

The role of seaweed bioactives in the control of digestion: implications for obesity treatments

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Electronic supplementary information

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Alginate inhibition of lipase

When using the lipase activity assay, as described by Wilcox *et al.* (2014),¹ the activity of lipase, in the absence of added calcium, was 80.4% (± 3.7) of the activity in the standard assay (8.6 μM), this difference was not significant. Fig. S2 showed that increasing the calcium concentration (up to 171.3 μM) had no effect on lipase activity, using the same test with differing calcium additions. However, above 171.3 μM Ca^{2+} the activity of lipase does drop off with increasing concentrations of calcium, to a minimum of 68.5% (± 1.1), showing that the highest calcium concentrations can significantly reduce the activity of the enzyme.

If alginate was inhibiting lipase by binding calcium, it would be expected that the inhibition would be overcome by the addition of further calcium. However the levels of lipase inhibition by alginate at low concentrations of calcium (0–171.3 μM) are not changed greatly. Maximum inhibition of 54.7% (± 12.7) was seen at the standard concentration of calcium (8.6 μM). The lowest level of inhibition (42.6% (± 1.5)) was seen at 171.3 μM . Even when the concentration of calcium was increased to 685.7 μM , alginate was still capable of inducing $39.8 \pm 4.8\%$ inhibition (Fig. S3).

Lipase inhibition by alginate is unlikely to be due to calcium binding by the biopolymer as inhibition remains constant (40% or greater) through the calcium range.

References

1. M. D. Wilcox, I. A. Brownlee, J. C. Richardson, P. W. Dettmar and J. P. Pearson, *Food Chem.*, 2014, **146**, 479–484.

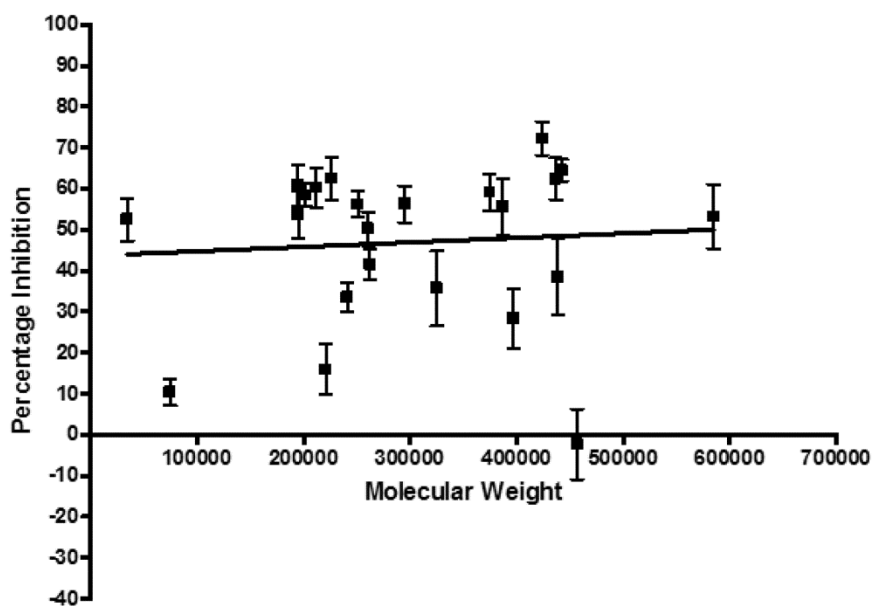


Fig. S1 Correlation of the molecular weight of alginate against lipase inhibition. There were no statistically significant correlations using these parameters at 3.43, 0.86 or 0.21 mg mL⁻¹. The percentage of lipase inhibition at 12 minutes caused by 3.43 mg mL⁻¹, alginate plotted against the molecular weight of the alginate polymers. The error bars show the standard error of the mean of six replicates using DGGR as the substrate as described by Wilcox *et al.* (2014).¹ The line of best fit is to indicate the direction of the correlation, if any.

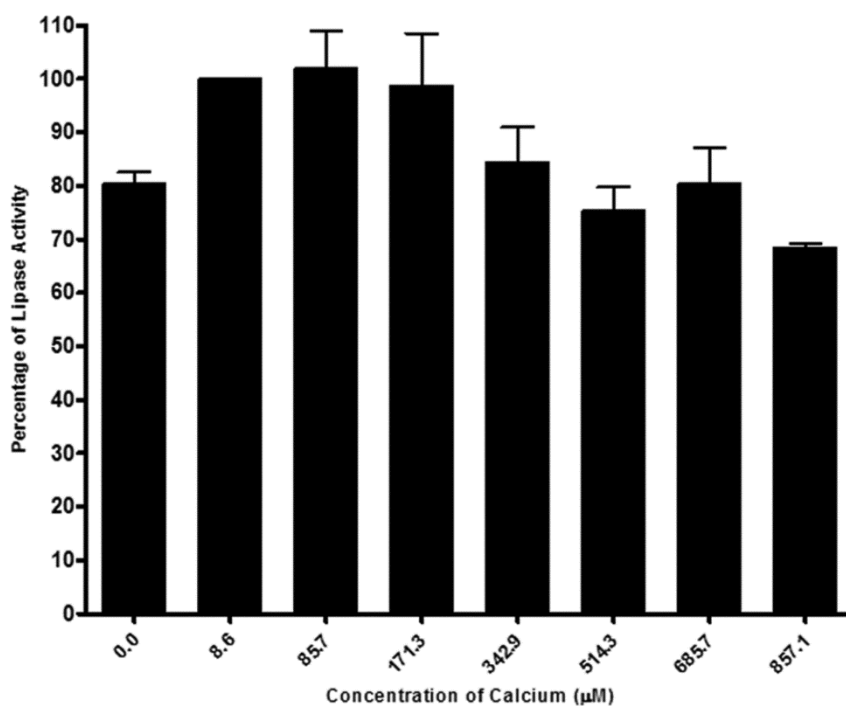


Fig. S2 The activity of lipase in the presence of increasing concentrations of calcium. The level of lipase activity at increasing calcium concentrations compared to the standard sample with 8.6 µM exogenous calcium in the final reaction mixture using DGGR as the substrate as described by Wilcox *et al.* (2014).¹ The error bars show the standard error of the mean of three replicates.

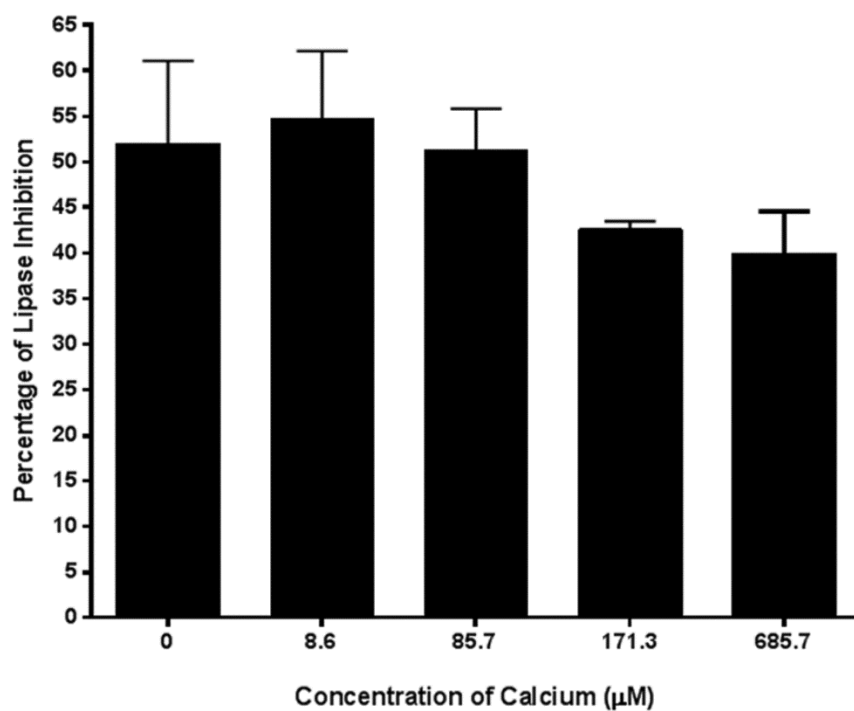


Fig. S3 Lipase inhibition by alginate with differing concentrations of calcium. The level of lipase inhibition at differing concentrations of calcium with 3.43 mg mL^{-1} alginate using DGGR as the substrate as described by Wilcox *et al.* (2014).¹ The error bars show the standard error of the mean of three replicates.