Seaweed (Ascophyllum nodosum) enriched bread is acceptable to consumers

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High-fibre foods (≥6 g dietary fibre/100 g) tend to be less appealing organoleptically than foods with higher energy densities\(^1\). Alginate is a dietary fibre found in brown seaweed species, e.g. Ascophyllum nodosum. It has been shown to have numerous health benefits\(^2-5\). We aimed to determine the acceptability of a seaweed-enriched bread.

We developed bread containing 0 g (control), 5 g, 10 g, 15 g and 20 g Ascophyllum nodosum (sea greens (SG); Seagreens\(^6\) Ltd, W. Sussex, UK) in 400 g loaves. Analysis using a combined SIGMA/Fibertech method showed the 20 g SG enriched loaf contained 17.8 v. 13.3 g/100 g dietary fibre in the control loaf. Seventy-nine untrained sensory panellists (18–65 years, 40 males) assessed the acceptability of the toasted breads topped with scrambled eggs\(^6\). Coded samples were randomly presented and rated overall, and across 5 sensory attributes\(^7\), using visual analogue scales (1–9; extremely unacceptable to extremely acceptable) in FIZZ software (Version 2.10c, Biosystemes, France) in accordance with accepted protocols. A score of 5 was used as a cut-off for lower level acceptability\(^8\). Results were analysed using one-way repeated measures ANOVA with Bonferroni post hoc analyses (SPSS V17.0, SPSS Inc. Chicago, USA).

The control bread was significantly more acceptable than the SG-enriched breads overall and for aftertaste, and significantly more acceptable than all but the 15 g SG bread for flavour (see table). Post hoc tests showed no significant differences between any of the enriched breads. Importantly, all bread samples were reported as acceptable overall and for all individual sensory attributes.

For the first time, this study has shown that seaweed-enriched bread, a high-fibre food, is acceptable when up to 20 g SG are added to a 400 g loaf. Previous studies have included alginate in drinks\(^2-3,5\) and foods\(^4,9\), and most authors\(^2-5\), but not all\(^9\) have reported beneficial health effects at levels similar to those found in SG-enriched bread. Seaweed presents an attractive option for food manufacturers who are keen to maximise the health-giving potential of their dietary fibre-rich products.

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<table>
<thead>
<tr>
<th>Amount of seagreens per 400 g loaf</th>
<th>0 g</th>
<th>5 g</th>
<th>10 g</th>
<th>15 g</th>
<th>20 g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Means</td>
<td>sd</td>
<td>Means</td>
<td>sd</td>
<td>Means</td>
</tr>
<tr>
<td>Appearance</td>
<td>6.42±</td>
<td>1.80</td>
<td>6.46±</td>
<td>1.58</td>
<td>6.41±</td>
</tr>
<tr>
<td>Aroma</td>
<td>6.38±</td>
<td>1.55</td>
<td>6.14±</td>
<td>1.45</td>
<td>6.06±</td>
</tr>
<tr>
<td>Flavour*</td>
<td>6.31±</td>
<td>1.83</td>
<td>5.56±</td>
<td>1.74</td>
<td>5.30±</td>
</tr>
<tr>
<td>Aftertaste**</td>
<td>6.34±</td>
<td>1.67</td>
<td>5.58±</td>
<td>1.59</td>
<td>5.63±</td>
</tr>
<tr>
<td>Texture</td>
<td>6.44±</td>
<td>1.80</td>
<td>5.94±</td>
<td>1.62</td>
<td>6.14±</td>
</tr>
<tr>
<td>Overall Acceptability***</td>
<td>6.60±</td>
<td>1.68</td>
<td>5.79±</td>
<td>1.52</td>
<td>5.95±</td>
</tr>
</tbody>
</table>

Data are presented as means and standard deviations. Different letters in the same row denote means that are significantly different to one another (*P = 0.008, **P = 0.003, ***P = 0.002).