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NZIFST Annual Conference
3 Minute Pitch Abstracts

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5 - 7 July, Rotorua

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Jessica O'Connor	3MP1	**Jessica O'Connor**, Phil Bremer, Sheila Skeaff, Gina Lucci, Miranda Mirosa	Lifting the lid on bins in dairy and beef.
Manasweeta Angane	3MP6	**Manasweeta Angane**, Janesha Perera, Simon Swift, Kang Huang, Christine A. Butts, Siew Young Quek	Synergistic antimicrobial interaction of plant essential oils and extracts against food-borne pathogens
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Sian Menson	3MP12	**Sian Menson,** Graham Eyres and Phil Bremer	Valorisation of spent hops from brewing and potential reuse
Wenwen Yu	3MP7	**Wenwen Yu**, Jaspreet Singh, Indrawati Oey	Development of low glycaemic bread containing navy bean cotyledon cells

3MP1

Lifting the lid on bins in dairy and beef.

Presenter: Jessica O'Connor– PhD – University of Otago

Food loss and waste is a significant issue in our food systems. It contributes to climate change, food insecurity and lost resources. To rid ourselves of our metaphoric rubbish bins throughout the food supply chain, adopting a circular economy approach is imperative. But first we need to understand the current landscape. In New Zealand data on the nature, quantity, and drivers of food loss and waste on-farm and at the processing level in beef and dairy is lacking. To address these gaps, my Ph.D, is using a mixed methods approach. Two case studies in each industry (each case study includes one processor and affiliated farmers) have been recruited to collect data. First, quantitative data will be obtained from participants on by-product and waste categories to understand what, how much, and their final destinations. Second, qualitative data will be collected from each participant through semi-structured interviews. Rationale by decision makers behind waste and by-product destination choices will be extracted through thematic analysis. Findings will provide an understanding of the systemic structures that prevent or enable food waste to occur. A better understanding about food loss and waste within the New Zealand dairy and beef sectors, on-farm and during processing will highlight opportunities and strategies for its reduction/utilisation or prevention to create the loops of a circular economy.

Affiliations: Department of Food Science & Department of Nutrition, University of Otago; AgResearch Ltd

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3MP2

Using Hyperspectral Imaging Combined with 1D-CNN to Evaluate Quality of Mānuka Honeys Before Extraction

Presenter: Hien Truong– PhD – Massey University

New Zealand mānuka honey is mainly derived from *Leptospermum scoparium* nectar. The potent antibacterial activity of mānuka honey comes principally from methylglyoxal (MGO), in addition to the hydrogen peroxide and other lesser activities present in all honeys. MGO is formed from dihydroxyacetone (DHA) unique to *L. scoparium* nectar. Mānuka honey also has an idiosyncratic phenolic profile useful as a chemical maker. Authentic mānuka honey is highly valuable but almost all honeys are formed from natural mixtures of nectars harvested by a hive over a time period. Once diluted by other nectars, mānuka honey irrevocably loses value. We aimed to apply hyperspectral imaging to honey frames before bulk extraction to minimise dilution of genuine mānuka by other honeys and ensure authenticity at source. This technology is non-destructive and suitable for an industrial setting. Partial Least Squares and Support Vector Machine showed limited efficacy in interpreting chemical footprints due to large non-linear relationships between predictor and predictand in a large sample set, likely due to honey quality variability across geographic regions. Therefore, one-dimensional convolutional neural networks (1D-CNN) were investigated for analysing hyperspectral data for extraction of biochemical information from honeys. The 1D-CNN model showed superior prediction of honey quality (R^2 = 0.74, RMSE = 2.201) to PLS (R^2 = 0.66, RMSE = 2.607) and SVM (R^2 = 0.67, RMSE = 2.559). Classification of mono-floral manuka honeys from multi-floral and non-manuka honeys exceeded 90 % accuracy for all models tried. This study reveals the potential of 1D-CNN modelling for evaluating honey authenticity.

Affiliations: Massey University, AgResearch, Riddet Institute

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3MP3

Impact of fortified reconstituted milk systems on gastrointestinal fate of curcumin nanoemulsion

Presenter: Haroon Qazi – PhD – Massey University

Fortification of milk-based products with bioactive compounds has become an attractive strategy to boost their health-enhancing attributes. The properties of skim milk powder used in food, nutraceutical and paediatric formulations to achieve desired proteins/solids contents and textural properties varies, which depend on the nature of the pre-heat treatment carried out during processing. Though many of these physicochemical modifications have been thoroughly investigated, little is known about their impact on digestion behaviour and release of bioactive compounds. Herein, we sought to incorporate curcumin nanoemulsions into food systems prepared with low-heated (MLH), medium-heated (MMH) and high-heated (MHH) skim milk powders to understand the impact on the digestion and the curcumin bioaccessibility. Results showed that although all the recombined milk systems formed a curd during dynamic in vitro gastric conditions, but distinct characteristics of their curds significantly reduced the gastric emptying of protein and entrapped emulsified nano oil droplets loading curcumin. The open fragmented curd formed by MHH in gastric chamber, due to modification in casein whey protein complexes formed during pre-heat treatment, resulted in higher proportion of protein and oil emptying compared to the low-heated samples. This variability in compositional profile of the gastric digesta was further linked to the different rates of free fatty acids release and the associated bioaccessible fraction of the curcumin during intestinal digestion. Thus, this study highlights how various food ingredients can govern the fate of added health promoting compounds, which significantly affect the functionality and application of the supplements claimed by the manufacturers.

Affiliations: Massey University, Riddet Institute

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3MP4

Characterization of fungal growth of Monascus spp. isolates on Coconut Cream Agar and citrinin production

Presenter: Abdul Halim Farawahida – PhD – Massey University

Monascus spp. are usually used as a fungal starter to produce red fermented rice. The objective of the study was to compare the growth of *Monascus* spp. isolates on Coconut Cream Agar (CCA) as a rapid method for indicating their citrinin (CIT) production. Two *Monascus* spp. isolates were isolated from RFR (MF1 and MS1), inoculated on CCA, and incubated at 30°C for 9 days. The fungal growth (the size of colonies, light blue fluorescence zone from upright side (ZU) and reversed side (ZR), the mass of fungi, and CIT production of these isolates were recorded after 4-9 days of incubation. Ultraviolet light was used to observe the size of ZU and ZR as an indicator of CIT production. High-performance liquid chromatography with a fluorescence detector was used to confirm CIT production. Both *Monascus* spp. isolates started producing ZR at day 4, with zone size increasing over time. The maximum size of the ZU and CIT production for MF1 and MS1 were achieved after 6 and 7 days of incubation, respectively. After 9 days of incubation, both *Monascus* spp. isolates produced the same amount of CIT (385 ng/g) even though the size of the colony and ZR, and mass of fungi of MF1 was greater than MS1. The fungal growth of MF1 and MS1 on CCA can be characterized based the size of their colonies, ZU, ZR, and mass of fungi. However, only the size of the ZU of *Monascus* spp. on CCA has a linear relationship with CIT production.

Affiliations: School of Food and Advanced Technology, Massey University.

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3MP5

Rate Controlling Mechanisms in Atmospheric freeze-drying

Presenter: Merit Mathew – PhD – Massey University

Atmospheric freeze-drying (AFD) can be considered as a cost-effective alternative to vacuum freeze-drying (VFD), but the very slow drying rates limit industrial scale adoption. Nevertheless, there are applications, particularly with thin sections such as in leaves and petals, where the rate of AFD is relatively high. It is important to understand the rate-controlling mechanisms in AFD and how they are affected by the structure of the herbage. Such understanding will help identify the bottlenecks of the process and thus the steps that may be taken to overcome them. This project has developed a heat and mass transfer model for AFD by considering the intrinsic material and structural properties and the sublimation kinetics of ice.

The model has been validated against experimental data using pure ice and hops. Because the study needed high-quality continuous in-situ weight loss data, a new experimental apparatus has been developed. The model predicts the process with very high accuracy. Results suggest that the AFD of pure ice is an external mass transfer limited and the AFD of hops is an internal mass transfer limited process. This model will also help the end-users to run simulations of the AFD for different products and arrive at the best drying strategies to achieve faster drying rates.

Affiliations: School of Food and Advanced Technology, Massey University & FIET

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3MP6

Synergistic antimicrobial interaction of plant essential oils and extracts against food-borne pathogens

Presenter: Manasweeta Angane – PhD – Auckland University

As the market becomes aware of the additives in food, there is an increasing demand for natural ingredients. Essential oils (EOs)/extracts from plants have demonstrated inhibitory activity against a range of pathogenic bacteria. In the present study, the antimicrobial activity of commercially available peppermint, thyme, lavender EOs and laboratory-derived feijoa EOs (leaf and peel) and ethanol extract (leaf and peel) were evaluated against food-borne pathogens (*Escherichia coli* and *Listeria monocytogenes*). The antimicrobial activity was determined as sensitive (<5%), moderately sensitive (5-10%) and tolerant (≥10%) based on the inhibitory concentration. The minimum bactericidal concentration (MBC) for Gram positive *L. monocytogenes* ranged from 1.25-3.12% (v/v). MBC values for Gram negative *E. coli* ranged from 0.6-5% (v/v). To improve antimicrobial potency, combination of EOs and ethanol extract were made and tested in checkerboard assays to calculate the fractional inhibitory concentrations (FIC) to define synergistic (< 0.5), additive (>0.5-1), indifferent (>1-4) and antagonistic (>4) interactions. Results showed that amongst all the combinations tested peppermint/thyme, peppermint/lavender and peppermint/feijoa peel extract exhibited synergistic interactions against *E. coli* and *L. monocytogenes*. The synergistic combinations were further investigated by performing time-to-kill kinetics. Synergistic combination of peppermint/thyme and peppermint/feijoa peel extract eradicated *E. coli* within 30 minutes, while it took 240 minutes to eradicate *L. monocytogenes*. Using these synergistic combination, the mechanism of action was then evaluated by monitoring the leakage of nucleic acids, adenosine triphosphate (ATP) and changes in membrane potential. This work highlights the potential of combinations of EOs and extracts as natural alternatives in food preservation.

Affiliations: University of Auckland, The New Zealand Institute for Plant & Food Research Limited

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3MP7

Development of low glycaemic bread containing navy bean cotyledon cells.

Presenter: Wenwen Yu – M – Massey University

There is an increasing consumer's demand for low-glycaemic foods since the rise in obesity and type 2 diabetes globally. White bread as a popular staple, has high glycaemic index due to very high content of digestible starch. Reducing the glycaemic response is a challenge for starchy products. Navy bean cotyledon cells are a novel ingredient, in which the starch granules are tightly embedded in a protein matrix surrounded by the intact cell walls. Several studies have explored the cotyledon cells properties, but rarely have focused on food product development with low glycaemic index. In the present study, we have studied the influence of partial substitution of wheat flour with isolated cotyledon cells on physico-chemical characteristics, quality (volume, texture and colour) and starch hydrolysis kinetics and digesta characteristics during oral, gastro-small intestinal digestion in vitro models. Selected samples of the bread were evaluated for their glycaemic indices through in vivo (human) trials. SEM observation evidenced that integrity of cell wall in bread was preserved in baked bread as well as digesta, and this led to a ~34% reduction in vitro digestibility compared to white bread when 50% of the wheat flour was replaced with intact cells. Similar trend was observed during in vivo (human) studies. This study is expected to propose an optimized process suitable for commercial production of cotyledon cells from legumes and their application to develop low GI baked products such as bread.

Affiliations: Riddet Institute, Massey University

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3MP8

Protein differences in the simulated gastrointestinal digestion of milk from different species

Presenter: Catherine Maidment – PhD – Massey University

Milk is a highly nutritious food source that has been an important component of the human diet since approximately 8000 BC. It provides a valuable source of proteins, fats, vitamins and energy. Although cow's milk is the most frequently consumed, milk from other species such as goat, sheep and even deer are becoming more prevalent in the market either for specialised products or as a less allergenic alternative. Prior to consumption, milk is processed either to kill microbes, preserve its shelf life or prepare it for further production. During digestion, milk proteins are hydrolysed into absorbable peptides and amino acids. Various factors such as species, breed, lactation stage and processing treatments have been shown to influence milk composition and structure, affecting how milk proteins are digested and consequently how the nutrients are absorbed. This study investigates how commercial processing treatments affect the protein structure and digestion of milks from ruminant species. The knowledge generated will provide a better basis for developing easily digestible milk products. To investigate this, milk obtained from several species and processing variants will undergo *in vitro* dynamic digestion and be characterised using LC-MS/MS proteomic analysis. It is expected that differences between species and/or processing will be discovered regarding peptide sequences, cleavage location and post-translational modifications.

Affiliations: Riddet Institute, AgResearch

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3MP9

Why eat bugs?

Presenter: Ruchita Rao Kavle – PhD – University of Otago

The UN has projected that the world population will reach 9 billion by the year 2050. This presupposes an increase in the demand for protein for consumption, and as such alternate and novel sources of protein need to be identified. Insects and insect juvenile forms have been gaining attention as a potential good source of nutrients and a sustainable and alternative source of food. The Food and Agricultural Organisation (FAO) has highlighted the critical role those indigenous foods can play in combating hunger, eradicating poverty, contributing to food security, and enhancing the quality of diets. These roles, together with global imperatives such as the United Nations Sustainable Developmental Goals (UN SDG) (particularly goals #2 and 3), justify the study of indigenous foods. Despite the long history of entomophagy in certain communities, uncertainties, and gaps in knowledge regarding the usage of various edible insects and their products as food have been emphasized in recent literature. This presentation will cover the potential nutritional quality and the safety risks associated with edible insects in relation to a New Zealand edible insect species, the Huhu grub.

Affiliations: University of Otago

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3MP10

Food choices influenced by expectations and emotions: A pilot study to understand relationship between extrinsic and intrinsic factors.

Presenter: Annu Mehta – PhD – Lincoln University

Expectations are pre-existing beliefs and attitudes developed due to prior interactions with products, which influence consumer's liking and decision-making. The objective of this study was to understand how the expectations raised from different types of packaging materials (4 textures x 2 font colours) affect the approach-based consumer behaviours (acceptability and purchase intention). Participants evaluated tetra pack, pouch, glass, or plastic bottles using white or orange colour fonts in blind (tasting without information), expectation (no tasting, presentations of packaging) and informed (tasting with packaging) sessions. Participants assessed their sensory and hedonic liking using labelled-magnitude-scale, and emotional responses were assessed using check-all-that-apply. Binomial scale was used for purchase intention. Just-about-right (JAR) was used to evaluate penalties on sensory attributes and liking in all sessions. It was found that expectations raised from packaging have a significant effect on the final product perception. Participants had higher expectations of the sensory and overall liking of the juice, which were not fulfilled during the informed session, resulting in an assimilation effect. Participants also penalised the juice from the glass bottle (orange and white) and tetra pack (orange and white) for different sensory attributes. No penalty was observed for tetra pack in the informed session. Positive emotions were observed during the blind and informed tasting session and were also drivers of the approach-based behaviours. Therefore, marketers and product developers can use this early product development research to identify consumers' expectations and emotions that drive liking and purchase behaviours in the market.

Affiliations: Lincoln University, New Zealand

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3MP11

The antimicrobial and antioxidant efficacies of mānuka oil vary in low- and high-fat meat paste systems

Presenter: Ramandeep Kaur – PhD – Massey University

The research studies on the influence of food composition, especially fat content, on the antimicrobial and antioxidant efficiencies of essential oils have rarely been reported; however, it is an essential factor to be studied. In this study, the antioxidant and antimicrobial effect of New Zealand mānuka oil with 25 % triketone content (*Leptospermum scoparium*) was tested in two different meat pastes having low (3 %) and high (12 %)-fat content prepared from the normal and wagyu beef tenderloins, respectively during storage for one week at 4 °C. The effects of this oil were compared against commonly used preservatives sodium nitrate and rosemary oil. In low and high-fat meat pastes, the mānuka oil showed a higher antimicrobial effect against gram-positive microbes than the gram-negative ones, and this effect was greater than the rosemary oil and sodium nitrate-containing pastes and controls (with no added preservatives). However, the rosemary oil inhibited the growth of gram-negative microbes more effectively. The antimicrobial effect of mānuka oil was higher in low-fat meat paste than in high-fat meat paste, which may be due to more solubility of mānuka oil in meat fat, thereby protecting the targeted microbes in the meat pastes. On the other hand, mānuka oil showed more antioxidant effects in high-fat meat pastes than low-fat meat pastes to inhibit lipid oxidation. Improvement in colour values was also noticed by adding mānuka oil in both meat pastes.

Affiliations: School of Food and Advanced Technology, Massey University; Riddet Institute, Massey University; AgResearch Ltd., Hopkirk Research Institute, Massey University

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3MP12 Valorisation of spent hops from brewing and potential reuse

Presenter: Sian Menson – BHons – University of Otago

Waste generation and its disposal poses a significant challenge for the brewing industry owing to its impact on yield, disposal costs and environmental impacts. The major food waste streams from brewing are spent grain, spent yeast, and spent hops. While the utilisation of spent grain and spent yeast have garnered the most attention due to the quantity produced and the presence of established products in the market, the upcycling potential of spent hops has not been explored. Hops are an expensive ingredient used to add the characteristic bitterness and flavour to beer. As brewers seek to brew more hop focussed beers, dry hopping has become a common process in which hops are added during or post-fermentation to add extra aroma. However, the utilisation of flavour and bittering compounds during dry hopping is inherently inefficient, which represents an economic loss as valuable components remain in the spent hops and in beer loss owing to absorption by the hop material. The spent hops also present an environmental impact through their disposal into wastewater or onto land.

By analysing the composition of the spent hops recovered from dry hopping, the feasibility of potential applications for their use will be able to be assessed. This research will hence add value to what is currently considered a waste product, potentially lead to the development of new products / processes and help to reduce food waste and disposal costs associated with spent hops.

Affiliations: Department of Food Science, University of Otago

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3MP13

Understanding the mechanisms of fibre formation by plant proteins during thermomechanical processing

Presenter: Boning Mao – PhD – Massey University

Plant-based meat analogues are gaining popularity due to their perception as a healthier and more sustainable alternative to meat. Various thermo-mechanical processes (TPM) are applied to create fibrous structures from plant-based ingredients. However, there is no consensus on meat-like fibrous structure development mechanics during TMP. This research aims at better understanding the fibrous structure formation by plant proteins through a novel High Temperature-Shear Process (HTSP). The rheological properties of several plant proteins (soy, pea, and rice) paste (25 % w/w) were investigated to explore their relationship to the fibrosity of the final product. The types of chemical bonding in raw protein dispersions and structured meat analogues were compared using different reagents. Furthermore, any changes in protein secondary structure occurring during HTSP were explored by Fourier Transform Infrared Spectroscopy.

The rheology results showed that the rice protein isolates created the weakest cross-link network. In contrast, soy protein isolates formed the most robust network, which was consistent with the hardness of the final products. Furthermore, the analogues made from pea or soy protein had a layered and fibrous architecture, whereas the rice protein formulations did not form any gelled/layered structure. The layered and fibrous structure of soy and pea protein-containing meat analogues was shown to be supported by hydrogen bonding, which was the most common type of presence in the products. Furthermore, the results also showed that disulphide bonds play a significant role in creating a fibrous structure by soy and pea proteins. This is a work in progress.

Affiliations: School of Food & Advanced Technology, Massey University; Riddet Institute, Massey University; AgResearch Ltd

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