

Seaweed (*Ascophyllum nodosum*) enriched bread is acceptable to consumers

A.C. Hall, A. Fairclough, K. Mahadevan and J.R. Paxman

Centre for Food Innovation, Sheffield Business School, City Campus, Howard Street, Sheffield, S1 1WB

INTRODUCTION

Fibre rich foods tend to have low level palatability due to their low energy density which makes them less appealing organoleptically than foods with a higher energy density⁽¹⁾. Foods are classed as 'high fibre' when they contain ≥ 6 g dietary fibre per 100g⁽²⁾. Typically, individuals who consume a low energy dense diet ingest fewer calories than those consuming a high energy dense diet. The latter has been linked to an increased risk of obesity⁽³⁾.

Alginate is an algal polysaccharide; a viscous dietary fibre found in the cell walls of brown seaweed species⁽⁴⁾ such as *Ascophyllum nodosum*. Alginate has been shown to have numerous benefits to human health including capacity to reduce energy intake in free living subjects⁽⁵⁾; reduce cholesterolaemic and glycaemic response to a meal⁽⁶⁻⁸⁾; increase satiety and decrease hunger⁽⁹⁾ and improve gut health⁽⁴⁾.

We aimed to determine the acceptability of a seaweed (*Ascophyllum nodosum*) enriched bread.

METHOD

79 untrained sensory panellists aged between 18 and 65 years (40 males) were recruited to assess the acceptability of 5 samples of bread containing 0g (control), 5g, 10g, 15g and 20g *Ascophyllum nodosum* per 400g loaf (Seagreens® Ltd, West Sussex, UK).

Bread samples were toasted on each side for 1 minute, cut with a pastry cutter (7.5cm diameter) to remove crusts and topped with scrambled eggs, prepared as described by McCance and Widdowson in The Composition of Food⁽¹⁰⁾.

Samples were randomly coded using 3 digit blinding codes and were presented in a random order to panellists. In accordance with standard protocol⁽¹¹⁾, five sensory attributes (appearance, aroma, taste, texture, aftertaste), as well as overall acceptability were evaluated on touch screen operated visual analogue scales anchored with the terms extremely unacceptable (1) and extremely acceptable (9) using industry standard FIZZ software (Version 2.10c, Biosystemes, France). A score of 5 was used as a cut off for lower level acceptability⁽¹²⁾. A timed break of 1 minute was enforced between samples, during which panellists were instructed to consume water (≤ 200 mL, Brontë Natural Spring water LTD (UK)) and crackers (Carr's Water Biscuit, United Biscuits (UK) LTD) to cleanse their palates.

Tests were conducted silently in temperature controlled (22-24°C) individual, sensory booths with standardised 'natural' lighting, and positive-air flow. Results were analysed using one-way repeated measures ANOVA and Bonferroni post hoc analyses on SPSS V17.0 (SPSS Inc. Chicago, USA).



FIGURE 1: Controlled sensory booths at Sheffield Hallam University

RESULTS

An analysis of the bread using a combination of the SIGMA and Fibertech methods showed the 20g seaweed bread (17.8g/100g) to contain 4.5g more dietary fibre/100g than the control bread (13.3g/100g). Thus all samples could be classified as high fibre foods.

The control bread (0g *Ascophyllum nodosum*) was deemed significantly more acceptable than the seaweed enriched breads for 3 attributes: flavour ($p=0.008$); aftertaste ($p=0.003$) and overall acceptability ($p=0.002$). No significant differences were seen across the remaining sensory attributes. The Bonferroni post hoc analyses show there were no significant differences between any of the Seagreens® enriched breads across any sensory attributes including overall acceptability.

Interestingly, the bread containing 20g *Ascophyllum nodosum* was considered slightly more acceptable overall than the product containing 5g *Ascophyllum nodosum* although this did not reach significance. Importantly, all bread samples were reported as acceptable to untrained sensory panellists

TABLE 1

Sensory characteristics of bread containing *Ascophyllum nodosum*

Amount of Seagreens per 400g loaf (g)	0		5		10		15		20	
Amount of Alginate per 400g loaf (g) ⁽¹³⁾	0		1.15		2.3		3.45		4.6	
	M	SD	M	SD	M	SD	M	SD	M	SD
Appearance	6.42 ^a	1.80	6.46 ^a	1.58	6.41 ^a	1.38	6.58 ^a	1.38	6.45 ^a	1.39
Aroma	6.38 ^a	1.55	6.14 ^a	1.45	6.06 ^a	1.53	6.30 ^a	1.55	6.09 ^a	1.44
Flavour *	6.31 ^b	1.83	5.56 ^a	1.74	5.50 ^a	1.74	5.67 ^{ab}	1.65	5.52 ^a	1.75
Aftertaste ‡	6.34 ^b	1.67	5.58 ^a	1.59	5.63 ^a	1.59	5.70 ^a	1.50	5.54 ^a	1.70
Texture	6.44 ^a	1.80	5.94 ^a	1.62	6.14 ^a	1.62	5.92 ^a	1.72	6.00 ^a	1.71
Overall Acceptability §	6.60 ^b	1.68	5.79 ^a	1.52	5.95 ^a	1.52	5.93 ^a	1.59	5.86 ^a	1.64

Data are presented as means and standard deviations.

Different letters in the same row denote means that are significantly different to one another (* $p=0.08$, † $p=0.03$, ‡ $p=0.02$).

CONCLUSION

This small scale pilot study positively indicates that it is acceptable to incorporate seaweed (*Ascophyllum nodosum*) as a source of dietary fibre into a staple food such as bread with no deterioration in acceptability when up to 20g Seagreens® are added to a 400g loaf.

Previous studies have incorporated alginate into beverages^(5,6,8,9) although a few have developed food products such as crispy bars⁽⁷⁾ and breakfast bars⁽¹⁴⁾. The amounts of alginate used in these studies (1.6g and 1.1g respectively) are comparable to those found in the bread containing 20g Seagreens® / 400g loaf. Most authors⁽⁵⁻⁹⁾, but not all⁽¹⁴⁾ have reported beneficial health effects at these levels.

Results from this study suggest that seaweed presents an attractive option for food manufacturers, particularly in the bakery sector, aiming to maximise the health-giving potential of their dietary fibre rich products.

Further study will be carried out to examine the effect of Seagreens® enriched bread on energy intake and glycaemic response.

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