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Understanding the effect of food structures on ileal environment and appetite Regulation

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Evidence suggests that the ileum is an important player in appetite regulation[(1)]. The ileum contains a high density of L-cells that secrete appetite suppressing hormones Glucagon Like Peptide-1 and Peptide YY (PYY) in response to luminal nutrients and bacterial fermentation products, short chain fatty acid (SCFAs)[(2)]. Processing of foods may change their structures and reduce the amount of carbohydrates reaching the ileum, which may reduce appetite hormone release. This can in part explain the association seen between processed food consumption and excess body weight[(3)]. However owing to access issues, very little is known about the ileum and how different food structures may impact this environment. The aim of this project was to understand the impact of food structures on the ileal environment and appetite hormone release.

A randomised crossover trial was conducted with 10 healthy human volunteers who were admitted as inpatients for 4 days and randomly assigned to one of the three intervention diets: High fibre, intact structures (I-HF); High fibre, disrupted structures (D-HF) or Low fibre, disrupted structures (LF). On day one, a nasoenteric tube was inserted into the distal ileum for the collection of ileal samples. On day four, ileal and blood samples were collected in fasted and postprandial states (hourly for 8 hours). Disrupting the food structures of a high fibre diet (D-HF) reduced the amount of maltose ($P = 0.049$) in the ileal space compared to a high fibre intact diet (I-HF). The numbers of bacteria and the concentrations of SCFAs in the ileum dramatically dropped from fasted to post-prandial states, and this effect was not different between the groups. Postprandial PYY release was significantly higher in D-HF ($P = 0.008$) but not in I-HF ($p = 0.068$) in comparison to LF group. Metabolomic analysis of ileal contents identified dynamic changes in several metabolites which were different between groups, including amino acids which were higher in D-HF group. Treatment of ileal organoids with postprandial ileal samples from D-HF group increased PYY release compared to the other diets, confirming that ileal metabolites are in part responsible for the observed PYY difference. D-HF group also had higher serum SCFAs compared to I-HF ($P = 0.010$) and LF ($P = 0.017$) groups despite a lack of difference in stool SCFAs.

Disrupting the food structures of a high fibre diet increased PYY release in comparison to a low fibre diet in healthy humans. This difference is likely to be driven by the different handling of the food structures in the gut and differences in ileal metabolites and microbial fermentation.

References

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