Assessing the effect of seaweed extracts (alginites) on digestive enzyme activity using a model gut system

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Background

- By 2050, half the UK population could be obese, doubling the cost of obesity to NHS (currently at £4.2 billion/y)
- Inhibiting pancreatic lipase decreases fat breakdown and absorption in the body.
- High-G alginates were effective pancreatic lipase inhibitors with no adverse effects on people (Wilcox et al., 2014).
- This research looks at three different alginates (GHB, DMB and PH 157) and their effects on lipase inhibition when released through bread during simulated digestion.

Hypothesis

1. Higher conc. of alginates gives higher percentage lipase inhibition.
2. Highest-G alginates inhibits lipase most; in the order GHB, DMB and PH 157.

Aims

1. Determine the percentage lipase inhibition of the three alginates as compared against orlistat (100%)
2. To quantify the inhibitory effects of bread baked with 4% Alginate (GHB) on fat digestion.

Methodology 1 - Lipase Activity Assay

- Effects of the three alginates were tested through a lipase activity assay, using olive oil as substrate.
- Modified methodology of Vogel and Zieve (1963).

Methodology 2 - Model Gut System

- Olive Oil control, Alginate (GHB) + Olive oil (OO) and Bread (GHB) + OO were run through a model gut system which replicates digestion in the mouth, stomach and small intestine.

Results 1 - Lipase Activity Assay

- Alginate GHB showed highest level of lipase inhibition (67%) at conc. 8mg/mL and least inhibition (18.5%) at conc. 0.5mg/mL; with an overall average inhibition of 39.5% (Fig. 1)
- Alginate DMB showed highest level of lipase inhibition (85%) at conc. 8mg/mL and least inhibition (25%) at conc. 0.0625mg/mL; with an overall average inhibition of 47.5% (Fig. 2)
- Alginate PH 157 displayed the highest level of lipase inhibition among the 3 alginates; at least 50% of lipase inhibition for all concentrations (Fig. 3)

Discussion

- Alginate PH157 appears to be the best lipase inhibitor (above 50% for all conc.).
- The hypothesis that highest-G alginates inhibits lipase most was rejected.
- Higher conc. of alginates (GHB & DMB) gives higher percentage inhibition.
- Bread (GHB) inhibited lipase more as compared to the alginate GHB alone.
- Baking (190°C) may have lysed the alginate molecules into smaller molecules and allows for more effective interaction with the lipase enzyme.
- Alginate at the crust (exposed to higher temp.) could be fragmented resulting in different size alginates being released upon digestion.
- Human trial intervention is required for further testing.
- Test whether the alginates interact with the active sites of lipases/ fats or both.

References