

atf

**animal
task
force**

A European Public-Private Partnership



EAAP

European Federation of Animal Science



LIVESTOCK ARE MORE THAN FOOD



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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”

Paul D. Cotter

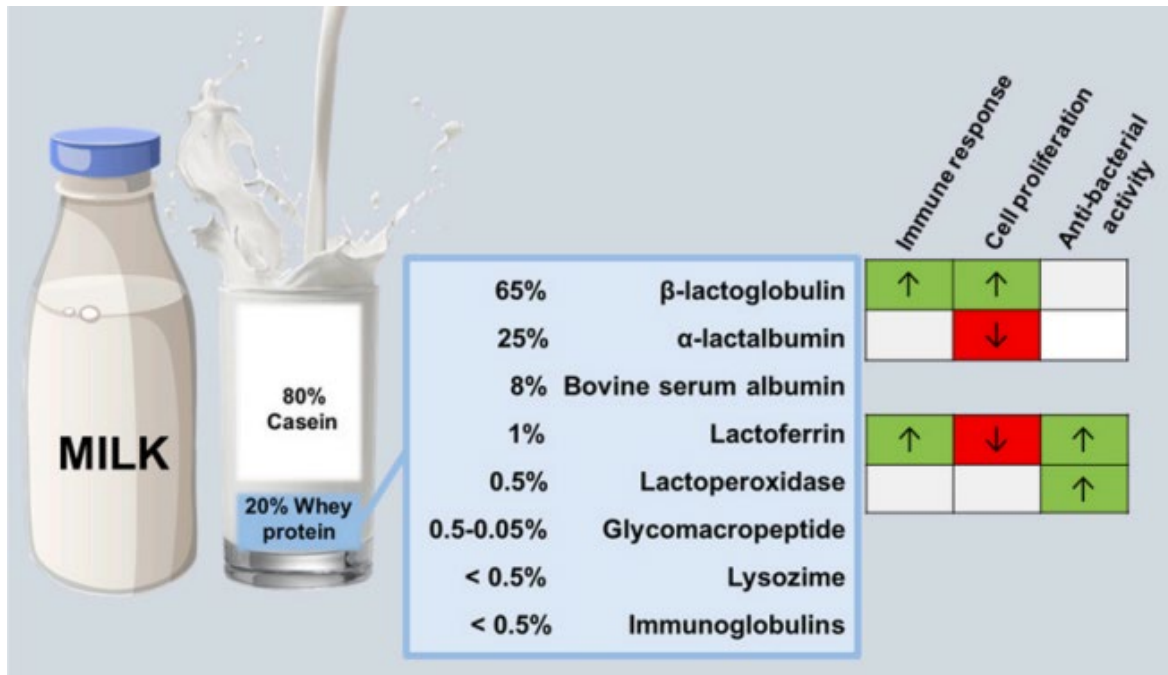
Head of Food Biosciences,

Teagasc, Ireland

paul.cotter@teagasc.ie ; @pauldcotter

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....

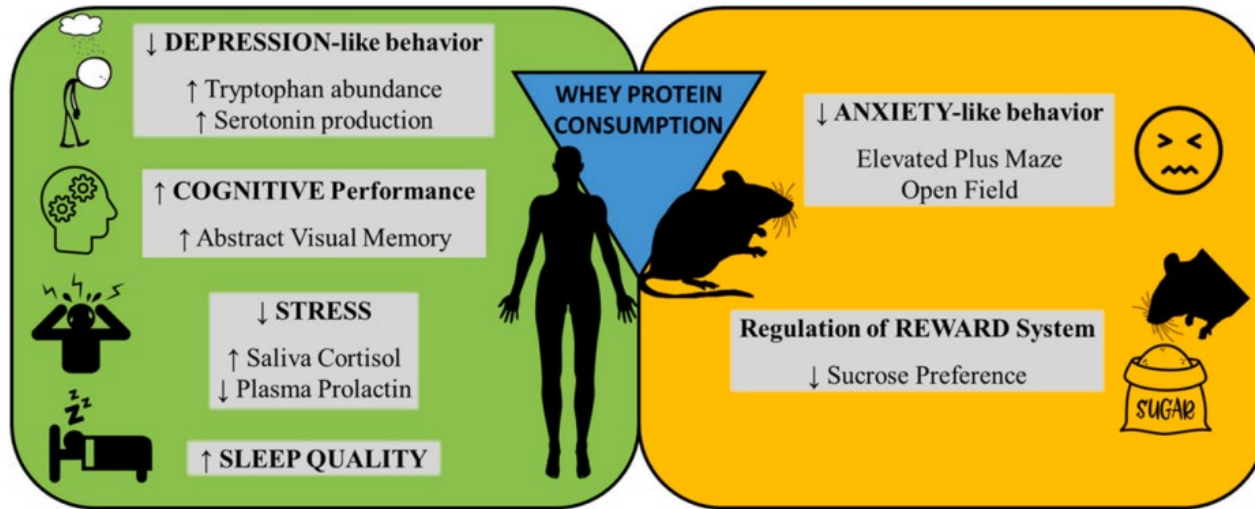
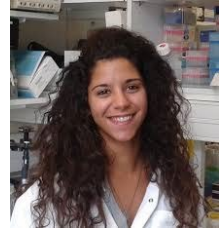


Contents lists available at [ScienceDirect](https://www.sciencedirect.com)
Trends in Food Science & Technology
journal homepage: www.elsevier.com/locate/tifs

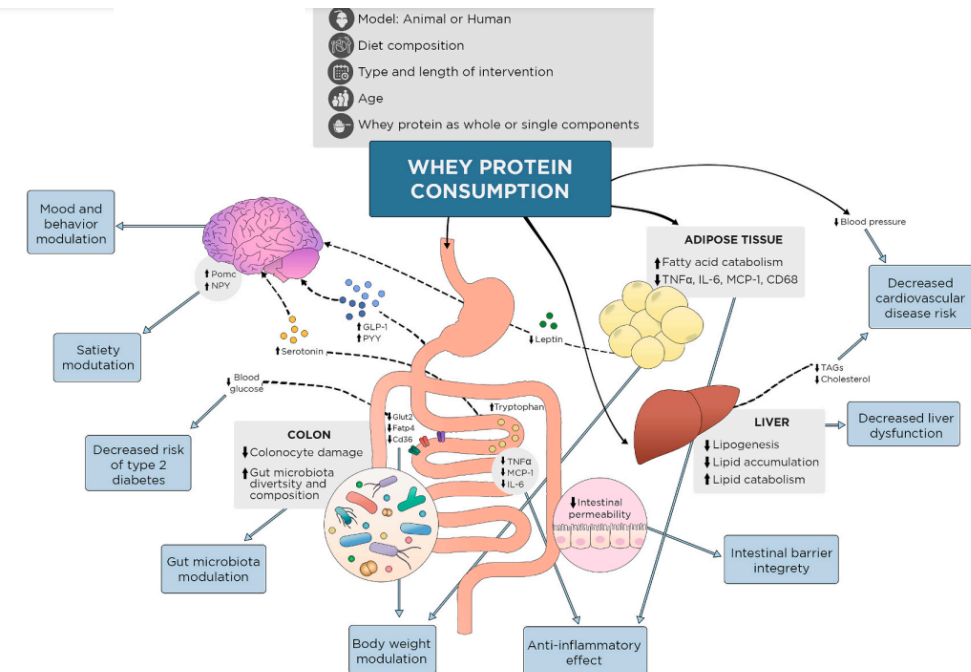


The 'Whey' to good health: Whey protein and its beneficial effect on metabolism, gut microbiota and mental health[☆]

Serena Boscaini^{a,b}, Peter Skuse^b, Kanishka N. Nilaweera^b, John F. Cryan^{a,c}, Paul D. Cotter^{a,b,*}



**Beneficial effects of whey protein on mood and cognition
(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

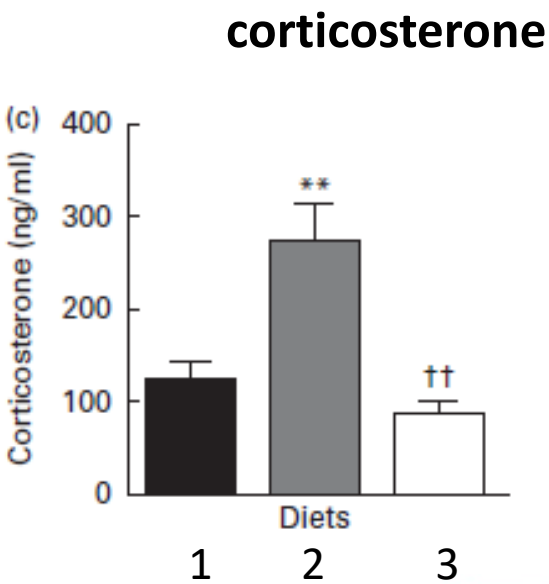
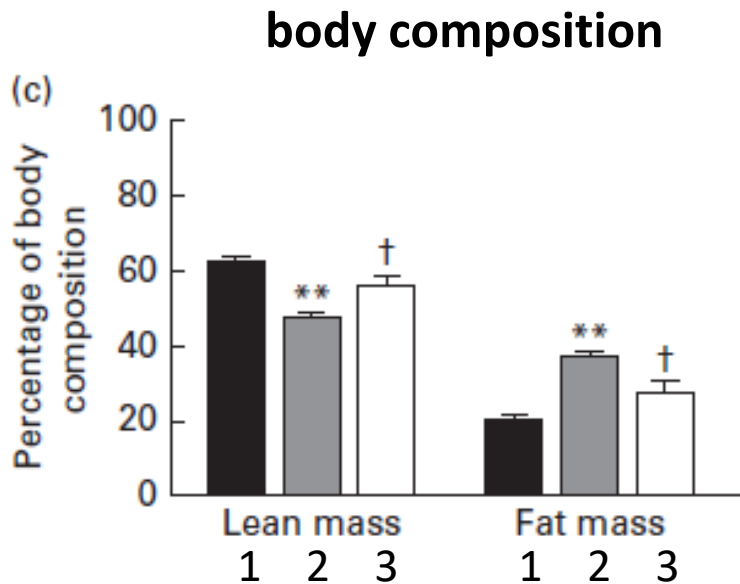
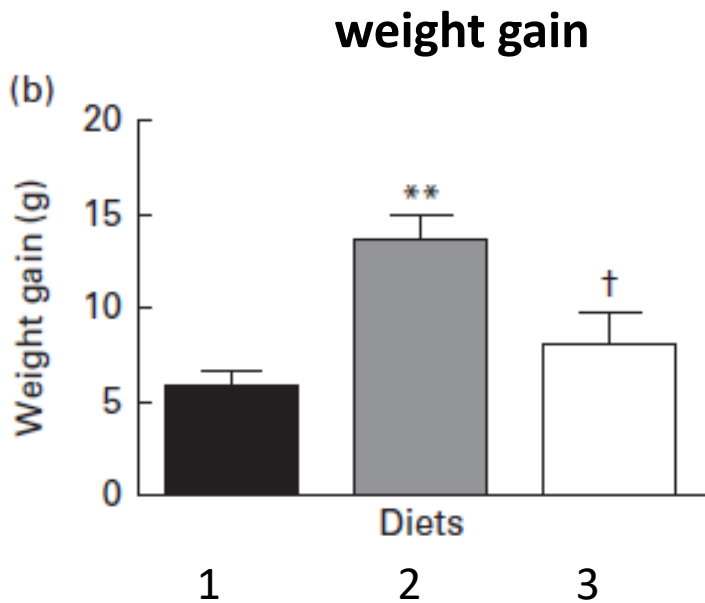
Bovine serum albumin (BSA) reduces weight gain, body fat and the stress hormone corticosterone

British Journal of Nutrition (2015), 114, 654–662
© The Authors 2015

doi:10.1017/S0007114515002123

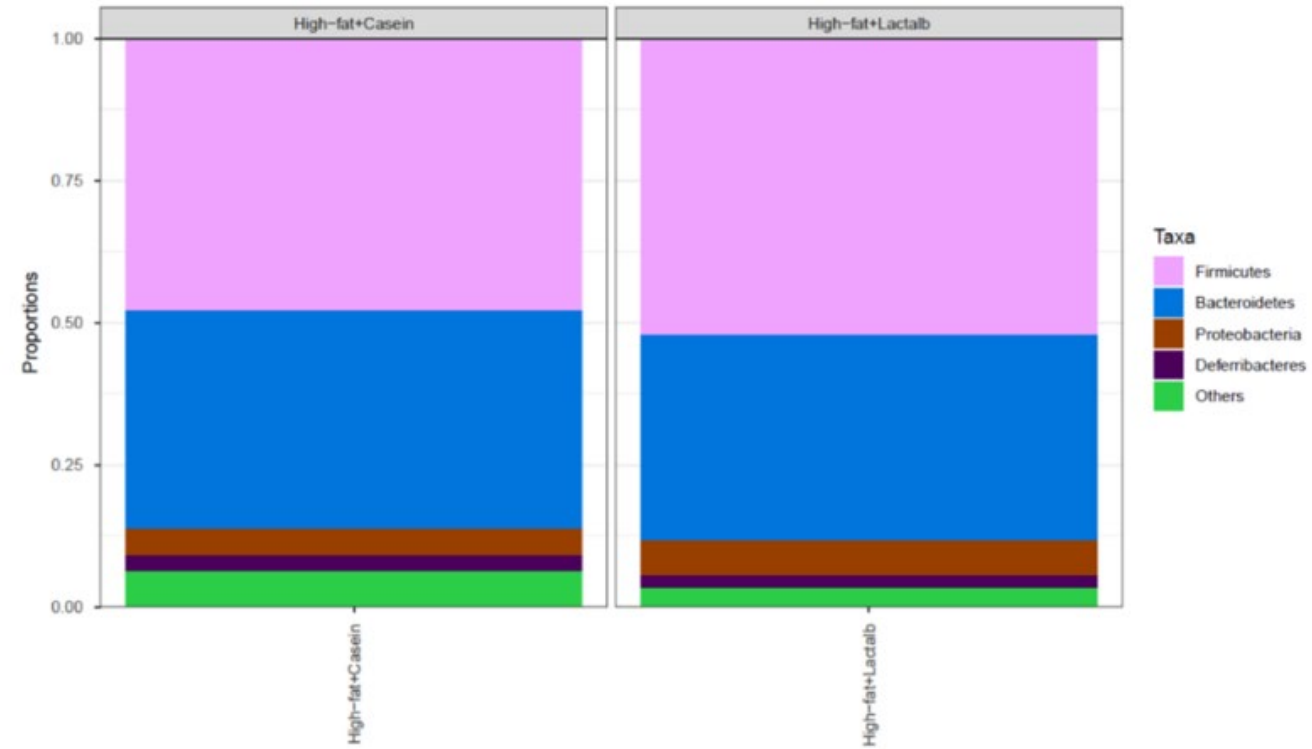
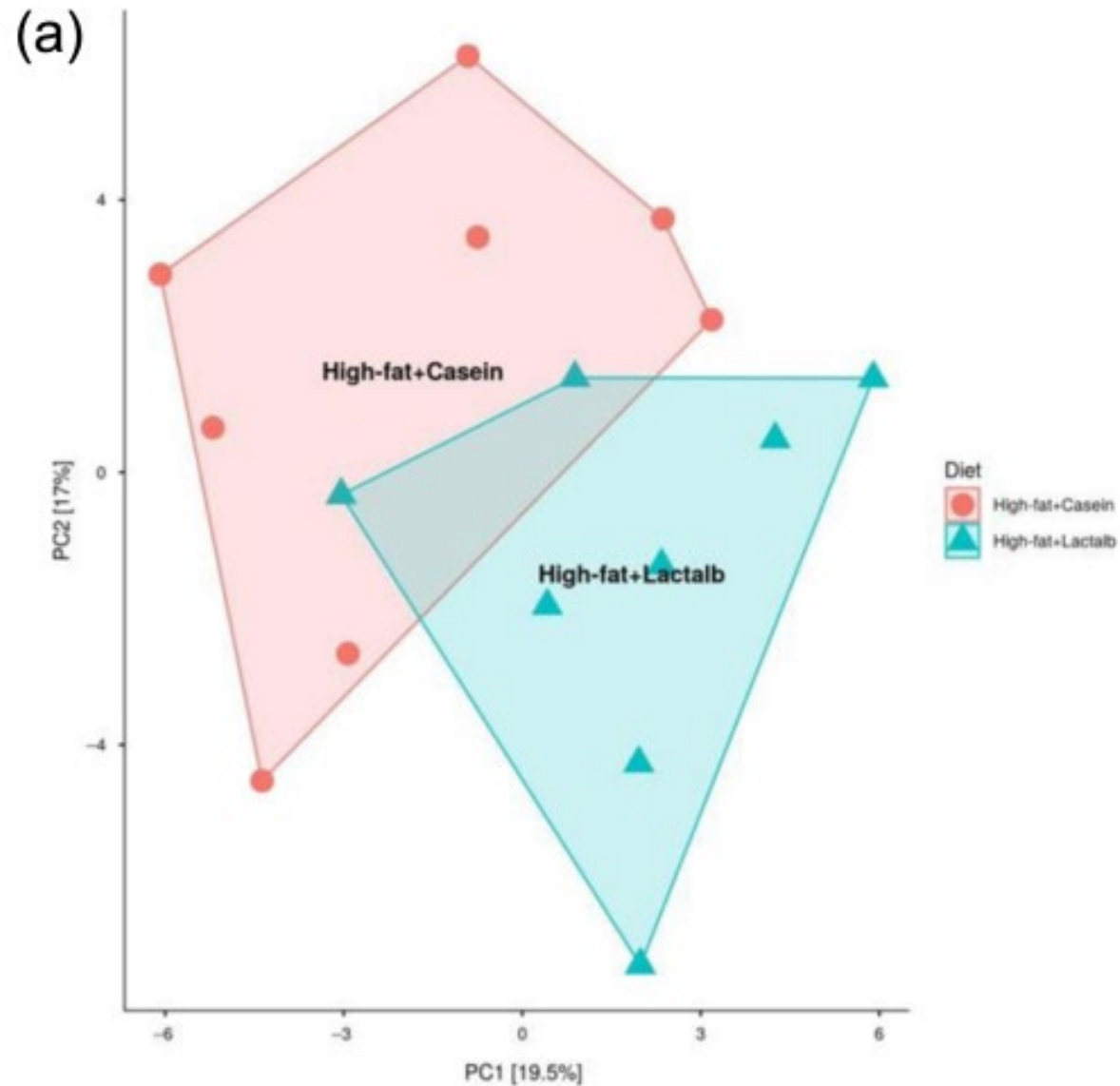
Bovine serum albumin as the dominant form of dietary protein reduces subcutaneous fat mass, plasma leptin and plasma corticosterone in high fat-fed C57/BL6J mice

Bettina L. McManus^{1,2}, Riitta Korpela², John R. Speakman^{3,4}, John F. Cryan^{5,6}, Paul D. Cotter^{1,5} and Kanishka N. Nilaweera^{1*}



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

Bovine alpha-lactalbumin alters the gut microbiota



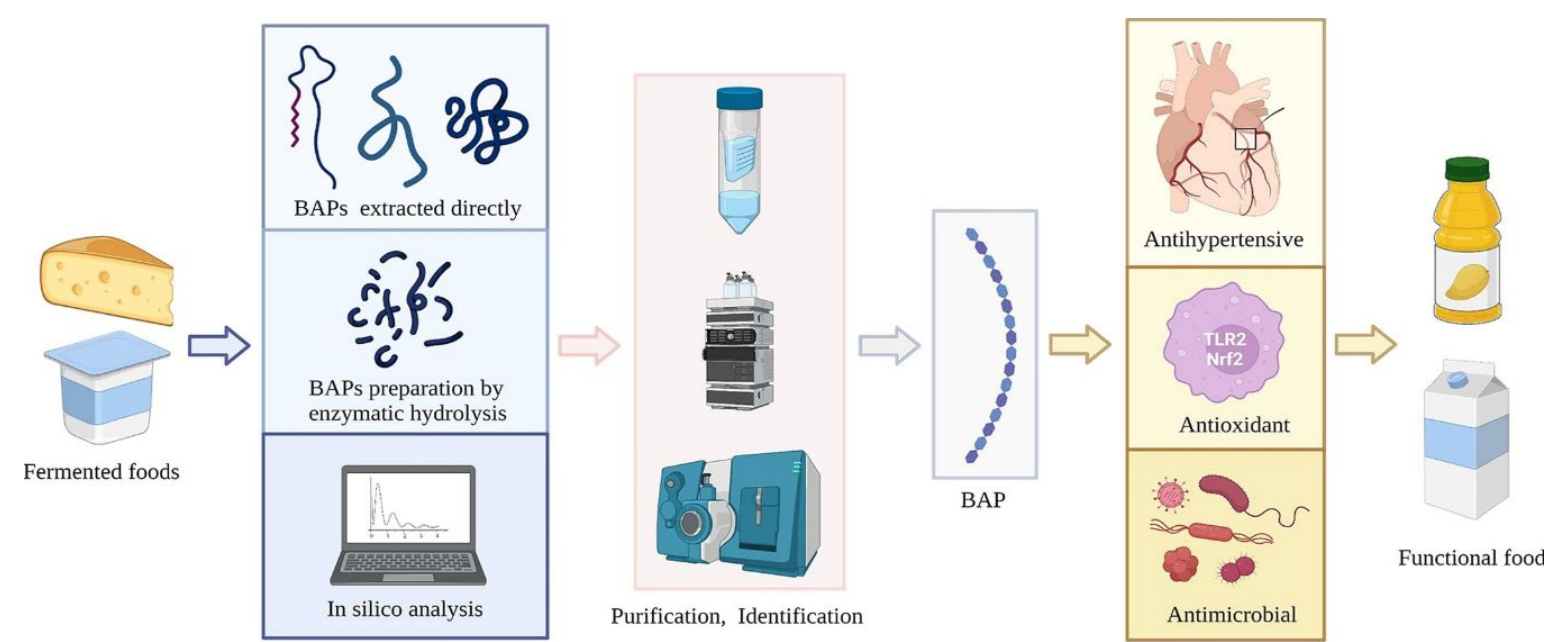
British Journal of Nutrition (2019), 121, 1097–1107
© The Authors 2019

doi:10.1017/S0007114519000461

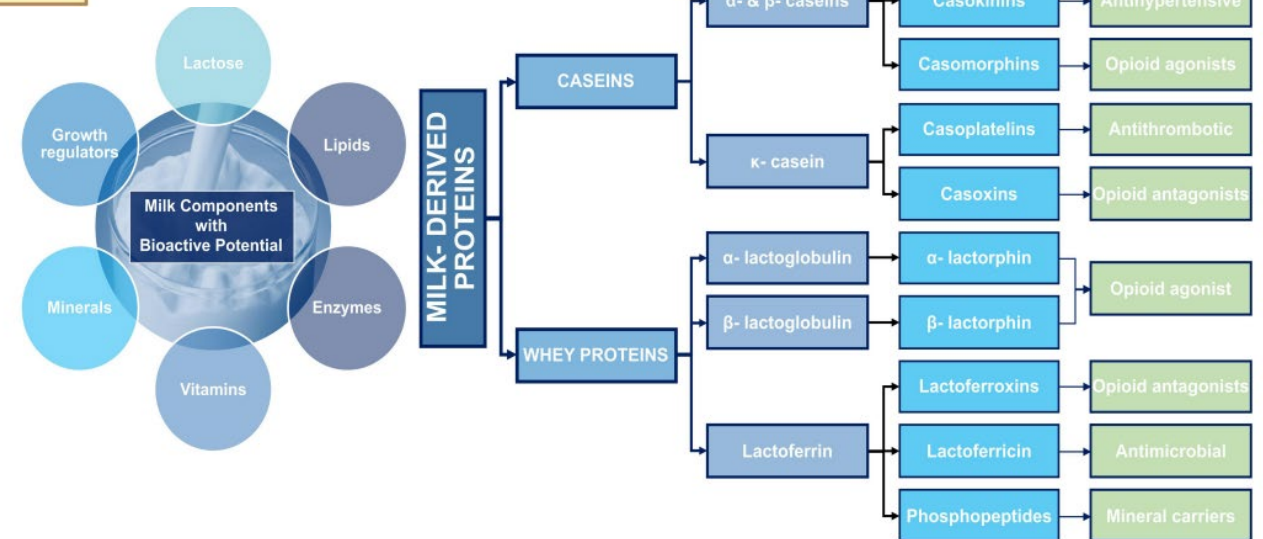
Dietary α -lactalbumin alters energy balance, gut microbiota composition and intestinal nutrient transporter expression in high-fat diet-fed mice

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

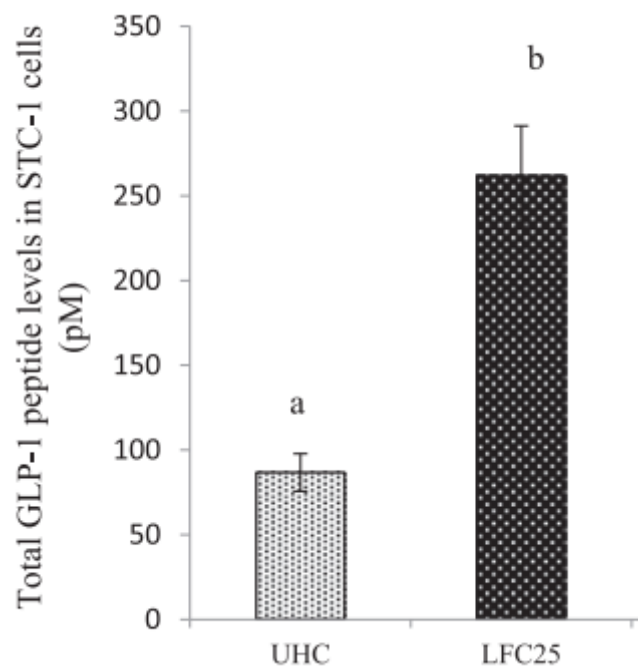


Examples of bioactive peptides from milk

Production of Bioactive Peptides

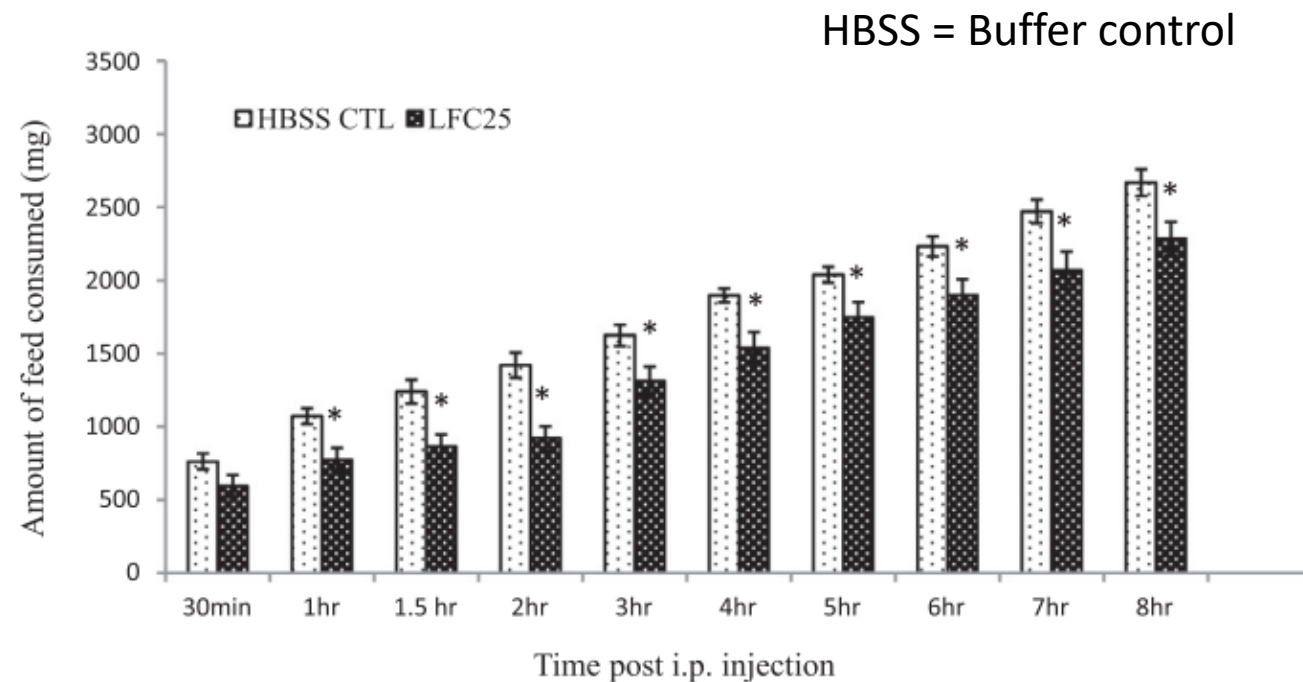
A casein hydrolysate increases GLP-1 secretion and reduces food intake

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



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Food Chemistry

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



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

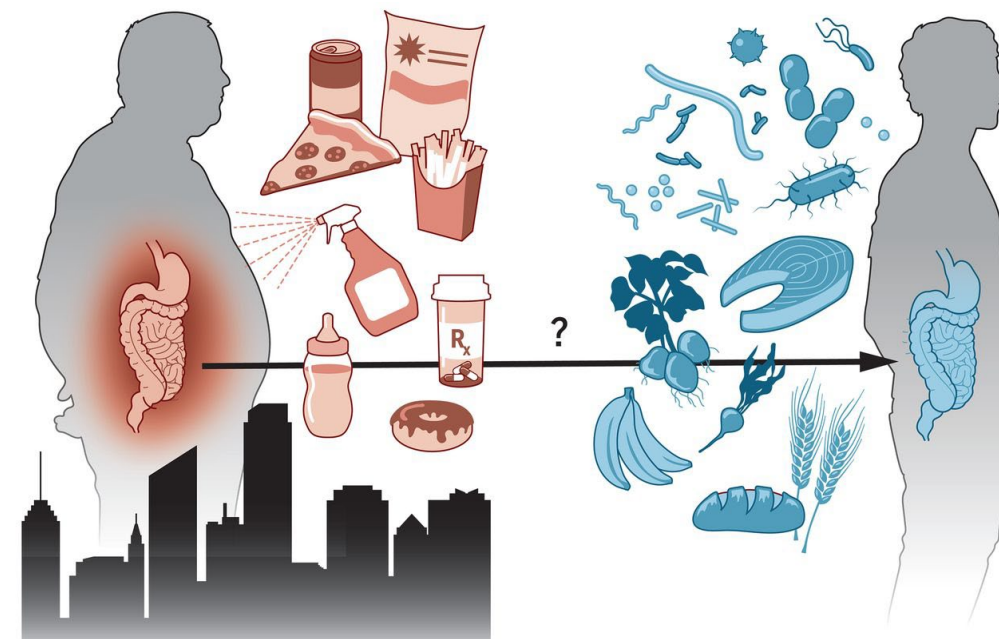
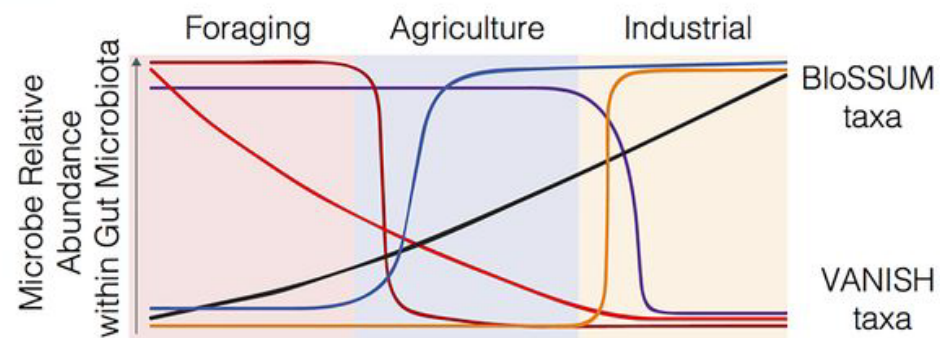
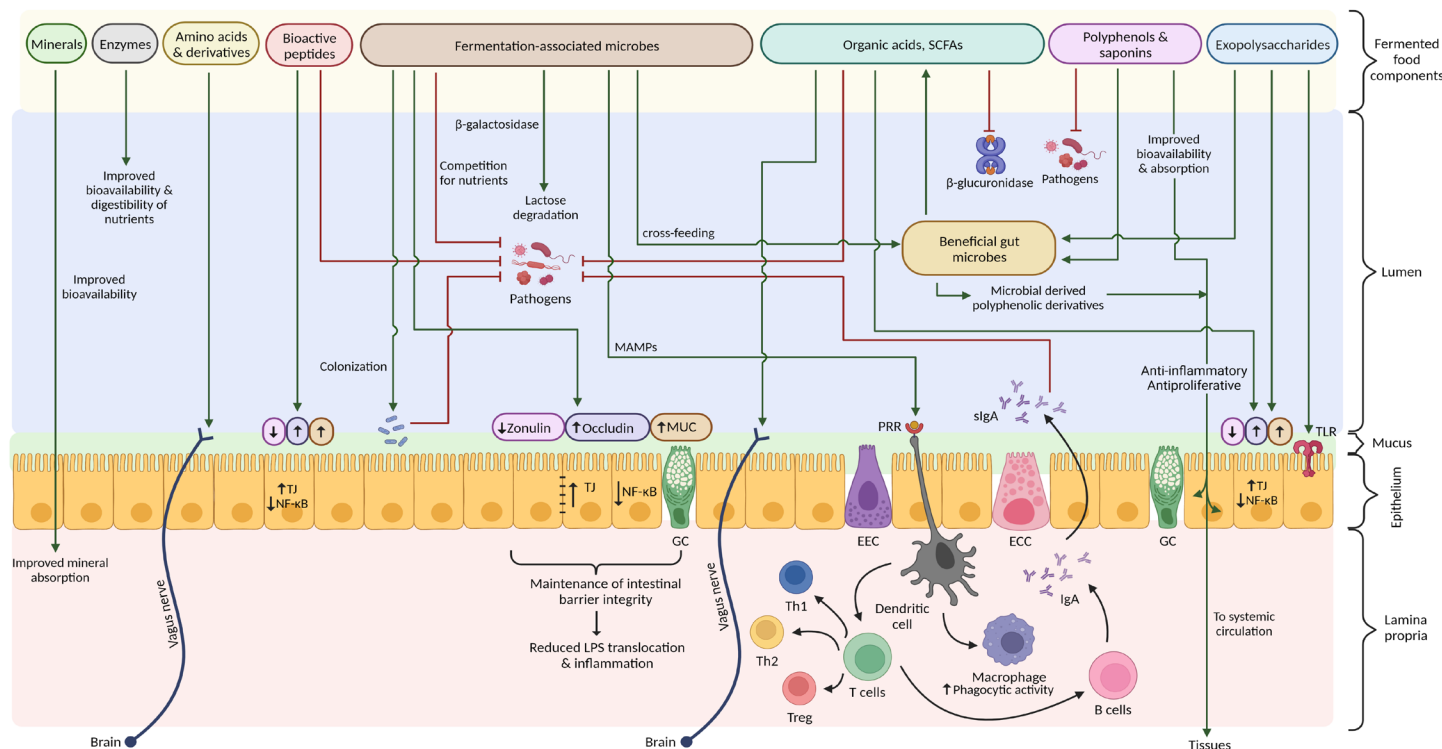
Fiona O'Halloran^{a,1}, Christine Bruen^a, Brian McGrath^b, Harriët Schellekens^c, Brian Murray^a, John F. Cryan^c, Alan L. Kelly^b, Paul L.H. McSweeney^b, Linda Giblin^{a,*}



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...



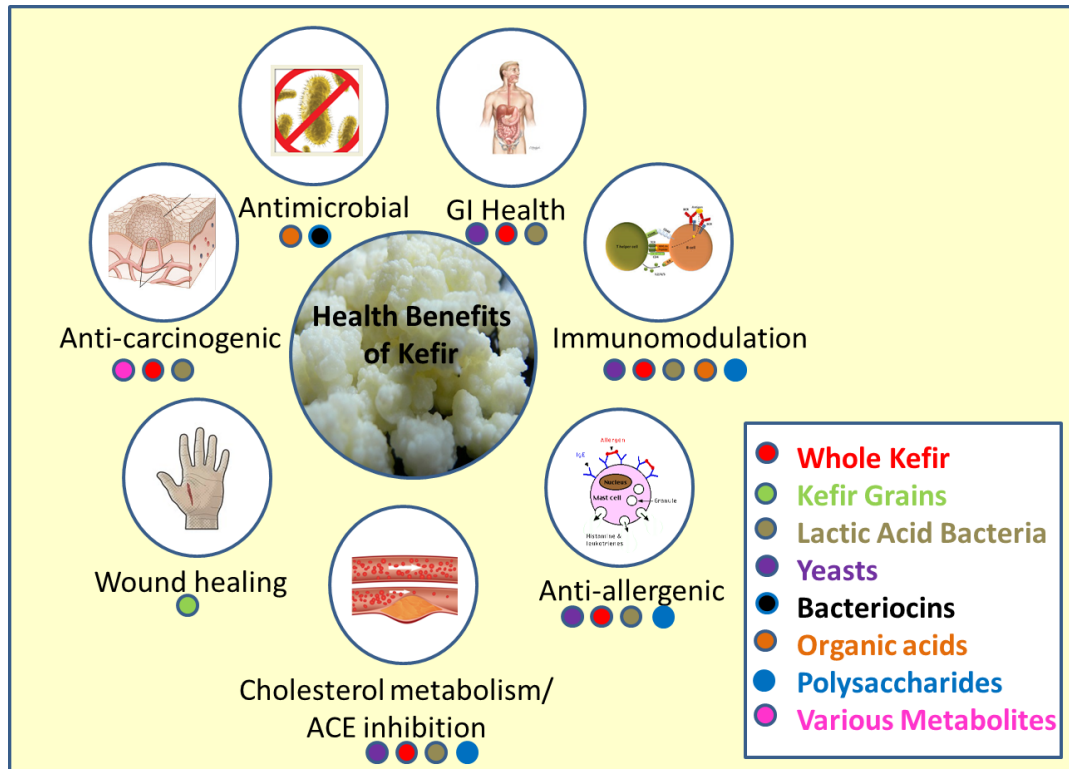
Fermentation

Mukherjee, Breselge et al *Nature Rev Gastro Hepatol* 2023

Sonnenburg and Sonnenburg *Science* 2019;366:eaaw9255

Health Benefits of Kefir

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



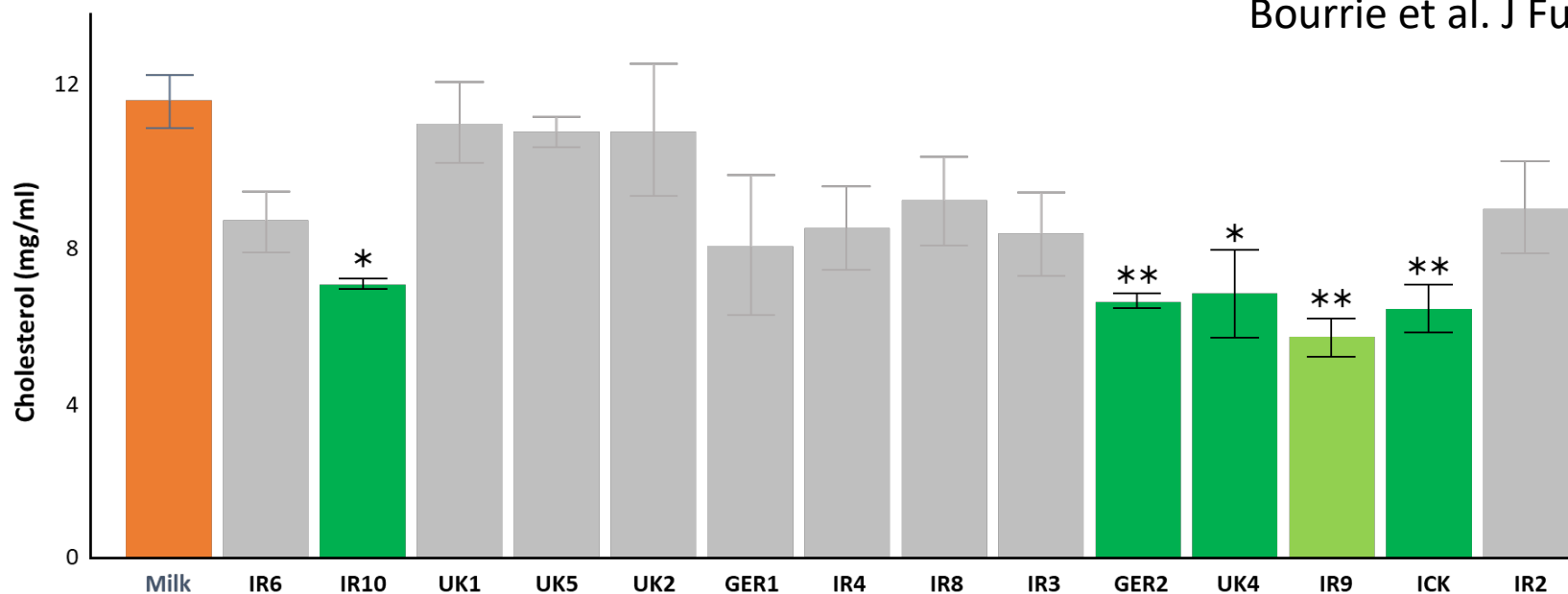
Some of the products on the market that are called 'kefir' are not really kefir

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

Cholesterol Assimilation in Milk

*=P≤0.05; **=P≤0.01

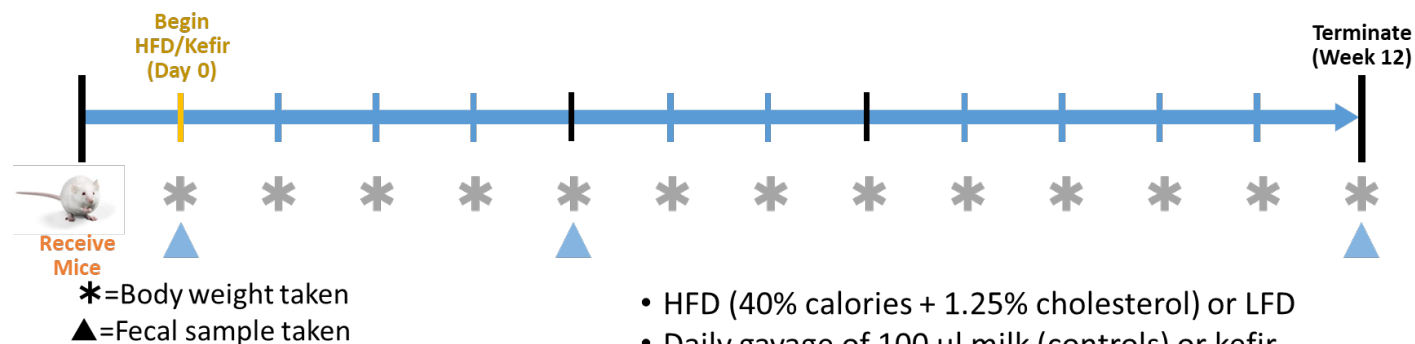
Bourrie et al. J Funct Foods. 2018;46:29



High Fat Fed Mice

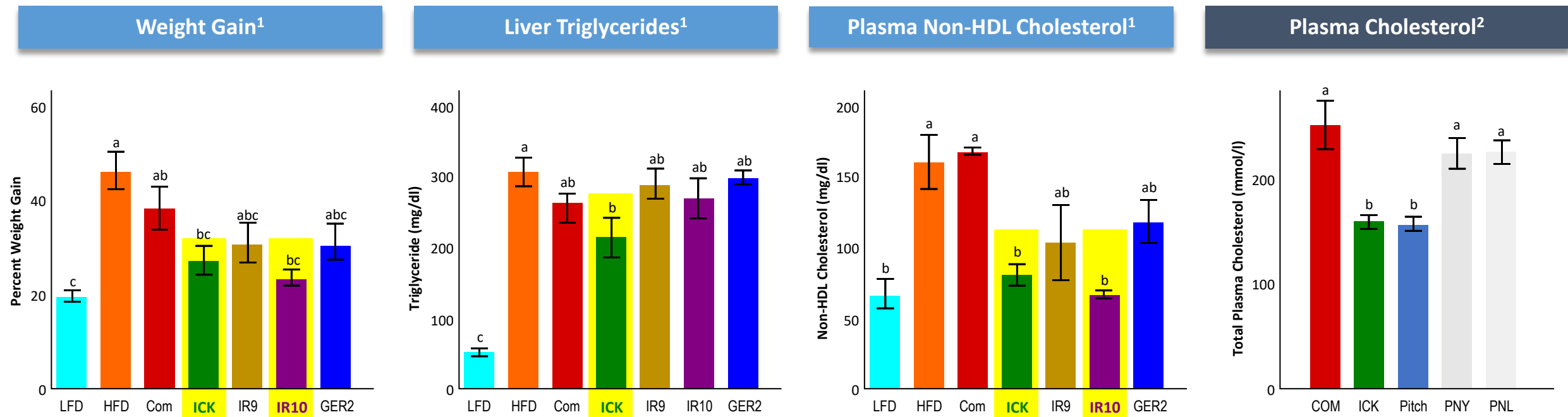
Groups:

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



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

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



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

1. Bourrie et al. J Funct Foods. 2018;46:29
2. Bourrie et al. British Journal of Nutrition. 2021;125:120

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

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



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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