

Specific dietary fibres reduce weight and obesity

Mixed fibres are ineffective: no weight loss at recommended daily intake levels

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Introduction

Overconsumption and obesity have become serious human problems. These excesses are drivers of the climate and biodiversity crises which we must endeavour to halt or reverse. Our previous work shows high fibre diets can act as a natural brake on our food intake^{1,2}, but we need a better understanding of how this works within the gut. This should help produce more informed and accurate dietary policy advice for healthier weight management, help the food industry produce healthier foods, and importantly, help advocate the benefits of more sustainable plant-based diets to the public.

The research

In our RESAS project RI-B7-08 we investigated the effects on intake of high-fat diets when supplemented with either one fibre type, pectin or FOS, or a mixed fibre diet (pectin, FOS, beta-glucan and inulin) when fed to mice. Effects on weight gain, the microbiome and satiety hormones are presented.

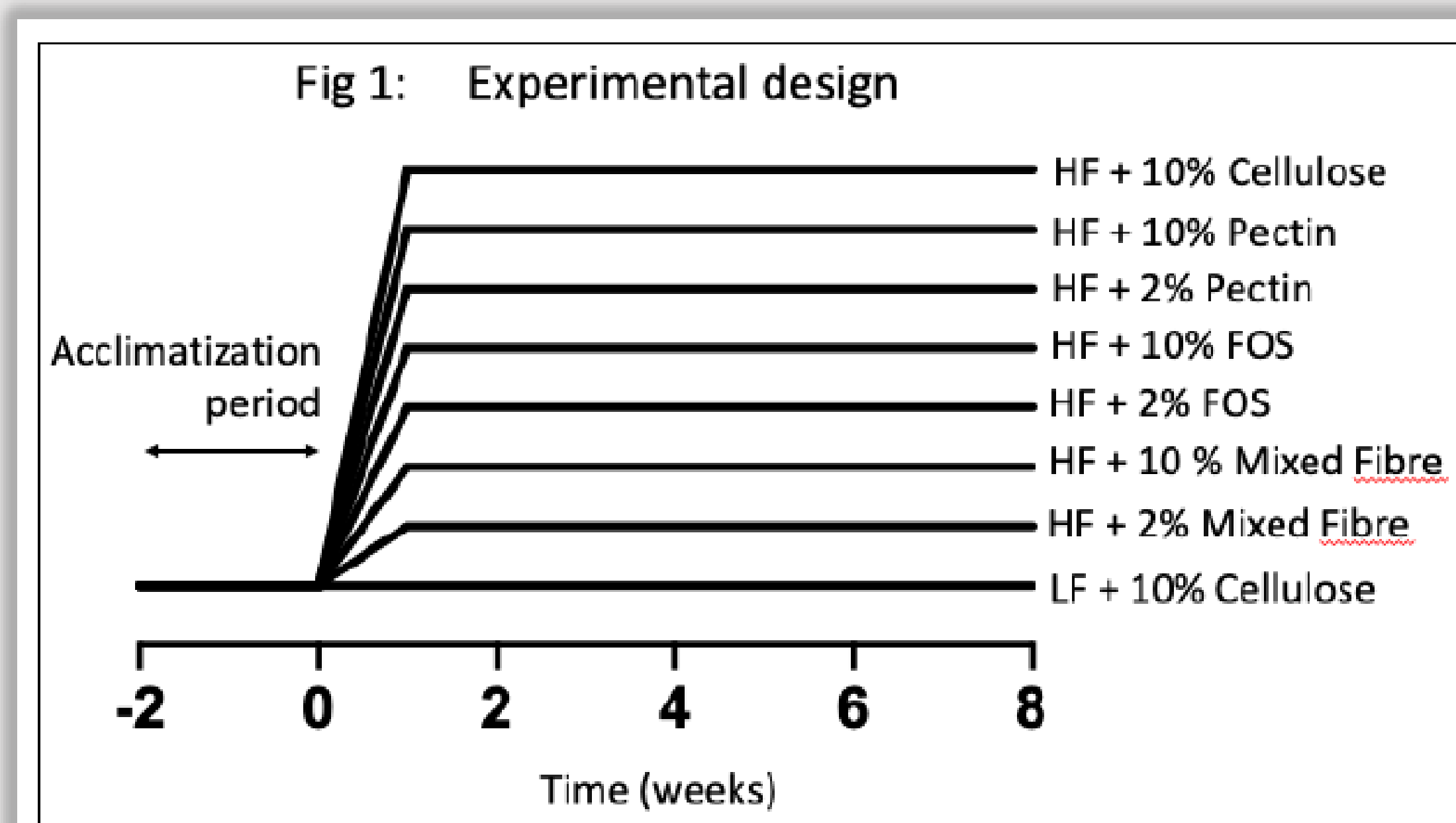
Methods

Male mice were paired at weaning and reared until 12 weeks of age, fed ad libitum on standard growing chow in a 12: 12h light: dark room with free access to water. Mice pairs were placed in weight-matched groups of 10 mice and fed a refined low-fat diet (Research Diets) for 2 weeks to acclimatize. Next mice were fed experimental diets ad libitum for eight weeks, as shown in Figure 1.

Body weights were recorded and after 8 weeks the animals were killed and blood and tissues were collected for analysis.

Figure 1 – Mouse experiment design:

Mouse study with different soluble, indigestible but fermentable dietary fibres. 8 groups (n = 10)



High Fat (HF) diets were isocaloric.

All diets have equal fibre content made up to 10% with cellulose.

Acknowledgement

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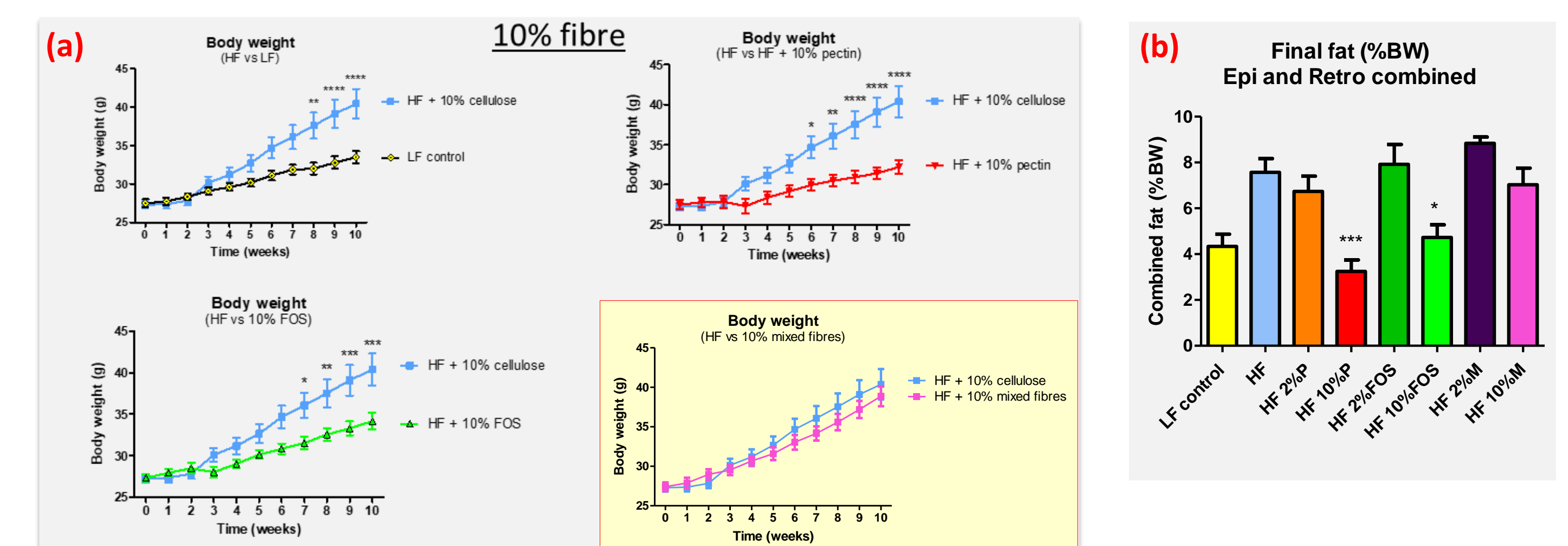
Links:

SEFARI blog: The health benefits of dietary fibre by Alexander Ross

Results

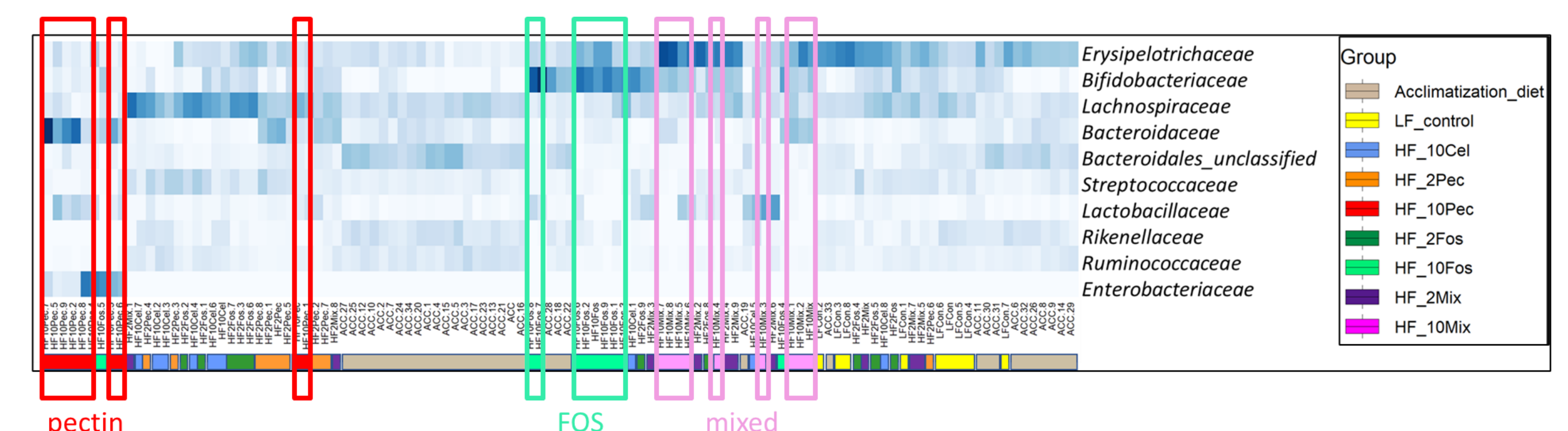
(1) Individual fibres at 10% reduced body weight gain and fat. Mixed fibres did not reduce body weight gain or fat.

Figure 2 - Body weight gain (a) and fat levels (b)



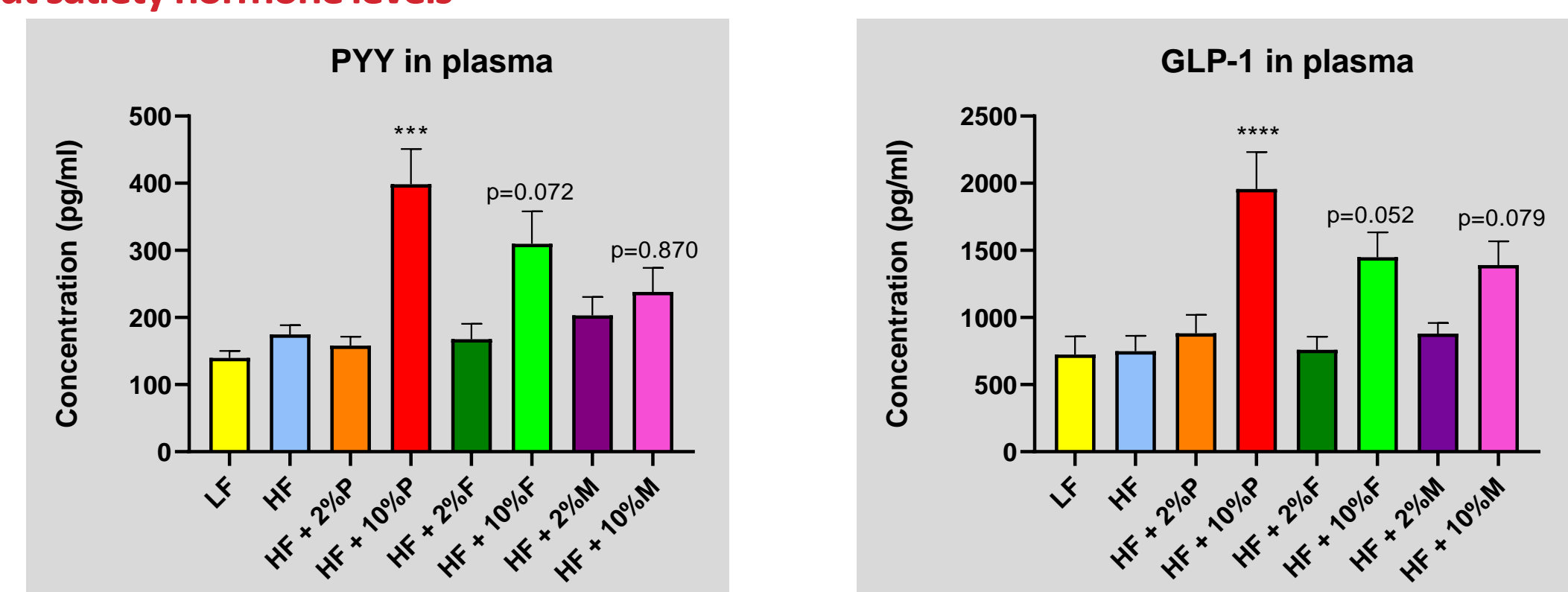
(2) Gut bacteria analysis showed the abundance of specific fibre-degrading species, but no common individual bacterium associated with body weight

Figure 3 – Heatmap of gut bacteria at family level of classification



(3) Gut satiety hormone levels show weight loss is likely to involve combined effects of both PYY and GLP-1 reaching a threshold. Threshold not reached with mixed fibres.

Figure 4 – Gut satiety hormone levels



Conclusions

- Mixed fibre diet more typical of human consumption has no effect on weight loss
- Individual dietary fibres can drive weight loss in mice, but effects are dose dependent
- No single bacterium nor specific bacterial responses in the gut microbiota revealed that correlate directly with body weight changes. A mixed response is likely.
- PYY and GLP-1 appear to be involved with the pectin response and likely FOS. Weight loss may involve combined effects of both satiety hormones reaching a threshold.
- Results are important for informing human studies on fibre type and dose .

This work is linked to current human trials on fibre in the RESAS SP (RI-B7-01) and builds on previous RESAS funded work on fibre – see references.

References

1. Adam, C. L., et al. (2014). "Different types of soluble fermentable dietary fibre decrease food intake, body weight gain and adiposity in young adult male rats." *Nutr Metab (Lond)* 11: 36.
2. Adam, C. L., et al. (2015). "Dose-dependent effects of a soluble dietary fibre (pectin) on food intake, adiposity, gut hypertrophy and gut satiety hormone secretion in rats." *PLoS One* 10(1): e0115438.