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CONTENTS

Student Poster Competition Abstracts: S1 to S15 **Page 3**

NB all Student Poster Abstracts have been Peer Reviewed

General Poster Abstracts: P1 to P22 **Page 12**

Please note that the notation PEER REVIEWED appears below the General Poster Abstracts that have been reviewed.

S1: The effect of food structure and distribution of aroma compounds and their impact on sensory perception

Authors: Ashly A. Kumar¹, Graham T. Eyres¹, Marco P. Morgenstern², Pat Silcock¹
Affiliation(s): ¹University of Otago, Department of Food Science; ²NZ institute for Plant and Food Research

Understanding how flavour is released during the oral breakdown of a food matrix is becoming increasingly demanding. This requires the food industry to take a different approach to altering food flavour distribution without reducing food quality and dissatisfying the consumers. The overall aim of this research is to investigate the effect of the structure of a food matrix and distribution of volatile aroma compounds and their impact on sensory perception on flavour. The mechanisms of different flavour release and sensory perception in a model food matrix was investigated using three levels of firmness (soft, medium and hard) and three different levels of aroma compound distribution. Food samples contained the same total concentration of added flavour in the matrix, but the distribution of the flavour was varied; homogenous distribution in the bulk matrix, and by concentrating the flavour in either large or small particles embedded in the matrix. Differences in perceived flavour were determined by sensory analysis, using a Difference Test. To determine the effect of food structure and distribution of flavour on aroma compound release during consumption, aroma compound release was measured using Proton Mass Transfer Reaction – Mass Spectrometry (PTR-MS) with a trained panel of six assessors. Results demonstrated that changing the firmness of a food matrix and the distribution of aroma compounds altered the aroma release during consumption, which in turn affected the sensory perception. This study will impact on food industry providing information on how to reformulate products without compromising consumer acceptability.

Keywords: Oral processing, flavour release, food structure, sensory perception.

S2: Identification of odour active compounds in New Zealand honeys

Authors: Adam Rowe, Graham T. Eyres and E. John Birch
Department of Food Science, University of Otago

New Zealand honey is some of the most desired in the world with substantial export value to New Zealand producers. With this growing industry, a greater understanding of the volatile organic compounds (VOCs) in New Zealand honey could be useful in developing and promoting the benefits in regards to flavour and quality. The odour activity of VOCs in honey is one area where there has been little research. A greater knowledge in this area would allow for the correlation of these compounds with the sensory attributes of honey.

Odour active compounds were identified in three varieties of New Zealand unifloral honey (manuka, thyme and rata) using gas chromatography mass spectrometry and olfactometry (GC-MS-O). VOCs were extracted from honey samples (1:1 with saturated NaCl solution) using headspace solid phase micro-extraction (SPME; extraction at 40°C for 30 min). A detection frequency GC-O method with a panel of six assessors was used to evaluate odour activity.

Thyme honey had the most odour active compounds while rata honey had the least. Some odour active compounds were found in common to all three honeys, such as

benzaldehyde, linalool and phenylethyl alcohol, whereas other odour compounds were distinct, being only identified in the specific samples. These findings could be useful for improving the export value by providing a greater understanding of how odour compounds and their sensory aspects relate to honey quality. This information could also be useful for monitoring changes in flavour during processing and storage.

Keywords: New Zealand Honey, odour compounds

S3: Synbiotic yogurt with Manuka honey and probiotic fermentation metabolites

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The potential prebiotic activity of some common Manuka honey varieties and an innovative blend incorporating probiotic fermentation metabolites (PFM) was evaluated by total plate count (TPC) enumeration. Viability of the probiotic *Lactobacillus reuteri* DPC16 was significantly enhanced by 5% Manuka honey (UMF 18+ and MGO 550+) in the synbiotic combinations assessed weekly over a period of four weeks. Invert syrup used as negative controls and Manuka honey blends supplemented with PFM at the recommended dosages, did not have a similar effect on bacterial growth. The lactobacillus strain also demonstrated high tolerance to acid and bile salts after exposure for 1-1.5 hours. Interestingly, *L. reuteri* DPC16, which produces the antimicrobial reuterin and Manuka honey with established anti-bacterial activity can thus be a promising synbiotic fermented product. Nevertheless, further research on characterisation of PFM for the presence of short-chain fatty acids (SCFA) and the reuterin is required to incorporate into honey to have a growth-promoting effect similar to Manuka honey with UMF/MGO ratings. The research contributes to establishing the prebiotic potential of Manuka honey and developing the less expensive blends containing beneficial fermentation metabolites that can be equally effective.

Keywords: Honey, probiotic, fermentation metabolites, prebiotic, synbiotic, antibacterial, reuterin.

S4: Germination in *Bacillus cereus* spores in response to heat and germinants

Authors: **Aswathi Soni**, Pat Silcock, Indrawati Oey and Phil Bremer*

Affiliation(s): *Department of Food Science, University of Otago*

Bacillus cereus is responsible for cases of food poisoning. This Gram-positive bacterium can form endospores which are highly resistant to heat, UV radiation, and chemical treatments. *Bacillus* spores can germinate to form vegetative cells, which can produce two types of toxins that cause food poisoning. While retorting (121°C) can eliminate the spores, this approach is not suitable for temperature sensitive foods. A better understanding of the factors that control germination will improve food safety by either 1) acting as a pre-processing hurdle step by inducing the spores to commence germination, thereby becoming less resistant to heat and other stressors, or 2) by preventing germination and cell proliferation. The induction

of germination using the germinant, L-alanine, and heat treatments were investigated using plate counts (before and after heat killing the vegetative cells at 80 °C for 15 min), dipicolinic acid (DPA) release and scanning electron microscopy (SEM). Heat activation (70°C) resulted in maximum release of DPA after 30 min, 99% germination, the highest number of vegetative cells after 60 min and prominent patterns on the spore cortex within 30 min. Reducing the time at 70°C to 10 and 20 min decreased germination rates to less than 50%, which could be enhanced to 60% if the spores were subsequently held at 30 °C for 60 mins prior to enumeration. As heat activation (70°C) induces 99% germination in *B. cereus* spores, this could be a useful hurdle step to induce germination in lower (less than 121 °C) temperature sterilisation regimes.

Keywords: Bacillus, germination, heat activation, dipicolinic acid (DPA), alanine

S5: Food regulation and food well-being: the role of consumer trust

Authors: Caixia (Ivy) Gan, Denise Conroy, Michael Lee

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Food well-being is the “positive psychological, physical, emotional, and social relationship with food at both the individual and societal levels” (Block et al. 2011, p. 6). Without trust, it is unlikely that a positive relationship can be built between consumers and their food, as trust is well recognised as essential in social relationships (e.g., Blau, 1964; Zucker, 1986). Prior studies indicate that food regulatory authorities play a crucial role in consumer trust in food (Kjærnes, Harvey, & Warde, 2007) and consumer food well-being (Block et al. 2011). Empirical findings from a case study of infant formula consumption in urban China suggest that there is a chain effect of trust in food system, and trust in food regulation system has an overarching effect on the entire food chain, from the farm to the table. Trust in food regulation is an institutional-based trust in relation to food system. When consumers have trust in the public food regulation system, they also have a general trust in the food chain under regulation, and consequently a sense of security with food provided by this food chain. However, food regulation may fail to promote consumer food well-being when distrusted by consumers, as the trustworthiness of the entire food chain under supervision is questioned in this case. For a better food well-being, consumers may bypass the distrusted food regulation system and utilise their interpersonal relationships to get connected with alternative trustworthy food chains, namely, the food chain of another country with trusted food regulation.

Keywords: Food regulation, food well-being, consumer trust, infant formula consumption, urban China

S6: Proximate composition and protein functionality of extracted locust powder and the key factors affecting consumer acceptance of its use as an ingredient

*Authors: Claudia Clarkson, Miranda Miroso, John Birch
University of Otago, Food Science Department*

The world population and demand for food, including meat, is increasing at a rapid rate. Due to the many nutritional and environmental benefits, edible insects have great potential as a protein and meat alternative. Although over two billion people worldwide consume insects as part of their normal diet, many western cultures are adverse to the idea. However, incorporating insects as an ingredient in food products could improve consumer's willingness to accept entomophagy. Currently there is limited research on consumer acceptance, and with over 2000 possible edible species, compositional investigations are very broad. The current study will be a combined consumer insights and compositional investigation. The aim is to research the composition and soluble protein from locusts, and the consumer acceptance towards its use as an ingredient. Proximate composition and aqueous extraction of the soluble protein will be conducted. This is followed by functionality analysis including solubility, water holding capacity and emulsifying ability. Furthermore, insights into factors contributing to consumer aversion will be investigated following the Delphi method. Experts in the area will be recruited and asked to fill out online questionnaires regarding the key factors affecting consumer adoption. Through subsequent interviews, the top ranked factors will be identified and illustrated into a graphical model.

Keywords: Locusts, protein, consumer acceptance, Delphi method.

S7: Subcritical water extraction of phenolic compounds from kiwifruit processing by-product (pomace)

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This study was designed to investigate the recovery of phenolic compounds from kiwifruit pomace using subcritical water extraction (SWE). The effect of key operating conditions was determined by altering the extraction temperature (170–225 °C) and time (10–180 min) under a constant high pressure (50 bar). The total phenolic and flavonoid content, as well as the antioxidant capacity of extracts, were assessed using Folin-Ciocalteu assay, aluminium chloride colorimetric assay, 2,2'-diphenyl-1-picrylhydrazyl radical scavenging assay (DPPH), 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonate) (ABTS) and ferric reducing antioxidant power (FRAP). To evaluate the feasibility of SWE technique the results were compared with those obtained using conventional solvent extractions and microwave-assisted extraction. High recovery of phenolic compounds (60.53 mg CaE/ g DW) was gained at 200°C and extraction time of 90 min presented 20-, 15-, 7.5-fold higher value than ethanol, methanol and acetone extraction respectively. Besides, both SWE and MAE have demonstrated shorter extraction time and higher extraction yield, but MAE entails a higher economical cost. HPLC-DAD analyses were performed to identify individual phenolic compounds extracted under the optimum conditions (200°C/

90min) which protocatechuic acid, (+)-catechin, chlorogenic acid, p-coumaric acid and caffeic acid were found to be the most abundant phenolic compounds. Furthermore, the formation of Maillard reaction products during SWE was investigated, and the level of 5-hydroxymethylfurfural (5-HMF) was determined using HPLC. The outcomes of this study indicated a potential formation of antioxidants from natural phenolic compounds and subcritical water is an effective solvent to extract certain phenolic compounds, in many cases more advantageous than conventional techniques.

Keywords: Kiwifruit pomace; subcritical water extraction; phenolic compounds; 5-HMF; solvent extraction.

S8: Lactic acid fermentation of paua (abalone) viscera

*Authors: Hamideh Gholizadeh, Eileen Kitundu, Aileen Huang, Owen Young
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The objective was to create an edible fermented product from the otherwise waste viscera of wild and cultivated animals. A commercial lactic starter culture intended for meat products was used to ferment 2% glucose and salt, added to cooked-then-minced viscera. Incubation was in vacuum bags incubated at 30°C for 96 hours. Variables analysed were pH, colour (L*, a* and b*), and fatty acid profile before and after incubation, and during ambient storage. Also, proximate composition, and flavor and texture attributes of the products were evaluated. Despite the significant differences between wild and cultivated viscera in terms of pH and colour prior to fermentation, the trend after fermentation followed the same pattern to at least 22 days. Colour and pH were very stable during storage. Fatty acid profile analysis by gas chromatography showed the fatty acids were also very stable at all time points. Palmitic acid was the most dominant fatty acid. Both viscera types contained high proportions of polyunsaturated fatty acids (PUFAs), and of these omega-3 PUFAs were predominant, especially docosahexaenoic acid. Its concentration in viscera was about 5% compared with a literature values of 0.5% in the paua foot. Cultivated viscera were a marginally better source of PUFAs than wild viscera. Proximate analysis after storage indicated the fat and carbohydrate contents of the wild paua viscera were higher than that of cultivated viscera. A limited sensory assessment showed that fermented cultivated paua viscera was the more acceptable product. The wild paua product had an intense fishy flavour and grainy texture.

Keywords: paua, viscera, abalone, lactic fermentation

S9: First description of *Arcobacter* species in New Zealand shellfish

*Authors: Jennifer Zezhou Man, Stephen L. W. On, Damien Althaus, Samuel Wong,
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Lincoln University*

The genus *Arcobacter* was established in 1992 following a reclassification of organisms previously defined as *Campylobacter* species. *Arcobacters* have been recovered from human faeces, livestock, and the environment. In recent times, a range of new species have been recovered from marine environments, including shellfish. We investigated shellfish in New Zealand for such organisms. Isolation

procedures described for recovery of marine arcobacters were applied on 12 batches of oysters, blue and green mussels, and paua investigated from February to May 2016. Isolates of interest were identified to genus level by 16S rRNA gene sequence comparison. Four *Arcobacter* spp. strains were recovered from three batches of green mussels. Whole-cell protein profile analysis infers some differences between strains; phenotypic and whole-genome sequence analysis is pending for finer taxonomic resolution. We believe this to be the first description of *Arcobacter* species in New Zealand.

Keywords: *Arcobacter*, New Zealand shellfish

S10: Centrifugal microfluidics for a near real-time bacteria counting device

Authors: *Joni White*^{1,2}, *Ming Yong*^{2,3}, *Matheus Vargus*³, *Cushla McGoverin*², *Cather Simpson*^{2,3}, *Simon Swift*⁴, *Fraser MacMillan*³, *Frederique Vanholsbeeck*²

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The current gold standard for bacterial enumeration involves inoculating known volumes on agar plates and counting the colonies that grow, assuming each colony derives from a bacterial cell in the original sample. This procedure is imprecise, subject to variation and error, and requires trained personnel in a laboratory environment. Additionally, it is a lengthy process, taking upwards of to 2-3 days, and can only be used for enumeration of live bacteria. These factors restrict the effectiveness of such testing within the food industry, where bacterial enumeration is central to the prevention of both microbial food spoilage and microbial food poisoning. As a solution, we are developing a centrifugal microfluidic device that allows enumeration of both live and metabolically inactive bacteria. Our device combines new and innovative technologies for faster detection of contaminated foods. Our goal is to provide a solution to bacterial enumeration of relatively large volumes of dilute samples that are acquired from food industry testing. Our device is designed to be used by workers in-house with minimal training, reducing costs, potential health risks, and the need for qualified personnel and a laboratory. The properties of the centrifugal microfluidic device are applicable beyond microbial enumeration for fluid analysis in the food industry and elsewhere.

Keywords: Centrifugal microfluidics, bacteria, enumeration, food testing, fluid analysis

S11: Impact of fruit ripening on cellular structure during avocado oil extraction

Authors: *Shuo Yang*¹, *Ian Hallett*², *H. Eustina Oh*¹, *Allan B. Woolf*², *Marie Wong*^{*1}

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In the avocado fruit mesocarp (flesh), most oil is found in the parenchyma cells. The cell walls must be broken to release oil droplets so that the oil can be separated

from cells. The aim of this study was to determine the effect of fruit ripening on the microstructural changes of the mesocarp of avocados and on oil yield, during various stages of the oil extraction process. 'Hass' avocado fruit at three different stages of ripening: minimally-, fully- and over-ripe, determined by firmness, were processed using a lab scale cold pressing oil extraction technique. The fruit flesh was ground then malaxed, samples were collected during these processes for light microscopy and impedance and conductivity measurements.

Light microscopy results showed more unbroken parenchyma cells were found in less ripe fruit at each sampling point. Electrical impedance spectroscopy and electrolyte leakage (determined by conductivity) were used to evaluate differences in flesh structure/integrity at specific steps during the extraction process. Prior to grinding, over-ripe fruit flesh exhibited the least electrical resistance compared to minimally-ripe fruit. The greatest reduction in electrical resistance was observed after the grinding step, suggesting that most cell disruption occurred due to grinding. Additionally, the over-ripe fruit showed higher electrolyte leakage and a lower electrical resistance values which indicates more cell disruption occurred during extraction of softer, riper avocado fruit. In conclusion, the cellular structure was ruptured more easily in ripe fruit resulting in earlier oil release during extraction.

Keywords: Avocado oil, microscopy, impedance, conductivity, ripeness

S12: Effect of *Chordaria cladosiphon* (Mozuku) powder on key quality parameters in wheat and gluten-free baked bread

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Massey Institute of Food Science & Technology, Massey University, Albany*

This poster has been withdrawn from the student competition and is now in the General Poster group.

S13: New Zealand lifestyle, increased BMI and risk of aggressive prostate cancer

Authors: Vaidyanathan, Venkatesh^{1,2}, Karunasinghe, Nishi², Naidu, Vijay³, Javed Anower⁴, Kallingappa Prasanna^{4,5}, Ferguson, Lynnette^{1,2}

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Although a number of studies have been carried out to analyse the role of foods and nutrients in cancer prevention, finding a specific link between any particular food or lifestyle and cancer is almost impossible. This molecular research analyses the link between increased BMI and risk of aggressive prostate cancer (PCa) using SNP genotyping data and analysing the FoodWorks™ database. Aggressive PCa increases the risk of mortality and can be difficult to differentiate from indolent disease in the initial stages.

97 single nucleotide polymorphisms (SNPs), located in 60 genes and 10 chromosomal locations that had been associated with risk of PCa were identified through an extensive literature search. 197 men identified to have aggressive and 57 non-aggressive PCa, and 369 men with no known diseases of the prostate (between the ages of 40-81 years and self-reported European ancestry) were recruited for this study between the years 2006 to 2014. Past or present smoking status and alcohol intake, red meat consumption frequency, BMI and details about Gleason score and prostate-specific antigen (PSA) level were also collected from these cohorts. Genotyping for the SNPs was carried by using SEQUENOM® MassARRAY iPLEX assay or TaqMan® Assay.

The SNPs that have come up indicate a unique situation for New Zealand men with PCa, because in our scenario, aspects such as obesity, vitamin D deficiency, higher intake of red meat and dairy products, possible deficiency in selenium intake etc. could be region-specific issues that may impact on mechanisms leading to higher risk of aggressive PCa.

Keywords: SNP Genotyping, BMI, aggressive prostate cancer

S14: Analysis of New Zealand hop cultivars using gas chromatography-mass spectrometry and chemometrics

*Authors: Victoria Purdy, Graham Eyres and Biniam Kebede
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Craft beer in New Zealand and around the world is rapidly growing in popularity, driven by increasing diversity in flavour. Newly released hop varieties add to this diversity of hop flavour in beer. To continue to develop and characterise new hop cultivars, more knowledge is needed in terms of what determines unique hop characters in beer. Previous studies have found over 500 aroma compounds within hops, however, it is predicted that there may be up to 1000 compounds present. The current study aims to identify the volatile compounds from the essential oils of hops that contribute to the aroma characteristics as a tool to support breeding of new hop cultivars. Eight commercial hop samples (NZ Hops Ltd.) were used in the study. Hot water extracts were analysed using headspace solid phase micro extraction (SPME) with gas chromatography mass spectrometry (GC-MS). The headspace-SPME-GC-MS procedure was optimised, with the aim of detecting a wide range of volatile compounds. The GC-MS data was analysed with multivariate data analysis (e.g. principal component analysis) to compare the volatile fraction of analysed hop samples. In the next step, with the aid of variable selection techniques, volatile compounds that are unique to each hop sample were determined. The result of identifying these compounds will facilitate future studies to determine the compounds that contribute to aroma characteristics using GC-Olfactometry.

Keywords: Hops, aroma compounds, volatile analysis, chemometrics

S15: Extraction and antioxidant activity of polyhydroxyl naphthoquinone pigments from New Zealand kina (*Evechinus chloroticus*) shell

*Authors: Yakun Hou (PhD Candidate), Alan Carne, Michelle McConnell and Alaa El-Din Ahmed Bekhit
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Evechinus chloroticus is a species of sea urchin endemic to New Zealand and is known locally as kina. Kina roe is considered a local delicacy that has potential for export. Harvesting kina roe generates a considerable amount of shell as waste that contains various polyhydroxyl naphthoquinone (PHNQ) pigments, also known as spinochromes. These pigments have antioxidant, anti-inflammatory and cardioprotection health promoting properties and hence the kina shells are an underutilised potentially valuable by-product. Although there exists a limited literature on extraction of PHNQ pigments from sea urchins, the effect of solvent extraction system on antioxidant activity of PHNQ pigments has not been addressed, especially for kina. This current investigation aimed to evaluate the antioxidant activities of PHNQ pigments extracted by different organic solvents including chloroform, diethyl ether and ethyl acetate from kina shells/spines. Antioxidant activity of PHNQ pigments was assessed through total polyphenol content, 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging activity, oxygen radical absorbance capacity (ORAC), ferric reducing/antioxidant power (FRAP) and 2,2'-azino-bis-3-ethylbenzthiazoline-6-sulphonic acid (ABTS) assays. Spine PHNQ pigments extracted using ethyl acetate gave the best yield: 3.87 ± 0.39 mg/g dry spine, 0.30 ± 0.03 mg/g PHNQ pigments - based on molecular extinction coefficient of spinochrome A spectrum - and highest antioxidant activities. These were 0.49 ± 0.01 mg Gallic Acid Equivalent/g total polyphenols content, DPPH scavenging activity IC₅₀ (concentration required for 50% of DPPH radicals) 46.35 ± 2.63 μ g spinochrome A equivalent /ml, ORAC value 52.60 ± 3.36 mM Trolox Equivalent/g spinochrome A, 15.23 ± 0.75 M Trolox Equivalent/g spinochrome A, 0.80 ± 0.05 M Trolox Equivalent/g spinochrome A.

Keywords: Kina shells/spines, organic solvent extraction, PHNQ pigments, antioxidant activity

General Poster Abstracts

P1: Extraction of bioactive compounds from New Zealand asparagus (*a. officinalis*) roots using novel technologies

*Authors: Abbey Symes, Amin Shavandi and Alaa El-Din Ahmed Bekhit
Department of Food Science, University of Otago, Dunedin, New Zealand*

Asparagus roots are wasted, as every 12-20 years' farmers mulch the roots in the soil before re-sowing new asparagus seedlings. The roots contain bioactive compounds with health promoting properties, such as improving the immune system and preventing cancer. Therefore, the roots are a valuable by-product. Pulsed Electric Fields (PEF) and Ionic Liquids (IL) have been used to extract bioactive compounds from various plant sources, but not asparagus roots. Therefore, the purpose of this investigation was to optimise of PEF and IL extraction parameters to obtain the maximum amount of bioactive compounds from NZ *Asparagus officinalis* roots. The PEF parameters investigated included voltage and frequency, using a Box-Behnken design. The IL parameters included the type of IL, ratio and time. Bioactive compounds were analysed through total polyphenol, total flavonoid, 2,2-diphenyl-1-picrylhydrazyl (DPPH), Oxygen Radical Absorbance Capacity (ORAC) and Ferric Reducing/Antioxidant Power (FRAP) assays. The optimal PEF conditions involved a frequency of 50 Hz and a voltage of 5.0 kV, giving 36 ± 0.4 mg GAE/mg extract polyphenols, 0.192 ± 0.01 mg RE/g flavonoids extract, $2.6 \pm 0.7\%$ DPPH inhibition, 27.2 ± 2.1 mM TE/g extract ORAC activity and 1675.8 ± 333.2 mM FeSO₄ E/g extract FRAP activity. The total polyphenol content was unable to be determined for the IL samples due to a precipitation of the Folin-Ciocalteu reagent. The optimal IL conditions involved using 0.5% [BMIM]Cl at a S:L ratio of 1:10 for 4 minutes, giving 0.94 ± 0.01 mg RE/mL flavonoids, $640 \pm 5.26\%$ DPPH inhibition, 4370 ± 239.93 mM TE/mL ORAC activity and 323714 ± 4421.1 mM FeSO₄ E/mL FRAP activity. IL offers better potential for recovery of bioactives from asparagus roots.

Keywords: NZ *Asparagus officinalis* roots, polyphenols, flavonoids, antioxidant activity

PEER REVIEWED

P2 Thermal solubility of PEF-treated connective tissue isolated from brisket

*Authors: Alahakoon, A.U.; Oey, I.; Silcock, P.; Bremer, P.
Department of Food Science, University of Otago*

Well-worked muscles such as brisket contain connective tissue which results in them being tough, low value meat cuts. To improve the tenderness, quality and value of such meat cuts, low temperature (around 60°C) cooking techniques (sous vide) can be used, however the rate of conversion of collagen into gelatine is slow such temperatures. This research investigated the impact of pulsed electric field (PEF) processing to increase the thermal solubility of connective tissue and thereby, reduce their cooking time. As brisket contains fat, collagen and muscle, all of which contribute to differing electrical conductivities, studying the influence of PEF on the individual meat components is complex. Therefore, a model system was developed

in which connective tissue isolated from deep pectoralis muscle (brisket) was placed between agar blocks at differing electrical conductivities representing the range of electrical conductivities observed in brisket, and exposed to PEF at combinations of electric field strength (1.0 and 1.5 kV/cm) and specific energy (50 and 100 kJ/kg). PEF treatment significantly ($p < 0.05$) decreased the thermal stability of connective tissue by decreasing the denaturation temperature and increasing the Ringer soluble collagen fraction compared to untreated samples. PEF treated samples showed higher solubilisation rate compared to the untreated samples at both 60°C and 70°C in heat solubility assays. PEF treatment physically weakens the connective tissue making it appear porous compared to untreated samples in SEM images. The results suggest that PEF could potentially be used to improve the tenderness and decrease the cooking time of connective tissue-rich meat cuts.

Keywords: Pulsed electric fields, connective tissue, meat, thermal solubility

P3: Effect of binary stabilising salts on the heat and physical stability of milk protein concentrate-soy protein isolate mixtures

Authors: XiaoJia Jin¹, Jun Qiang Seah², Quang Son Pham³, Xiang Li³, YiChao Liang⁴ and BiYe Chen³

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The current study aims to evaluate the effect of binary stabilising salts on the selected physico-chemical properties of calcium chloride (CaCl_2)-fortified milk protein concentrate-soy protein isolate mixtures (ratio of milk protein concentrate to soy protein isolate 5:5; total protein: 8.5% w/w). Such mixtures were subjected to in-container sterilisation (115 °C × 15 min). Three binary salt-stabilised mixtures (10 mM) were prepared -with two of three stabilising salts, trisodium potassium (TPC), dipotassium hydrogen phosphate (DPHP) and potassium dihydrogen phosphate (PDHP), at five different ratios (0:10, 2:8, 5:5, 8:2 and 10:0 mM/mM).

Without stabilising salts, a visible coagulation occurred during in-container sterilisation due to the addition of 8 mM CaCl_2 . Following in-container sterilisation, there was a greater increase in protein size and hydration whilst a lesser decrease in pH value when a higher TPC was used in binary stabilising salt mixtures.

Incorporation of stabilising salts into CaCl_2 fortified milk protein-soy protein mixture retarded sedimentation of protein during accelerated physical stability testing and significantly improved heat stability. DPHP-TPC combinations at a ratio of 10:0 exhibited greater heat stability and smaller sediment height and compressibility than other binary salt-stabilised mixtures. The results demonstrated that the proportion and type of stabilising salts used strongly affected the heat and physical stability of milk protein concentrate-soy protein isolate mixtures by various mechanisms including chelation of calcium, dissociation of casein micelles and formation of new calcium-stabilising salts complexes.

Keywords: stabilising salts, milk protein concentrate, soy protein isolate, heat stability

PEER REVIEWED

P4: Optimisation of parameters for the enzymatic hydrolysis of a beef waste stream using response surface methodology

Authors: Clara Shui Fern Bah^{1}, Santanu Deb-Choudhury², and Li Day¹.*

¹AgResearch Ltd., Grasslands Research Centre, Palmerston North, New Zealand

²AgResearch Ltd., Lincoln Research Centre, Lincoln, New Zealand

Waste streams from the meat processing industry can be a rich source of ingredients with functionalities that can be exploited, leading to the development of new products. A beef waste stream (BWS) was identified as one such resource. The hydrolysis of BWS using commercial food industry related enzymes, is being explored as a possible option to create meat protein extracts. The present work aimed to optimise the parameters of the enzymatic hydrolysis of BWS with the commercial protease papain, using response surface methodology (RSM). The hydrolysis of BWS by papain was studied to evaluate the influence of three process parameters, temperature (43 to 77°C), time (1.32 to 4.68 hours) and pH (4.32 to 7.68) on the responses of degree of hydrolysis and solubility. The influence of temperature, time and pH on the degree of hydrolysis and solubility was modelled, and the reaction was optimised to obtain the maximum degree of hydrolysis and solubility using RSM. Results of the optimum conditions determined as well as characterisation of the protein hydrolysate obtained using the optimised process conditions will be presented.

Keywords: degree of hydrolysis, hydrolysates, response surface methodology, solubility

PEER REVIEWED

P5: Predicting the release of bioactive peptides from dairy proteins: an in silico study

*Authors: Dominic Agyei, Alaa El-Din Ahmed Bekhit, and Edward John Birch
Department of Food Science, University of Otago, Dunedin, New Zealand*

Background: In recent times, bioactive peptides, i.e. peptides which impart health functions beyond nutrition, have gained a wide interest among health-conscious consumers. State-of-the-art '-omic' (e.g. peptidomics) methods for the identification and discovery of bioactive peptides rely on bioinformatic tools and databases to predict and validate the potential release of peptides from various food proteins.

Method: In this study, the database BIOPEP

(<http://www.uwm.edu.pl/biochemia/index.php/en/biopep>) was used as an in silico platform to screen for bioactive peptides from uterine precursor milk proteins from cow (*Bos tauros*; UniProtKB P21814) and sheep (*Ovis aries*; and UniProtKB P46201) after sequential digestion with the GI proteases (pepsin, trypsin and pancreatic elastase). BIOPEP descriptors were used to assess the frequency of bioactive fragments occurrence in protein sequence ('A') and the relative frequency of release of fragments with given activity by selected enzymes ('W').

Key results: Peptides generated after in silico digestion of both cow and sheep milk proteins had the same relative abundance (A values) of predominantly antidiabetic (dipeptidyl peptidase-4 inhibitory); antihypertensive (angiotensin-converting enzyme inhibitory); and to a lesser extent antioxidative and glucose uptake stimulating peptides. However, relative frequency of release of these peptides by GI enzymes was different based on W values.

Conclusion: Cow and sheep milk are a storehouse of proteins that can be tapped and translated into marketable biologically active peptides. As the world's largest exporter of dairy ingredients, New Zealand can harness the high throughput and predictive powers of bioinformatics and '-omics' techniques as tools for developing novel bioactive peptides that can be used as ingredients in functional foods.

Keywords: Bioactive peptides; In silico studies; milk; functional foods; New Zealand dairy industry

PEER REVIEWED

P6: The effect of pulsed electric field on bovine muscle protein digestibility in vitro

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Pulsed electric field (PEF) is a non-thermal process involving the application of electric current to food which often leads to cell disintegration and pore formation. Previous research has discovered that PEF treatment resulted in significant shear force reduction in post-treatment aged meat, showing PEF's potential to shorten meat maturation time. However, little information is available on the protein digestibility of PEF-treated muscle. We have investigated the effect of PEF on bovine muscle digestibility in vitro. Two days' post-mortem bovine longissimus dorsi were treated with PEF using electric field strength of 1.00 - 1.25 kV/cm at two different pulse numbers of 500 and 2000 to create specific energy of 48.65 ± 15.65 kJ/kg and 173.91 ± 34.62 kJ/kg respectively, at a constant pulse width of 20 μ s and frequency of 50 Hz. The control-untreated and PEF-treated samples were subjected to in vitro gastro-small intestinal digestion and their protein digestibility was determined as free amino nitrogen released measured using a ninhydrin assay and protein fragmentation using SDS-PAGE. Both PEF-treated samples were at least 11 % more digestible, in terms of ninhydrin-reactive amino nitrogen ($p < 0.05$), than the control after three hours of in vitro digestion, possessing significantly improved protein digestibility. Differences in protein profiles among the control and PEF-treated samples at different digestion times were observed using SDS-PAGE. Dynamic structural changes during simulated digestion are being studied to better understand the impact of PEF on muscle structure and digestibility, which may be useful in the development of nutritious novel muscle-based foods.

Keywords (maximum 5 words): Pulsed Electric Field; Beef Longissimus dorsi; Protein Digestibility

P7: NeoSEEK™ detection of the Super 7 Shiga toxin producing *Escherichia coli* in New Zealand beef enrichment samples.

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ESR, Christchurch Science Centre (LR, BH), ESR, Enteric Reference Laboratory (MD), and the Ministry for Primary Industries (HW).

The United States has a zero-tolerance policy for imported raw, non-intact beef products containing Shiga toxin producing *Escherichia coli* (STEC) E. coli belonging to the O157:H7, O26, O45, O103, O111, O121 and O145 serogroups (collectively known as the “Top-7” STEC). At the time of this study, the New Zealand STEC testing programme was a two-stage process with an initial molecular screen of meat enrichments (BioControl Assurance GDS®) followed by culture confirmation using the USDA-FSIS MLG5B.05 method for any that were screen positive. NeoSEEK™ technology is a PCR-based method coupled with mass-spectrometry, which generates a Top-7 genetic profile (using 86 genetic targets) of a sample which is then compared to a reference library. The results indicate whether one of the Top-7 STEC are present in the sample and defines them as pathogenic or non-pathogenic. In this study 394 trim enrichments previously tested by routine methods were screened using NeoSEEK™. NeoSEEK™ analysis detected Top-7 STEC in 80% (95% CI: 75.5% - 83.3%) of the GDS screen positive results compared to the culture method, which confirmed 32% (95% CI: 27.4%-37.1%). The percentage point increase in conversion of GDS screen positive results from using NeoSEEK™ compared to the culture methodology was estimated for individual processing plants. The plant percentage point increase was on average higher in the South Island (approximately 50%) compared to the North Island (approximately 35%). As well as greater product assurance, molecular analysis using NeoSEEK™ is a rapid and cost effective alternative to traditional culture methods for confirmation.

Keywords: Shiga toxin producing *Escherichia coli*

PEER REVIEWED

P8: Improving the extraction potential of polygodial from Horopito by the application of emerging technologies

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The University of Auckland*

New Zealand is a country with a variety of unique flora and fauna due to its geographically isolated position. “Horopito” (*Pseudowintera colorata*) is an ancient native plant that has survived for more than 65 million years by resisting microbial attack and evolving through climate changes. It has been discovered that the essential oil of this plant contains chemical (or plant bioactive) known as polygodial, which plays the most important role in Horopito’s antifungal properties. This study investigated two emerging technologies/methods, namely pulsed electric field (PEF) and deep eutectic solvent (DES) that both have immense scope for the extraction of bioactive compounds from plant material. PEF as a pre-treatment was applied with different processing parameters (pulsation time, electric field strength) on milled horopito dried leaves of particle size $0.2 < d < 0.85$ mm, using ethanol as a solvent with a s/l ratio of 1:10. Results revealed that PEF treated leaves gave 10.6% higher amount of polygodial when compared to non-PEF treatment. Meanwhile, few selected DESs were investigated as an alternative to commonly used conventional solvents, in terms of their extractability and stability of polygodial, as well as reusability of the solvent. It was found that both technologies have the potential to improve polygodial extraction, from technological and environmental perspectives

Keywords: emerging technologies, extraction, horopito, polygodial

P9: Effects of wheat gluten levels on the physicochemical properties of extruded soy-based meat analogues

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Meat analogues are food products that are designed to have similar properties and sensory experiences to meat, but are made from non-meat ingredients. Plant proteins are currently used as the primary source of ingredients to produce meat analogues such as soy proteins, wheat gluten, pea protein, etc. Wheat gluten acts as a supplementary role in holding the fibre together in the matrix for meat analogues, by serving as a binder in the system to stick the product together and remain stable. In this study, the objective is to investigate the effects of wheat gluten levels (0, 10, 20 and 30% dry weight) on the structural and textural properties of extruded meat analogues. From the results, meat analogues with 30% gluten exhibited highest degree of texturisation (2.544 ± 0.479) among the samples for textural cutting force. Fibrous structures with interconnecting fibres networks were observed for meat analogues with 30% and 20% gluten under scanning electron microscopy (SEM) and confocal scanning laser microscopy (CSLM). Meat analogues with 30% gluten also exhibited the highest amount of disulphide bonds based on protein solubility, with 1.767 ± 0.157 g/100g protein solubilised in an extracting solution made of phosphate buffer and dithiothreitol. The extent of disulphide bonding between meat analogues decreased with decreasing gluten concentration suggesting wheat gluten plays an important role in forming fibrous networks.

Keywords: Soy protein concentrate, wheat gluten, high-moisture extrusion cooking, physicochemical properties, fibrous structure

PEER REVIEWED

P10: Presence of Salmonella, Campylobacter, Escherichia coli and Staphylococcus aureus in environmental samples from a broiler farm in New Zealand

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Public demand for poultry products has increased over the years, partly due to their health benefits and relatively low cost. Intensive production of poultry at broiler farms gives an opportunity for contamination, thus creating potential foodborne hazards to consumers. In New Zealand, foodborne pathogens are monitored by the Institute of Environmental Science and Research. The aim of this project was to determine the prevalence of *Campylobacter* spp., *Salmonella* spp., *S. aureus* and *E. coli* at a selected broiler farm in Auckland. Swab samples (n=744) were collected from feeders, feed loaders, drinkers, fans, vents, annex, and crevices to determine the extent of contamination before cleaning and after disinfection. All samples (n=372) collected before cleaning were contaminated by at least one pathogen. After disinfection, different areas of the shed were still contaminated by the pathogens, posing danger to the next flock. Crevices and drinkers were observed to be the most contaminated areas, as accumulated organic matter during rearing were likely protecting pathogens against disinfectants. The ventilation system was also heavily contaminated. Dust was present on the ventilation screen after disinfection,

potentially making air vents possible sources of contamination. Contaminated dust could settle into various areas of the shed, thereby increasing contamination levels before cleaning. Moreover, microbial concentration in the annex was higher after disinfection, suggesting the introduction of pathogens from the outside environment, highlighting the importance of erecting hygiene barriers at the entrance of the main shed.

Keywords: Foodborne pathogens, broiler farm, cleaning and disinfection, contamination.

PEER REVIEWED

P11: Red meat discrimination using Hyperspectral Imaging

Authors: Mahmoud Al-Sarayreh, Marlon Reis, Wei Qi Yan, and Reinhard Klette. Auckland University of Technology, AgResearch

This poster reports about the performance of hyperspectral imaging for detecting the adulteration in red meat species. Images are acquired from muscles of lamb, beef, or pork. We consider the cases of fresh, frozen, and thawed meat. For each case, packing and unpacking the sample with a transparent bag is considered and evaluated. The spectral data are collected from images by pixel-wise selection followed by correlation analysis. Meat muscles are defined as one class of lamb (class A), and another class of beef and pork (class B). For visualisation purposes, the fat regions are also considered (class C). Principal component analysis was used for dimensionality reduction. We visualise the patterns between the defined classes. Two models are evaluated for classifying the red meat, partial least squares discriminant analysis as a linear model, and a support vector machine with radial basis kernel (SVM-RBF) as a nonlinear model. The extracted spectral data are pre-processed by four methods, spectral smoothing, first derivative, second derivative, and standard normal variate. The results show that SVM-RBF provides the best performance when it is applied on data pre-processed by first derivative. The results show that the developed model yields a significant performance in all cases. In the case of fresh unpacked meat products, the resulting sensitivity for class A and B are 96.53 and 97.29, respectively. The results clearly show that hyperspectral imaging systems are promising tools for discriminating lamb muscles from other types of red meat.

Keywords: Hyperspectral Imaging, red meat, adulteration, meat processing.

PEER REVIEWED

P12: Proton transfer reaction-mass spectrometry (PTR-MS) for rapid detection of oxidised odour in milk during storage.

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Milk flavour varies greatly depending on its oxidation state, which can be measured by several methods like HPLC or GC-MS. However, due to constraints associated with methodological complexity, time of analysis and costs, implementation of these methods in food industry is often limited. Recently, proton transfer reaction-mass spectrometry (PTR-MS) has been proposed as an alternative analytical technique, especially for food quality control. PTR-MS offers advantages over some traditional methods including the involvement of a mass spectrometer based on soft ionisation. This means that the resulting mass signals are mainly composed of protonated parent ions derived from volatile organic compounds (allowing their straightforward interpretation). Moreover, PTR-MS allows direct and continuous measurement and suitable for rapid on-line monitoring of foods during processing or storage. Therefore, PTR-MS was used here for rapid detection of milk oxidation. Oxidation state was determined by measuring hexanal, a well-known marker of fat oxidation in milk samples. Hexanal was monitored by tracking the changes in the abundance of the mass fragment at m/z 83. Different oxidation states in milk samples were induced by spiking different concentrations of Cu^{++} (i.e. increasing from 0 to 32 ppm) during storage conditions (4°C). Results showed that the intensity of the mass fragment at m/z 83 evolved following a sigmoidal trend with a maximum rate proportional to the Cu^{++} content in milk. The proposed analysis procedure is fast, sensitive ($8.8 \pm \text{ppbv}/\mu\text{M}$), precise (RSD < 6%; low limit of detection: $0.5 \mu\text{M}$), and non-invasive. Therefore, this PTR-MS procedure is suitable for rapid detection of hexanal to monitor the oxidative changes in milk.

Keywords: milk oxidation, copper, hexanal, rapid method.

PEER REVIEWED

P13: An assessment of the potential environmental impact of an integrated subcritical lipid hydrolysis and supercritical esterification process for biodiesel production

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In this study, comparative assessments of the conceptual potential environmental impact of an integrated subcritical lipid hydrolysis and supercritical esterification, and a one-step supercritical esterification for biodiesel production have been undertaken using the waste reduction algorithm. The process performance of the integrated subcritical lipid hydrolysis and supercritical esterification has been modelled using the ASPEN plus process analysis software. The modelled results have been compared with the operation results of a previously-studied one step supercritical esterification process obtained from the literature. A hypothetical kinetic model based on previously reported experimental data, has been utilised in describing the preliminary subcritical lipid hydrolysis process and the model has been tested statistically to establish the limits of its validity. The secondary supercritical esterification process has however been modelled using a well-developed kinetic model from experimental work in the literature. Having assessed the conceptual potential environment impact of the alternative catalyst free biodiesel production pathways using the waste reduction algorithm, the one step supercritical transesterification reaction was established as more benign environmentally. Crucially the reduced conditions of temperature and pressure of the supercritical esterification reaction of the 2 step biodiesel production process

did not translate to a reduction in the environmental cost. This study however identified further modifications in the design that may improve the environmental performance of the integrated subcritical lipid hydrolysis and supercritical esterification process for biodiesel production.

Keywords: Waste reduction algorithm, potential environmental Impact, biodiesel production; supercritical fluids

PEER REVIEWED

P14: Mapping food product label claims against mandated nutritional information

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In this pilot study, mandated nutritional information (the macronutrients: protein, carbohydrate and sugars, fat and saturated fat, fibre, and sodium, all per 100 g or mL) was mapped against price and label claims on 200 foods selected by transect sampling in a New Zealand supermarket. The aim was to confirm or deny that so-called junk foods were promoted more than so-called healthy foods, and in what way. The 17 claims commonly identified were first reduced to 8 by grouping. Thus, macronutrients claims were grouped ('low in fat' for example); likewise 'contains no artificial colours/flavours/preservatives' were grouped. In a similar way the foods were grouped in 12 categories, such as: 'biscuits/cakes/cereals'; meats; yoghurts, and soft drinks. Mapping was done by discriminate analysis to visualise patterns of correlation between, nutrients, food categories, price and claims. The 200 foods had 315 claims, led by 'no artificial colours/ flavours/preservatives (127), macronutrient claims (60), and so on to finally health claims, least at 14. Analyses showed that cheaper foods had more claims than higher priced foods. The cheaper foods were obviously dominated by carbohydrates, and sugar was the nutrient most linked to 'colours/flavours/preservative' claims, 'macronutrient' claims and 'health' claims. Meats, cheese and seafood were remarkably low on claims, although calcium claims were common for yoghurt for example. It is concluded that high sugar foods are indeed promoted by arguably spurious claims.

Keywords: Nutrition information tables, promotional claims

PEER REVIEWED

P15: Understanding milk after high pressure processing: a SAXS study with synthetic casein micelles

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The structure and function of many milk components are altered during high pressure processing (HPP) with the familiar opaque, white liquid becoming translucent. Some of these changes are not reversed after HPP and a full, definitive explanation why, remains elusive. Using synthetic casein micelles (SCM's) we have studied the influence of whey proteins on the casein micelle following HPP. Natural milk and SCM's were characterised before and after HPP using Small Angle X-ray Scattering (SAXS) at the Beijing Synchrotron. Prior to HPP the SCM's and natural milk micelles had similar "high q" scattering peaks at q values of $\approx 0.8 \text{ nm}^{-1}$, which relates to the internal structure of the micelles. However, following HPP, the high q peak of milk shifts to $\approx 0.6 \text{ nm}^{-1}$ while changes in the SAXS pattern for the SMC's

following HPP greatly depended on the presence of whey proteins. There was no change in the high q scattering peak post HPP for SCM's in the absence of whey or when whey was added after SCM formation. However, the high q peak completely disappeared following HPP in the case of SCM's that were formed in the presence of whey. Explanations and implications of these observations will be presented.

Keywords: milk, HPP, casein micelles, irreversible changes

PEER REVIEWED

P16: Is faster detection always better for food safety?

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Rapid detection of bacteria in seafood is gaining popularity; rapid results mean faster despatch of safe products to markets. However, it is important to know whether faster testing is actually reliable and, hence, better. Unacceptably high numbers of *Escherichia coli* in seafood results in recalls. We compared four commercially available rapid testing kits to detect and quantify *E. coli* in seafood matrices (Greenshell™ mussels, cold smoked salmon and Pacific oysters) and a food contact surface (conveyor belt). A cocktail of nine strains of *E. coli* was applied to the surfaces at both high and low inoculum concentrations. The sensitivity and relative ease of use of the four kits (MicroSnap™, Petrifilm™, Compact Dry™ and SimPlate®) were compared with the standard American Public Health Association (APHA) method. Only the APHA method was sensitive enough to quantify to the 2.3 *E. coli*/g standard required for molluscs. Compact Dry was the easiest to use, while SimPlate was the most complicated. The MicroSnap test was the fastest to get results (6.5 h), and easiest to use, but gave inconsistent results. The other rapid kits all took a little over 24 h and performed similarly to the APHA method when tested against low concentrations, except Petrifilm which gave significantly lower bacteria counts in oysters. SimPlate performed the best for oysters and conveyor belt (Similar to the APHA method), but only at high inoculum concentrations. Rapid test kits could provide a faster alternative to conventional testing but need to be critically evaluated against standard methods.

Keywords: *Escherichia coli*, mussel, salmon, oyster, rapid testing kit

PEER REVIEWED

P17: Frictional and mechanical properties of oral nutrition supplements (ONS) with CaCO₃

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Calcium is an essential mineral for human health. However, the presence of calcium greatly affects the physico-chemical properties of protein based oral nutrition supplements (ONS). Therefore, this present work aimed to investigate the effect of insoluble calcium carbonate (CaCO₃) on the tribological and rheological properties of reconstituted adult ONS powder. A reconstituted protein base commercial ONS emulsion was added with CaCO₃ and subsequently characterised by tribological and rheological measurements (oscillation and large deformation). Average values of coefficient of friction (CoF), complex viscosity, storage modulus and apparent viscosity were determined on repeated measurements.

Particle size of reconstituted ONS samples added with CaCO_3 showing a tri-modal or tetra-modal distribution with mean values of approximately 7.5 micron and D90 of 24 micron. Presence of these insoluble micro particles created additional friction in tribological measurements which resulted in higher CoF recorded. Similarly, CaCO_3 caused a mild but noticeable increment of storage modulus of the ONS (at 10 rad/s), suggesting a slightly more elastic behaviour. On the other hand, the difference of apparent viscosity at 500 s⁻¹ between the control and CaCO_3 -added samples was minimal. It is, however, important to note that the selection of correct region and values in the tribology and rheology spectra is crucial in order to provide insightful interpretation of the data.

In brief, the present work has provided a preliminary understanding on the effect of insoluble calcium on the properties of reconstituted adult ONS powder. This will further support the instrument-sensory mouthfeel evaluation and correlation study.

Keywords: oral nutrition supplements, calcium carbonate, tribology, rheology

PEER REVIEWED

P18: Why consumers in emerging markets prefer foreign food products: an institutional perspective on purchase preference

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This paper proposes an institutional perspective of country-of-origin (COO) and its effect on consumers in emerging markets. We conceptualise COO cues as indicators of country institutions used by consumers during purchase decision-making of food products, and test the effect of COO cues on purchase preference. We specify two aspects of COO: country-of-brand origin (COB) and country-of-manufacture (COM), and categorise food products into domestic products, foreign products, and two types of hybrid products. Study 1 tests the influence of COO cues on consumers' perceptions of institutions. The results show that COB has a strong influence on general perception of legitimacy, while COM has an impact on perception of the normative environment. Specifically, participants perceive foreign products as having a higher degree of legitimacy than any hybrid or domestic products. Study 2, a best-worst scaling study, investigates the effect of these institution-based COO cues on consumers' purchase preference and the moderators of this effect. The first analysis supports a nested choice structure, where participants perceive foreign products as a relevant alternative to any domestic or hybrid product, and they also perceive domestic products and hybrid products as relevant alternatives. The second analysis shows that COO cues are applied in participants' purchase decision-making. Participants have a higher purchase preference and are more willing to pay a premium for foreign products. This effect is strengthened when an industry-wide crisis occurs in the emerging market rather than in a foreign market. This paper offers implications for international marketing researchers and practitioners.

Keywords: Country-of-origin, institutional theory, purchase preference, international marketing, emerging markets

P19: Influence of ethanol adaptation on *Salmonella enterica* Serovar Enteritidis survival in acidic environments and expression of acid tolerance-related genes

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Cross-protection in *Salmonella* poses a great threat to food safety because it can undermine food processing interventions. In this work, the ability of *Salmonella enterica* Serovar Enteritidis (*S. Enteritidis*) to develop acid resistance following ethanol adaptation (5% ethanol for 1 h) was evaluated. It was found that ethanol-adapted *S. Enteritidis* mounted cross-tolerance to malic acid but not to acetic, ascorbic, lactic, citric and hydrochloric acids. The survival rate of *S. Enteritidis* in orange juice was not significantly ($p > 0.05$) influenced by ethanol adaptation. However, an increased tolerance was noted with ethanol-adapted cells of *S. Enteritidis* compared to non-adapted cells in apple juice stored at 25°C ($p < 0.05$), but not at 4°C. RT-qPCR revealed increased transcription of a general stress response gene (*rpoS*) and two acid shock genes (*asr* and *SEN1564A*), following ethanol adaptation. The relative expression of other genes (*bloA*, *hdeB*, *nlpD* and *clpP*) of *S. Enteritidis* did not change. These findings suggest cold storage as a convenient strategy to prevent the development of cross-protection in acidic fruit juices. The resistance phenotypes and transcriptional profiles also provide an evidence for the relevance of *rpoS*, *asr* and *SEN1564A* in the ethanol-induced acid tolerance mechanism of *S. Enteritidis*.

Keywords: *Salmonella Enteritidis*; ethanol adaptation; acid tolerance; gene expression; cross-protection

P20: Comparative genomics revealed pathogenic potential and international spread of *Staphylococcus argenteus*

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Staphylococcus argenteus and *S. schweitzeri* were recently proposed as novel species within *S. aureus* complex (SAC). *S. argenteus* has been reported in many countries and can threaten human health. *S. schweitzeri* has not been associated with human infections, but has been isolated from non-human primates. Questions regarding the evolution of pathogenicity of these two species will remain elusive until a strong evolutionary framework is established. Here, we present genomic comparison among members of SAC based on a pan-genome definition, which included 15 *S. argenteus* genomes (five newly sequenced), six *S. schweitzeri* genomes and 30 divergent *S. aureus* genomes. Of 111 tested virulence genes of *S. aureus*, 85 and 86 homologous genes were detected in *S. argenteus* and *S. schweitzeri*, respectively. There was no difference in virulence gene content among the three species, but the sequence of most core virulence genes was divergent. Analysis of the *agr* locus and the genes in the capsular polysaccharides biosynthetic operon revealed that they both diverged before the speciation of SAC members.

Furthermore, the widespread geographic distribution of *S. argenteus*, sequence type 2250, showed ambiguous biogeographical structure among geographically isolated populations, demonstrating international spread of this pathogen. Meanwhile, many results indicated that *S. aureus* is more closely related to *S. schweitzeri* than *S. argenteus*. We suppose that *S. argenteus* has undergone a recent host adaptation and has spread all over the world with a similar pathogenic potential but different invasion mechanism compared to *S. aureus*.

Keywords: *Staphylococcus argenteus*, *S. schweitzeri*, comparative genomics, pathogenic potential

P21: Consumer insights on the best ways to communicate New Zealand's food safety message to Chinese consumers

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Recent well documented food-safety scandals in China have meant that safety is a top concern for Chinese consumers. As China is the largest export market for NZ foods, it is important that NZ food companies gain insights into how Chinese consumers perceive food safety and food safety messages.

The goal of this project is gain a better understanding of how Chinese consumers perceive food safety information (e.g. safety related messages, images, certifications and symbols), other food safety-related "cues" (e.g. price, brand, manufacturing country) and information communication channels (e.g. on product, company website, social media), in order to determine best practice advice for NZ food exporters on how and where to communicate the safety of their products. NZ exporters (n=10) will be interviewed to understand their perspectives and experience in providing food safety information to Chinese consumers. Structured focus groups (n=4) will be conducted in China, to better understand the information and cues that Chinese consumers use to assess a product's safety. Chinese participants (n=300) will complete an online conjoint-based survey to provide an empirical investigation into how Chinese consumers prioritise these food safety messages and cues when making their purchase decisions.

This research will provide information on the food safety messages, cues and information channels that Chinese consumers perceive to be of greatest importance. This knowledge will help NZ food producers to maximise the effectiveness of their food safety message in the appropriate information channels that resonate well with Chinese consumers.

Keywords: Food safety, Chinese consumers, qualitative research, conjoint analysis, New Zealand

P22: Impact of divalent cation salts on selected properties of milk protein concentrate-soy protein isolate mixtures

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This study investigated the effects of adding calcium chloride and magnesium chloride on heat and physical stability of milk protein concentrate-soy protein isolate mixtures (with a ratio of 8:2 and 10% w/w total protein) subjected to in-container sterilisation (115 °C × 15 min).

Adding CaCl₂ and MgCl₂ to the mixtures slightly increased protein particle size, sediment percentage and sediment height, and decreased the pH value and hydration before heat treatments. For the protein mixtures fortified with 6 mM MgCl₂, 8 mM MgCl₂ or 8 mM CaCl₂ aqueous solutions, visible coagulation occurred during in-container sterilisation. Increasing the pH of all the protein mixtures from 6.7 to 7.2 resulted in a slightly increase in viscosity following heat treatment. Adding CaCl₂ ranging from 2 mM to 6 mM resulted in a smaller reduction in pH and heat stability than adding MgCl₂ upon in-container sterilisation. Two unique and independent sediment regions were observed in the milk protein concentrate-soy protein isolate mixtures at a ratio of 8:2 during accelerated LumiSizer centrifuge likely resulted from the repulsive forces of two classes of sedimenting particles. The results demonstrate that addition of divalent cation salts and pH change strongly influenced heat and physical stability of milk protein concentrate-soy protein isolate mixtures.

Keywords: divalent cation salts, milk protein concentrate, soy protein isolate, physical stability, heat stability

PEER REVIEWED

P23 Effect of *Chordaria cladosiphon* (Mozuku) powder on key quality parameters in wheat and gluten-free baked bread

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Many seaweeds such as *Chordaria cladosiphon*, (mozuku), have been shown to contain health promoting components such as dietary fibre, antioxidants, and a range of bioactive compounds. Brown seaweeds and their isolated components, specifically a long-chain polysaccharide known as fucoidan, are reported to retard the formation and growth of various cancer cells in humans as well as having anticoagulation, antiviral and immunological activities. Additionally, research conducted in Japan and Malaysia revealed a close link between the ingestion of fucoidan from brown seaweeds and increased insulin secretion thereby indicating its potential for use in diabetes management. The aim of this study was to enhance the potential health promoting properties of wheat and gluten-free bread formulations by fortifying them with mozuku powder whilst retaining acceptable levels of quality.

The effect of mozuku powder on bread quality were assessed by measuring key bread quality parameters: texture, crust and crumb colour, specific volume and water activity. Samples of wheat and gluten-free bread were also evaluated for likability by consumer sensory panellists. Gluten-free and wheat bread with added mozuku powder had reduced specific volume, altered crumb texture and decreased breadcrumb and crust colour lightness. There were no changes in water activity ($p \leq 0.05$). Wheat bread containing 1% and 2% mozuku powder were well-liked by consumer sensory panellists, receiving mean scores of 6.8 and 6.4 respectively, for overall liking on the 9-point hedonic scale. Overall, acceptable wheat and gluten-free bread formulations containing mozuku powder were developed thus indicating the

potential use of mozuku powder to increasing the nutritional and potential health promoting properties of baked breads.

Keywords: Mozuku, gluten-free bread, wheat bread, product development, consumer evaluation.

PEER REVIEWED