Development of a highly acceptable bread with high alginate content for weight management

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Introduction

Obesity is an emerging pandemic throughout the world (Balasubramaniam *et al.*, 2013). Worldwide obesity has nearly doubled since 1980 (WHO, 2014).

Alginate, extracted from brown seaweed has identified to have a number of possible health benefits with reduced activity in certain digestive enzymes within the upper GI tract (Brownlee *et al.*, 2005). To aid weight loss through reduced digestion, bread was chosen as a potential food vehicle for alginate as it is regularly consumed in western diets.

Aim and Objectives

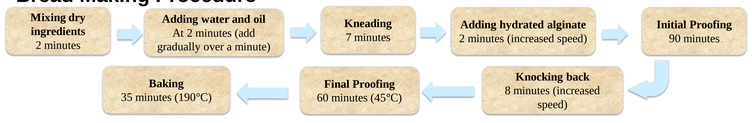
The aim of this project is to develop an alginate bread with high consumer acceptability for weight management with the objectives of:

- Creating a methodology to make alginate bread
- Optimizing the quality of alginate bread by varying alginate samples and their quantities
- Evaluating consumer acceptability of alginate bread through a series of consumer-based trials and taste test questionnaires

Materials and Methods

Raw materials for bread production (strong white flour, water, granulated sugar, olive oil, yeast and salt) and three different alginate: GHB, DMB and pH 157 were used.

Bread Making Procedure



Mechanical Measurements: A Kinexus rheometer (Malvern, UK) was used for measurement of bread firmness with a 25-mm thick slice of bread. The different bread were compressed within the parallel plate PU 20: PL 65 (20-mm plate above, 65-mm lower plate).

Sensory Analysis

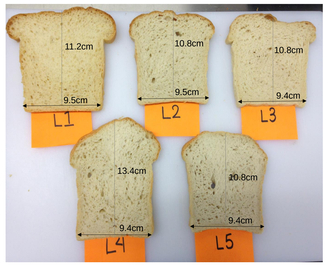
5 samples were prepared**:**
41 untrained participants in the NU Food sensory tasting laboratory. Two sections were performed:

- Descriptive analysis of six characteristics: appearance, crumb colour, smell, taste, texture and overall score
- Affective test where participants had to rank the bread in order of preference

Statistical Analysis

- One-way ANOVA test, Minitab (Version 17, USA)
- $p < 0.05$ is considered significantly different.

Results



Alginate bread produced with different samples of alginate powder. L1 control, L2 4% GHB, L3 4% DMB, L4 4% pH 157, L5 8% DMB

Elasticity of the alginate bread dough

Loaf	mm on ruler before test	g on scale when stirrer depressed 10 mm	mm on ruler after test	Force in N	Elasticity in %
L1	25.667	2.600	19.333	0.026	74.505
L2	27.333	3.200	21.333	0.031	78.114
L3	29.333	2.933	23.333	0.029	79.540
L4	28.667	7.567	23.000	0.074	80.055
L5	27.000	5.367	21.333	0.053	78.760

Elasticity of alginate bread dough

- Increase in elasticity with the addition of alginate
- L4 (pH 157) showed the highest percentage

Height of the central slice

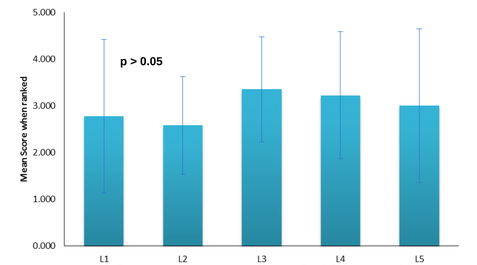
- Decrease in height in alginate bread with the exception of pH 157

Firmness of alginate bread

- Increase in firmness with the addition of alginate

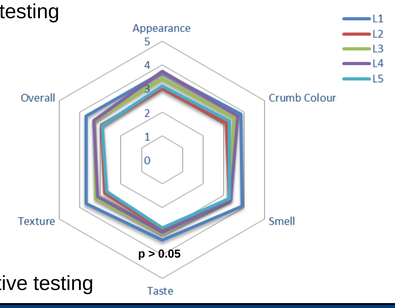
Sensory Analysis

- No significant differences were seen in both descriptive and affective tests.
- L2 (GHB) was ranked highest in affective test.

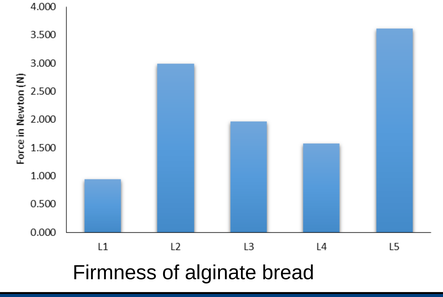


NB: The lowest mean score shows the highest ranking.

Affective testing



Descriptive testing



Firmness of alginate bread

References

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Brownlee, I.A., Allen, A., Pearson, J.P., Dettmar, P.W., Havler, M.E., Atherton, M.R. and Onsøyen, E. (2005) 'Alginate as a source of dietary fiber', *Critical Reviews in Food Science and Nutrition*, 45(6), pp. 497-510.
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Discussions

The gluten network is only slightly developed for the dough with alginate and higher concentration of alginate, thereby resulting in low expansion of the loaf.

The increase in crumb firmness of the alginate bread may be a consequence of the thickening of the walls surrounding the CO_2 gas bubbles (Rosell et al., 2001b).

Alginates have high water-absorbing capacity due to their chemical structure. This result in a bread with higher moisture content after baking as compared to bread without the use of alginate powder.

The addition of alginate influences the crumb colour. Alginate bread with higher concentration showed the darkest crumb (Refer to figure attached).

Conclusions

Sensory analysis has provided evidence that alginate bread is acceptable to consumers, showing the product has a great potential to be used in weight management.

The data in descriptive test suggests up to 8% of alginate powder could be used in bread making while maintaining the quality of final product.

Future Work

- Further Improvements in bread textural properties
- Conduct sensory analysis with trained panel
- Include a wider range of characteristics in taste test questionnaires

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