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Development of a Beverage Model to Test Appetite Control Food Ingredients

**A thesis presented in partial fulfilment of the requirements
for the degree of**

**Master of Technology
in
Food Technology**

at Massey University, Palmerston North, New Zealand

**Hui Hsing Irene Ho
2013**



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Abstract

The present project is part of the broader 'Foods for Appetite Control' research programme of Plant & Food Research. The programme aims to deliver validated satiety effects (reduce appetite and provide more than four hours of satiety) in foods through phytochemicals and macro-nutrients. As it is necessary to validate the satiety effects through clinical trials, a beverage model was developed. It served as a 'vehicle' for incorporating phytochemicals (e.g. fruit extract) and macro-nutrients (e.g. viscous fibre – alginate) to deliver their satiety effects, which were validated by a satiety measurement trial.

The development work began with the characterization of viscous fibres. Based on the literature review, pectins and alginates appear to be more satiating than other viscous fibres. It is believed that gastric gelation can induce satiety, through the formation of a gel that has some strength (presumably in the stomach). Based on rheological measurements, Protanal[®] LF120 alginate and Grindsted[®] Pectin LA410 were selected for further evaluation in the beverage model. These viscous fibres met the criteria of providing viscosity to the beverage, showing sensitivity to acids and calcium ions resulting in gelation, and contributing to higher gel strength than others that were evaluated.

The beverage model was developed as a partial-meal replacer beverage, which is non-dairy, soy protein-based, fruit-flavoured (blueberry), 250 mL and of neutral pH (~7.2). The development work has established a base formulation and processing method for the beverage model and has successfully incorporated Protanal LF120 (0.25% and 0.5%) and fruit extract (0.2%). Due to its low viscosity and poor stability in UHT-processing even at high levels, Pectin LA410 was excluded from further evaluation. Incorporation of quercetin and isoquercetin into the beverage model was unsuccessful because of their insolubility in water and interactions with soy proteins.

A methodology for satiety measurement was established and a trial was carried out to validate the satiety effects (subjective appetite) of the fruit extract and Protanal LF120 in the beverage model. The trial used a preload (6 test beverages), within-subject ($n = 12$), repeated measures, completely balanced, crossover and randomized design. The satiety effect of Protanal LF120 was found to be dose-dependent; higher alginate level significantly increased the satiety effect of the beverage. Differences in mean appetite

ratings ($P < 0.05$) between low and high alginate levels were 6.9%, 8.3%, 10.6%, 6.3% and 6.7% for hunger, fullness, satiety, desire to eat and prospective food consumption ratings, respectively.

On the other hand, the data did not reveal statistically significant results across all appetite scales (except for hunger, $P = 0.015$) between beverages with and without fruit extract. In addition, the interaction of alginate*fruit extract was not statistically significant, implying that the higher satiety effect of the high level alginate + fruit extract beverage could be purely due to the alginate. Further testing is warranted: (1) to incorporate higher levels of fruit extract in the beverage model to evaluate any dose-dependency, (2) to determine if an additive or synergetic satiety effect exists with a higher level of fruit extract and high alginate level in the beverage, and (3) to modify the current experimental design to increase power of the study to 80% by increasing the number of subjects.

Acknowledgements

This project is funded by the New Zealand Ministry of Business, Innovation and Employment (MBIE) through the 'Foods for Appetite Control' research programme. I would like to acknowledge the administrative, operational and other support provided by The New Zealand Institute for Plant & Food Research Ltd (PFR) and The Institute of Food, Nutrition and Human Health (IFNHH) of Massey University.

I would like to express my deepest gratitude and sincere thanks to my supervisors, Dr. Lara Matia-Merino (IFNHH) and Dr. Lee Huffman (PFR), for their valuable advice, guidance, support and encouragement throughout the project. It has been a very enriching and enjoyable project journey with them.

There are many helpful professionals who have kindly supported the project work, in one way or another. Sincere thanks to (Ms./Mrs./Mr./Dr.) Garry Radford, Warwick Johnson, Michelle Tamehana and Steve Glasgow of IFNHH; Duncan Hedderley, Virginia Corrigan, Claire Redman, Shiji Nair, Sarah Eady, Kevin Sutton, Chrissie Butts, Carolyn Lister, Carl Massarotto and Michelle Hopson of PFR; and Paul Ginn of Sanitarium. The prompt organization of ingredients by many suppliers is highly appreciated; they include Graeme Nealie (Hawkins Watts), Derek Horne (DuPont Nutrition and Health), Sarah Brodrick (GS Hall), Friederike Socik (Salkat) and Clinton Meharry (Sherratt).

A very big THANK YOU to all participants of the satiety measurement trial, the trial will not be possible without their enthusiasm and helpfulness. Participants who have consented to be acknowledged are (Ms./Mrs./Mr./Dr.) Sheridan Martell, Marian McKenzie, Greg Sawyer, Carl Massarotto, Belinda Diepenhenheim, Sue Middlemiss-Kraak, Hannah Smith, Lei Wang, Robert Simpson, Mareike Knaebel, Siva Sivakumaran, Huaibi Zhang and Kerry Bentley-Hewitt.

Last but not least, special thanks to Ms. Esther Chong for her company, encouragement and support during hectic times of the project.

Table of Contents

Abstract	i
Acknowledgements	iii
Table of Contents	v
List of Tables and Figures	viii
Chapter 1 Introduction	1
Chapter 2 Literature Review	3
2.1 Introduction	3
2.2 Appetite control: Satiation and Satiety	3
2.2.1 Defining satiation and satiety	3
2.2.2 Factors affecting satiation and satiety	4
2.2.3 Measuring satiation and satiety	7
2.2.3.1 Free-living versus laboratory studies	7
2.2.3.2 Preload study design	8
2.2.3.3 Covert vs. overt experimental protocol	11
2.2.3.4 Common models and designs of satiety studies	11
2.2.3.5 Types, reliability and validity of self-report scales in satiety studies ..	12
2.2.3.6 Confounders in satiety studies	15
2.2.3.7 Biomarkers of satiation and satiety	15
2.3 Food Ingredients for Enhancing Satiety	16
2.3.1 Fibres and hydrocolloids	17
2.3.1.1 Pectins	22
2.3.1.2 Alginates	23
2.3.1.3 β -glucans	25
2.3.2 Proteins	36
2.3.2.1 High protein diets	36
2.3.2.2 Different sources of protein	37
2.3.2.3 Mechanisms of action	38
2.3.2.4 Controversy on the safety of high protein diets	39
2.3.3 Plant- and lipid-based ingredients	40
2.4 Summary and recommendations	46
Chapter 3 Materials and Methods	49
3.1 Introduction	49
3.2 Characterization of viscous fibres	49
3.2.1 Materials	49

3.2.2	Methods.....	49
3.2.2.1	Preparation of viscous fibre solutions.....	49
3.2.2.2	Rheological measurements.....	50
3.3	Beverage formulation and production.....	53
3.3.1	Materials.....	53
3.3.2	Methods.....	53
3.3.2.1	Beverage processing.....	53
3.3.2.2	Rheological measurements.....	54
3.3.2.3	Solids content and pH measurements.....	57
3.3.2.4	Solubility tests.....	57
3.4	Satiety measurement trial.....	57
3.4.1	Participants.....	57
3.4.2	Test beverages and standard breakfast.....	58
3.4.3	Study design and procedures.....	60
3.4.4	Statistical data analyses.....	61
Chapter 4	Characterization of Viscous Fibres.....	63
4.1	Introduction.....	63
4.2	Results and discussion.....	64
4.2.1	Viscosity profiles and pH of the pectin and alginate solutions.....	64
4.2.2	Reactivity of the pectins and alginates to acidification and calcium ions...65	
4.2.2.1	Pectins.....	65
4.2.2.2	Alginates.....	72
4.3	Conclusion.....	80
Chapter 5	Beverage Formulation and Production.....	81
5.1	Introduction.....	81
5.2	Results and discussion.....	82
5.2.1	Commercial beverage as benchmark.....	82
5.2.2	Basis of the formulation.....	83
5.2.3	Use of carboxymethylcellulose (CMC) in the control formulation.....	83
5.2.4	Determining the usage levels of Protanal LF120 in the beverage model..87	
5.2.5	Determining the usage levels of Pectin LA410 in the beverage model.....	88
5.2.6	Effects of potassium citrate in the beverage.....	90
5.2.7	Effects of ultra-high temperature (UHT) processing on the beverages.....	95
5.2.8	Evaluation of quercetin and isoquercetin in the beverage model.....	101
5.2.9	Evaluation of fruit extract in the beverage model.....	110
5.2.10	Finalized formulation(s) of the beverage model.....	111
5.3	Conclusion.....	112

Chapter 6 Satiety Measurement Trial	113
6.1 Introduction	113
6.2 Results and discussion.....	113
6.2.1 Microbiological testing of the beverages.....	113
6.2.2 Estimated nutritional contents of the test foods	114
6.2.3 Solids content, pH and rheological properties of the beverages	117
6.2.4 Sensory evaluation of the beverages	121
6.2.5 Subjective appetite.....	125
6.2.5.1 Satiety effect of the fruit extract	125
6.2.5.2 Satiety effect of the alginate.....	126
6.2.5.3 Satiety effect of fruit extract + alginate.....	128
6.2.5.4 Power analysis	135
6.2.5.5 Sources of variation.....	135
6.3 Conclusion	138
Chapter 7 Key Findings, Conclusions and Recommendations.....	139
References.....	144
Appendix I – Advertisement 'Seeking participants for a satiety measurement trial'	152
Appendix II – Participant Information Sheet and Consent Form.....	153
Appendix III – Appetite Rating Form	159
Appendix IV – Sensory Evaluation Form	172

List of Tables and Figures

Table 1 Factors affecting satiation and satiety (Adapted from Benelam, 2009; Blundell <i>et al.</i> , 2010).....	5
Table 2 Recommended primary scales for self-reported appetite in healthy adults, using line scales of 100 or 150 mm on paper or appropriate length for electronic capture systems (Adapted from Blundell <i>et al.</i> , 2010)	9
Table 3 Issues and considerations when using preload study design (Adapted from Benelam, 2009; Blundell <i>et al.</i> , 2010).....	10
Table 4 Confounders in satiety studies (Adapted from Benelam, 2009; Blundell <i>et al.</i> , 2010).....	15
Table 5 Grouping of fibres and their assumed physicochemical properties (Adapted from Wanders <i>et al.</i> , 2011).....	20
Table 6 Studies investigating the effects of viscous fibres on satiety, with a focus on pectin, alginate and β -glucan in beverages or liquid test meals. Abbreviations: Visual analogue scales (VAS), <i>ad libitum</i> (AB).....	27
Table 7 Potential ingredients for satiety enhancement and/or weight management....	41
Table 8 List of materials used in the characterization of viscous fibres.....	50
Table 9 Formulations of the GDL-acidification method.....	52
Table 10 List of materials / ingredients used, their supplier and functionality.....	55
Table 11 Age and BMI data of the participants.....	58
Table 12 The test beverages.....	59
Table 13 List of materials used in the satiety measurement trial.....	59
Table 14 Product information, pH and viscosity data of the pectins and alginates.....	66
Table 15 Beverage concepts (Adapted from Kleef <i>et al.</i> , 2011).....	81
Table 16 Usage levels of ingredients for the beverage model	83
Table 17 Viscosity data of beverages with various levels of CMC, beverages without hydrocolloid and the commercial beverage	86
Table 18 Viscosity data of beverages with various levels of Protanal LF120, and the commercial beverage (CB).....	87

Table 19	Viscosity data of Pectin LA410 solutions, old and new samples.....	89
Table 20	Viscosity data of beverages from laboratory trials and pilot plant trials.....	96
Table 21	Descriptions and results of the evaluation of quercetin and isoquercetin in the beverage model.....	104
Table 22	Formulations of the beverages for satiety measurement trial	112
Table 23	Microbiological test results of the beverages.....	115
Table 24	Estimated nutritional contents of various combinations of test beverage and breakfast	117
Table 25	Solids content, pH and viscosity data of the test beverages.....	118
Table 26	JAR score means and ANOVA results of the beverages.....	122
Table 27	RMANCOVA results comparing beverages with and without fruit extract..	125
Table 28	Mean appetite ratings and RMANCOVA results comparing none, low and high alginate levels in the beverages.....	127
Table 29	Mean appetite ratings, RMANCOVA results and mean total AUC of the beverages.....	129
Figure 1	The ‘Satiety Cascade’ linking the timing and sequence of eating motivations and behaviours to associated cognitive and physiological processes (Source: Blundell <i>et al</i> , 2010)	5
Figure 2	The SLIM scale (Source: Cardello <i>et al.</i> , 2005).....	14
Figure 3	Chemical structure of pectin (a repeating segment of the molecule) (Source: Thakur <i>et al.</i> , 1997)	22
Figure 4	Chemical structure of alginate (a) monomers, (b) chain conformation, and (c) block distribution (Source: Draget <i>et al.</i> , 2005)	24
Figure 5	General structure of cereal β -glucans (Source: Gómez <i>et al.</i> , 1997)	25
Figure 6	Anton Paar Physica MCR 301 Rheometer.....	51
Figure 7	Settings of the rheometer for viscosity measurements.....	52
Figure 8	Settings of the rheometer for gelation (small deformation oscillatory) measurements.....	53
Figure 9	Process flowchart of the beverage model	56

Figure 10	Presentation of the standard breakfast.....	59
Figure 11	Timeline of a typical test session in the satiety measurement trial.....	61
Figure 12	Viscosity curves of various (a) pectin solutions and (b) alginate solutions (1% and 2% w/w), measured at 20°C.....	67
Figure 13	Viscosity curves of (a) Pectin Classic AF101 and (b) Pectin AMD780 solutions (2% w/w), measured at 37°C, with and without pH adjustment to 2.0.....	68
Figure 14	Gelation profiles of Pectin LA410 (2% w/w), changes in G' and G'' correlation to lowering of pH by 0.5M GDL, tricalcium phosphate was used at 0.4% w/w (equivalent to 0.16% Ca ²⁺), measured at 37°C, 1 Hz and 0.2% strain.....	70
Figure 15	Equations of the chemical reactions involved.....	71
Figure 16	Gelling mechanism of low methoxyl pectins; complexing with calcium ions (Source: Herbstreith & Fox, 1999).....	71
Figure 17	Viscosity curves of Pectin Classic AF101, Pectin AMD780 and Pectin LA410 solutions (2% w/w), measured at 37°C, with pH adjustment to 7.0 using NaOH (1N) ..	72
Figure 18	Viscosity curves of Kelcosol solutions (2% w/w), measured at 37°C, with and without pH adjustment to 2.0.....	73
Figure 19	Gelation profiles of Protanal IC2053 (2% w/w), changes in G' and G'' correlation to lowering of pH (a) by either 0.5M or 1M GDL, and (b) by 1M GDL, tricalcium phosphate was used at 0.4% w/w (equivalent to 0.16% Ca ²⁺), measured at 37°C, 1 Hz and 0.2% strain.....	74
Figure 20	The egg-box model for binding of divalent cations e.g. Ca ²⁺ to homopolymeric blocks of α-L-guluronic residues, and a probably binding site in a GG-sequence (Source: Draget <i>et al.</i> , 2005).....	75
Figure 21	Gelation profiles of Dariloid QH (2% w/w), changes in G' and G'' correlation to lowering of pH by 1M GDL, tricalcium phosphate was used at 0.4% w/w (equivalent to 0.16% Ca ²⁺), measured at 37°C, 1 Hz and 0.2% strain.....	76
Figure 22	Gelation profiles of Protanal LF120 (2% w/w), changes in G' and G'' correlation to lowering of pH by 1M GDL, tricalcium phosphate was used at 0.4% w/w (equivalent to 0.16% Ca ²⁺), measured at 37°C, 1 Hz and 0.2% strain.....	77
Figure 23	The slip effect phenomenon observed in Protanal LF120.....	78
Figure 24	Gelation profiles of the pectin and alginates (2% w/w), changes in G' correlation to lowering of pH by GDL, (a) without and (b) with tricalcium phosphate used at 0.4% w/w (equivalent to 0.16% Ca ²⁺), measured at 37°C, 1 Hz and 0.2% strain.....	79

Figure 25	Viscosity curves of the commercial beverage, measured at 4°C and 20°C	82
Figure 26	Viscosity curves of the control beverage (initially without hydrocolloid), commercial beverage and beverages with 0.5% Pectin LA410 / Protanal LF120, lab trial (LT) 3/5/12, measured at 20°C.....	84
Figure 27	Viscosity curves of the commercial beverage, beverage without hydrocolloid, and beverages with various levels of CMC, measured at 20°C.....	85
Figure 28	Gelation profiles of beverage without hydrocolloid and beverage with 0.3% CMC, changes in G' and G'' correlation to lowering of pH by 0.5M GDL, measured at 37°C, 1 Hz and 0.2% strain	86
Figure 29	Viscosity curves of the commercial beverage and beverages with various levels of Protanal LF120, measured at 20°C.....	88
Figure 30	Viscosity curves of Pectin LA410 solutions (1%, 1.5% and 2% w/w), old vs. new samples, measured at 20°C.....	89
Figure 31	Viscosity curves of the commercial beverage and beverages with various levels of Pectin LA410 (new sample), measured at 20°C.....	90
Figure 32	Viscosity curves of beverages with and without potassium citrate, measured at 20°C	92
Figure 33	Gelation profiles of beverages (a) with 0.4% Protanal LF120 and (b) 2.9% Pectin LA410, with and without potassium citrate, changes in G' and G'' correlation to lowering of pH by 0.5M GDL, measured at 37°C, 1 Hz and 0.2% strain.....	93
Figure 34	Diagram showing the chemical reactions that could occur in beverages with potassium citrate, tricalcium phosphate, and alginate or pectin, during acidification by GDL.....	94
Figure 35	Viscosity curves of commercial beverage and control beverages with pasteurization in lab trial (LT) vs. UHT-processing in pilot plant trial (PT), measured at 20°C	97
Figure 36	Viscosity curves of beverages with (a) low level alginate and (b) high level alginate, pasteurization in lab trial (LT) vs. UHT-processing in pilot plant trial (PT), measured at 20°C.....	98
Figure 37	Viscosity curves of beverages with (a) low level pectin and (b) high level pectin, pasteurization in lab trial (LT) vs. UHT-processing in pilot plant trial (PT), measured at 20°C.....	100
Figure 38	(a) Fruit extract in water, 0.1% (left) and 0.2% (right), (b) Beverages after centrifugation, from left to right: Control, 0.1% fruit extract (before heating), 0.1% fruit	

extract (after heating), 0.2% fruit extract (before heating) and 0.2% fruit extract (after heating).....	110
Figure 39 Pilot plant beverages, from left to right: (1) with fruit extract, (2) with fruit extract and colourings and (3) without fruit extract, with colourings.	111
Figure 40 NIP and ingredients of the beverages – (a) Control and CMC + fruit extract, (b) LLA and LLA + fruit extract, (c) HLA and HLA + fruit extract, negligible nutritional contribution by fruit extract is assumed	116
Figure 41 Viscosity curves of the commercial beverage and the test beverages (UHT-processed), measured at 20°C.....	118
Figure 42 Gelation profiles of beverages (a) Control (694) / CMC + fruit extract (786) and (b) LLA (694) / LLA + fruit extract (127), changes in changes in G' and G'' correlation to lowering of pH by 0.5M GDL, measured at 37°C, 1 Hz and 0.2% strain	119
Figure 43 Gelation profiles of beverages HLA (905) / HLA + fruit extract (289 and 281), changes in changes in G' and G'' correlation to lowering of pH by 0.5M GDL, measured at 37°C, 1 Hz and 0.2% strain	120
Figure 44 Gelation profiles of the test beverages, changes in changes in G' correlation to lowering of pH by 0.5M GDL, measured at 37°C, 1 Hz and 0.2% strain	121
Figure 45 Histogram of JAR score means of the beverages, grouping using Tukey Method, 95.0% confidence, NSD: not significantly different.....	124
Figure 46 Top row left to right: beverages without fruit extract – 543, 694 and 905; bottom row left to right: beverages with fruit extract – 786, 127 and 281	124
Figure 47 Histogram of appetite ratings; means \pm SE, $n = 12$, grouping using Tukey Method, 95.0% confidence, NSD: not significantly different.....	126
Figure 48 Histogram of appetite ratings; means \pm SE, $n = 12$, grouping using Tukey Method, 95.0% confidence, NSD: not significantly different.....	128
Figure 49 Histograms (a) Mean ratings (b) Total AUC; means \pm SE, $n = 12$, grouping using Tukey Method, 95.0% confidence, NSD: not significantly different.....	131
Figure 50 Hunger ratings, means \pm SE, $n = 12$, after consumption of preload (test beverage) and breakfast. BL: baseline (~5 minutes before preload).....	132
Figure 51 (a) Fullness and (b) Satiety ratings; means \pm SE, $n = 12$, after consumption of preload (test beverage) and breakfast. BL: baseline (~5 minutes before preload) .	133
Figure 52 (a) Desire to eat and (b) Prospective consumption ratings; means \pm SE, $n = 12$, after consumption of preload (test beverage) and breakfast. BL: baseline (~5 minutes before preload)	134

Figure 53 Interval plot of appetite rating data comparing females and males, 95% confidence interval for the mean..... 136

Figure 54 Interval plot of appetite rating data (a) hunger and fullness, (b) satiety, desire to eat and prospective consumption; comparing 12 subjects, 95% confidence interval for the mean 137

Figure 55 Summary on the key findings and methodology of the project 140