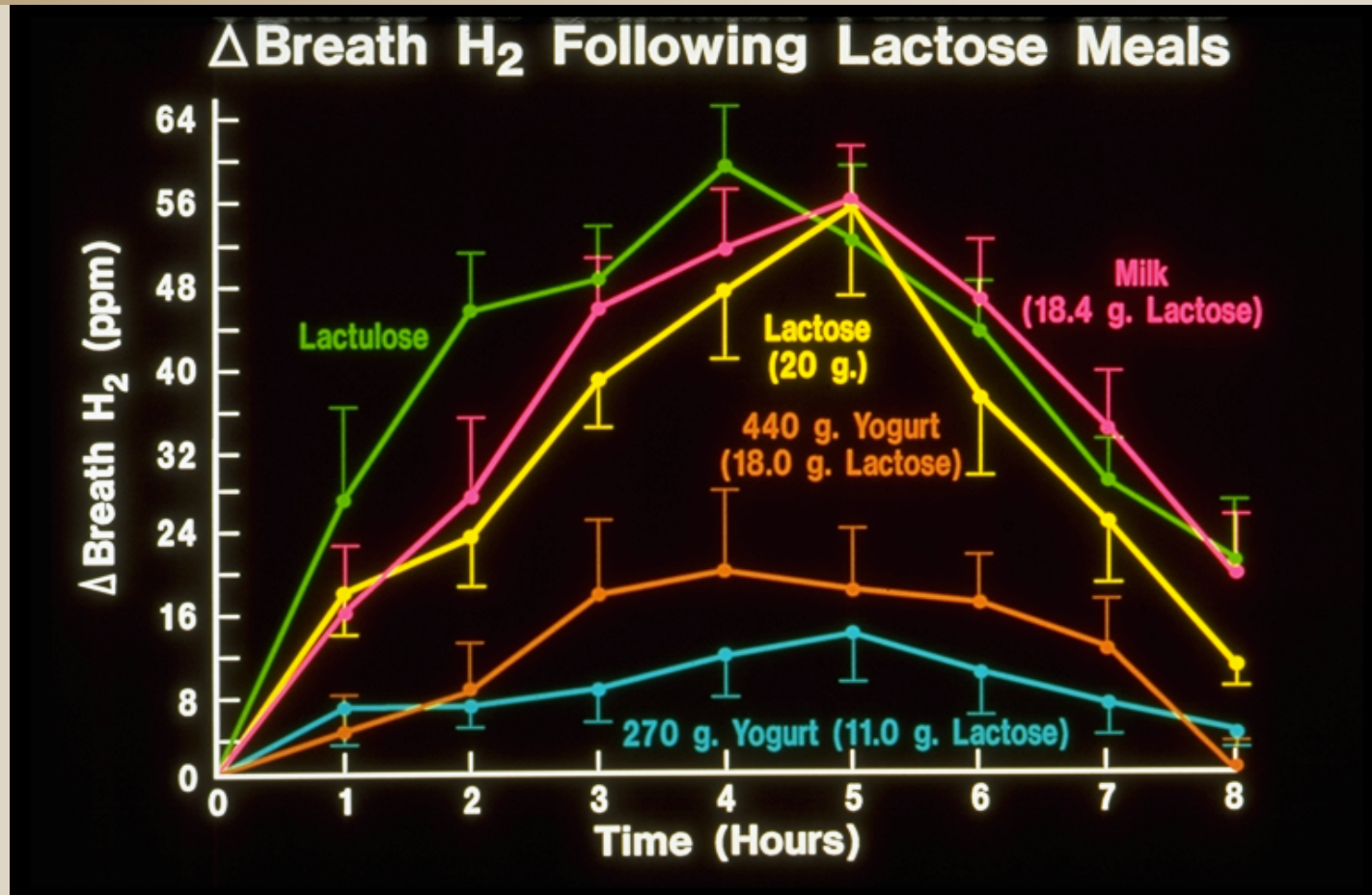
Leichter (1973)

- Lactose in water 2.7 ± 0.2
- Skim milk 2.0 ± 0.1
- Whole milk 1.2 ± 0.2

0-None 1-Minor 2-Moderate 3-Severe



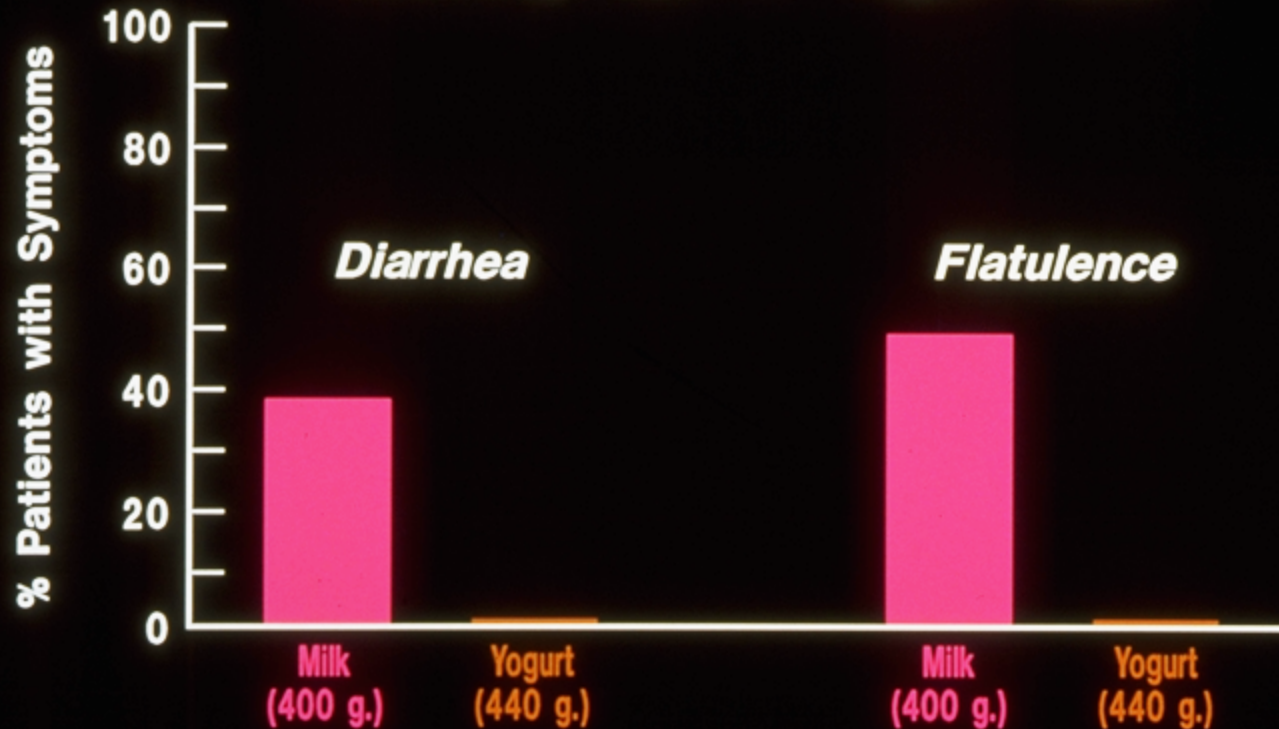
Yogurts are well tolerated regardless of their lactose content



NEJM 1984;310:1-4



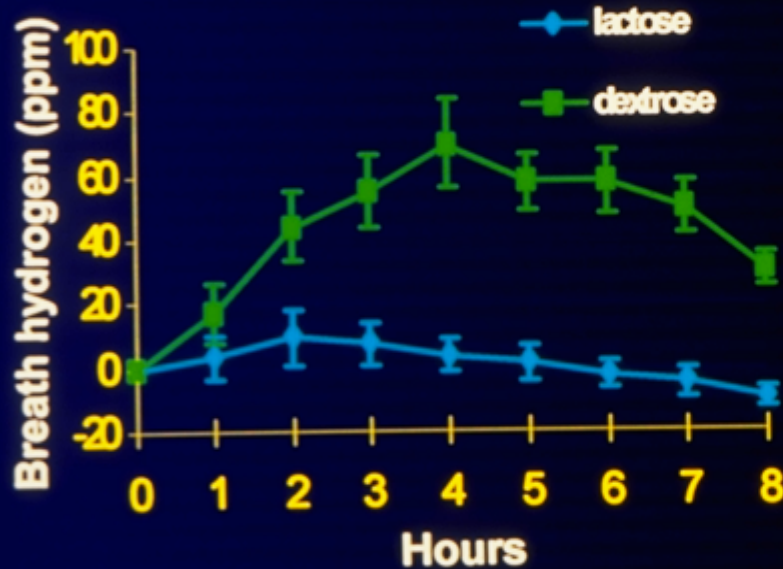
Frequency of Symptoms Following Milk or Yogurt Meal



Colon Adaptation

AJCN 1996;64:232-6

Breath hydrogen and symptoms

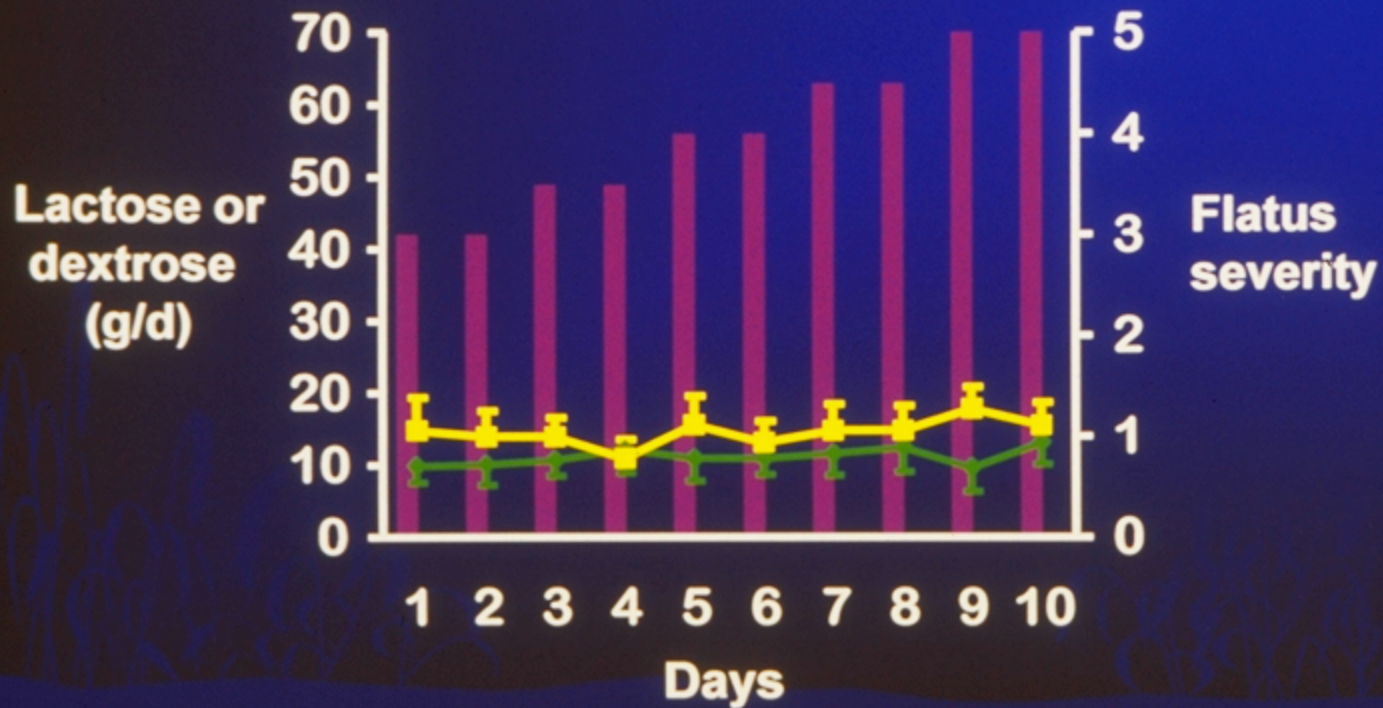


Symptom	Dextrose	Lactose
Flatus Ratings	8.1 ± 1.6 [†]	4.5 ± 1.0 [†]
Flatus Frequency	23.0 ± 2.8 [‡]	11.0 ± 2.6 [‡]

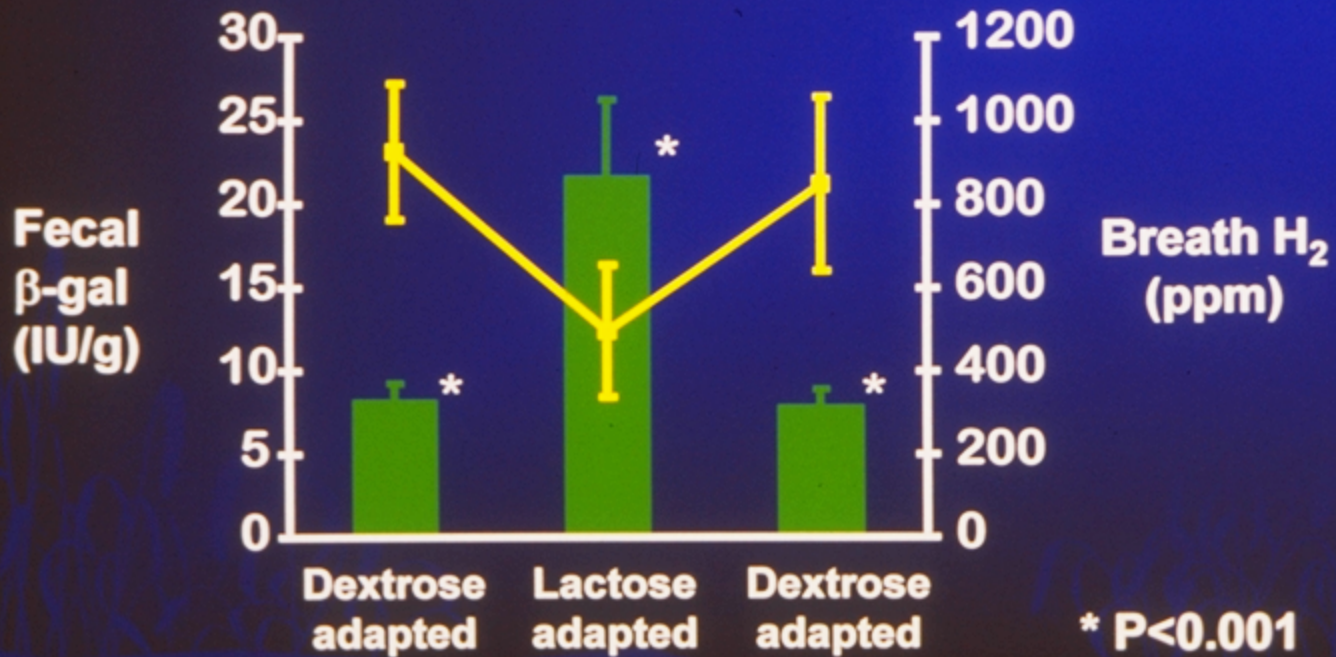
[†]P=0.025
[‡]P=0.028



Flatulence symptoms during lactose (■) and dextrose (■) feeding in Study 2

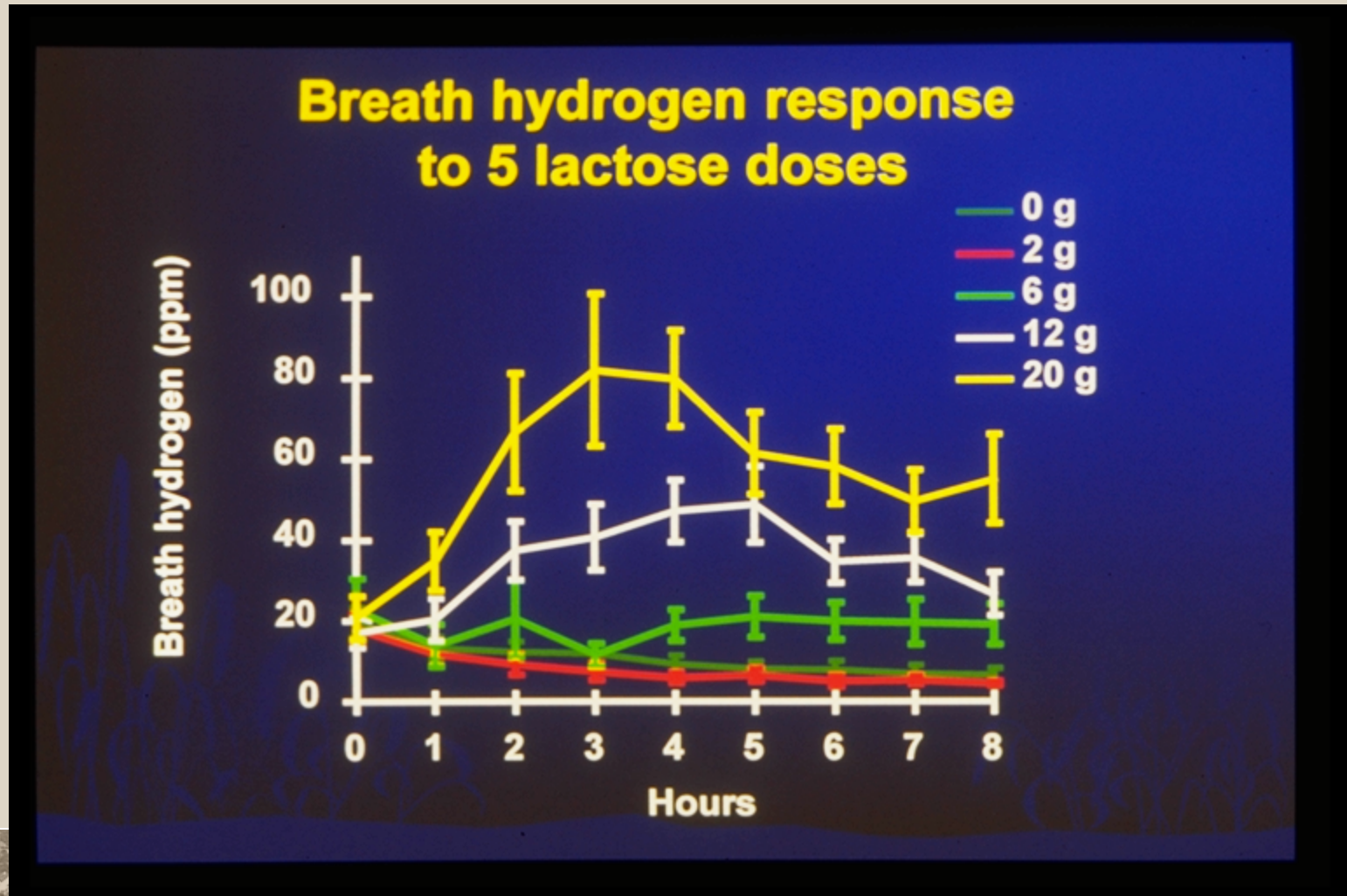


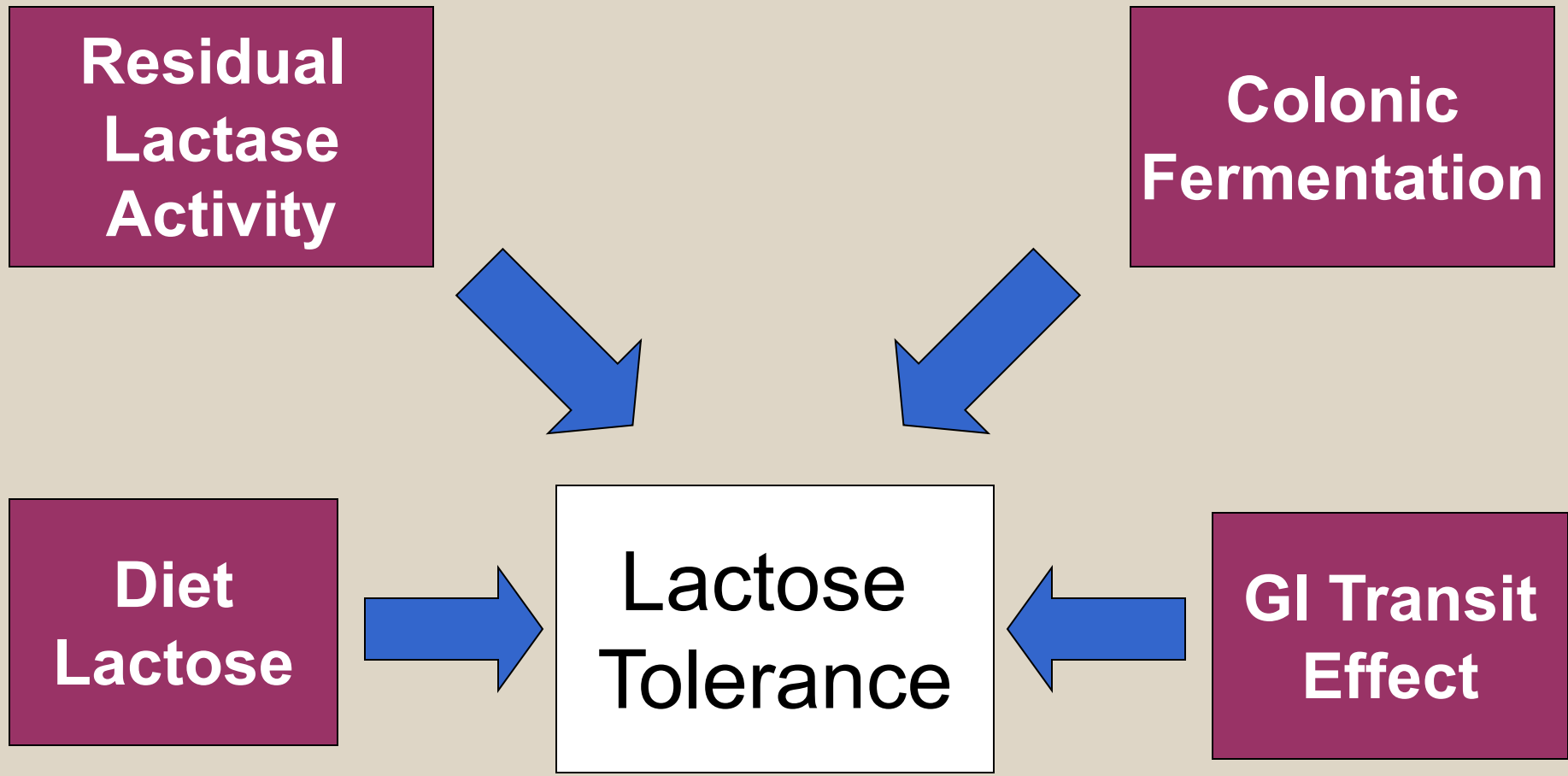
Breath hydrogen (■) and fecal b-gal (■) in Study 1



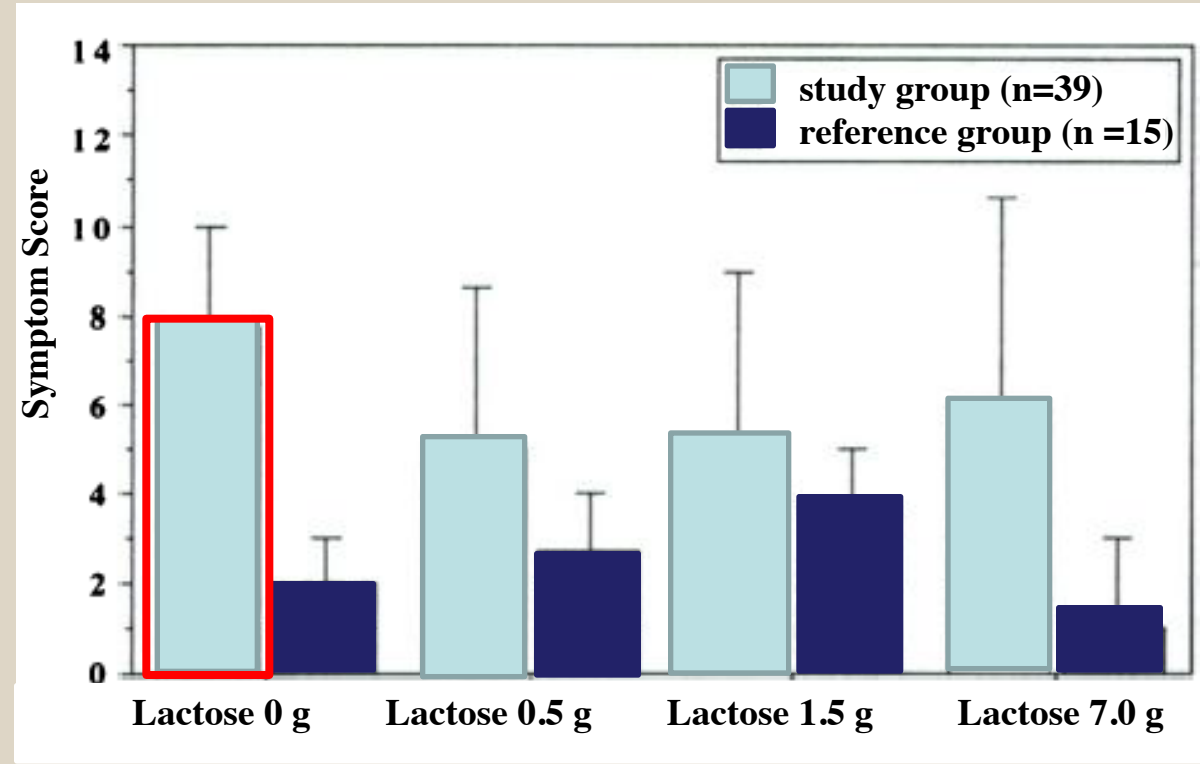
Dose-Response

JADA 1996:96:243-246





Milk Intolerance: Is it only lactose?



Study Group: Maldigesters with moderate symptoms

Ref Group: Digesters with no symptoms

Randomized, crossover, double-blinded

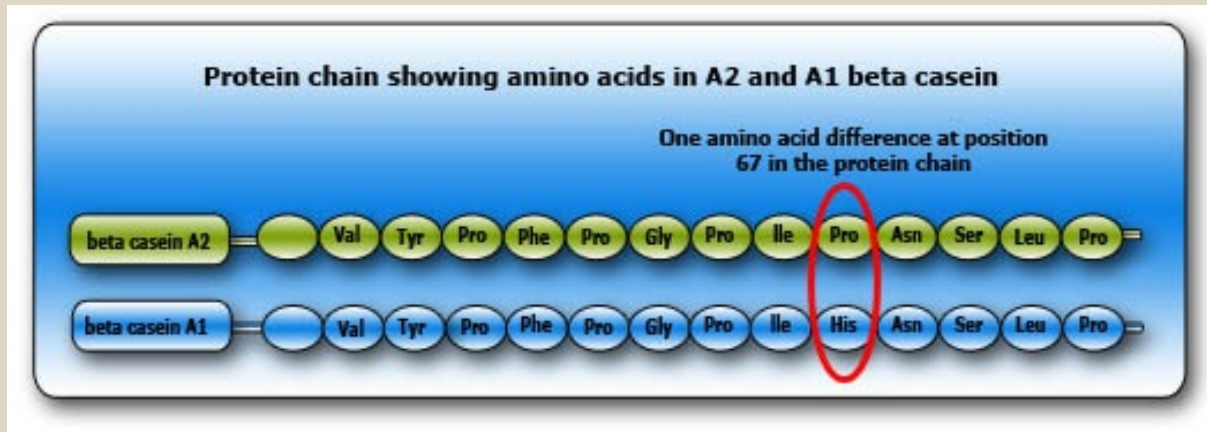
The doses: 200 mL fat-free milk
Strict control of fiber in addition to dairy

Vesa et al. Am J Clin Nutr 1996

Vesa's Conclusion: GI symptoms may be induced by factors other than lactose in some individuals.



The difference between A1 and A2 β -casein families

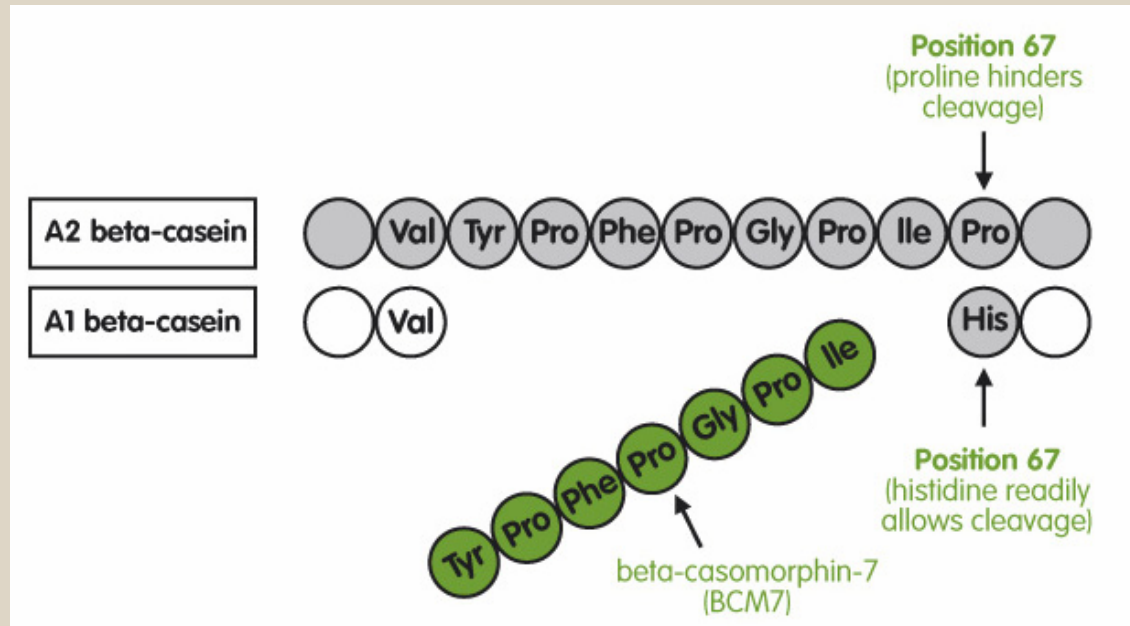


- The only difference in the **209 amino acid chain of beta-casein** is a single amino acid at position 67 (proline in A2 instead of a histidine A1)
- However, this has a profound effect on the way the protein digests.

(Kaminski et al., 2007)



Peptides released on digestion



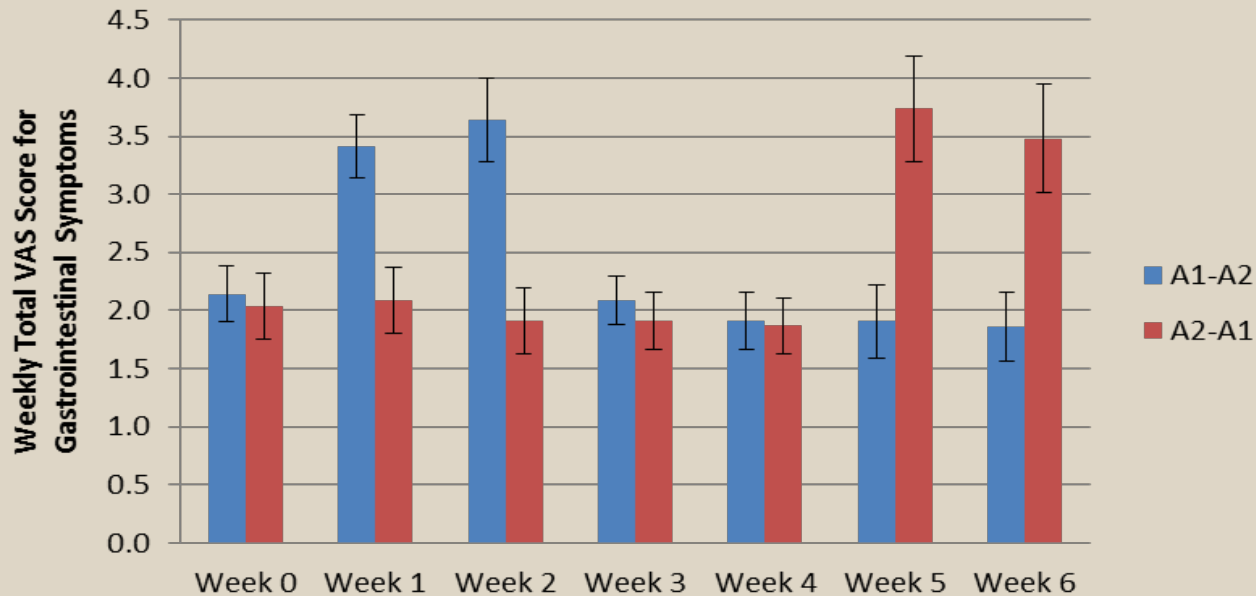
Beta-casomorphin-7 (BCM-7) released from A1 in physiologically active amounts

(Jinsmaa, et al. 1999; Ul Haq et al. 2015; Wada Y, et al. 2015)



Gastrointestinal symptoms with vs. commercial milk (A1 and A2 beta-casein)

Jianqin et al. Nutrition Journal (2016) 15:35



- Blue group fed commercial milk for weeks 1-2, and a2 Milk™ for weeks 4-6
- Red group fed a2 Milk™ for weeks 1-2, and commercial milk for weeks 4-6
- Gastrointestinal symptoms were the same as baseline values and washout period ($p < 0.05$) for both sequence groups during the consumption of a2 Milk™.



Comparison of the impact of bovine milk β -casein variants on digestive comfort in females self-reporting dairy intolerance: a randomized controlled trial

Milan et al. Am J Clin Nutr (2020) 111:1

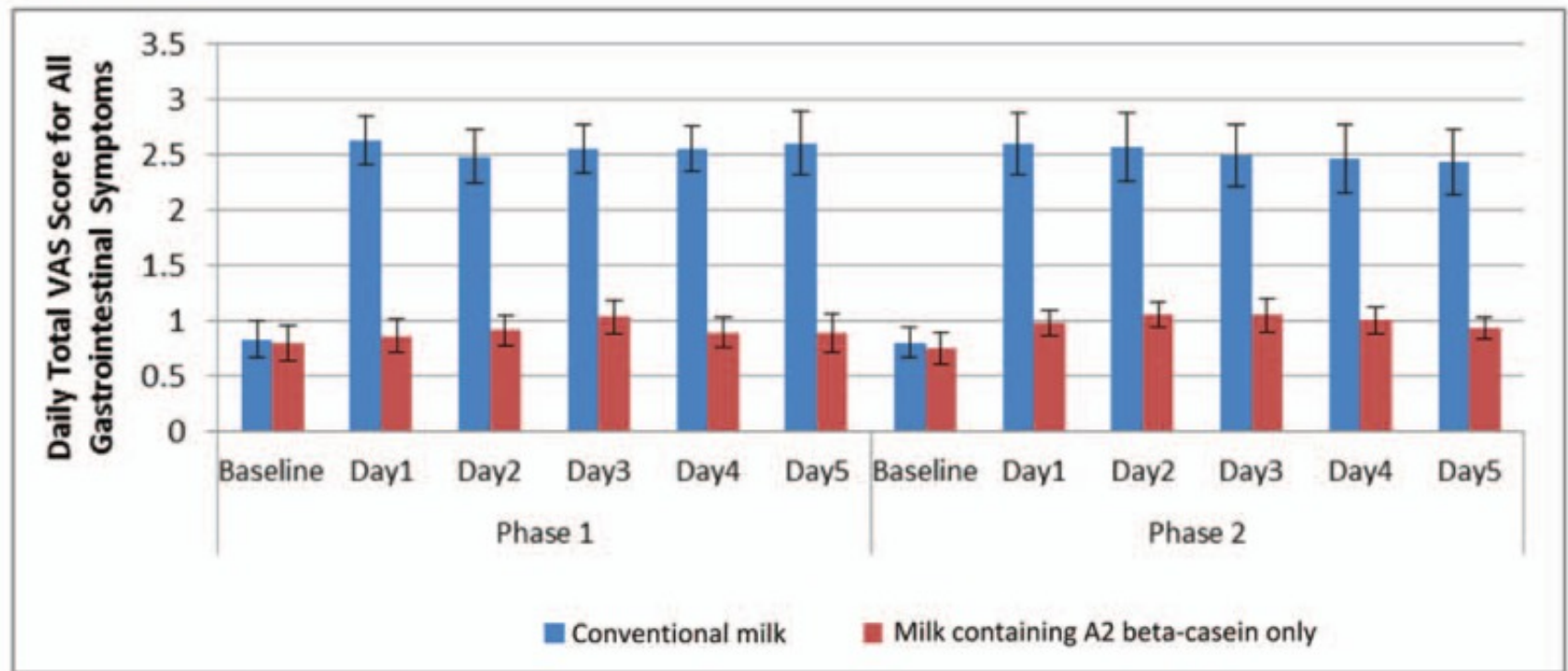
- Lactose Maldigesters (n=10) experienced less nausea and fecal urgency with a2 Milk™ compared with conventional milk irrespective of time
- Non-lactose dairy intolerant subjects (n=20) and dairy tolerant subjects (n=10) did not report any differences in symptom severity between milks in respect of nausea, fecal urgency, or digestive comfort
- There was reduced breath hydrogen production following a2 Milk™ consumption relative to conventional milk in lactose maldigesters



Effects of Conventional Milk Versus Milk Containing Only A2 β -Casein on Digestion in Chinese Children: A Randomized Study

Xiaoyang Sheng, Zailing Li, Jiayi Ni, and Greg Yelland, JPGN (2019) 69:3

A Overall

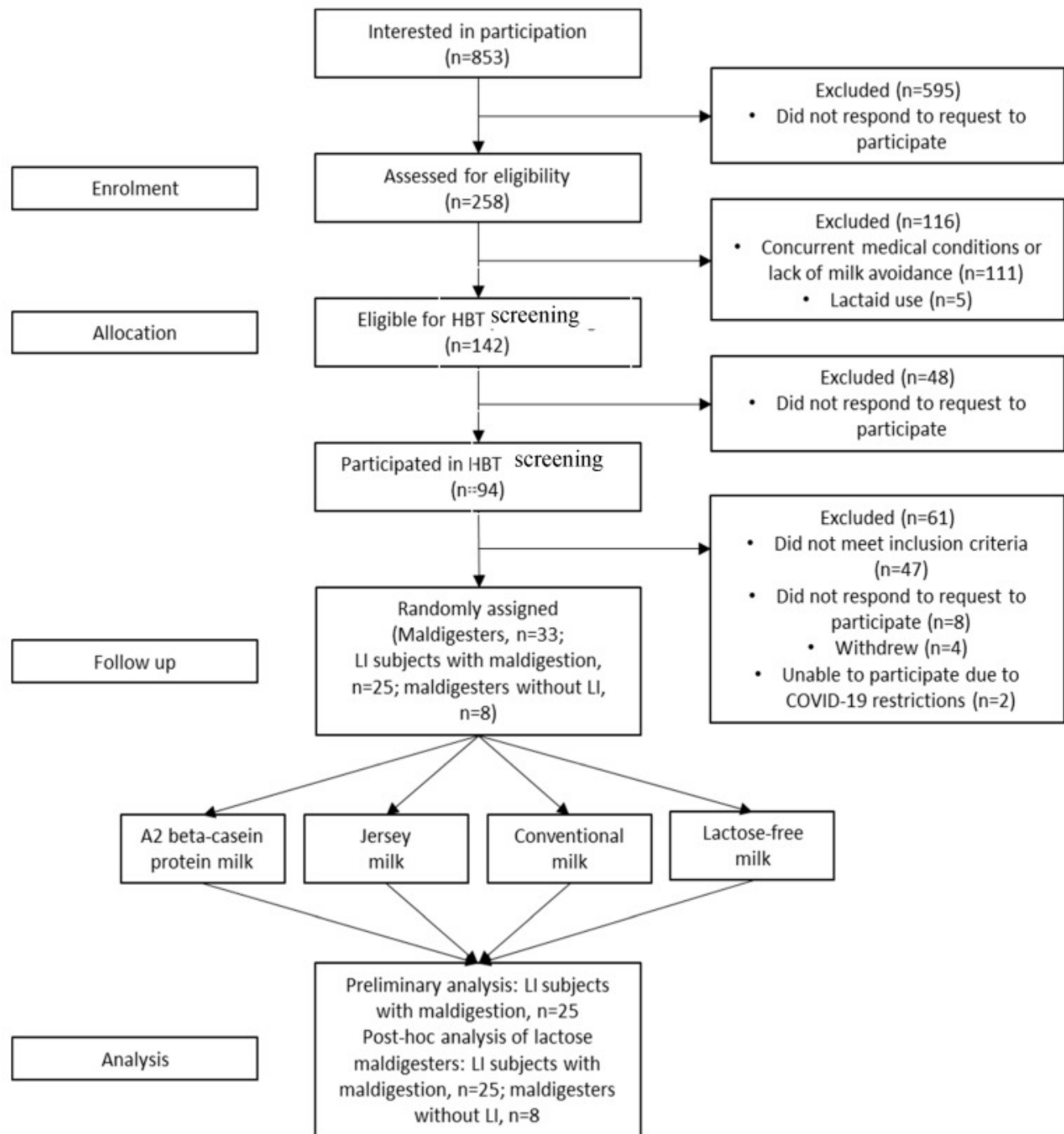


Milk Containing A2 β -Casein ONLY, as a Single Meal, Causes Fewer Symptoms of Lactose Intolerance than Milk Containing A1 and A2 β -Caseins in Subjects with Lactose Maldigestion and Intolerance: A Randomized, Double-Blind, Crossover Trial

Monica Ramakrishnan , Tracy K Eaton , Omer M Sermet ,
Dennis A Savaiano

Nutrients. 2020 Dec 17;12(12):3855. doi: 10.3390/nu12123855.





A2/A1 β -casein ratios in test milks

- A2 milk 100% A2
- Jersey milk 25% A1 75% A2
- Conventional milk 75% A1 25% A2

- Lactose-free 60% A1 40% A2

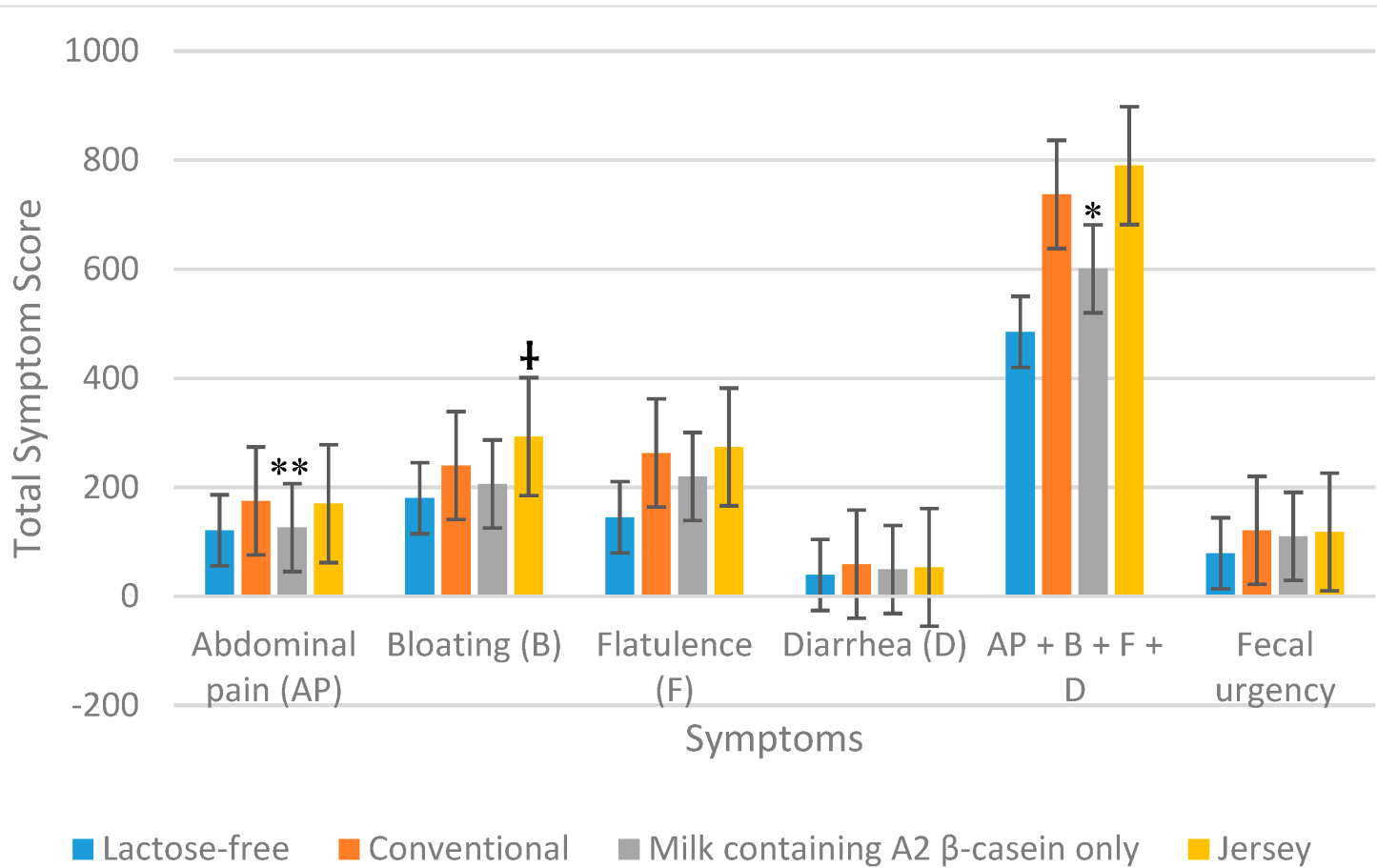
Primary analysis:

Conventional vs A2

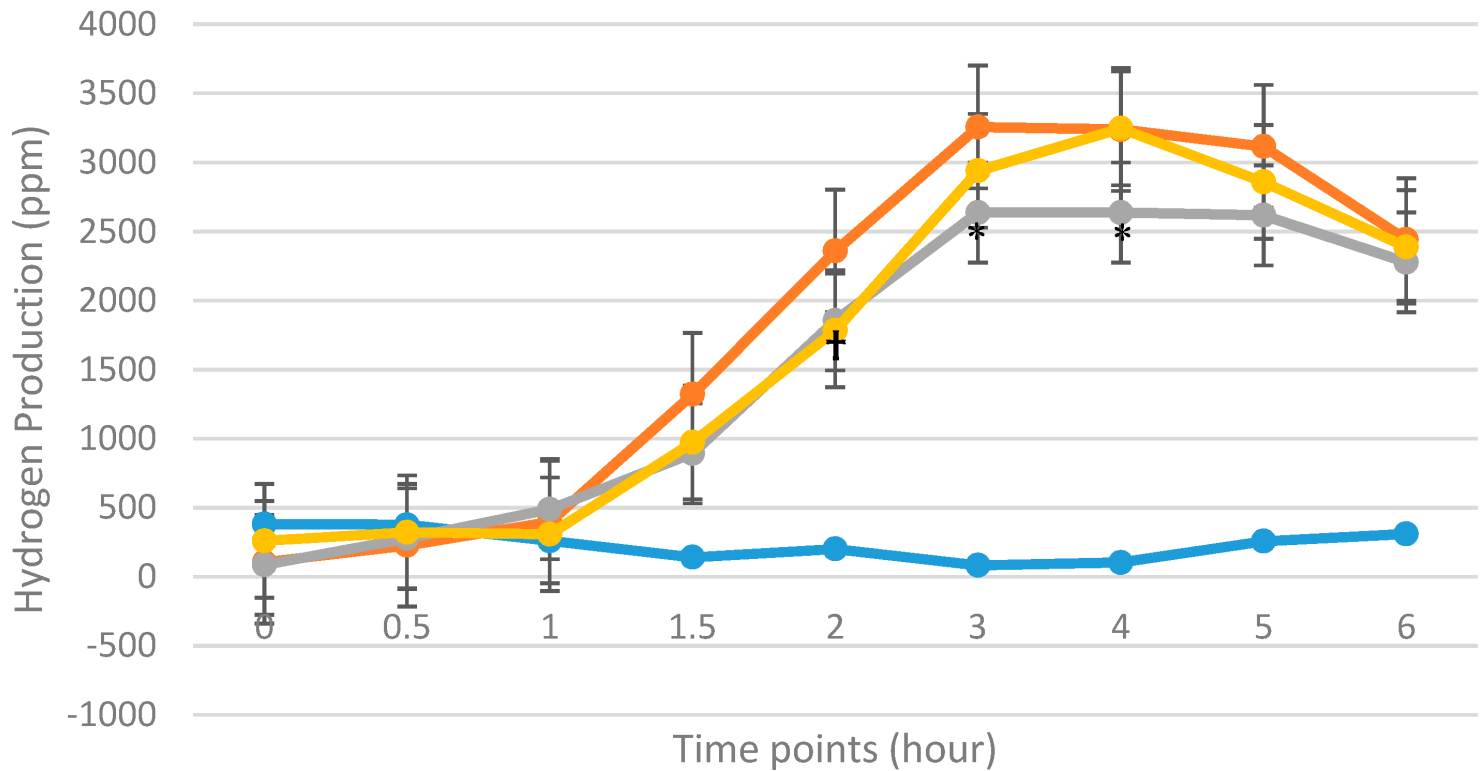
Conventional vs Jersey



Intolerance symptoms reported during 6 hours following milk challenge among 33 lactose maldigesters

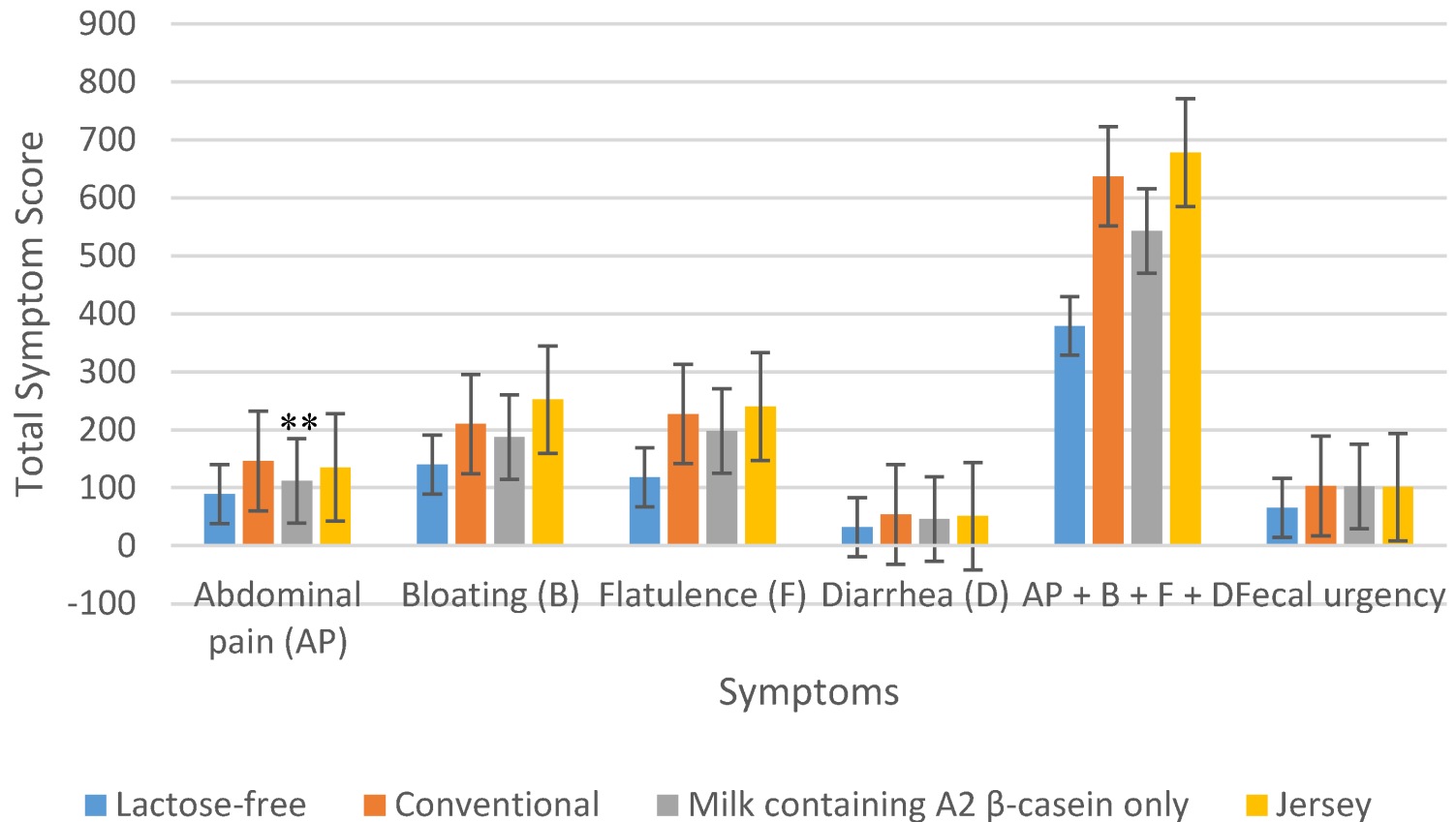


Gas production during 6 hours after milk consumption among 33 lactose maldigesters

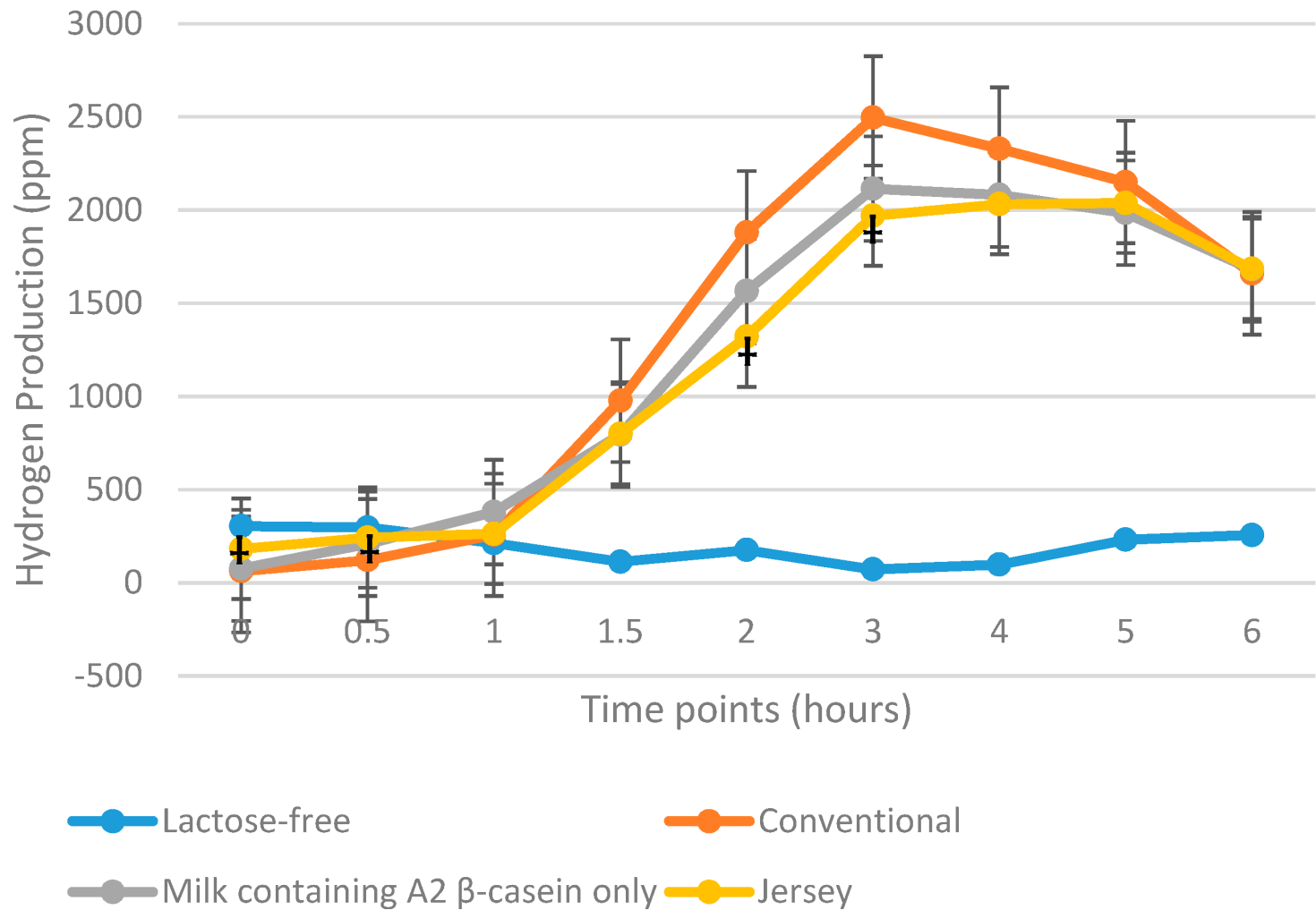


● Lactose-free ● Conventional
● Milk containing A2 β-casein only ● Jersey

Intolerance symptoms reported during 6 hours following milk challenge among 25 lactose intolerant maldigesters



Gas production for 25 lactose intolerant maldigesters



β-casein involvement in gene expression



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J Nutr Biochem. 2014 October ; 25(10): 1011–1018. doi:10.1016/j.jnutbio.2014.05.004.

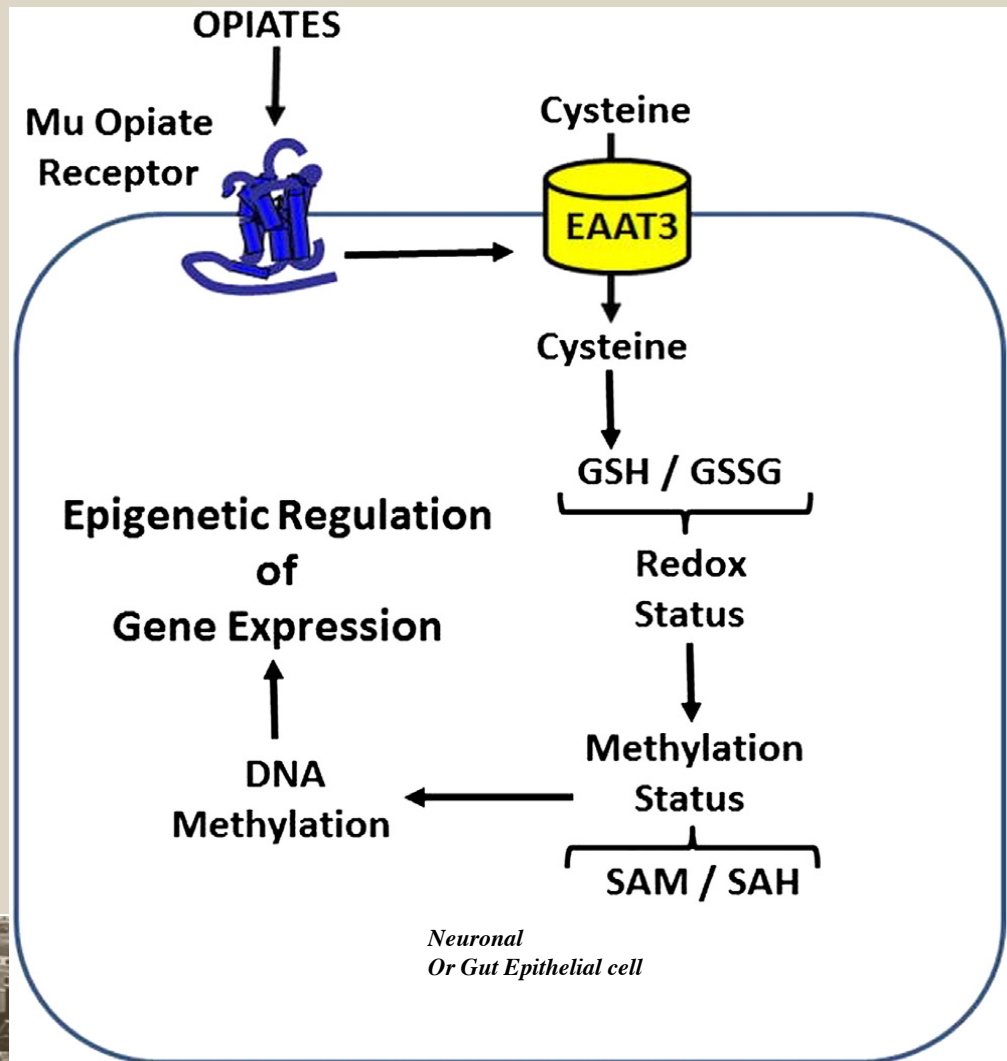
Food-derived opioid peptides inhibit cysteine uptake with redox and epigenetic consequences

Malav S Trivedi¹, Jayni S Shah¹, Sara Al-Mughairy², Nathaniel W Hodgson³, Benjamin Simms³, Geert A Trooskens³, Wim Van Criekinge³, and Richard C Deth^{3,1}

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Summary

- Lactose maldigestion is genetically determined.
- Symptoms of intolerance depend on dose and can be minimal when milk is eaten with a meal.
- A1 beta-casein containing milk may cause greater symptoms for some individuals.
- To label someone lactose intolerant is to further the 'myth' and ignore the basic mammalian physiology that allows for adequate dairy consumption among maldigesters.

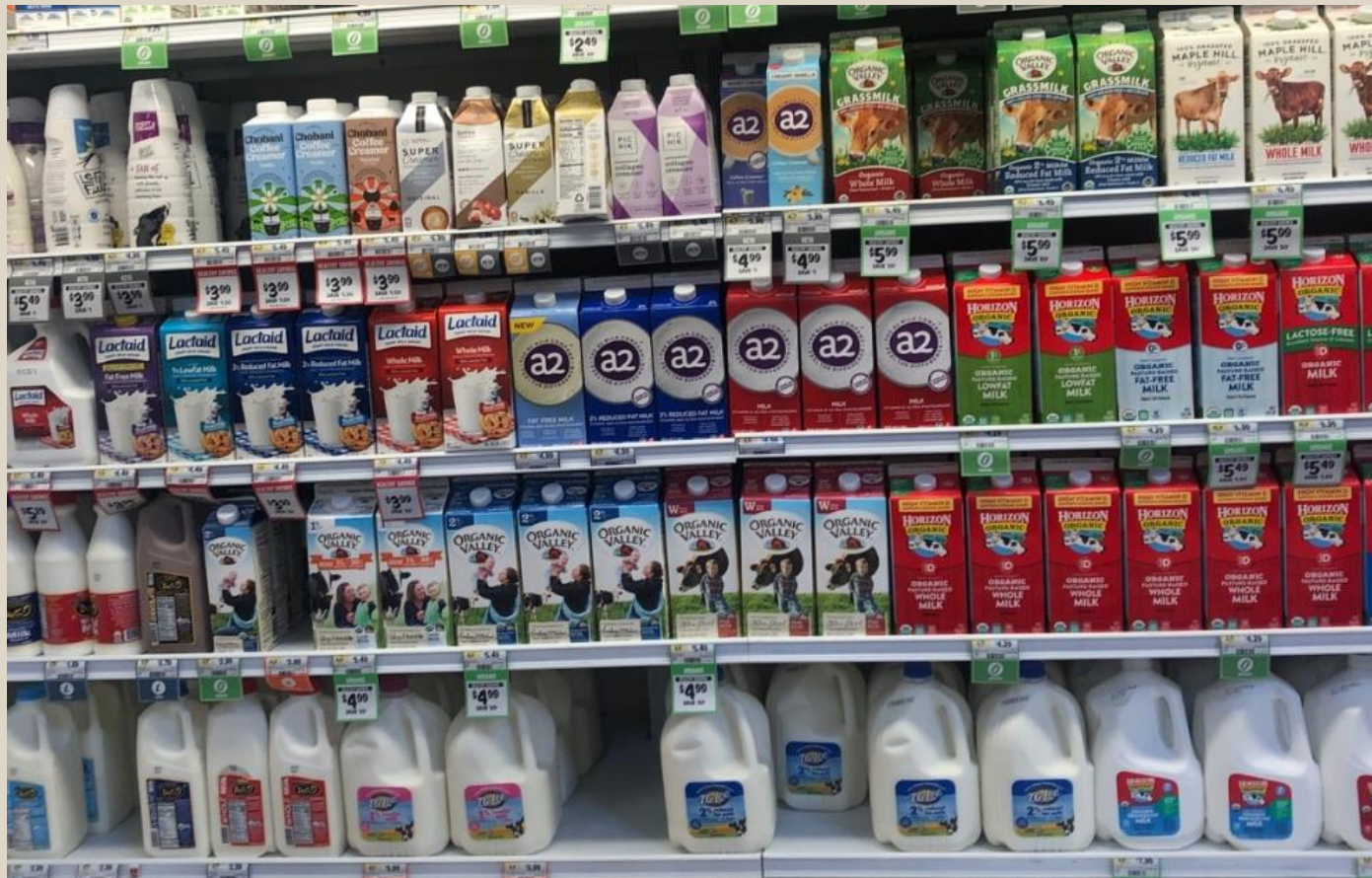


Must reads

- National Institutes of Health Consensus Development Conference: Lactose Intolerance and Health, February 2010
 - <http://www.annals.org/cgi/content/full/0003-4819-152-12-201006150-00248v1>
 - <http://consensus.nih.gov/2010/lactoseabstracts.htm#Tishkoff>
- LI in Infants, Children and Adolescents. MB Heyman for the Committee on Nutr. Pediatrics 2006
 - <http://www.pediatrics.org/cgi/content/full/118/3/1279>



Questions?



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