Does fermentation of sheep milk affect protein digestion & gut function differently from cow milk?

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Fermented foods for health

Milk is a nutritious protein source

During digestion milk proteins break down into smaller pieces (peptides) that can then be absorbed.

Peptides may influence gut function and health:

- bioactive actions on the GI tract or once absorbed
- gut microbiota in the large intestine

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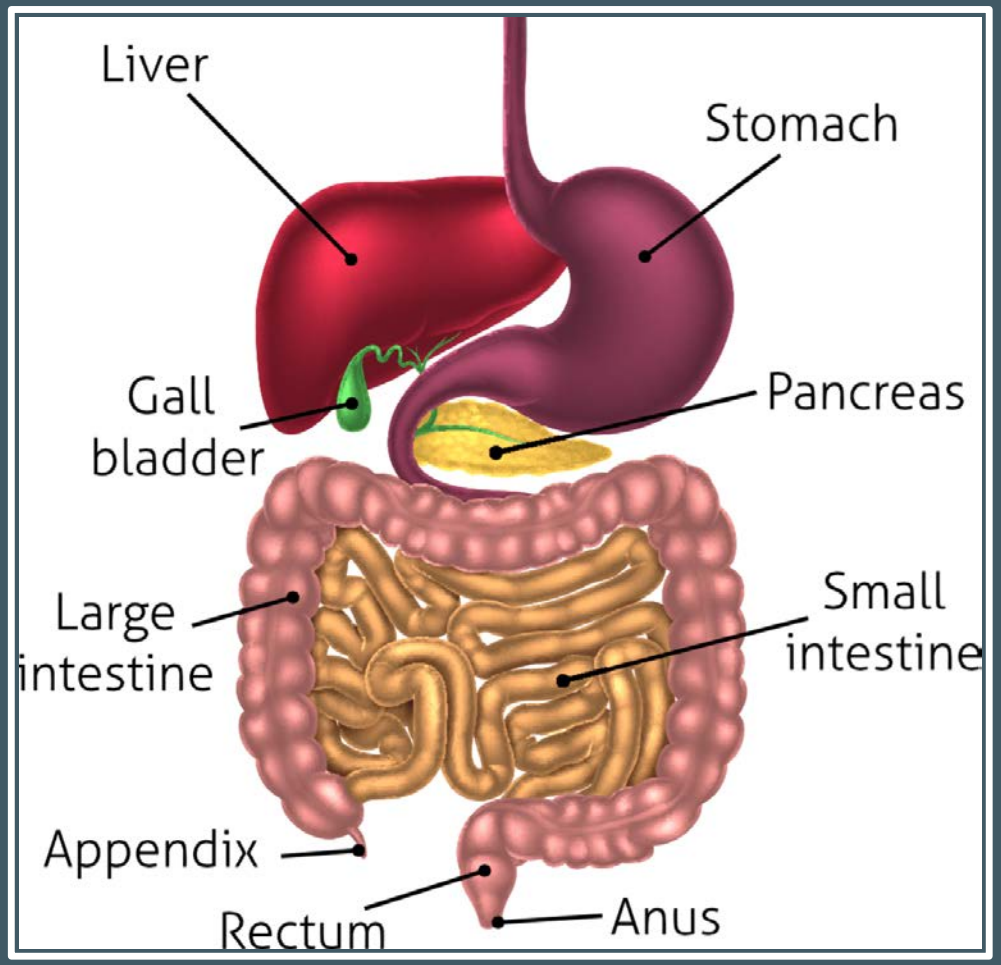
Gastrointestinal (GI) tract



The gastrointestinal tract. Christos Georghiou/Shutterstock

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Dairy proteins – cow & sheep

Composition	Cow	Sheep
Protein (%)	3.2	6.2
Fat (%)	3.5	7.9
Lactose (%)	4.7	4.9

Park et al., 2007, *Small Ruminant Nutr* 68:88-113.

Standardised to 3% protein

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Intestinal function

Is fermented milk (yogurt) digested differently from milk?

Does this differ whether of sheep or cow orgin?

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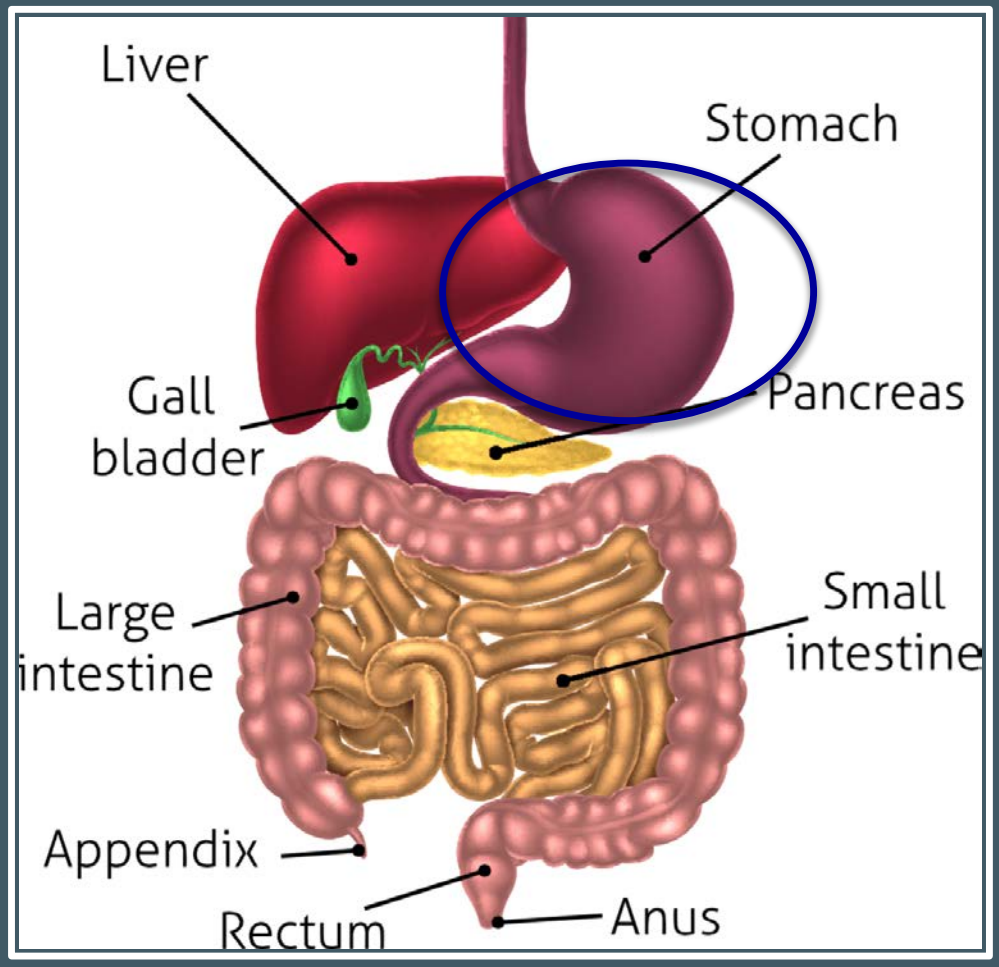
In vitro digestion

Stomach:
acidic pH 3.0
pepsin enzyme



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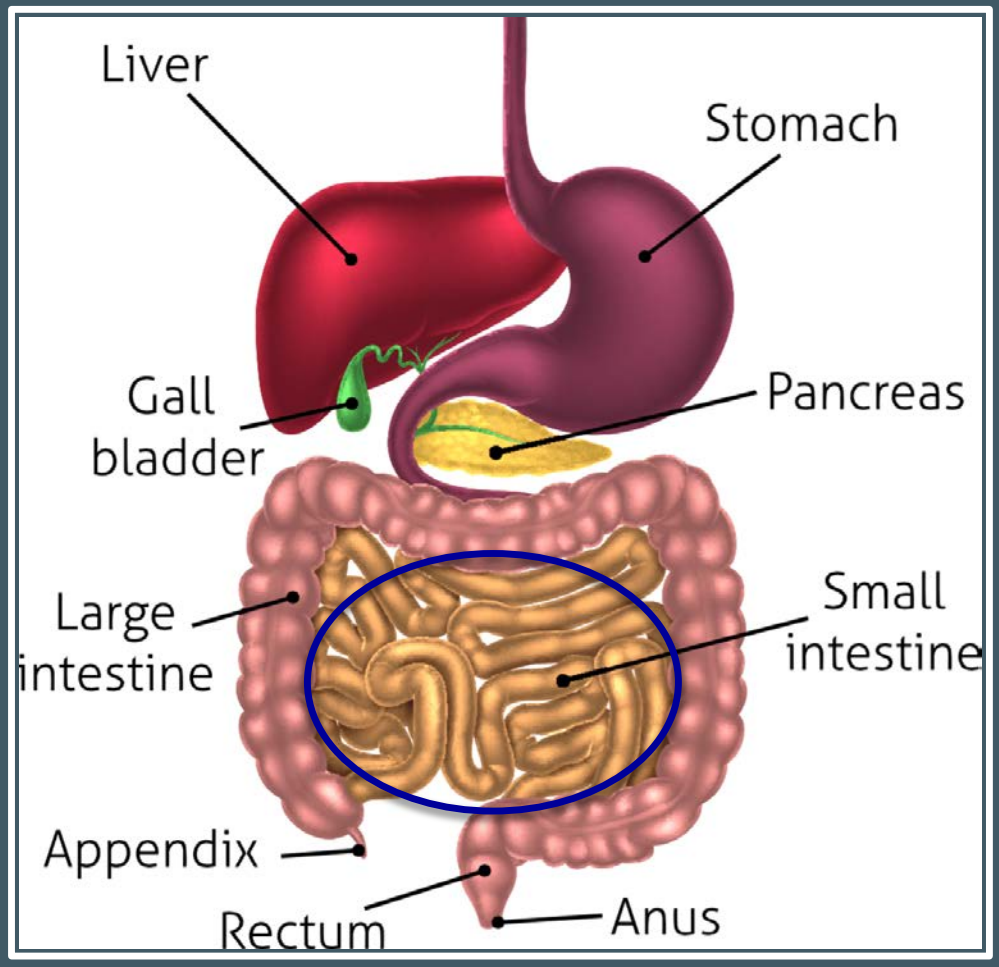
In vitro digestion

Stomach:
acidic pH 3.0
pepsin enzyme

Small intestine:
neutral pH 7.0
pancreatin enzyme
bile salts



The gastrointestinal tract. Christos Georghiou/Shutterstock

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Hypothesis: That the abundance and variety of peptides released during *in vitro* digestion will differ between milk and yogurt.

Skim milk

Yoghurt (Yoflex)

Mass spectrometry

Identify bioactive peptides

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Bioactive peptides

Number of peptides (MW < 3kDa) that differed between milk and yogurt per species during *in vitro* digestion (Infogest static method*)

Digestion (min)	Cow	Sheep
Gastric 0	0	0
Gastric 10	47	27
Gastric 120	26	37
Intestinal 10	28	15
Intestinal 120	19	20

* Minekus *et al*., 2014 *Food Funct*, 5, 1113-1124.

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Peptides

Regardless of species, a higher amount of specific bioactive peptides were released from yogurt than from milk during *in vitro* digestion, i.e. antihypertensives.

A higher proportion of small peptides were released from sheep milk and yogurt compared with those from cow.

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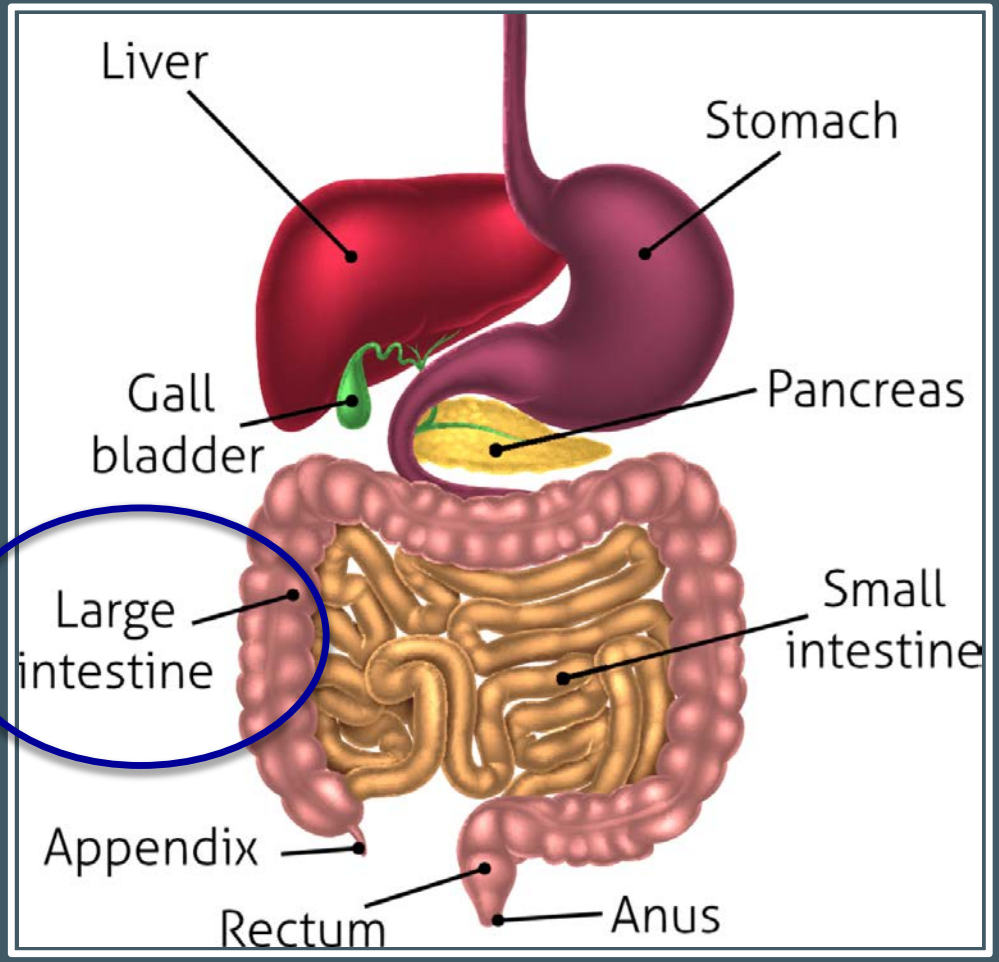
GI tract

GI transit:
Small and large intestine

Microbiota:
Large intestine



The gastrointestinal tract. Christos Georghiou/Shutterstock

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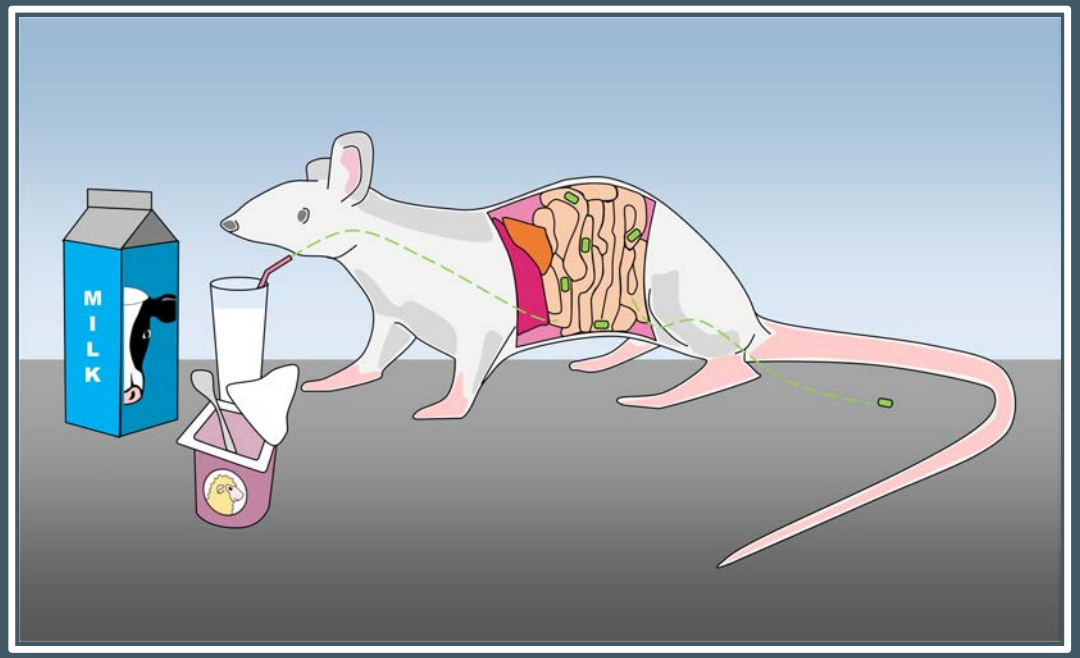
Intestinal function

Does fermentation of milk alter GI transit of contents?

Rats fed dairy-free diet for 2 weeks with 3% protein dairy drink



A. Baillie, AgResearch, Graphical abstract: Dalziel et al., 2018, *J Funct Food* 47, 116-26.

Sheep milk, sheep yogurt, cow milk, cow yogurt (n=12 per group)

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GI transit *in vivo*

Fermentation did not alter transit of contents.

Stomach emptying was faster for sheep yogurt than for cow yogurt.

Colonic transit was faster for sheep milk & yogurt than for cow milk & yogurt.

The species differences were evident above any fermentation effect.

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GI transit *in vivo*

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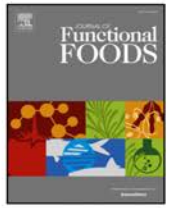

Differential effects of sheep and cow skim milk before and after fermentation on gastrointestinal transit of solids in a rat model

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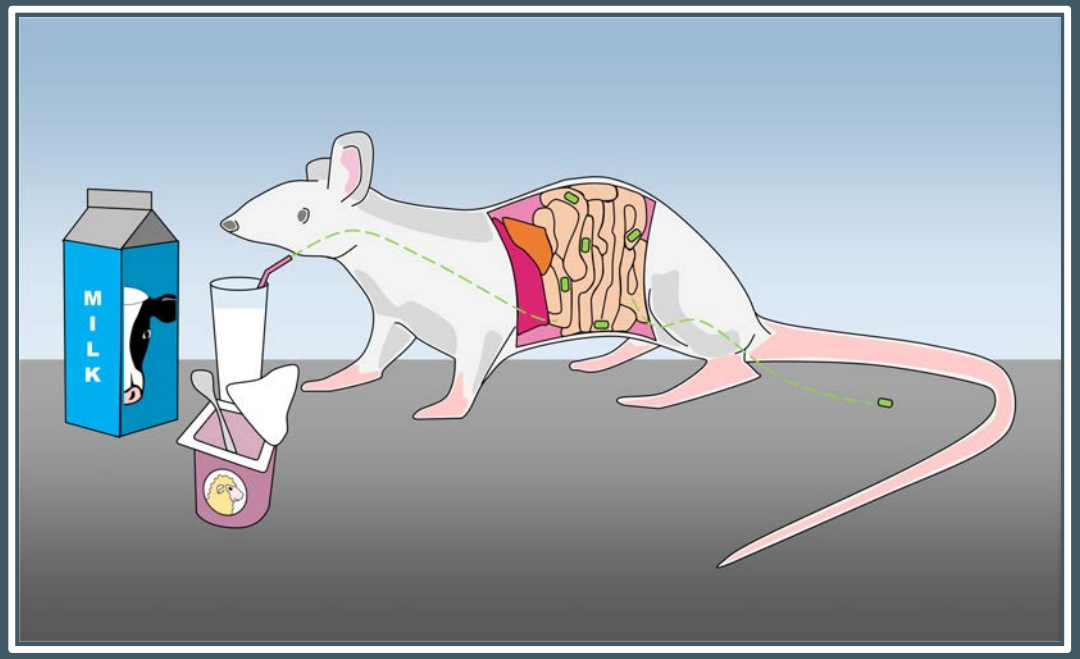
Intestinal function

Does fermentation alter GI transit of contents?

Does fermentation affect the gut microbiota?

Treated dairy drinks to deplete bacteria.



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Gut microbiota

Fermentation of the milks had a greater effect on the gut microbiota than the animal species of origin.

In yogurt compared with milk fed animals:

Phylum level

↓ Firmicutes:Bacteroidetes ratio (↓ BMI)

↑ Proteobacteria, ↓ Actinobacteria

Genera level

↑ Phascolarctobacterium – positive mood, SCFA butyrate

↑ Desulfovibrio – sulfate-reducing bacteria

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Gut microbiota

frontiers in Microbiology

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Check for updates

The Effects of Unfermented and Fermented Cow and Sheep Milk on the Gut Microbiota

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Findings

↑ cardiovascular bioactives from yogurts than milks
↑ small peptides from sheep milk and yogurt than cow

→ suggests more bioactive functions to discover for sheep peptides

Fermentation had a greater influence on the composition of the gut microbiota than did milk species of origin

→ Some changes in the gut microbial communities associated with good health

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