atf animal task force
A European Public-Private Partnership

EAAP European Federation of Animal Science

4th one-day symposium of the Animal Task Force & the EAAP Commission on Livestock Farming Systems: *Livestock are more than food*

"Cow's Milk – Going beyond basic nutrition to harness functional components"

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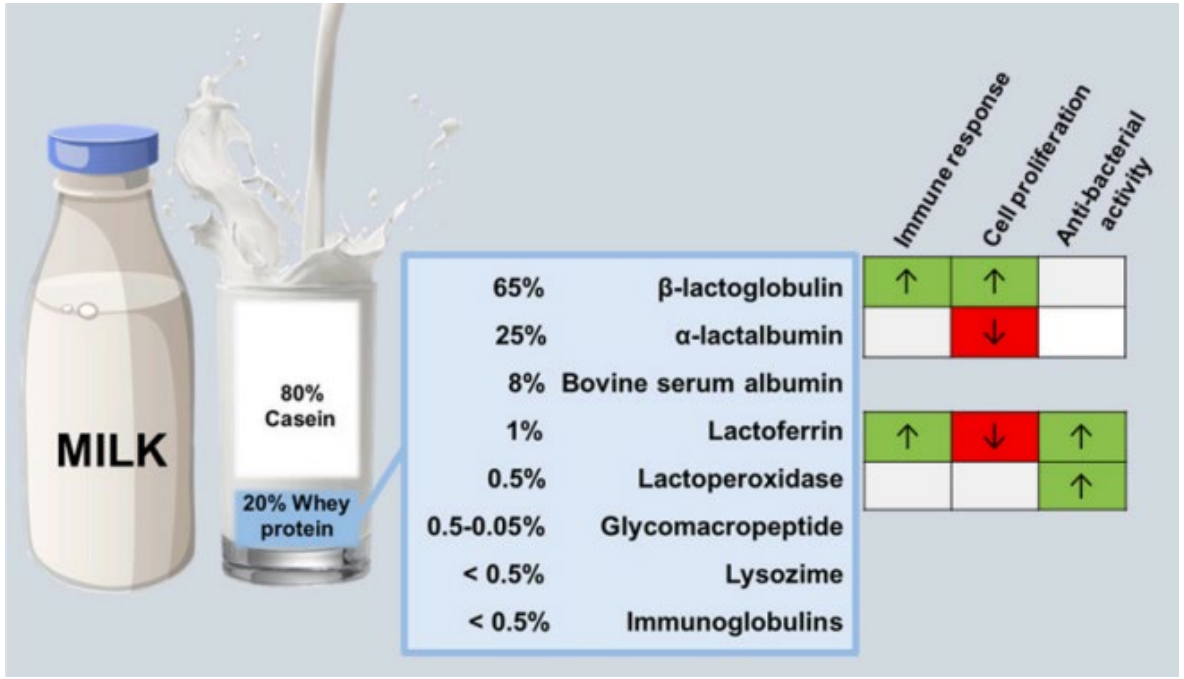
Context

In cow's milk, ~ 80% of milk protein is casein and 20% is whey protein.



These & other components possess a variety of different health promoting functionalities that **go beyond basic nutrition**.

Can be further optimised through processing to **concentrate**, **hydrolyse** through enzymatic hydrolysis of milk to reveal new functionalities (such as cryptic peptides) or **fermentation** (generating yoghurt, kefir and other potentially health promoting products).

Such functional can control weight, appetite, inflammation, hypertension, stress as well as prebiotic effects and benefits arising from modulation of the gut microbiome.

Some examples….

Trends in Food Science & Technology 133 (2023) 1–14

Contents lists available at ScienceDirect

Trends in Food Science & Technology

journal homepage: www.elsevier.com/locate/tifs

The 'Whey' to good health: Whey protein and its beneficial effect on metabolism, gut microbiota and mental health☆

Serena Boscaini [a,b], Peter Skuse [b], Kanishka N. Nilaweera [b], John F. Cryan [a,c], Paul D. Cotter [a,b,*]

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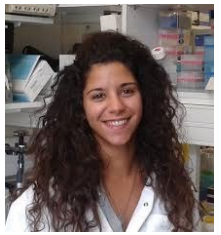
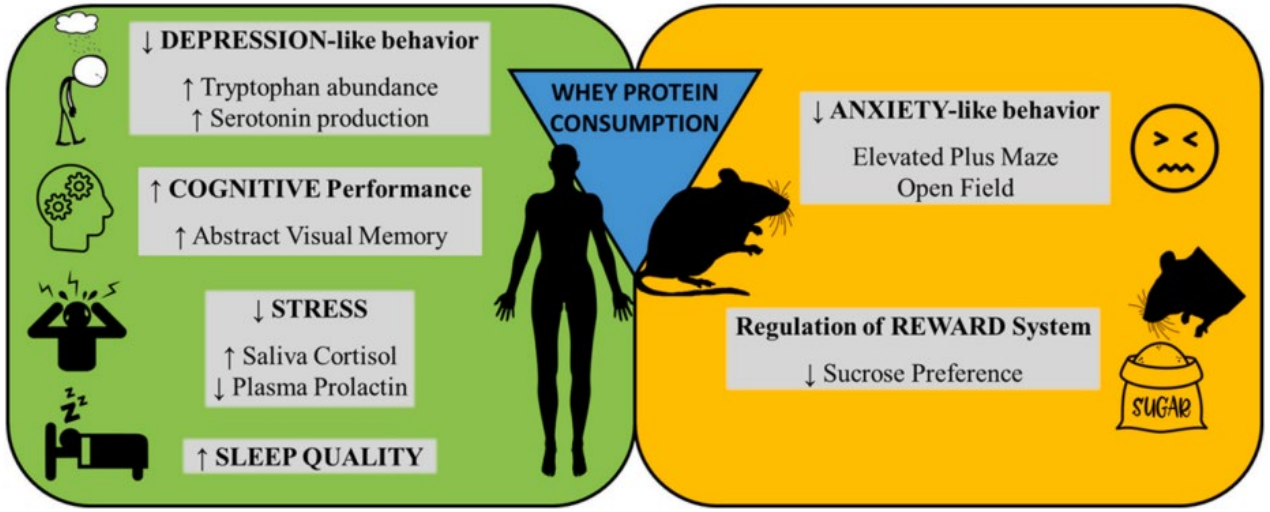
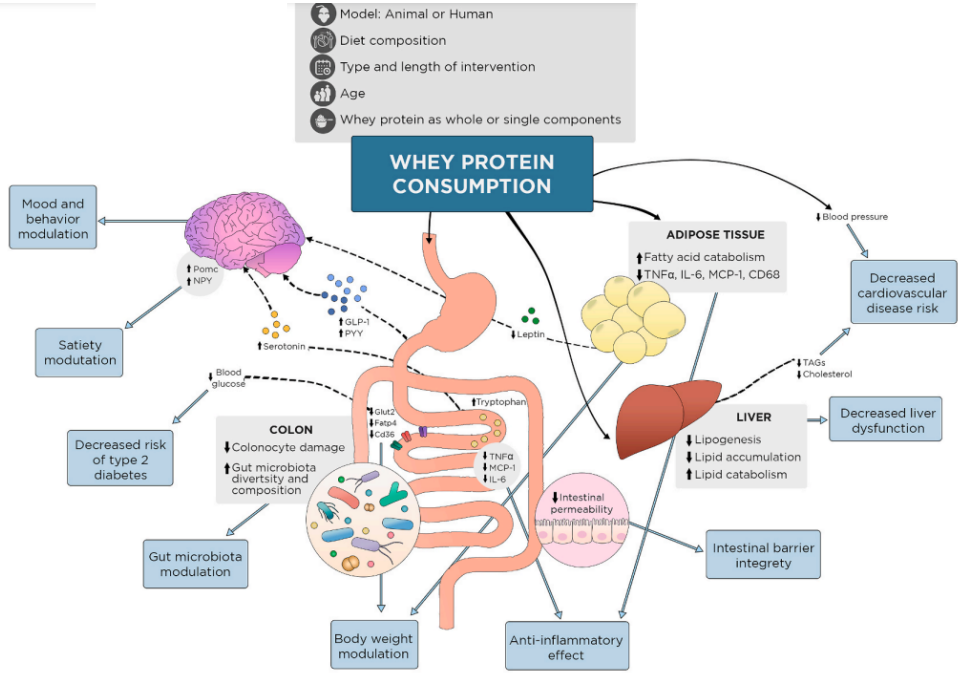
Boscaini et al., Trenda Food Sci Tech 2023





Beneficial effects of whey protein on mood and cogniti (as assessed in rodents and humans)



Beneficial effects of whey protein on obesity-related dysfunction and co-morbidities

Concentration

Whey proteins have different bioactivities influencing body weight and stress

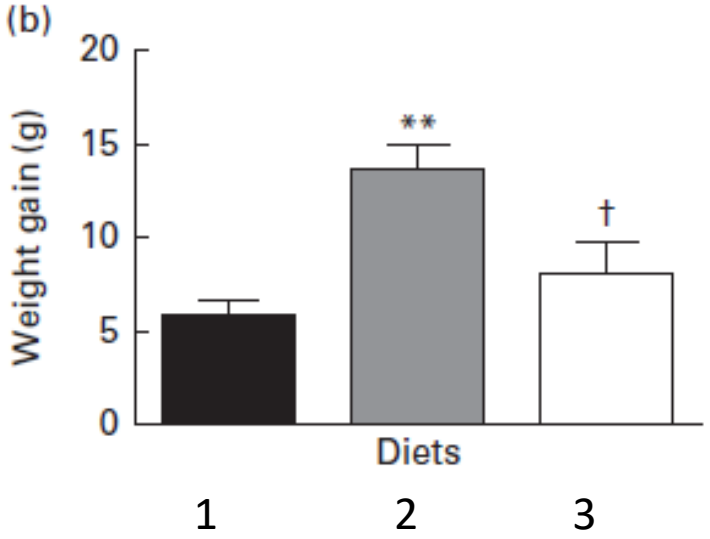
Bovine serum albumin (BSA) reduces weight gain, body fat and the stress hormone corticosterone

British Journal of Nutrition (2015), **114**, 654–662
doi:10.1017/S0007114515002123

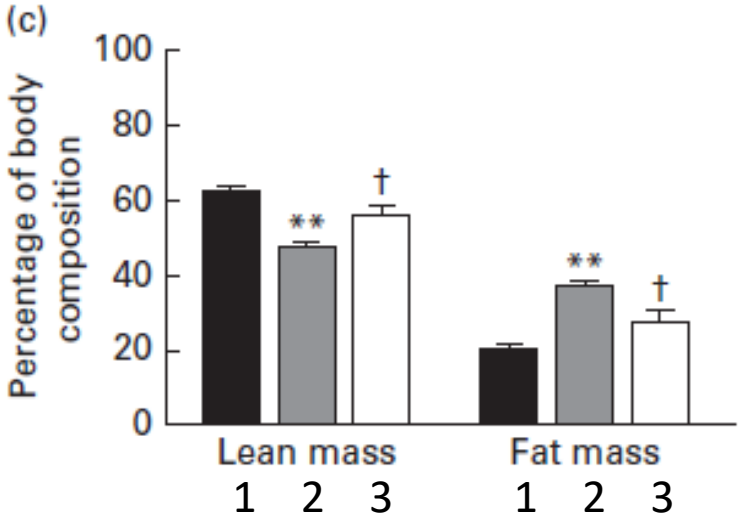
Bovine serum albumin as the dominant form of dietary protein reduces subcutaneous fat mass, plasma leptin and plasma corticosterone in high fat-fed C57/BL6J mice

Bettina L. McManus[1,2], Riitta Korpela[2], John R. Speakman[3,4], John F. Cryan[5,6], Paul D. Cotter[1,5] and Kanishka N. Nilaweera[1*]

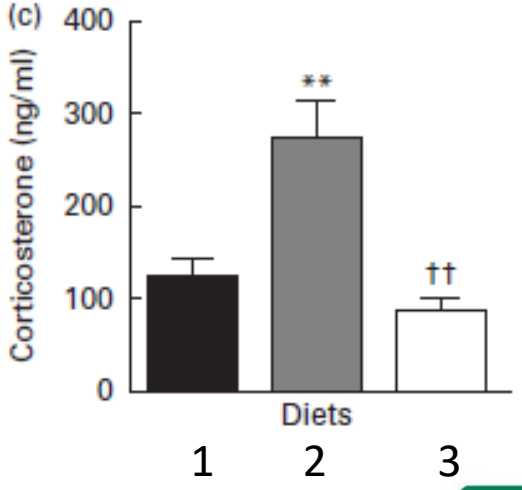
weight gain



body composition



corticosterone



Diets: **1. Low fat 2. High fat 3. High fat + BSA**

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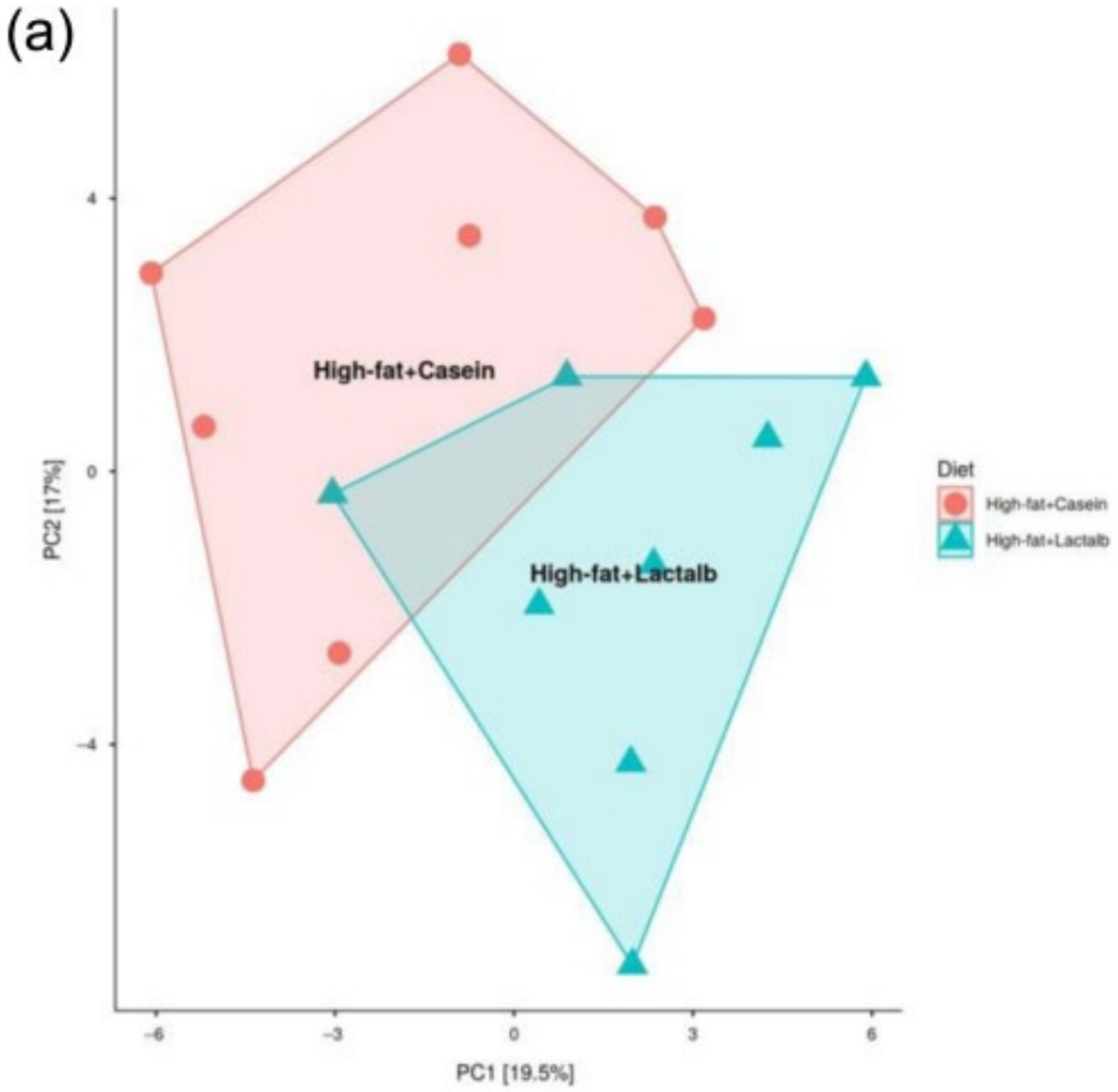
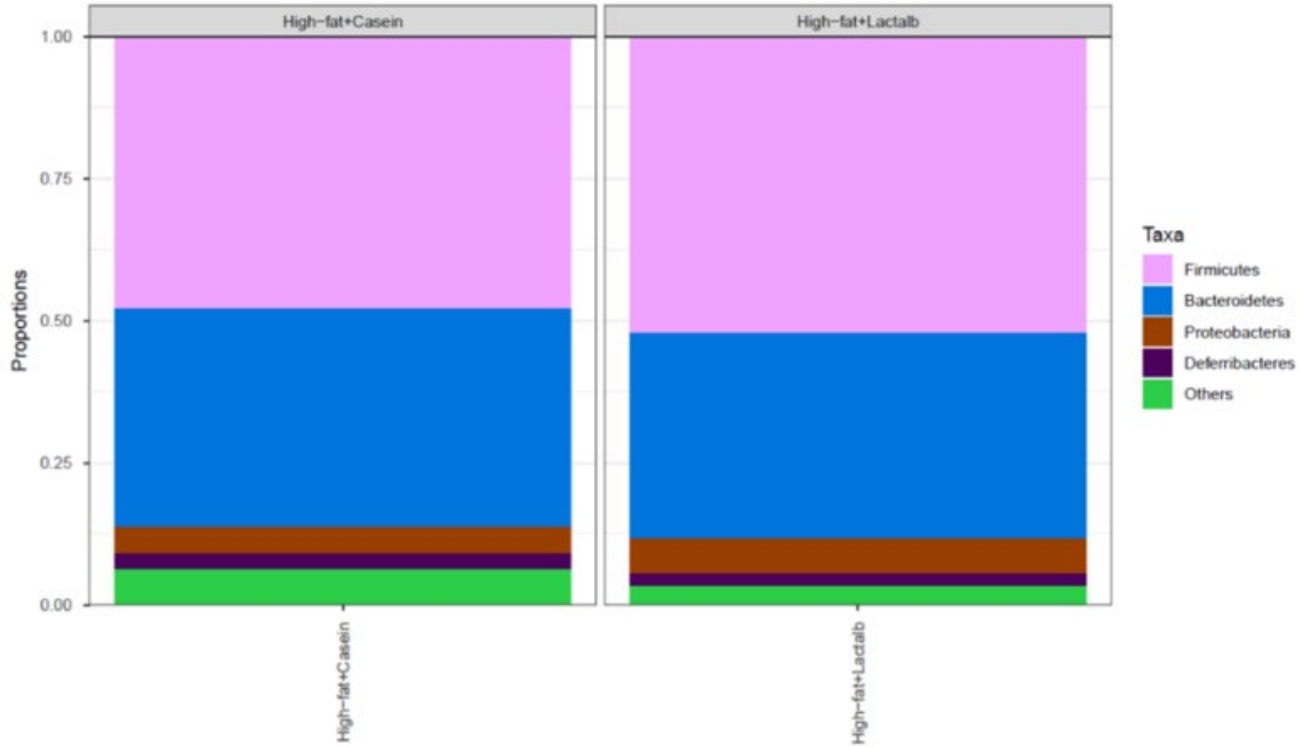
Bovine alpha-lactalbumin alters the gut microbiota





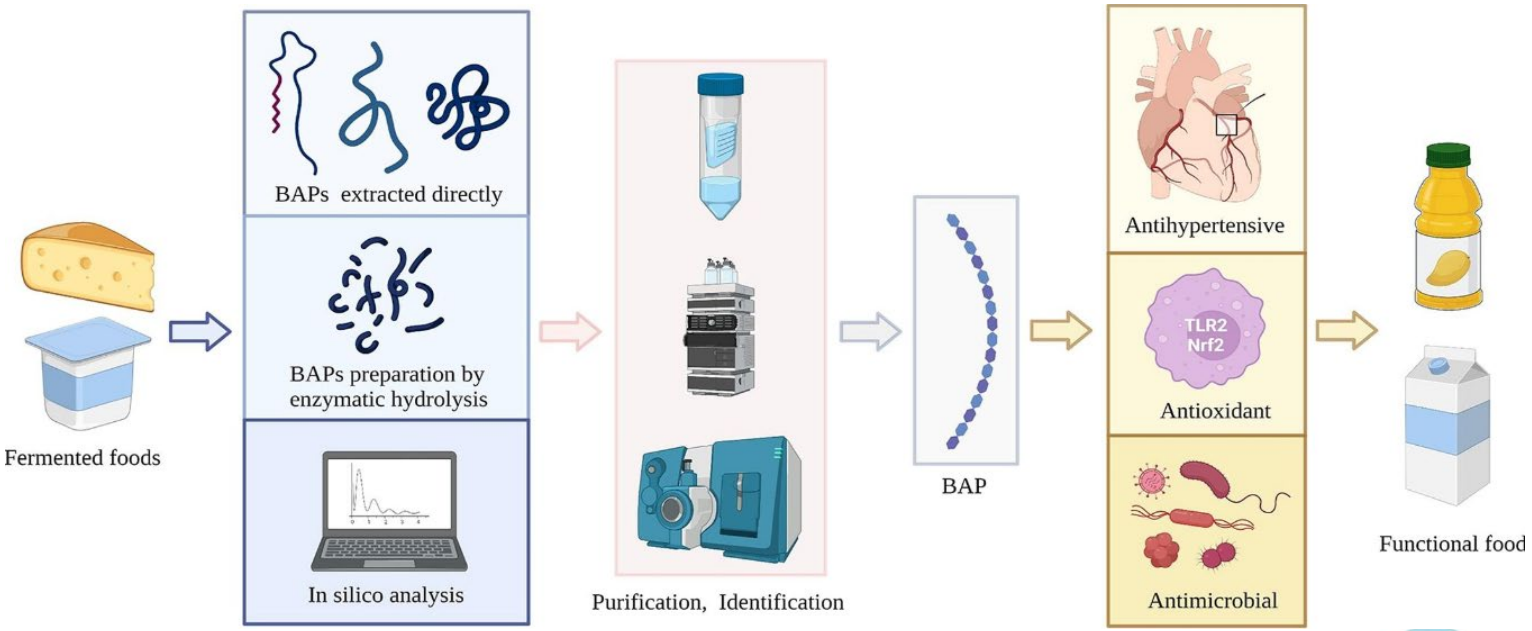
British Journal of Nutrition (2019), 121, 1097–1107
doi:10.1017/S0007114519000461

Dietary α-lactalbumin alters energy balance, gut microbiota composition and intestinal nutrient transporter expression in high-fat diet-fed mice

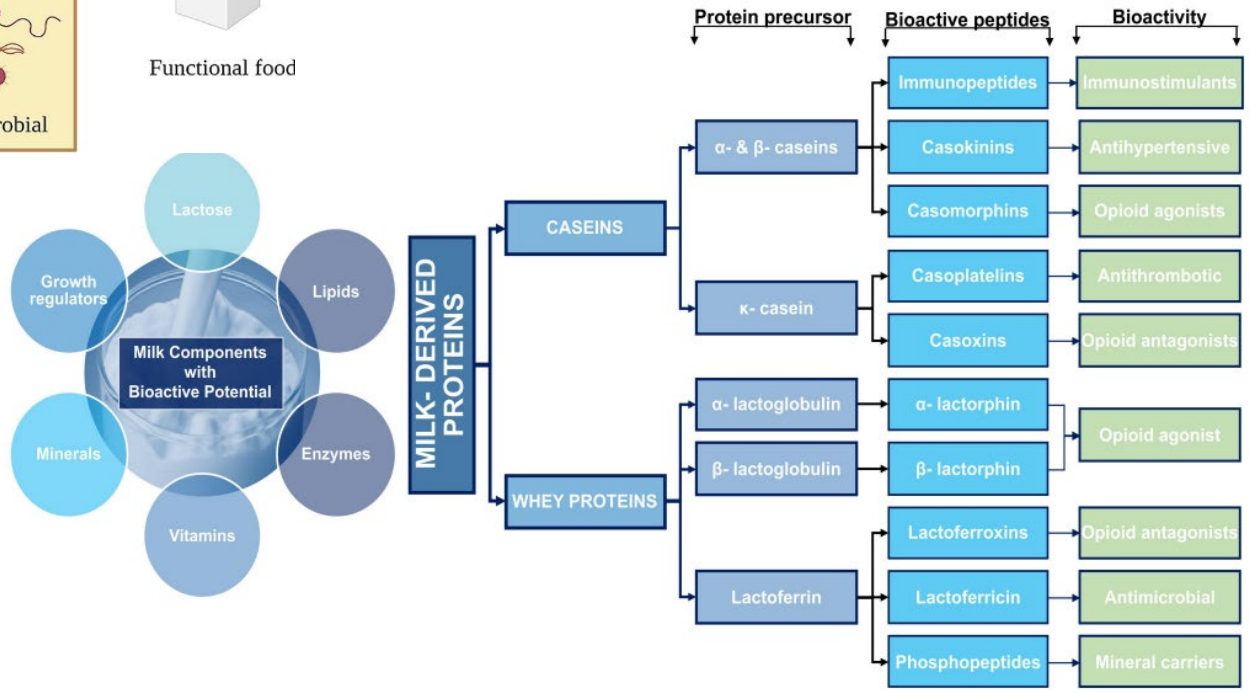
Serena Boscaini[1,2,3], Raul Cabrera-Rubio[1,2], John R. Speakman[4,5], Paul D. Cotter[1,2], John F. Cryan[2,3] and Kanishka N. Nilaweera[1,2]*

Guo et al. 2023. J. Funct. Foods 101:105422

Murtaza et al. (2022) Front. Nutr. 9:780151



Generation of (BAPs) from dairy



Examples of bioactive peptides from milk

Production of Bioctive Peptides

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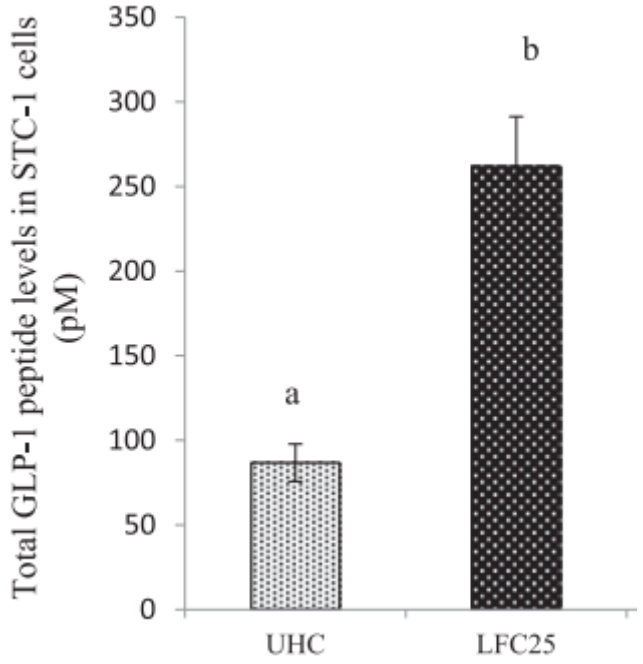
A casein hydrolysate increases GLP-1 secretion and reduces food intake

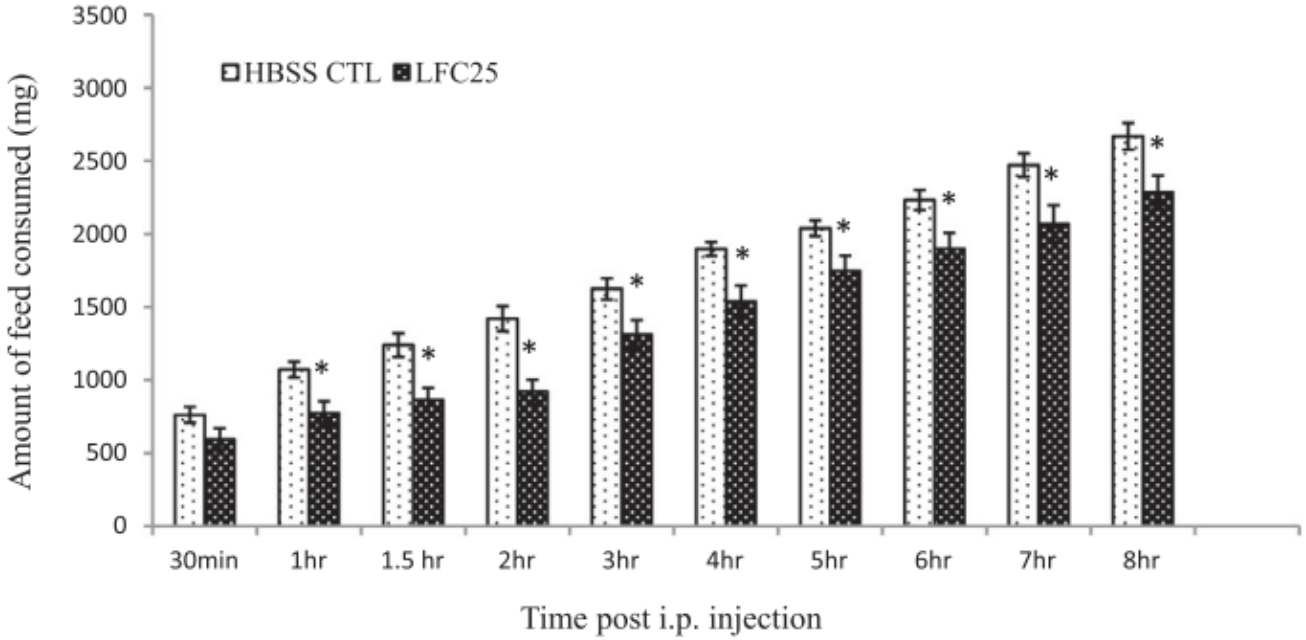
Screening identified a sodium caseinate hydrolysate, LFC25, which increased secretion of the satiety hormone, GLP-1, enteroendocrine cell line, STC-1, in a dose dependent manner.



UHC = Unhydrolysed casein

Administration of this hydrolysate to mice reduced the cumulative food intake over an eight hour period

HBSS = Buffer control



Contents lists available at ScienceDirect

Food Chemistry

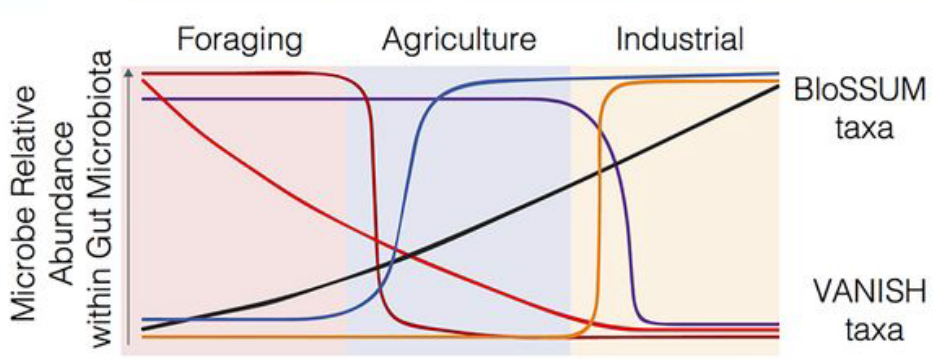
journal homepage: www.elsevier.com/locate/foodchem

A casein hydrolysate increases GLP-1 secretion and reduces food intake

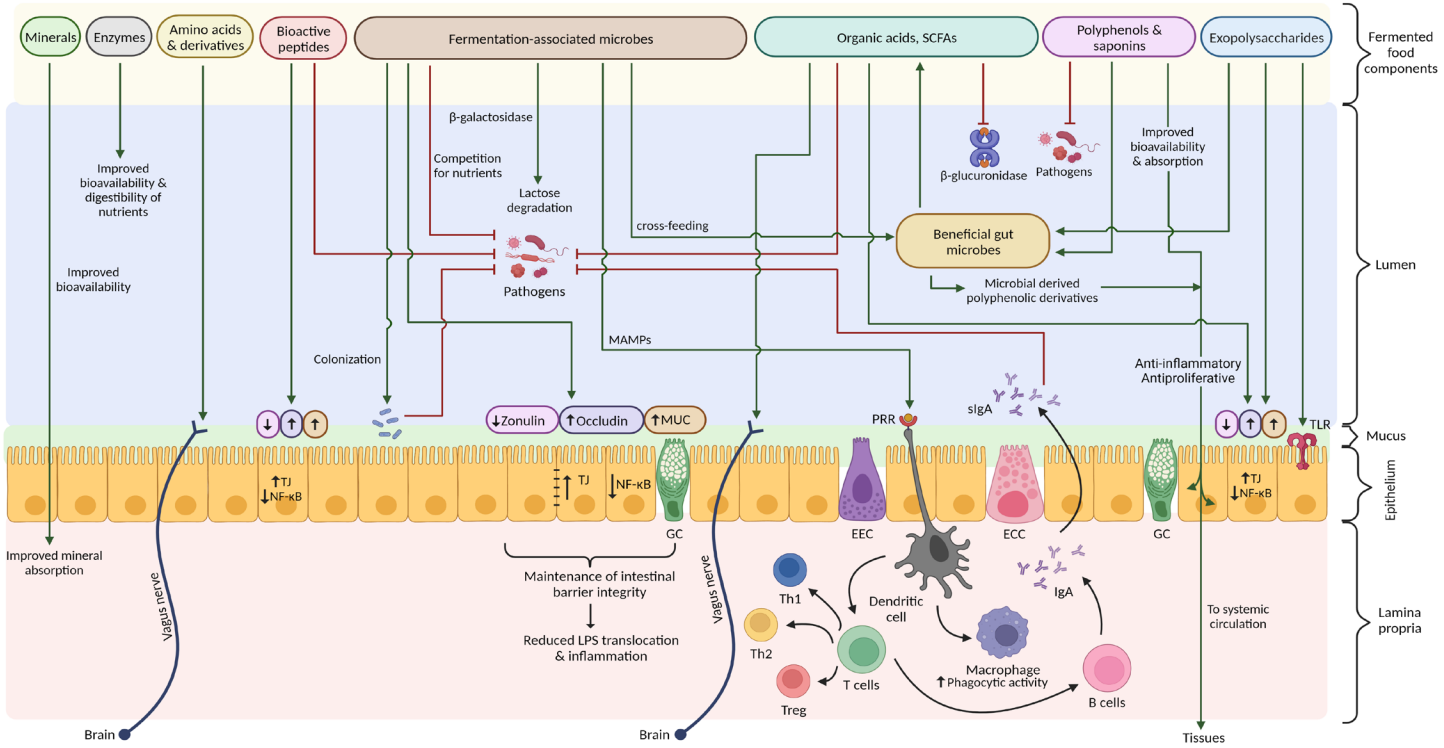
Fiona O'Halloran[a,1], Christine Bruen[a], Brian McGrath[b], Harriët Schellekens[c], Brian Murray[a], John F. Cryan[c], Alan L. Kelly[b], Paul L.H. McSweeney[b], Linda Giblin[a,*]

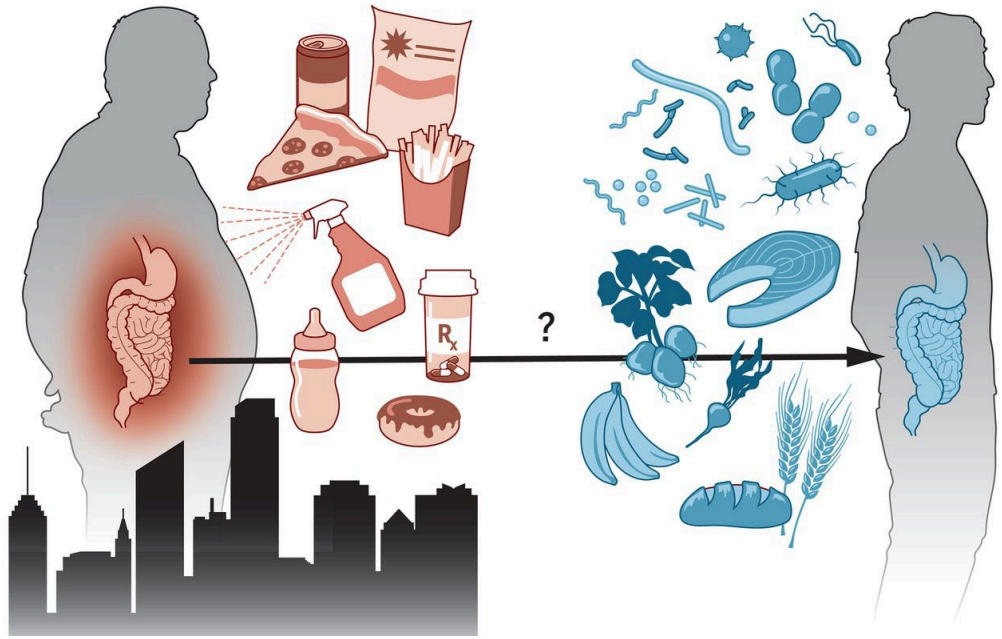
Foods made through desired microbial growth and enzymatic conversions of food components"

Marco, et al. *Nat Rev Gastro & Hepatol.* 2021;18(3):196–208.



Mechanisms responsible for contribution to health…





Fermentation

Mukherjee, Breselge et al Nature Rev Gastro Hepatol 2023

Sonnenburg and Sonnenburg Science 2019;366:eaaw9255

eagasc
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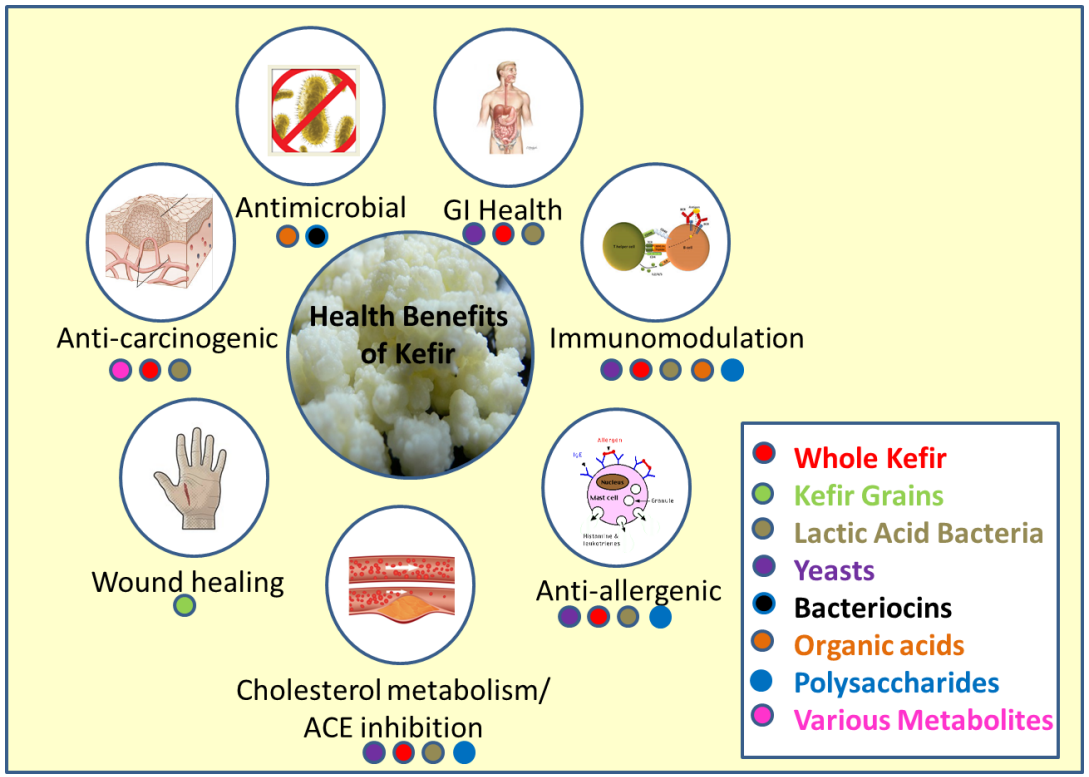
Health Benefits of Kefir

Kefir = milk fermented with kefir grain (containing a consortium of bacteria and yeasts)



Many putative health benefits but quality of many of the associated publications leaves a lot to be desired

Some of the products on the market that are called 'kefir' are not really kefir

Bourrie et al. Front. Microbiol 2016.

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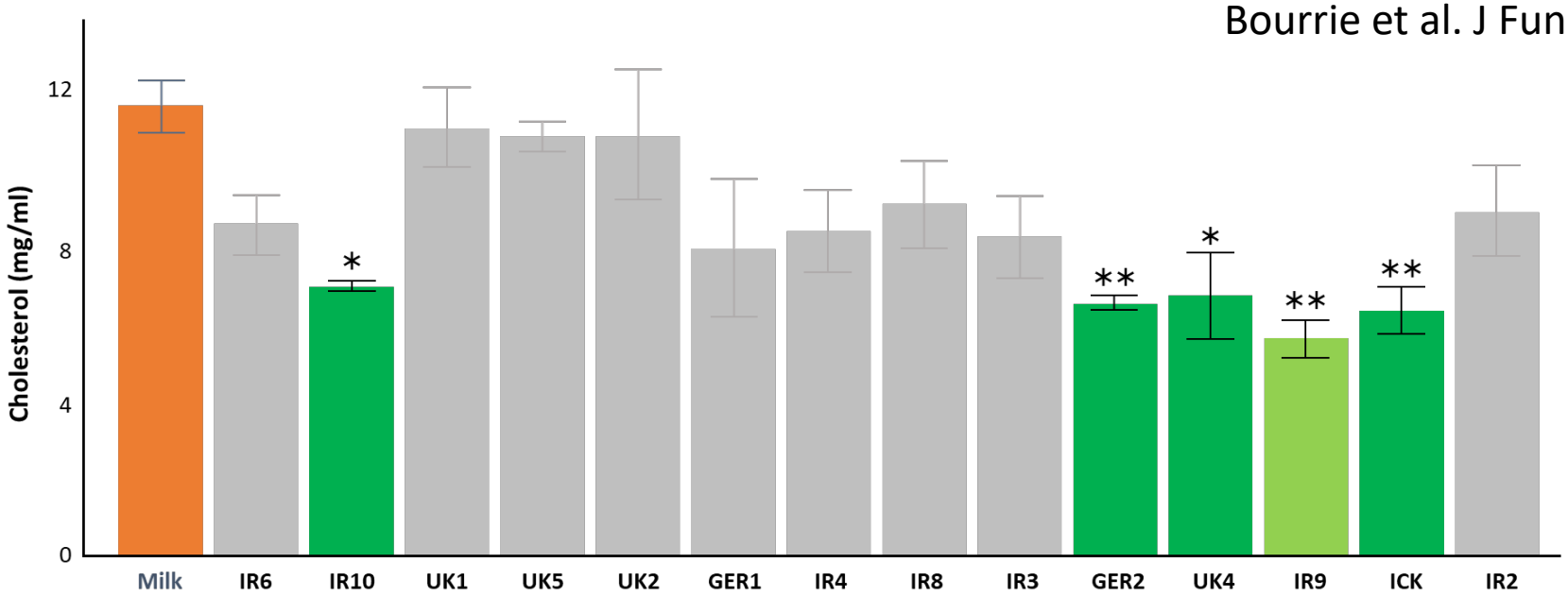
Cholesterol Assimilation in Milk

∗=P≤0.05; ∗∗=P≤0.01

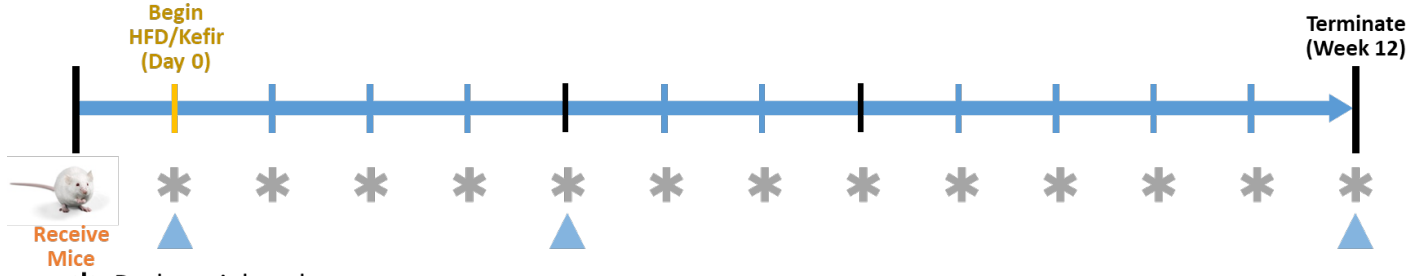
Bourrie et al. J Funct Foods. 2018;46:29



High Fat Fed Mice

Groups:

- LFD Control
- HFD Control
- HFD + Commercial
- 4 X HFD + Traditional Kefir Groups



∗=Body weight taken

▲=Fecal sample taken

- HFD (40% calories + 1.25% cholesterol) or LFD
- Daily gavage of 100 µl milk (controls) or kefir

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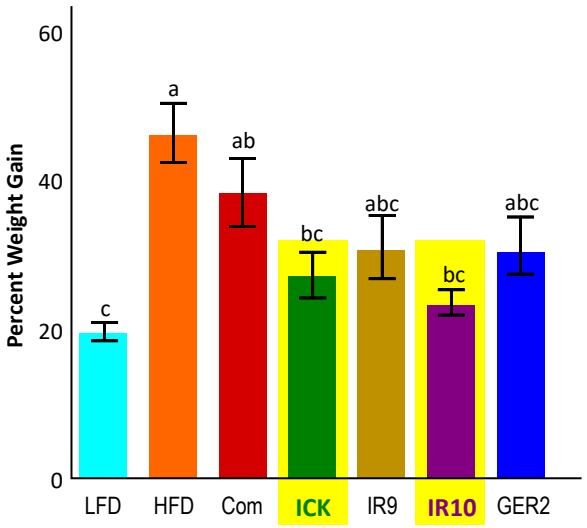
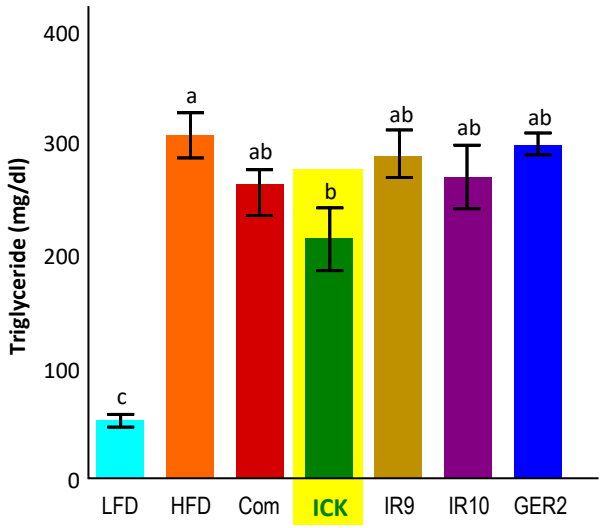
Major differences in health promoting attributes of kefir depending on the microbes present

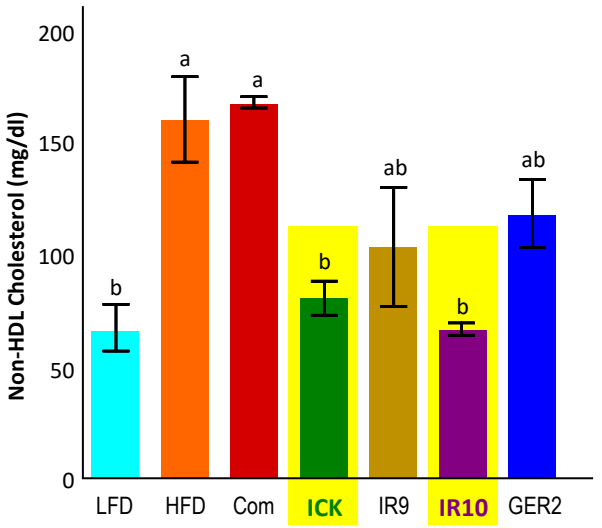
Weight Gain[1]



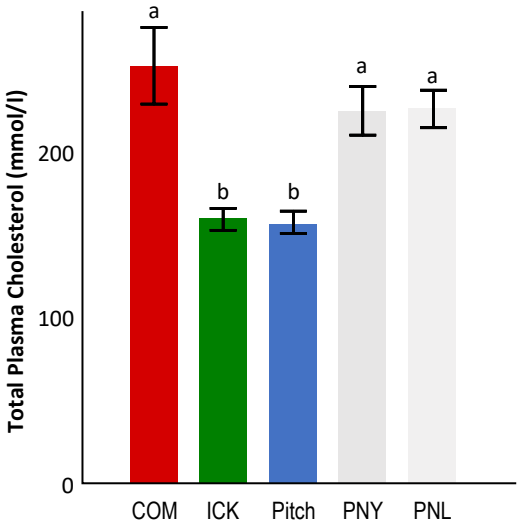
Liver Triglycerides[1]



Plasma Non-HDL Cholesterol[1]



Plasma Cholesterol[2]



Benefits (cholesterol and TAG) of an artisanal kefir (ICK) recreated through use of a 'Pitched' kefir (5 bacteria & 4 yeast).

Benefits lost in absence of LAB or yeast

Significant differences are represented by different letters (a, b, c)

1. Bourrie et al. J Funct Foods. 2018;46:29
2. Bourie et al. British Journal of Nutrition. 2021;125:129

Other kefirs show beneficial effects in addressing stress and anxiety by targeting the gut-brain-microbiome axis

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Conclusion/Summary

- Components of milk possess a variety of different health promoting functionalities that **go beyond basic nutrition**.

- These can be further optimised by through **concentration**, **hydrolysis** and/or **fermentation**

- Such functional can control weight, appetite, inflammation, hypertension, stress as well as prebiotic effects and benefits arising from modulation of the gut microbiome.

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