

Effects of Thermization on Yogurt Functionality in different Populations

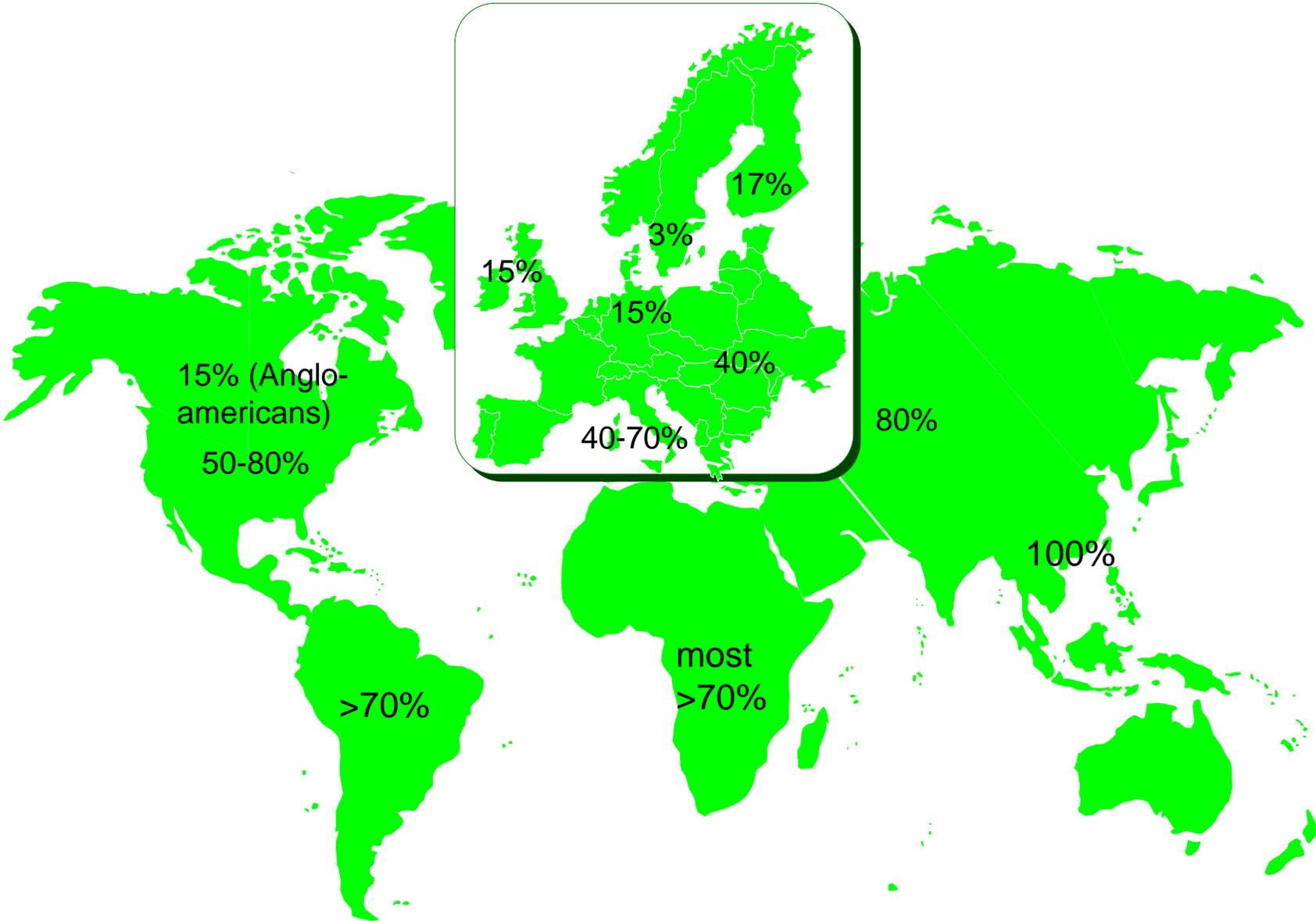
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**The good news is that you don't have
mad cow's disease,
the bad news is that you're
lactose intolerant**

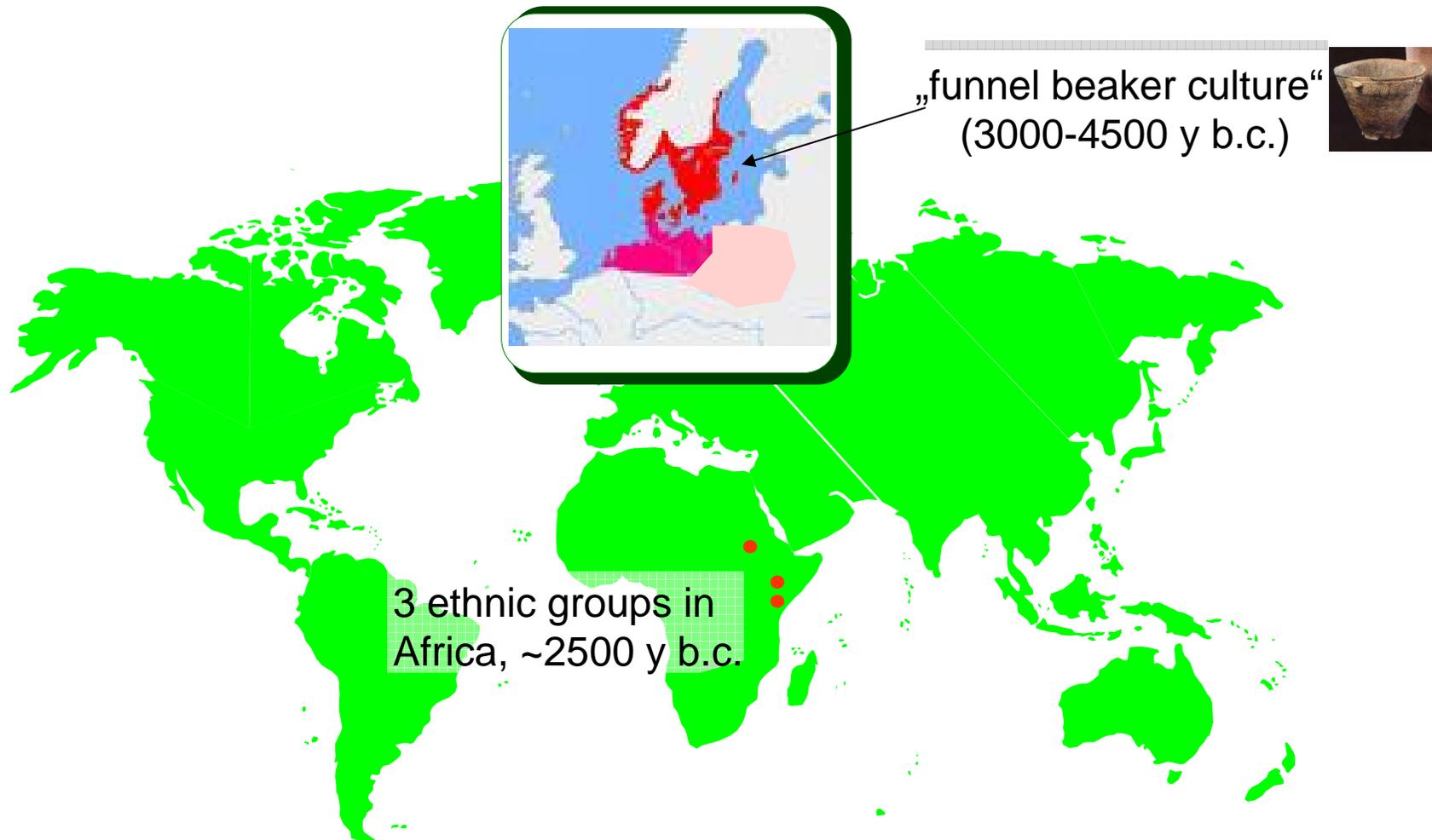


Prevalence of lactose maldigestion



The origin(s) of lactase persistence

US and German geneticists identified lactase persistency polymorphism:
The lactase persistency mutation has occurred independently both in Africa and Europe ~5000 y ago and arose from 0 to >70% within ~3000 years



Yogurt – only life?

Lactose is under debate also in countries without lactose intolerance problems (like Germany):

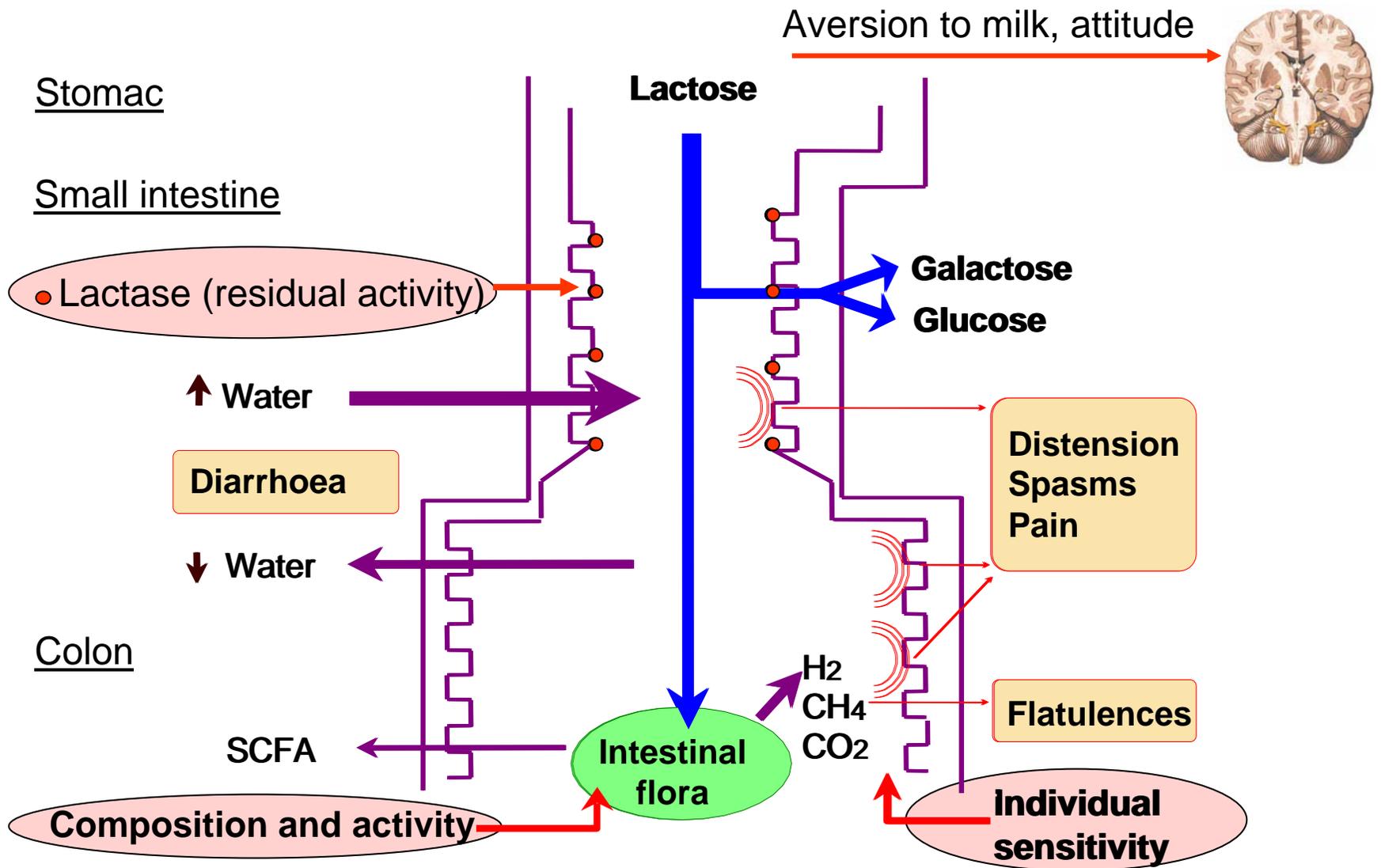
- Native yogurt with viable starter bacteria contains native microbial lactase (β -galactosidase), which, upon ingestion, increases lactose digestion in lactose malabsorbers.
- Heating kills starter bacteria, inactivates microbial lactase and by this reduces digestibility of lactose in lactose maldigesters
- However: this difference in digestibility has no obvious clinical repercussions and clinical studies showed no significant difference in lactose tolerance between native and heated yogurt.

What are the reasons?

Explanations

- Reasons for this weak association in clinical studies between improvement of lactose digestion, decrease in lactose intolerance and the ingestion of native or heat-treated yogurt:
- Methodical weakness
 - incomplete pasteurization, limitations of the H₂ breath test, different lactose test doses (50/25/12.5 g/test), non-adjusted questionnaires,
- Weak correlation between the amount of undigested lactose reaching the colon and the severity of (subjectively assessed) lactose intolerance symptoms

Explanatory scheme for lactose maldigestion and intestinal complaints



Hypothesis

In populations with a low prevalence of malabsorption no clearcut distinction (according to the H₂ breath test) between „still lactose absorbers“ and „already malabsorbers“ is possible;

a continuous transition from hypo- to normo-lactasia is observed

Design of a clinical study:

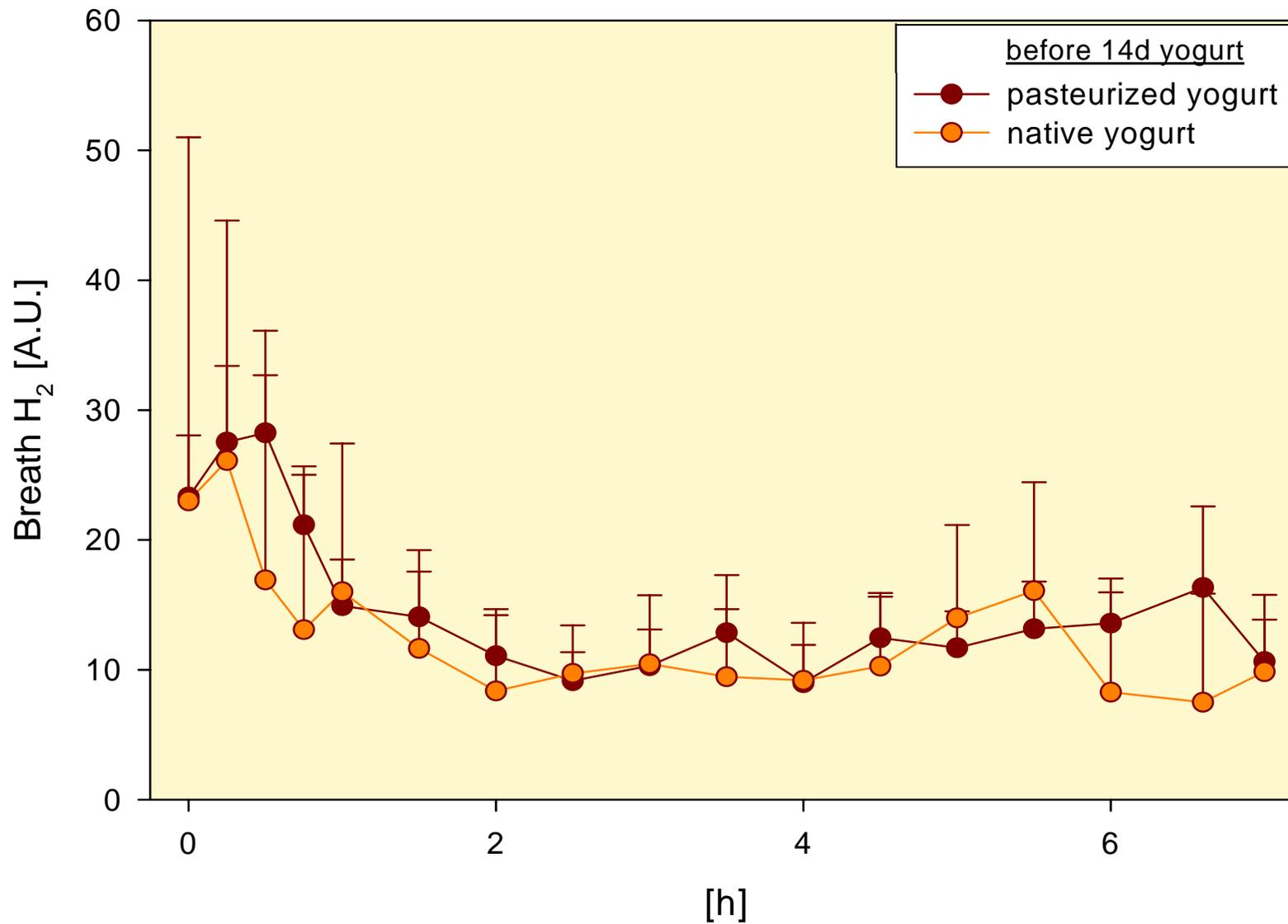
„Effect of live and heated yogurt on lactose digestion and GI symptoms in lactose digesters and subjects with less pronounced malabsorption/intolerance

- Screening of 220 residents of Kiel by breath H₂ test
- Study design: randomized, controlled, double blind, cross-over
- Participants: 24 healthy lactose absorbers with unspecific GI complaints and 23 malabsorbers
- Products: native (>10⁸ cfu/g) or pasteurized (<10² cfu/g) yogurt (S85, Danone)
- Design: 2 periods (4 weeks each) with 4x125g/d native or pasteurized yogurt divided by a 4 week wash-out period without yogurt (+cross-over).
Daily record of GI symptoms by the study participants
- At the beginning and end of each yogurt period.
 - Measurement of lactose digestion (breath H₂ tests; ¹³CO₂ breath tests)
 - Blood sampling (glucose, insulin, free fatty acids)
 - Determination of GI-transit times (breath tests; colonic markers)

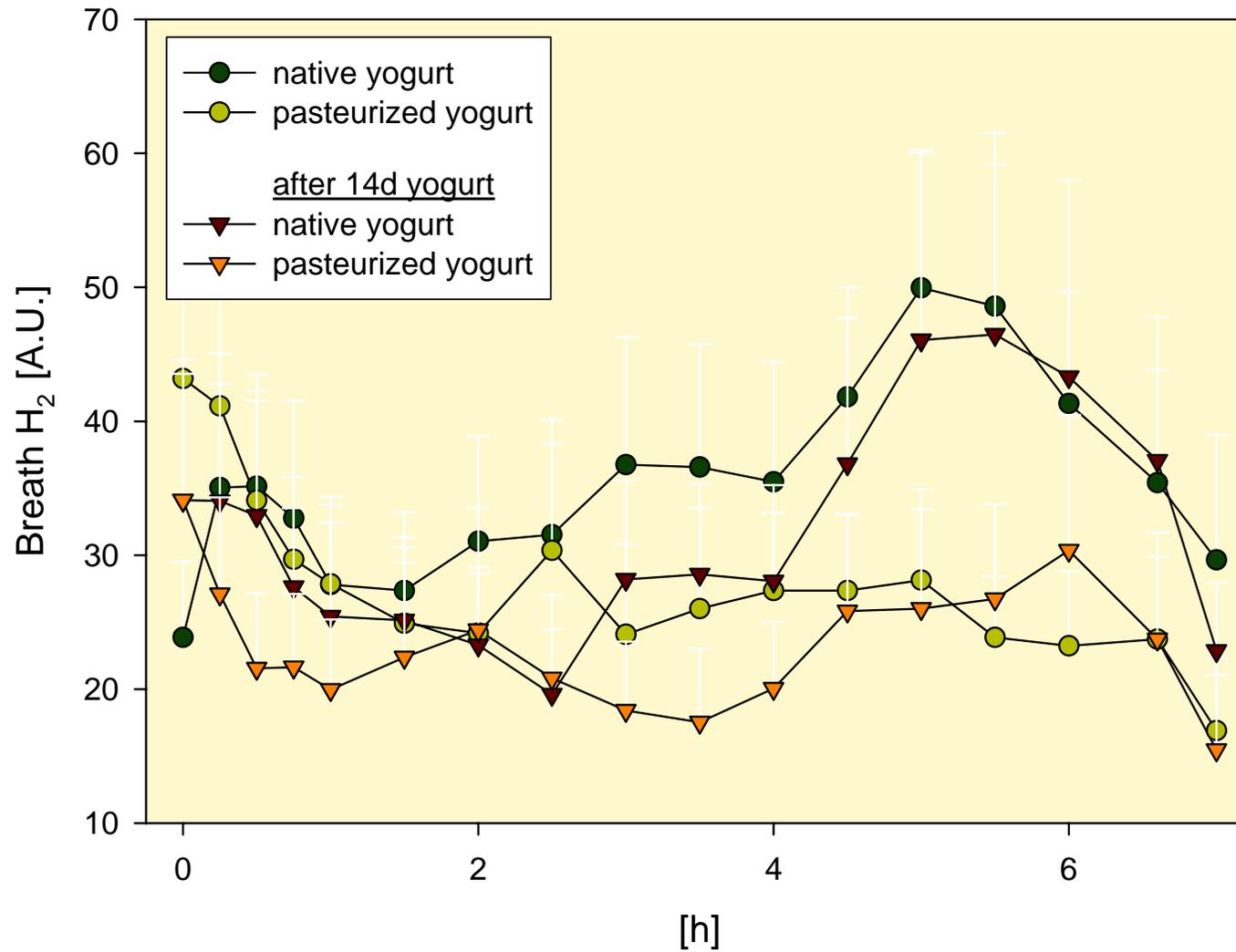
Prevalence of lactose maldigestion and intolerance in (Northern) Germany (Screening of 220 subjects)

Breath H ₂ test outcome	
<p>14.3% lactose maldigesters</p> <p>85.7% lactose digesters</p>	<p>43% intolerant</p> <p>57% tolerant</p> <p>1% intolerant</p> <p>99% tolerant</p>
Self-reported	
<p>11.3% lactose intolerant</p> <p>88.7% lactose tolerant</p>	<p>43% maldigesters</p> <p>57% digesters</p> <p>11% maldigesters</p> <p>89% digesters</p>

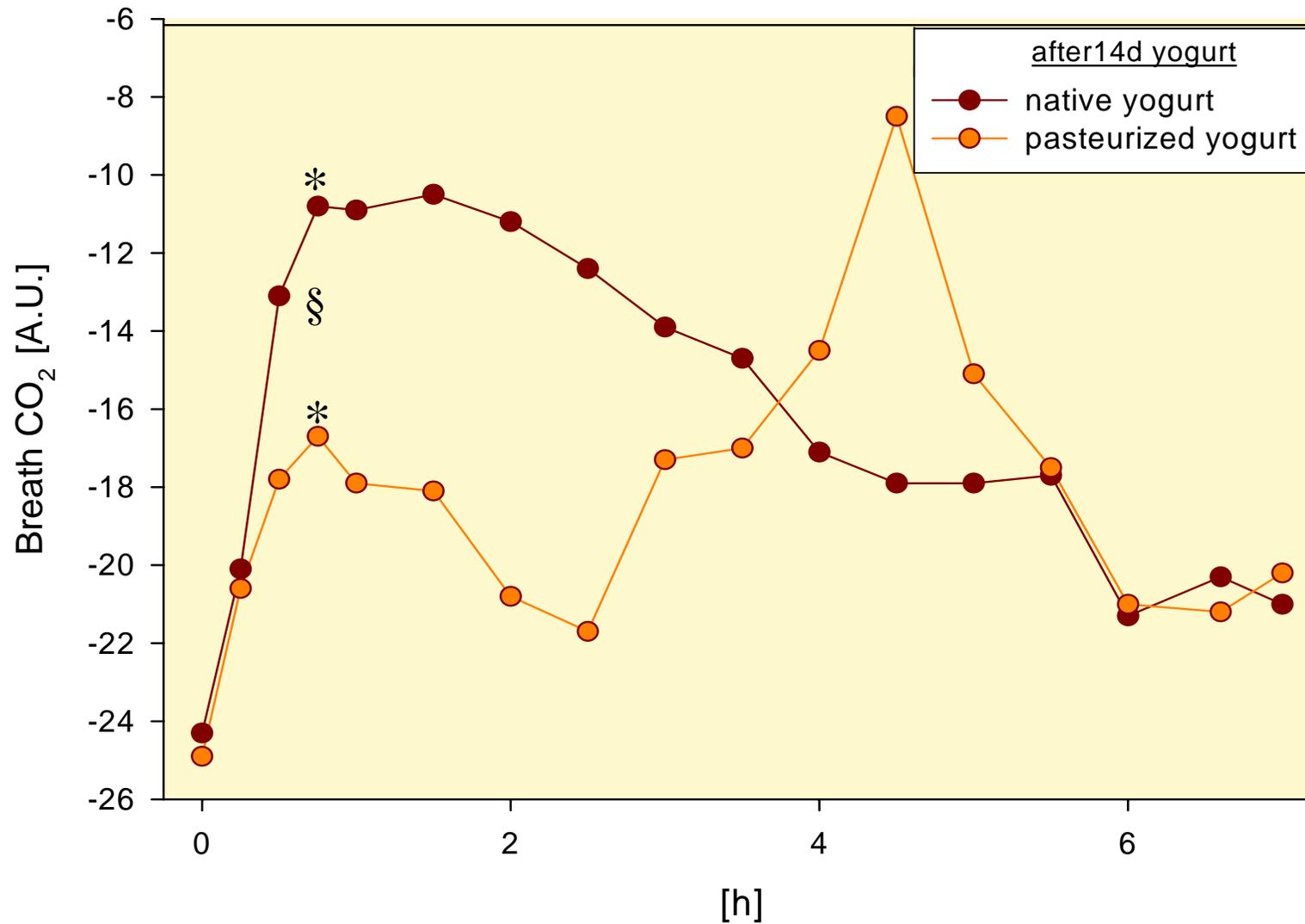
Effect of native and heated yogurt on lactose digestion (breath H₂ in lactose digesters)



Effect of native and heated yogurt on lactose digestion (H₂ breath test in lactose maldigesters, exp. days 1+3 and 2+4)

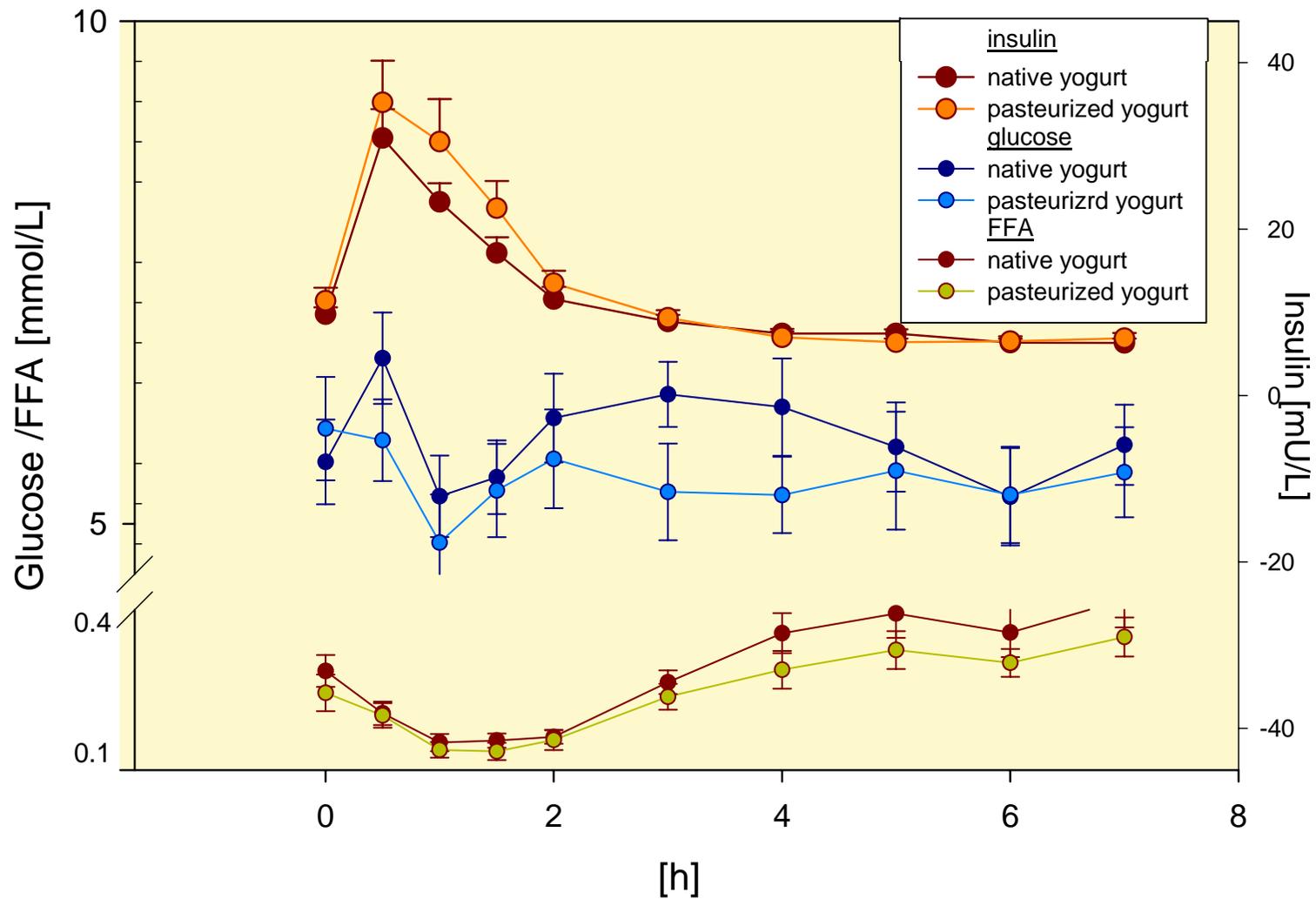


Effect of native and heated yogurt on lactose digestion (breath $^{13}\text{CO}_2$ in lactose maldigesters)



*significantly different from baseline ($p < 0.05$); § significant difference native vs. pasteurized yogurt ($p < 0.05$)

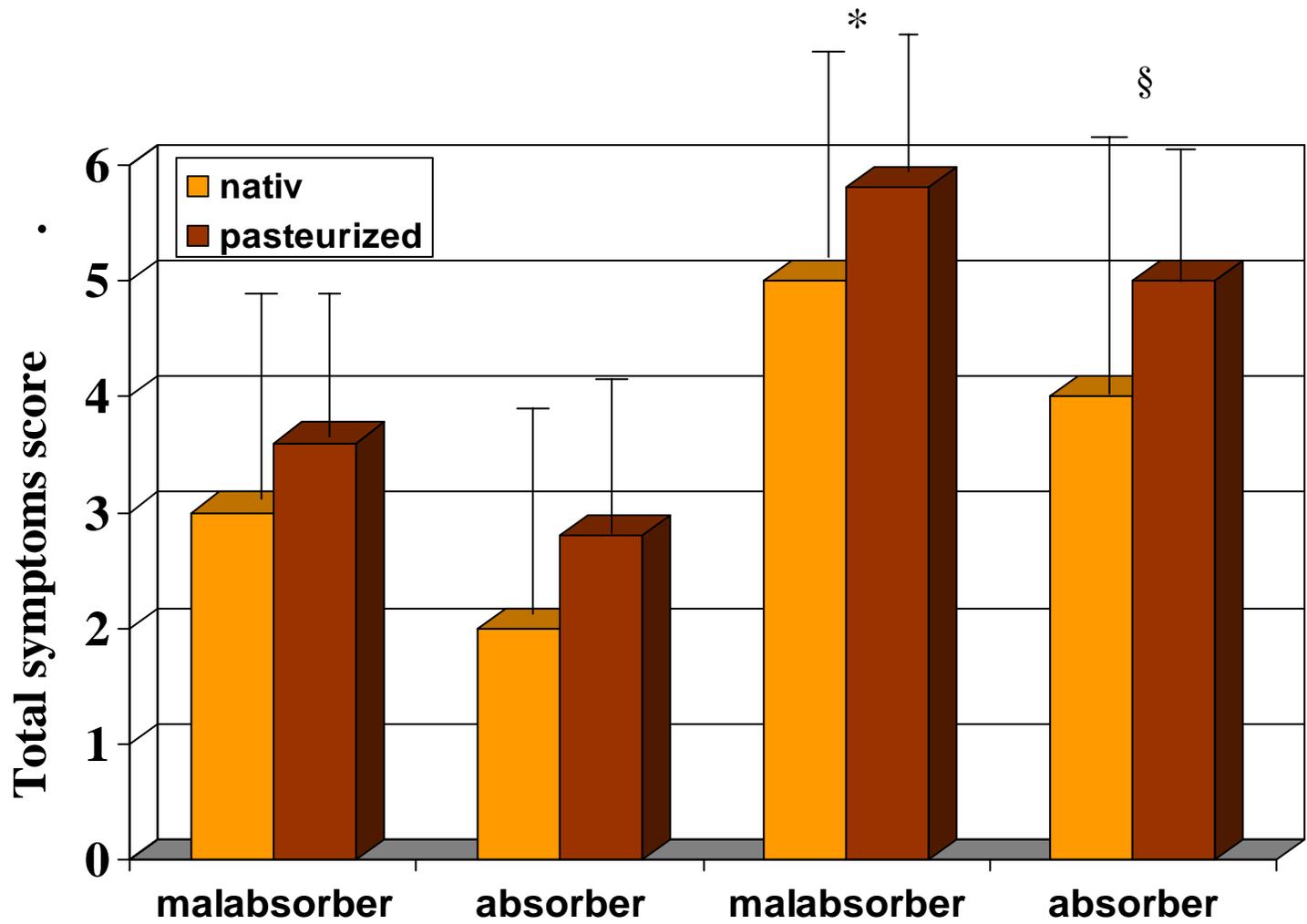
Effect of native and heated yogurt on lactose digestion (insuline, glucose and FFA in lactose maldigesters)



Gastrointestinal transit times in lactose (mal)digesters following yogurt ingestion

Lactose-tolerance	Yogurt	Gastric emptying [h]	Orofecal transit time [h]
Digester	native	1:28	48
	pasteurized	1:14	53
Maldigester	native	1:23	45
	pasteurized	1:16	45,5

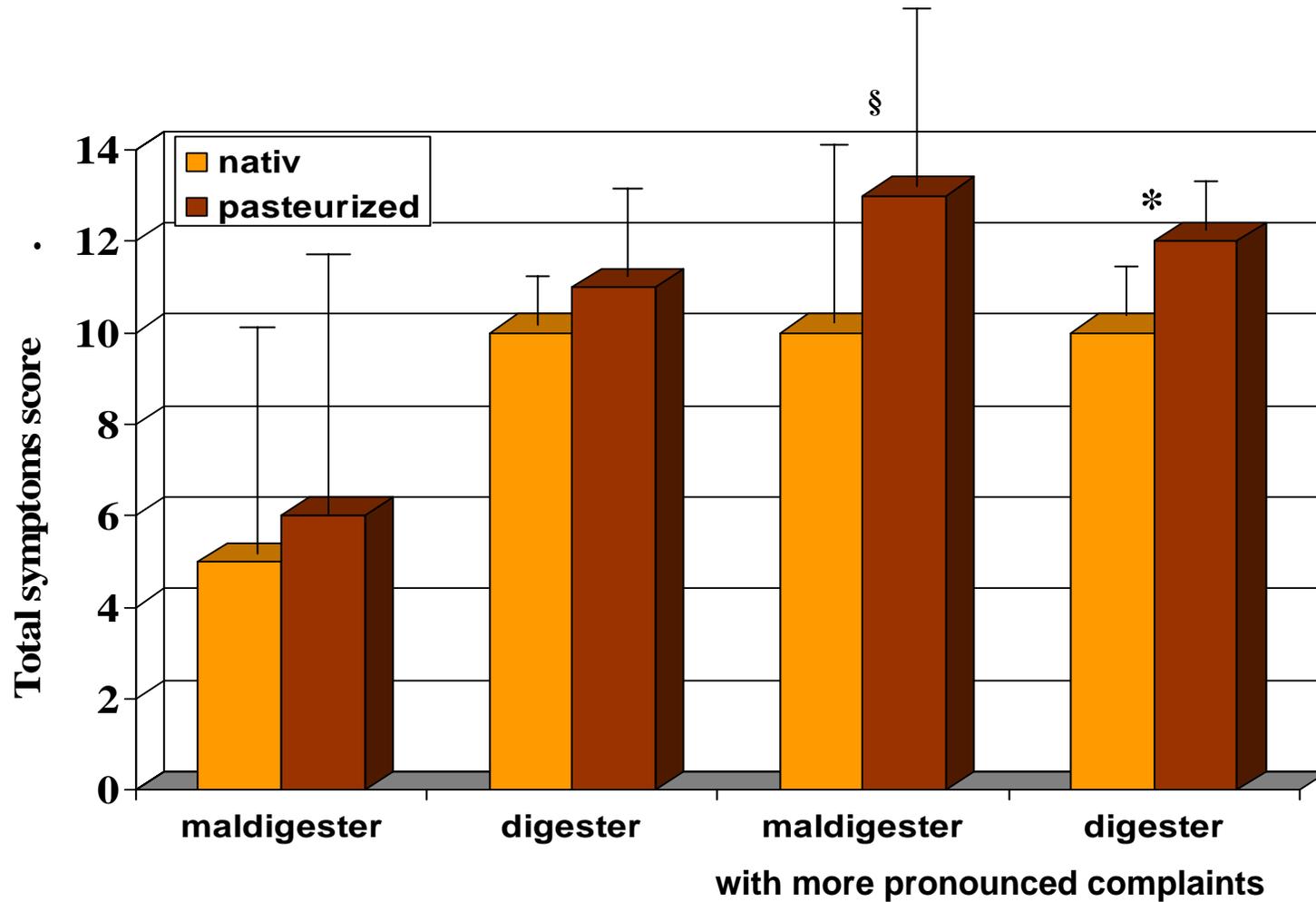
Sum of gastrointestinal complaints after a one-time consumption of 25 g lactose on experimental days 1-4 in digesters and non-digesters and in subgroups with more pronounced complaints



* p < 0.05; wilcoxon

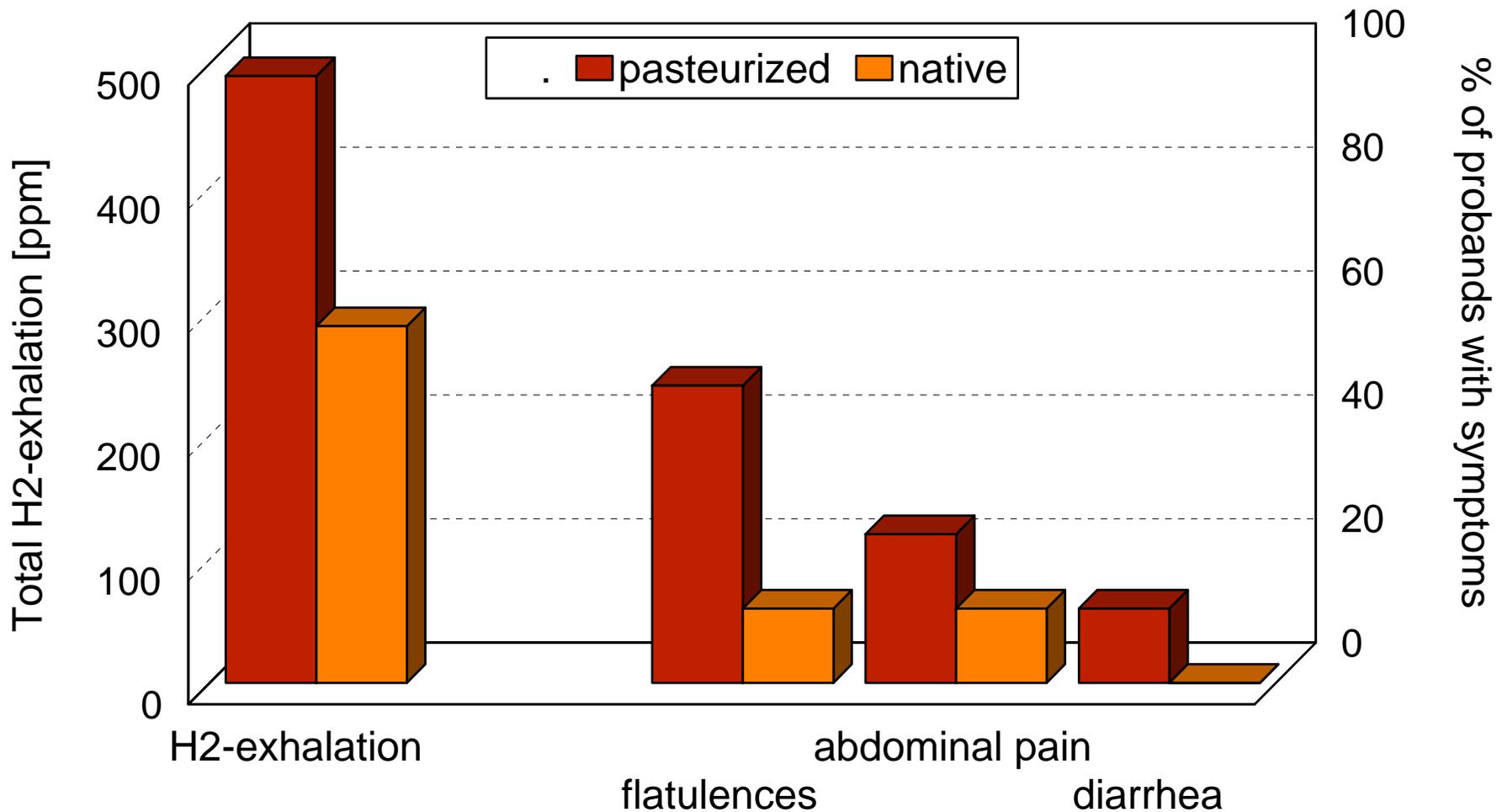
Sum of GI complaints during yogurt periods (4x125g/d)

in digesters and non-digesters and in subgroups with more pronounced complaints



* / § p < 0.05/0.1; wilcoxon

Breath H₂ and clinical symptoms in 10 healthy African and South-East Asian nurses consuming pasteurized or native fermented milk



Conclusions

- Native (compared with pasteurized) yogurt
 - significantly improves lactose digestion in malabsorbers and
 - decreases GI discomfort (pain, diarrhoea, others) significantly in populations with higher prevalence of lactose malabsorption and enhanced severity of intolerance (South Europe, Africa, S-E. Asia)
- Heated yogurt – if at all – may improve lactose digestion by slowing down GI transit and/or modification of the intestinal microflora
- In populations with less severe lactose malabsorption and -intolerance
 - only non-significant trends towards less complaints were observed
 - comparing live with pasteurized yogurt,
 - and absorbers with nonabsorbers.
- Significant differences were found in subgroups with stronger complaints.
- „Still lactose absorbers“ with low or intermediate lactase activity and „already malabsorbers“ with residual lactase, subjects with a high or low individual sensitivity to GI pain and people who avoid milk due to unknown or mental reasons may contribute to the weak association between lactose malabsorption and –intolerance.