3MP ABSTRACTS

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ABSTRACTS

3MP 1 Emily Fanning
University of Otago

Geographical and quality indicators of New Zealand hops to establish 'terroir'

ABSTRACT
The popularity of craft beer is growing rapidly, and hops are an essential part of the brewing process. Essential oils in hops impart aroma and flavour attributes, while alpha acids provide bitterness. The geographical origin, which encompasses the soil, farming practices, climate and environment, impacts the hop's chemical composition and overall beer flavour. New Zealand has some of the most sought-after hops worldwide due to their unique flavour attributes. Despite the high demand, NZ only contributes approximately 1.5% of the world's hop production, and demand is outperforming supply. Thus, there is potential to expand hop production in NZ, including expanding production into different regions, but scientific research is required to determine how hops differ from various areas to establish ‘terroir’ in hops.
This project will use various advanced analytical techniques to authenticate the geographical origin and identify key quality indicators of NZ hops from different farms and regions. We hypothesise that hops accumulate and form unique chemical attributes due to their growing location, which can be used to verify their origin and unique flavour attributes. Such findings will arm hop growers with scientific evidence to promote their hops in the global market and allow consumers full transparency about the product's origin. The outcome of these methods could provide essential information for brewers and marketers seeking hops with a specific provenance for beer.

3MP 2 Khushboo Soni
University of Otago

Determination of deforestation biomarkers in soybean

ABSTRACT
Soybean has developed a reputation as a superfood due to its nutrient profile, health benefits, and versatility. Currently, South America accounts for over 50% of the world's soybean production, and China has become the largest importer with a 2000% surge in soybean imports from Brazil since 2000. Over the same period, the soybean harvested area in Brazil has increased by 160% with an increased production rate of 122%, resulting in a production of almost 358 MMT in 2021/22. However, these extreme production rates have led to lower quality products, adulteration, illegal trade, deforestation, biodiversity loss and exploitation of indigenous communities. To address these concerns, the EU has passed a regulation requiring companies to ensure that products entering/exiting the EU market do not come from land deforested after

December 31, 2020 and soybean tops their list of five critical commodities as it has the highest import value. This creates an urgent need for an efficient technology to verify soybean's provenance. We propose that deforestation's impact on the soil will alter the soybean crop's chemical attributes which can serve as measurable biomarkers of deforestation that can be traced. Our research aims to develop a fingerprinting toolbox by employing advanced spectrometry and spectroscopy to understand the soybean at the molecular level, followed by multivariate data analysis to identify potential deforestation biomarkers. This fingerprinting toolbox is anticipated to provide a reliable way to detect and measure the deforestation markers to confirm soybean's origin and help address environment concerns surrounding the soybean production resulting in promoting sustainable practices and enhance environmental sustainability and social responsibility in the global food industry.

3MP 3 Rebecca Yang
University of Otago

Smoke flavour of food as a function of smoking conditions
ABSTRACT
Artisanal smoked foods are perceived by consumers as being natural and high quality, with a distinct flavour profile. Food smoked by New Zealand indigenous woods, such as Kānuka and Mānuka, develops unique smoke flavour characteristics. However, polycyclic aromatic hydrocarbons (PAHs), that are transferred into the food as a result of the smoking process are suspected carcinogens and a potential health issue. By regulating the smoking process and smokehouse conditions, flavour of the smoked products can be controlled, and the harmful components can be minimised. This research aims to develop a scientific understanding on how smoke flavour of food varies as a function of smoke generation parameters and smoke smokehouse conditions, aiming to manipulate target flavour compounds. This will facilitate producers to optimise flavour quality, thereby supporting the New Zealand food industry to increase the value of the smoked food products.

3MP 4 Aylin Sen
Massey University

Emulsification potential of coconut oil body membranes
ABSTRACT
The interfacial biomaterials from plant oil bodies (OBs) are called OB membrane materials (OBMMs), which can be used as emulsifiers. Coconut was chosen as a model system to understand what is happening during the extraction of OBs and OBMMs. After diverse washings of OBs, the non-membrane proteins were found to be strongly associated with the oil body membrane through hydrophobic and electrostatic interactions. After harsh washings, the main OBMM proteins,

oleosins, were identified at 11 kDa by SDS-PAGE. To obtain OBMMs, two natural and solvent-free methods were chosen. These methods are based on shear or temperature alterations, including subsequent lipid removal, and OBMM collection. Temperature dependent process was more effective in destabilizing the OBs because the membrane was more prone to the physical stress applied by temperature than shear. To increase the efficiency, this process was repeated, resulting in an OBMM fraction with good emulsification properties. However, compared with commonly used plant emulsifiers, such as soy lecithin and pea protein, OBMMs had poor emulsification properties, mainly because of droplet flocculation. It was hypothesized that the oil body membrane breaks as fragments, and these fragments adsorb to the droplet surface, leading to flocculation. In the future, the state of the broken membrane will be analysed, and new OBMM extraction methods will be explored. Further functionality studies will be carried out to determine the applicability of these OBMMs in food systems.

3MP 5 Rebecca Roberts
University of Otago

Monitoring dynamic biotransformation of terpenes during beer fermentation

ABSTRACT
To meet consumer demand for hop-flavour driven beers, there is increasing interest to control, optimise and predict hop flavour development in beer. Few aroma compounds present in hops directly contribute to beer flavour due to changes during fermentation via yeast biotransformation reactions. However, current knowledge of the effect of yeast on hop volatile compounds during fermentation is limited. This makes it impossible to accurately predict how hop additions will impact the aroma of finished beer. The overall aim of the research was to gain a mechanistic understanding of the biotransformation reactions responsible for hop flavour development in beer. To understand hop aroma generation and the role of yeast, pure terpene compounds and model beer systems were investigated using both *Saccharomyces cerevisiae* and *Saccharomyces pastorianus* yeast strains. Individual terpene compounds (10 ppm), yeast (pitching rate: 1x106 cells/mL) and model wort were added to 20 mL glass head-space vials, sealed and incubated at 20oC for 5 days. Volatile organic compounds were measured throughout fermentation using gas chromatography mass spectrometry (GC/MS) and proton transfer reaction time-of-flight mass spectrometry (PTR-ToF-MS) to further understand the biotransformation of hop terpenes. The results showed that different terpenoids were formed during fermentation, with the depletion of geraniol closely followed by the generation of citronellol, citronellyl acetate, and geranyl acetate as yeast-derived products. The abundance of the products and their formation behaviour was yeast strain dependent. A better understanding of the ability of different yeast strains to biotransform hop terpenes will help brewers predict, control, and optimize the aroma of the finished beer.

3MP 6 Victor Da Silva
Massey University

Modelling the influence of foods on the colonic microbiome
ABSTRACT
The colonic microbiota strongly influences host health. Among the factors that shape the composition and function of this microbial community, diet is key. Therefore, determining foods that positively modulate the colonic microbiome is crucial to promote human health. Here, genome-scale metabolic models simulated the effect of foods on the colonic microbiome of humans, selecting food candidates for further investigation based on the outcome predictions of microbial growth rate and fluxes of produced metabolites. In short, this research advances the understanding between the colonic microbiome and the host diet.

3MP 8 Yijun Liu
University of Auckland
Sustainable and self-cleanable "ice cubes" for reducing microbial cross-contamination throughout the cold chain

ABSTRACT
Temperature abuse in the cold chain can lead to microbial food spoilage, resulting in significant food waste and economic loss. This project aims to develop reusable, non-melting, and self-cleanable “ice cubes” to facilitate temperature control and minimise microbial cross-contamination in the cold chain. This was achieved by using green-synthesised cellulose-based hydrogels combined with food-grade photosensitisers. Cellulose hydrogels were synthesized by crosslinking citric acid and CMCNa/HEC cellulose. The composition optimisation results indicated that the cationic hydrogel obtained by using 10%w/w citric acid and 4%w/w cellulose (CMCNa:HEC = 3:1) showed better mechanical properties and higher efficiency to absorbing food-grade photosensitisers, compared to anionic hydrogels. The mechanical properties of cellulose-based hydrogels remained stable after 10 cycles of freezing-thawing cycles. The hydrogel-based ice cubes exhibited comparable cooling capacity, cooling efficiency, and water-holding ability compared to traditional water-based ice cubes. The cellulose hydrogel is super compressible, facilitating low-cost transportation and storage. It remained the water-absorbing ability after compression to one tenth of its original volume and vacuum storage for four weeks. The results also demonstrate that the water-absorbing ability was not affected significantly after 10 simulated dehydration and rehydration cycles. After absorbing food-grade photosensitiser Erythrosine B (EB), the hydrogel exerts strong photo-induced antimicrobial activity. The EB-absorbed hydrogel ice cubes can kill 6 logs of Listeria spp. on the surface after one-hour irradiation of LED daylight. In summary, the developed food-grade, reusable, non-melting, and self-cleanable hydrogel-based “ice cubes” can potentially reduce water consumption in the food supply chain and food waste by controlling microbial cross-contamination.

3MP 9 Abdul Halim Farawahida (Farah)
Massey University

Changes of citrinin, pigments, and pH during incubation of Monascus spp. on Coconut Cream Agar
ABSTRACT
Monascus spp. are usually used as a fungal starter to produce red fermented rice (RFR). Pigments produced by *Monascus* spp. are important to act as colour and flavouring agents and have health benefits. Unfortunately, citrinin (CIT) is also produced during *Monascus* spp. fermentation and this is a food safety concern. The objective of this study was to determine the citrinin, pigments and pH levels during incubation of *Monascus* spp. isolates on Coconut Cream Agar (CCA). Two *Monascus* spp. isolates from RFR (MF1 and MS1), inoculated onto CCA, were incubated at 30˚C for 30 days. The citrinin, pigments and pH levels were recorded along the incubation period using HPLC, a microplate reader and pH meter, respectively. CIT levels increased from day 4 until day 6-8 and then decreased during the incubation. The pigments produced by *Monascus* spp. increased after 8 days of incubation suggesting a relationship between pigment production and citrinin reduction. The pH of both isolates on CCA increased from 7 to 8.4. These results provide a basic understanding on the relationship between the CIT, pigments, and pH levels during incubation of *Monascus* spp. on CCA.

3MP 10 Strathadevi Rajendran
University of Otago

Effect of medium compositions on fermentation VOCs analysed by PTR-ToF-MS and SPME-GC-MS
ABSTRACT
Growing consumer demand for plant-based alternatives that resemble meat or dairy products has resulted in increased number of various types of meat and dairy analogues. However, the biggest challenge is producing plant-based analogues with characteristic meat or dairy flavours. Lactic acid bacteria (LAB) via plant-based fermentation provide a promising approach to generate realistic meat or dairy-like flavours, however a fundamental understanding of the impact of medium compositions on the volatile organic compounds (VOCs) produced is lacking. The production of specific VOCs in relation to different medium compositions by LAB was investigated by varying the carbon sources (either glucose or fructose), fatty acids (either oleic acid, linoleic acid, or linolenic acid), or amino acids (either L-leucine, L-isoleucine, L-phenylalanine, L-threonine, L-methionine, L-aspartic acid or L-glutamic acid separately or combined) in a defined minimal nutrient medium containing glucose, peptone, mineral salts, vitamins, and sodium acetate for the growth of Lactobacillus brevis WLP672. The specific VOCs of interest such as diacetyl, 2,3 butanediol, ethanol (pyruvate-derived), phenylethyl alcohol, benzyl alcohol (L-phenylalanine-derived), dimethyl disulfide (L-methionine-derived), 2/3 methyl-1-butanol (L-isoleucine/L-leucine-derived), and hexanol (linoleic acid-derived) were identified by two headspace techniques; proton transfer reaction-time of flight-mass spectrometry (PTR-ToF-MS) during fermentation at 7 and 14 days and confirmed by solid-phase microextraction-gas chromatography-mass spectrometry (SPME-GC-MS) after 14 days of fermentation. This

study will help understanding on how to target the production of fermentation VOCs that mimic meat or dairy-like flavours by changing the medium compositions and the knowledge gained could be applied to plant-based alternatives.

3MP 11Kelly-Anne Bentley
Lincoln University
Design and analysis of novel 3D printed foods with re-purposed animal and plant proteins.
ABSTRACT
Food Transition 2050 describes the need for New Zealand to diversify its food products. This has led to an increased interest in evaluating new food applications for animal, plant, fungal and microbial proteins. One of the approaches to increase available protein is to reduce food wastage and fully utilize existing animal and plant-based proteins by improving the functional and nutritional value of side streams from the food industry. Often these have either poor texture or visual appeal. 3D food printing technology offers the opportunity to turn these side streams into complex shaped foods with increased functional and nutraceutical value.
With the insights on 3D food printing technology and the newly installed in Lincoln University, The current project uses 3D Foodini food printers (manufactured by Natural Machines) to develop the tools and prototype processes that will allow the industry to gain greater value from the NZ resource base by producing new-to-NZ protein ingredients and foods. Our team has successfully established animal protein based (meat or dairy), pea protein based and hybrid (pea-meat; pea-dairy; pea-dairy-meat) 3D printed foods, and then determined their textural and rheological properties of these 3D printed protein constructs. These attractive 3D printed soft-textured protein-rich products will be particularly useful to people with special dietary requirements like dysphagia and geriatrics.

3MP 12 Xi Gong
Lincoln University
Peptidomic analysis of anionic oat intestinal peptides.
ABSTRACT
Many studies have focused in recent years on the functional and nutritional properties of proteins in cereal and the bran and the bioactive attributes of peptides derived from these proteins. In vitro digestion model in combination with anion exchange chromatography isolates the cereal anionic intestinal peptides which, unlike cereal hydrophobic peptides, has not been proven to strongly relate to the bioactivity of peptides.
The aim of my PhD project is to identify the bioactive anionic peptides derived from the storage protein of cereal bran and to assess their bioactivity. The protein was extracted from oat bran, wheat bran and barley and was then subjected to in vitro digestion model. The intestinal digesta of oat bran protein showed highest overall antioxidant and ACE inhibitory activity and was fractionated by anion exchange chromatography, and the fractions of which with highest antioxidant and ACE inhibitory activity were selected for sequencing by R-HPLC-MS/MS. The peptides in the fraction candidates were

identified. In addition, the most abundant peptides in the fraction candidates were identified and the relation of those abundant peptides to bioactivity was evaluated.
For future perspective, the ACE inhibitory peptide candidates will be analysed by molecular docking. The peptide will be selected for synthesis and assayed to confirm the discovery of the novel peptides. Meanwhile, it is interesting to bring the novel peptides to cell-line works and in vivo.

3MP 13 Linda Nezbedova
Massey University

Effects of Monty's Surprise apple consumption on acute antioxidant capacity and postprandial glucose: A randomized control crossover trial.

ABSTRACT
Monty's Surprise (MS) is a heritage apple cultivar discovered in New Zealand with high phytochemical concentrations. Several studies have reported that apple phytochemicals can help regulate blood glucose, improve glucose uptake in cells, and reduce oxidative stress, which is implicated in developing chronic diseases. This study investigated the impact of MS apple puree consumption on human plasma antioxidant activity and glucose levels.
Twelve healthy male and female participants received either 500 g of apple puree or a macronutrient-matched placebo in a randomized crossover human study. Blood samples were collected at baseline after overnight fasting and at regular intervals up to 8 hours post-meal consumption. Plasma samples were examined for postprandial glucose and total antioxidant activity using Ferric Reducing Antioxidant Power (FRAP).
MS apple puree consumption significantly increased the total antioxidant capacity of plasma compared to the placebo group ($p < 0.05$). The mean FRAP values of the apple puree group increased from baseline to 170.78 μmol/L at 30 minutes, while the placebo group showed no significant change (from the baseline to 24.26 μmol/L at 30 minutes). Moreover, apple puree consumption led to significantly lower ($p < 0.05$) glucose levels in plasma (0.55 mmol/L) compared to the placebo group (1.20 mmol/L) 15 minutes after meal consumption.
This study demonstrated that MS apple consumption increased the antioxidant capacity and decreased glucose levels in plasma. These findings suggest that consuming MS apple could be a promising dietary strategy to reduce oxidative stress and prevent chronic disease development.