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In-vitro fermentation of whole seaweed and a polysaccharide-rich extract derived from the edible red seaweed *Palmaria palmate*

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Dietary fibre is considered an important component of a healthy diet, with evidence indicating that fibre may positively modulate gut microbiota composition and metabolism(1). There is increased attention upon the potential health benefits of seaweeds due to high fibre content(2), where the commonly consumed red seaweed *Palmaria palmata* is of particular interest due to the presence of the fermentable fibre Xylan, previously shown to exert prebiotic effects(3). This study aims to provide initial indications of the impact of *Palmaria palmata* and its polysaccharide fibre component on the composition of the human microbiota.

This study used faecal batch culture models to assess the *in-vitro* fermentability of pre-washed, freeze dried, whole seaweed (WS) and polysaccharide-rich (PR) extracts of *Palmaria palmata*, alongside Synergy 1 (positive control) and cellulose (negative control). Treatments underwent an *in-vitro* simulated upper gastrointestinal digestion process followed by a 48 hour *in-vitro* batch culture faecal fermentation (1% w/v treatment). Enumeration of total bacteria, *Lactobacilli* and *Bifidobacteria* was determined using qPCR as well as culture based methods at all time points (t = 0, 5, 10, 24, 36 and 48 hours). Data was log-transformed prior to two-way ANOVA statistical analysis (n = 3).

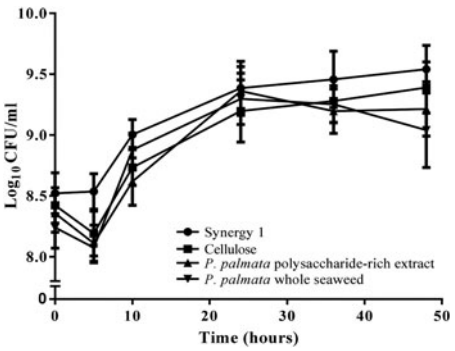

Fig. 1. Total bacteria.

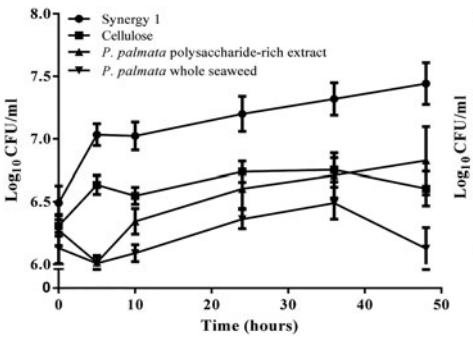

Fig. 2. Lactobacilli.

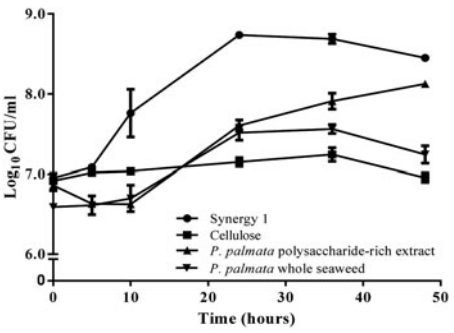

Fig. 3. Bifidobacteria.

qPCR analysis (Fig. 1–3): No significant differences were observed in total bacterial counts between substrates at any time point (Fig. 1; $P > 0{\cdot}1$). Neither WS nor PR treatments showed a significant increase in *Lactobacilli* relative to cellulose (Fig. 2; $P > 0{\cdot}1$). WS triggered a significant increase in *Bifidobacteria* relative to cellulose at 24 h and 36 h (Fig. 3; $P < 0{\cdot}05$), whilst PR was shown to have a stimulatory effect at 24 h, 36 h and 48 h ($P < 0{\cdot}001$). Further, PR samples were analogous to Synergy 1 at 48 h ($P > 0{\cdot}1$). Similar trends were observed in the culture based analysis.

These data suggest that freeze dried *Palmaria palmata* powder and polysaccharide-rich extracts of *Palmaria palmata* exhibit bifidogenic activity. Metagenomic sequencing of the microbial population and targeted metabolomics is required to verify these findings.

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