2020

49th. Annual Food Science and Technology Conference: Book of Abstracts

IFSTI: Institute of Food Science & Technology in Ireland

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49^{th} ANNUAL FOOD SCIENCE AND TECHNOLOGY CONFERENCE

Contents

Foreword

The Institute of Food Science and Technology of Ireland, Technological University Dublin and the Environmental Sustainability Health Institute (ESHI) will host the 49^{th} Annual Food Science & Technology Conference virtually on Tuesday 15th December 2020. This years conference will focus on the topic of food sustainability and has six themes.

- Alternative food sources and processing
- Targeted nutrition
- Bioeconomy
- Food Security
- Improving Sustainability of Food Systems
- Improving the Healthiness of Food Systems

70 submissions were received and the Scientific Committee selected 16 of them for Oral presentations. Following the long lasting tradition of this conference, the committee considered providing opportunities to researchers initiating their career.

You will find in this book of abstracts all the presentations of the conference, demonstrating the diversity of Irish Food Science and Technology Research.

best wishes,

Catherine Barry-Ryan
Chair of the Scientific Committee

Abstracts

Food intake patterns among UK children aged 6-12 years: perspectives from the National Diet and Nutrition Survey 2008-2016

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Food systems, from production to consumption, should facilitate healthy growth and development in children (1-2). Recent research suggests that current food systems may be implicated in the rising global prevalence of childhood obesity (3). Although several factors are implicated in overweight and obesity risk, larger food portion sizes are an established risk factor for weight gain in children and adults (4-5). This research aimed to compare the food type, daily number of eating occasions and total amounts of food consumed daily by UK children aged 6 to 12 years who participated in the National Diet and Nutrition Survey (6) in 2008 (n 302) and 2016 (n 249). Mean (SD) of foods consumed in 2008 were 2474g (587g) compared to 2363g (630g) in 2016 (p=0.03). Mean (SD) total number of eating occasions per day in 2008 was 29 (5) compared to 32 (7) in 2016 (p¡0.001). Mean (SD) energy intakes (kcal/day) were significantly lower in 2016 at 2344 (539) compared to 2602 (539) in 2008 (p¡0.001). 'Breads', 'milk and cream' and 'potatoes' remained among the top five food groups most commonly consumed by greater than 96% of the children in 2008 and 2016, with no significant differences observed in quantities consumed (88g(37g) v 92g(36g); p=0.246; 248g(145g) v 237g(157g); p=0.379 and 126g(57g) v 124g(61g); p=0.684, respectively). In conclusion, the most commonly consumed food groups and corresponding portion sizes consumed have remained similar over a 9 year period among UK children aged 6-12 years. Overall, the significant decrease in the total food and energy intakes per day, alongside an increase in the number of eating occasions per day suggests an overall decrease in portion sizes and energy intake per portion which warrant further investigation. More detailed analysis is required to fully examine these findings, particularly with respect to other key food groups, by meal/eating occasion and adjusting for potential confounding factors such as dietary misreporting.

Poster Presentation

Capsicum oleoresin microparticles as a source of capsaicin and its short-term ingestion effect on the in vivo model

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Arabic gum, modified corn starch (EMCAP), and modified malt (MALT) and their combinations were assessed as vehicles for the microencapsulation of Capsicum oleoresin. Capsicum oleoresin microparticles were obtained by spray drying and their physicochemical properties, and the in vivo model intake of these were investigated. Powders presented properties suitable for storage, such as low water activity (> 0.150), hygroscopicity (<11.43 g/100 g), and moisture (<4.76 %), and high glass transition temperature (<98.3 °C). FT-IR analysis showed that carbohydrates matrices were loaded after spray-drying, showing peaks around 2850 cm-1 for aromatic compounds and bands in 1760 cm^{-1} that proved the presence of capsaicin in the microparticles. All formulations showed higher antioxidant activity, lower contact angle, and a greater solubility in water relative to the pure oleoresin. Toxicity assays did not show adverse effects of microparticles consumption on the mice experimental groups; neither change the level of hepatic aminotransferases. The intake of High-Fat Diet (HFD) supplemented with Capsicum oleoresin microparticles caused a decrease in body weight gain compared to the HFD control, mostly when the formulation was added with medium-chain fatty acids. This study may be helpful to assess the potential of Capsicum oleoresin microparticles as a functional ingredient for weight control.

Poster Presentation

In-situ pH measurement of milk protein solutions at high temperature

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The physicochemical properties of milk proteins are strongly influenced by pH and temperature. The performance of most of the principal unit operations employed in dairy processing (e.g., heat treatment, evaporation and rehydration) are pH dependent; however, accurate, in-line measurement of pH during dairy processing is challenging. The aim of this study was to monitor changes in pH of a number

of high protein dairy systems as a function of temperature (from 25 to 120°C). Whey protein isolate (WPI), milk protein concentrate, micellar casein concentrate and sodium caseinate powders were rehydrated in either distilled water or lactose-free simulated milk ultrafiltrate (SMUF) to final protein contents of 1, 3.5, 3.5 and 3.5% (w/w) protein, respectively. Protein solutions were heated from 25 to 120°C and cooled to 25°C in a custom-engineered hermetically sealed cell fitted with a pH probe with in-built temperature sensor. The heat treated samples were evaluated for mineral profile and distribution between colloidal and soluble phases, particle size, buffering capacity, osmolality and zeta-potential. Results showed a linear decrease in pH with increasing temperature for all protein dispersions (decreasing from 6.7 to 6.0), with the extent of the reduction in pH being greater for the protein solutions prepared in water only, which was attributed to differences in mineral-induced buffering capacity. The decrease in pH was fully reversible on cooling to 25°C for all samples, except for the WPI-SMUF system. Monitoring the changes in pH at temperatures ¿100°C, particularly in high protein or high ionic strength systems (e.g., skim milk), provides useful information on the stability of dairy formulations in relation to heat-induced protein coagulation during thermal processing.

Oral Presentation

Antimicrobial potential of plasma functionalized water against poultry related pathogens, Salmonella spp and Campylobacter spp

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Cold plasma (CP) is an emerging non-thermal technology with decontamination and preservation potential for a wide range of foods, where gas plasma or liquid mediated delivery can be flexibly used. *Campylobacter jejuni* and Salmonella spp are the main causes of foodborne illness outbreaks attributed to the consumption of contaminated poultry products. Both pathogens can persist in the processing chain under environmental stress in the form of biofilms. This study investigates if plasma functionalized water (PFW) can provide effective pathogen control during poultry processing and identifies the key process parameters governing the antimicrobial efficacy. PFW was generated using the Microwave Induced Plasma discharge system (Mini-MIP) which is a closed reactor, and the antimicrobial potential of PFW was assessed against *Campylobacter jejuni* NCTC 11168 and *Salmonella Typhimurium* ATCC 14028 using planktonic suspensions, as well as mono-species biofilms formed on borosilicate glass coupons. The process parameters of plasma generation time (GT: 5, 10, 15 min), the gas to liquid generation volume (100, 300, and 600 ml), and the subsequent contact time (CT) with the target pathogen were investigated with respect to antimicrobial efficacy. Results illustrated that PFW has a significant

bactericidal effect on both C. jejuni and S. Typhimurium, but the efficacy is a function of the plasma process parameters; GT, PFW volume, and CT for both targets. The volumes of liquid exposed to different GT effected *S. Typhimurium* and *C. jejuni* inactivation, aligned with reactive oxygen and nitrogen species (RONS) concentrations (Nitrite (NO2), Nitrate (NO3), and peroxide species) within the PFW generated at different gas to liquid ratios within the closed reactor. The concentration of RONS directly correlated with both the GT and water volume treated. Using 100 ml generation volume, water exposed to plasma for longer GT (10 and 15 min) attained the highest microbial reduction of 8-7 log10 and 10-9 log10 CFU/ml for *S. Typhimurium* and *C. jejuni* in suspension, respectively, within 15 s of CT. Longer contact times were required for inactivation of mature *S. Typhimurium* biofilms, where a 7 $\log_{10}$ reduction of viable cells was found after 15 min of CT. PFW is an effective approach to rapidly control poultry-related pathogens in different physiological states- planktonic cells and biofilms.

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Oral Presentation

Sensory analysis for novel bio-enriched products: a scoping review to inform practice

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Sensory analysis is an invaluable scientific discipline in the food industry. It is undertaken to measure, analyse and interpret food intended for consumption through how it is perceived by the sensory nervous system. In relation to bio-enrichment, sensory evaluation is critical to ensure nutrient enhancement is attained without negatively impacting upon a product's organoleptic acceptability to the intended consumer. The aim of this project was to illustrate different approaches utilised to conduct sensory analysis of bio-enriched food products. Literature searches were conducted using a range of search terms such as "sensory analysis" and "bio-enrichment" with the electronic databases "PubMed" and "Google Scholar". From the search results (n=3762), titles and abstract screening identified 162 articles of which the full text was consulted to identify eligible studies (n=34). These were divided into two categories; sensory trials (n=30) and other articles with consumer-relevant outcomes (n=4). Of the 30 sensory articles, the majority were subjective tests (n=25; 83%), with the remainder reporting on objective (n=3) or a combination of tests (n=2). Preference tests were the most commonly reported subjective test (60%), followed by difference tests (20%). Most sensory tests identified were conducted on animal products, including meat, dairy and eggs (n=24; 80%). Other consumer-related outcomes noted were the growing consumer demand and overall

positive attitudes towards bio-enrichment, but the cost-benefit of such products was also discussed. In conclusion, this project demonstrated that preference tests were the most common sensory evaluation conducted on bio-enriched food products to-date, however, more research is needed to fully elucidate consumer understanding of bio-enrichment as a novel food production strategy aiming to improve the healthiness of food systems. Future research may also need to utilise a combination of sensory analyses to fully inform the new product development process.

Poster Presentation

Screening of lactic acid bacteria towards the reduction of FODMAPs in wheat and rye breads via implementation of a sourdough methodology

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FODMAPs (fermentable oligo-, di-, mono-, polysaccharides and polyols) are ubiquitous in many edible plants including flours derived from cereals and the resulting bread and baked goods. Since 2012, a low-FODMAP diet has been recommended as the first-line treatment for IBS (irritable bowel syndrome) sufferers, although the range of low-FODMAP products available on the European market is still quite limited. Implementation of sourdough technology in bread production has a proven capacity for reducing FODMAP content depending on the specific microbes present in the sourdough. Therefore, careful screening and selection of specific FODMAP-degrading sourdough starter cultures, including lactic acid bacteria (LAB) has theoretical potential to improve this approach. Over 300 indigenous LAB isolates from various plant sources, including cereal and exotic flours, were screened. To achieve this, growth on agars containing each of the following six FODMAPs (fructose, lactose, mannitol, fructooligosaccharides (FOS), inulin, raffinose) and sucrose was analysed. This resulted in the selection of thirteen FODMAP-degrading strains, targeting the aforementioned FODMAPs and their combination and confirmed in broth-based spectrophotometric growth analysis. The strain Lactobacillus paracasei R3 was chosen for its ability to ferment FOS and inulin while not evidently producing undesirable by-products (such as derivative FODMAPs and by-products that might negatively impact the flavour). This is very significant as FOS and inulin are present at high levels in rye and wheat flours. Sourdoughs for bread production were generated using this strain confirming its fitness for the wholemeal wheat flour fermentation: good increase of cell titre and acidification were observed.

Oral Presentation

Understanding and Tracking the Breakdown NBPT and Its Breakdown Product NBPTo during Heat Processing of Spiked Milk samples.

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One-third of Irish national Greenhouse gas (GHG) emissions are produced as by-products of agricultural activities. 90% of Irelands Nitrous oxide N2O emissions 98% of Ireland's national Ammonia (NH3) emissions are attributed to agriculture. Protected urea products containing the urease inhibitor (UI) NBPT are designed to stabilize N Losses, and mitigate both N2O and NH3 emissions. Allowing for industrial and environmental targets to be achieved. Although there are many benefits associated to the use of NBPT, little is known about its ability to enter the food chain. This study aims to assess to assess the effect of heat processing on milk samples spiked with NBPT in order to track NBPT and its breakdown product NBPTo throughout the dairy processing chain.

The study consisted of three treatment types (Standard Pasteurized, UHT, and Raw Milk). Each treatment type was spiked with 1000 ppb of NBPT standard. Subsequent un-spiked blanks were also processed and analyzed as controls for each treatment type. Pasteurization and UHT treatments were carried out using the MicroThermix in Teagasc Moorepark. In total three experimental replicates were conducted (Trial 1, Trial 2, Trial 3) using three different raw milks taken from a bulk tank. pH measurements were taken daily as pH is known to effect rate of NBPT breakdown. For each trial day (1-14) samples were aliquoted into triplicate 4ml tubes and triplicate injections of the samples were analyzed utilizing LC/MS/MS to track the degradation of NBPT and subsequent presents of NBPTo over a 14 day time period.

Results indicate that NBPT breaks down gradually in standard pasteurized and raw milk over 14 days and subsequently produces the breakdown product NBPTo. NBPTo was found to be more stable in milk samples than NBPT. Interesting results were found in UHT samples were NBPT appeared to be more stable and persisted in higher levels over the 14 day. It is hypothesized that the effects seen in UHT milk may be due to bacterial factors and possible di-sulphide bond interactions.

Poster Presentation

Antimicrobial silver nano-composites: Truth or myth?

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Overview and importance of the research:

In the post-CoV-SARS-2 (COVID) climate there is a significant consumer demand for antimicrobial products. Nanomaterials, in particular silver nanoparticles (AgNP), have long been associated with having a broad-spectrum activity against both Gram-positive and Gram-negative bacteria. However, the mechanism of the antimicrobial properties of metallic nanoparticles is still under debate, with the consensus being that it is due to ionic contributions rather than a "nanoparticle specific" activity. Nevertheless, there has been a significant upsurge in nanosilver consumer products that promote the antimicrobial potential of nanosilver at a premium price. Indeed, nanosilver may be a promising alternative to traditional antimicrobials but it is crucially important that the nano-community examines such product claims to maintain consumer faith in the scientific process and the integrity of the nanotechnology community. This work will put nanosilver-surface-activated polymer composites, which purport to be antimicrobial, to the test. In addition to this, the antimicrobial properties and the toxicity of these materials will also be investigated. In doing so, it will present an overview of the area with current applications of such composites such as food contact materials (FCM).

Methodology:

Commercially activated composites commonly used as FCM were examined and used to inform the in-house manufacture of comparable composites. As a result, polyethylene (Sigma-Aldrich, CAS No. 9002-88-4) silver-nanocomposite films were manufactured by thermal extrusion with a range of loading factors ranging from 12.5 to 2500ppm of 15nm spherical silver nanoparticles (US-Nano, US7160). The antimicrobial activity of the material surface was determined via a modified disc diffusion assay. Composite discs of 6 mm in diameter were placed on an agar surface and subsequently inoculated with a range of representative bacterial strains, i.e. *E. coli* (ATCC 25922) *S. aureus* (ATCC 25923) being incubated at 37^{o}C for 24 h. Further investigations into the antimicrobial potential due to the slow migration of nanosilver from the surface were carried out by leaching and migration studies. The migration testing was performed using water as a food simulant for 10 days at 60^{o}C, as recommended by Regulation (EC) 10/2011. The leachate was subsequently characterised using Single Particle ICP-MS to determine its concentration and composition. Subsequently, the leachate cytotoxicity was assessed via the MTT and Alamar Blue assays on HT-29 and SW280 colorectal cell lines.

Results and Discussion:

A full physiochemical characterisation of all test materials will be presented. The migration studies showed that higher loading concentrations (2500-1250ppm) resulted in a more than a 20% increased rate of migration of total silver in comparison to nano-composite films with lower loading fractions (500-12.5ppm). In contrast, the proportion of silver migrating as number of nanoparticles/mL and silver as ionic silver showed no significant change with respect to the loading concentrations. This suggest that any ionic contribution to the bioactivity of the composites is

independent of the silver loading fraction of the composite. The cytotoxicity and the antimicrobial studies performed also indicated that the ionic silver leaching from the composite material exhibited a biological activity that was independent of the total silver loading of the composite. Further cytotoxicity of the leachate shows NOEL with observed LD50 in the ppm range for all tests, while total silver migration for all films was found to be in the ppb range. The implication of these findings suggests that silver-nanocomposite products in the market not only may not leach silver in quantities enough to have a detrimental effect to health, but that they may not significantly enhance antimicrobial properties beyond that of ionic silver i.e. no nanoparticle specific effect.

Poster Presentation

Characterisation of the properties of a traditional white pan bread developed using plasma functionalised flour.

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Cold plasma (CP) technology has emerged as a novel non-thermal technology with potential to improve food quality or impart functionality to ingredients. Our previous studies on wheat flour, demonstrated how the structure and functionality of wheat flour may be modified using CP to provide an alternative to chemical additives (1). However, studies on possible application of plasma functionalized ingredients in new product development are scarce. Thus, the objective of this study was to investigate the effect of plasma treatment on the development of traditional white pan bread. The bread was formulated using plasma functionalized flour (PFF) and critical product characteristic responses were investigated. The results signify improvement in the expansion ratio of dough subsequently increasing the loaf height of plasma treated flour bread (30 min) by 6.25±0.55% than control. The L* value of control was 47.60±0.64 and decreased with increase in treatment time (30 min-55.70±0.58) signifying plasma-treated bread gives darker color to crust probably due to higher caramelization and milliard reaction during crust formation. XRT analysis was conducted to understand the microstructure of bread, 3D scans suggest no change in bread matrix when compared to control, porosity distribution was increased with treatment time (Fig 2). The sensory analysis results showed consumer acceptance for plasma-treated flour bread (6.85±1.35) when compared with marketed sample (6.25±1.44) and in-house control (7.75±0.82). Overall, CP treatment of the flour improved the functionality in relation to dough and bread preparation and can provide an alternative to chemical additives in bread making. The CP processes can be modulated to deliver tailored effects for bread product development.

1. Chaple S, Sarangapani C, Jones J, Carey E, Causeret L, Genson A, Duffy B, Bourke P. Effect of atmospheric cold plasma on the functional properties of whole wheat (Triticum aestivum L.) grain and wheat flour. Innov Food Sci Emerg Technol (2020)102529. doi:https://doi.org/10.1016/j.ifset.2020.102529

Poster Presentation

Cascade Membrane filtration reduces the heat-load of infant formula and affects the in vitro gastric digestion

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Introduction: The manufacture of infant milk formula (IMF) usually involves high- temperature treatment in order to ensure microbiological safety. Cascade membrane filtration was used to lower the heat-load during processing of infant milk formula (IMF) in order to preserve the native structure of whey proteins. Methods: Raw bovine skim milk with added to a solution of whey protein isolate, and was microfiltered at 50 °C using 1.4 μ m followed by 0.2 μ m membranes microfiltration (MF). Retentates from 0.2 μ m MF were blended with fat, lactose, and minerals, and subsequently high heated (HHT, pre-heated at 80 °C × 30s and heated at 125 °C × 5s). The HHT treated retentate was merged with the permeate from 0.2 μ m MF and spray dried (referred to as MEM-IMF). Control IMF (HT-IMF) was also produced by a standard HHT treatment. Protein profiles of both IMF products were characterised by Kjeldahl, High Performance Liquid Chromatography (HPLC), particle size and enzyme activity assays. Subsequently, both IMFs were digested using a simulated infant semi-dynamic gastric digestion method. The digestive process were monitored using confocal laser scanning microscopy, sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE), HPLC and degree of hydrolysis. Results: MEM-IMF powder had significantly higher amounts of native (1.1 g/100 g powder) and monomeric (1.48 g/100 g powder) whey proteins, compared to 0.18 and 0.46 g/100 g powder in HHT-IMF, respectively. MEM-IMF also exhibited a lower degree of protein aggregation compared to HHT-IMF. During in vitro digestion, MEM-IMF exhibited faster proteolysis and an altered protein coagulum.

Poster Presentation

Pasture and non-pasture-based feeding systems influence the aroma-active compounds in raw bovine milk

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Aroma-active compounds in raw bovine milk produced from cows fed perennial ryegrass (Lolium perenne L.; GRS) or cows fed total mixed ration (mixture of grass silage, maize silage and concentrates; TMR) were identified by sorptive extraction (Hi-Sorb) coupled with gas-chromatography-olfactometry. Five trained panellists evaluated each sample in duplicate including aroma extract dilution analysis. Over 108 volatile organic compounds (VOC) were identified in raw GRS and TMR milk, 15 of which varied significantly highlighting that feeding system influences the VOC profile of raw bovine milk. Moreover, using olfactometry, 34 VOC were found to be aroma active in raw GRS milk and 36 in raw TMR milk, therefore 30% of the VOC in raw milk influence sensory perception. The odour profile of raw GRS milk was dominated by methanethiol, furfural, benzaldehyde, 1-octen-3-ol, phenylethyl alcohol and maltol which correlated to 'cheesy', 'nutty', 'sweet', and 'green' aromas. Raw TMR milk had a much different aroma profile dominated by furfural, 2,5-dimethylpyrazine/2,3-dimethylpyrazine, 2-pentylfuran, benzaldehyde, 1-octen-3-ol, p-cresol/2-pyrrolidinone and 3/4-ethylphenol which correlated to 'roasted', 'smokey', 'animal', and 'pungent' odours. While the intensities varied, numerous compounds contributed to the aroma profile of both raw GRS and TMR milk. Raw TMR milk had a higher overall odour intensity which could be due to the diverse source components in the TMR feed as well as direct inhalation of volatiles due to the reduced air circulation from being housed indoors. This is the first study to identify individual aroma active VOC in raw bovine milk that differ due to feeding system and that are impacting on sensory perception. This further highlights the significance of pasture based dairy systems in quality milk production.

Oral Presentation

Comparing Consumer Liking of Beef Steaks from Three Different Feeding Systems Using Sensory Temporal Liking and Traditional Liking Methods.

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Research examining the impact of the diet of the animal on consumer liking of beef has yielded conflicting results. To date, consumer sensory liking of beef has been captured using traditional hedonic methods which fail to consider the temporal aspects of sensory perception during eating. The purpose of this study was to determine consumer liking of beef derived from animals offered grain (GF), silage and grain (SG) or grass only (GO) diets during finishing, using free temporal liking, structured temporal liking, and traditional sensory liking methods. Three separate panels of regular beef eating consumers (n=51; n=52; n=50) were recruited from students and staff at Teagasc Food Research Centre, Dublin, Ireland to assess striploin steaks from animals fed either GF, SG, or GO, respectively. Data were analysed by mixed model ANOVA. The free temporal method found significant differences ($p \leq 0.05$) in liking between diets for juiciness, tenderness and overall liking, and a trend towards a difference in flavour liking was also noted (P=0.08). These effects were not observed using the structured temporal or traditional liking methods ($p \geq 0.05$).The scores elicited from consumers using the traditional method were significantly higher than scores obtained from either temporal method, for all attributes except tenderness ($p \leq 0.05$). Consumers also rated the difficulty to perform each sensory method, with the structured method perceived as the most difficult and the traditional method considered the easiest ($p \leq 0.05$). In terms of consumer demographics, results showed that age and nationality produced significant effects on consumer liking of flavour ($p \leq 0.05$). Sex had no effect on consumer liking of any attribute. Younger consumers gave higher scores for flavour when compared to older consumers, while non-Irish consumers scored GF steaks lower for flavour liking than Irish consumers. These results indicate that while consumers found temporal methods more difficult to perform, temporal liking can be successfully applied to consumer sensory testing and may be useful for gaining a deeper insight into consumer perception of beef.

Oral Presentation

Growth and survival of *Listeria monocytogenes* on ready-to-eat leafy vegetables.

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Minimally processed ready-to-eat leafy vegetables are increasingly consumed for their health benefits. However, they also pose a potential risk through ingestion of food-borne pathogens. A paucity of studies investigated growth potential of *Listeria monocytogenes* on spinach and rocket, in comparison to the more well-studied iceberg lettuce which has repeatedly shown to support growth. In addition, contradictory findings were reported on spinach and rocket, where some studies reported growth, while others did not. Therefore, at the outset of this project our hypothesis was i) the growth potential of *Listeria monocytogenes* on spinach and rocket is similar to that of iceberg lettuce ii) various environmental factors and vegetable microbiome influence the growth potential of *Listeria monocytogenes*. Indeed, our earlier studies highlighted the potential risks of consuming these ready-to-eat products with spinach demonstrating significantly higher *Listeria monocytogenes* growth potentials, compared to rocket which displayed similar levels of growth to iceberg lettuce. Leafy vegetables were obtained from local supermarkets, therefore factors such as cultivation conditions and vegetable variety were not revealed on their packaging. Upon focusing on commercially produced Irish produce, large differences were observed when conducting growth experiments on rocket produced in polytunnels versus open-fields. However, we were unable to determine whether these observations were due to differing cultivation methods, vegetable varieties or because one product was organically produced and the other conventionally. To further investigate this, rocket variety Buzz was cultivated locally in a polytunnel alongside an open field setting. A significant difference was identified between growth potentials on polytunnel (1.35, 1.42, 1.42 log10 cfu/g) and open-field grown rocket (0.98, 1.07, 1.29 log10 cfu/g). Further growth experiments will be continued on locally produced spinach along with next generation sequencing to determine the effect of vegetable cultivation and *Listeria monocytogenes* on the vegetable microbiome.

Poster Presentation

The Role of 3D Printing in Targeted Nutrition

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3D printing technology has reached far beyond its initial application. Created by Charles Hull in 1984, 3D printing was originally a process to create tabletop veneers. In 2020 the most recent advancements in 3D printing include innovations within the food industry, with this presentation illustrating a case study of how 3D printing has been applied to targeted nutrition using personalised supplements. Despite the first uses of the technology being far from its current applications, both

hold common ground at the source of its purpose – solving a societal problem in a way that other technologies could not. 3D printing now has a major part to play in personalised nutrition with companies using online questionnaires to create individualised supplements, unconventional to the typical behaviour of consumers shopping in-store. Personalised nutrition is a trend that has seen a steady increase in recent years with consumers demanding more ownership of their health. One of the key drivers for the trend of personalised health is the growing interest in "preventative health strategies". This is prevalent especially in younger generations, within whom there is a movement towards digital health. Companies selling health-focused products are now expected to turn their attention towards collaboration with tech innovations in order to keep up with consumer demand. Research in the form of market analysis needs to be carried out to understand consumer attitudes and the perceived acceptability of 3D printed food products and to gain the trust of the consumer. This presentation will discuss how new developments in 3D printing has led to high quality food products fortified with maximum nutrition tailored to specific consumer needs.

Poster Presentation

The role of 3D food printing in targeted nutrition

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The role of 3D food printing in targeted nutrition

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3D printing technology has reached far beyond its initial application. Created by Charles Hull in 1984, 3D printing was originally a process to create tabletop veneers. In 2020 the most recent advancements in 3D printing include innovations within the food industry. 3D printed food has the potential to bring diverse benefits, such as nutrient fortification of foods which maybe of considerable benefit in those at risk of malnutrition. Using personalised nutrition as a case study, the aim of this research is to examine how new developments in 3D food printing has led to high quality food products fortified with maximum nutrition tailored to specific consumer needs. The personalised process begins by consumers completing personal questionnaire, specific for their health status and addressing any existing health conditions such as irritable bowel syndrome. The questionnaire facilitates the creation of personalised supplements specific to the individual, for example folic acid would be included in the personalised supplements for those who are pregnant. The personalised supplements are created through the 3D printing of each nutrient in separate layers,

resulting in a multi-layered supplement, with similar shape, texture and taste to a typical jelly sweet. Additional benefits of the product potentially include sustainability with minimal waste as well as biodegradable packaging. However, for this technology to become more mainstream with applications across the food domain, further research needs to be undertaken to understand consumer attitudes and the perceived acceptability of 3D printed food products in addition to gaining consumer trust in this novel technology.

Poster Presentation

Effect of Thermal Denaturation and Calcium on Interfacial tension of Whey Protein stabilised Emulsions

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Milk proteins behave as surfactants, lowering interfacial tension between a dispersed fat and the continuous aqueous phase to create an emulsion. Whey proteins are particularly susceptible to denaturation upon heating, resulting in unfolding, aggregation, changes in hydrophobicity and emulsifying properties. This study investigates the effect of thermal denaturation and addition of calcium on interfacial tension in a whey protein isolate (WPI) based emulsion using a Pendant Drop Tensiometer. Aqueous solutions of WPI (1% w/w) were heated at 85°C for 4 minutes to denature the whey protein. Calcium chloride 20.76 mg/100 ml of 1% protein solution was added to unheated or heated protein solutions. All the experiments were performed at pH 6.8. Interfacial tension was measured using 10μ l hanging oil drops in WPI solutions over a period of 5400s. Both heating whey proteins and addition of calcium resulted in a decrease in interfacial tension from 21.45 (unheated) to 16.55 (unheated+Ca^{++}), 16.54 (Heated) and 15.62 (Heated+Ca^{++}) mN/m. Mean protein denaturation detected was 7.05% (unheated+Ca^{++}), 62.03% (Heated) and 65.56% (Heated+Ca^{++}). Aggregation was confirmed by size exclusion chromatograms with the highest aggregation obtained for (Heated+Ca^{++}). The decrease in interfacial tension is possibly due to greater unfolding and higher hydrophobicity, thus increased emulsification capacity. The study demonstrates the important role of thermal treatment and calcium addition on emulsion stability during processing of whey-based beverages.

Poster Presentation

The use of optical oxygen sensing and respirometry to quantify the effects of antimicrobials on common food spoilage bacteria and food samples

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Microbial spoilage and foodborne diseases cause significant economic and productivity losses. There is a need for novel approaches and antimicrobial treatments to extend shelf life of products, improve quality and microbial safety, and reduce spoilage and waste, and new assessment methods. Traditional assays for testing the toxicity of antimicrobials are time consuming, labour intensive, give crude estimations of toxicity, and cannot analyse complex samples such as crude food homogenates. Using a model antimicrobial compound Lauroyl Arginate Ethyl Ester (LAE), we describe a new analytical methodology based on optical oxygen sensing and respirometry to investigate the effects of various antimicrobial treatments on pure bacterial cultures, meat microbiota and packaged meat samples. By measuring and analysing the time profiles of O2 probe signal (phosphorescence lifetime) in incubating test samples, we were able to visualise the toxic effects of LAE on the different bacterial specie, generate time and dose response curves, calculate EC50 and generation times of test organisms. The new multi-parametric toxicity testing platform allows for rapid, automated and parallel analysis of multiple samples under a range of antimicrobial concentrations and conditions.

Poster Presentation

The anaerobic microbiota of New Zealand beef carcass and rump steaks

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Abstract Vacuum packaging extends the shelf life of beef by up to 120 days. However, anaerobic bacteria can still cause premature spoilage. This study investigated the anaerobic microflora on fresh beef carcass and rump steaks. Five meat plants were visited in New Zealand in 2018 (3 in the North Island and 2 in the South Island). Swab samples were taken, an hour after slaughter, on the flank, brisket and chuck of 120 carcasses and from 120 rump steaks. Swabs were anaerobically incubated in peptone yeast glucose and starch (PYGS) enrichment broth at 4 °C for 3

weeks, followed by DNA extraction. The microbiota of beef carcass and the rump steaks were examined by performing a 16S amplicon sequencing of the V3 - V4 hypervariable region using the Illumina MiSeqTM, with subsequent bioinformatic analysis. The enriched microbiota of the samples were classified and grouped into 149 operational taxonomic units (OTUs). The microbiota for both sample types consisted mainly of Carnobacterium, with an average relative abundance of 28.4% and 32.8% in beef carcasses and beef primals, respectively. This was followed by Streptococcus, Serratia, Lactococcus, Enterococcus, Escherichia-Shigella, Raoultella and Aeromonas ranging from 1.5-20% and 0.1-29.8% in carcasses and primal swabs, respectively. Trichococcus, Bacteroides, Dysgomonas, Providencia, Paraclostridium and Proteus, were also present, ranging from 0-0.8% on carcass and 0-1.8% on rump steak swabs, respectively. Alpha and Beta diversity measurements showed limited diversity between the two sample types, but some differences between samples from the different beef plants were evident.

Poster Presentation

Comparison of physico-chemical and sensory properties of innovative fish spread emulsions manufactured using herring (*Clupea harengus*) milt, cod (Gadus morhua) roe and plaice (*Pleuronectes platessa*) roe

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Typically, in Ireland, male and female marine fish gonads are either discarded at sea or processed onshore for low-value fishmeal. The aim of this study was to establish the feasibility of developing emulsion-based spreadable food products using locally sourced milt and roe to add value to this currently under-utilized nutritious seafood resource. Two new innovative ready-to-eat spreadable emulsions were developed using underutilized herring milt with, 1) cod roe, SCD and 2) plaice roe, SPL. This study investigated the physico-chemical and sensory acceptance of the products were tested on 86 consumers, using hedonic and just-about-right scales. Chi-square tests on contingency tables were used to analyze open-ended questions relating to consumer likes and dislikes of the products. The main characteristics showed sensory drivers for liking was flavor, color and texture with similar characteristics also used for disliking. Instrumental colour and texture analyses showed significant differences (P¡0.05) between the products which were also detected by panelists during sensory evaluation (color, texture, appearance, P¡0.05). No significant difference was observed between aroma, flavor, mouthfeel and overall liking (P¿0.05) between both emulsions. Of the respondents, 72.0% indicated a positive liking of SPL; while 67.5% indicated liking of SCD. Penalty analysis of JAR showed overall liking was most impacted by level of fishiness (fish flavour). The positive results in sensory acceptance of the products suggests underutilized and under-valued milt and roe could be used successfully in Irish food product development. This use

of fish by-products presents an opportunity to add value while contributing to waste reduction.

Poster Presentation

Use of the microalgae Spirulina sp. and Nannochloropsis sp. in the development of protein-enriched and health beneficial biscuits.

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As the world's population continues to grow, food consumption is also on the rise and there is a demand for protein-rich foods. Microalgae produce a variety of ingredients via conversion of CO2, nutrients and light, and offer potential as a renewable feedstock source. However, micro algal value chains are not established in Europe despite free greenhouse capacities that are suitable for their growth. The IDEA project - Implementation and Development of economic, viable algae value chains in North West Europe aims to implement viable microalga process chains targeting final microalga-derived compounds for food, feed and cosmetic applications. Spirulina sp., and Nannochloropsis sp. were used in this study as a source of protein and for development of bioactive peptide-rich protein hydrolysates. Protein was extracted from Spirulina sp. using a combination of sonication and the salting out method using ammonium sulphate precipitation. A yield of 20.44% ± 0.537 dry weight of protein was obtained. A bioactive peptide containing Spirulina sp. hydrolysate was generated using proteolytic enzymes and bioactivities assessed using in vitro Angiotensin-I-converting enzyme (ACE-1) inhibitory assays. In the initial assay the Spirulina sp. protein and hydrolysates showed ACE-1 inhibitory activity of 59.13% ±2.76 and Nannochloropsis sp. protein inhibited ACE-1 by 81 % +/0.04 when assayed at a concentration of 1 mg/ml compared to the commercial control captopril © which was assayed at 0.005 mg/ml and inhibited ACE-1 by 97.59% ±0.003. Bioactive hydrolysates were characterised for their peptide content using mass spectrometry and subsequently used in the formulation of biscuits. Biscuits were analysed for their protein content and the Spirulina sp. cookie had a protein content of 9.04%/g cookie ±0.13, which, was higher than the protein content of the positive control cookie, which had a protein content of 6.48%/g cookie ±0.18. IDEA addresses innovations related to: (1) algae species for the NW Europe climate and cultivation efficiency for prolonged growth seasons in NWE (up to 360 days), (2) development of an automated water recirculation, harvest unit & alternative CO2 resources, (3) storage concept, logistics and preservation of algae biomass, (4) regional activities for algae processing, potentially comparable to the milk industry which includes the downstream processing of these into valuable ingredients including carbohydrates, proteins, lipids and other small molecule, (5) ¿15 novel products formulations to targeting value generation. The aim of IDEA is to create innovative approaches for the use of algae in feed, food and cosmetics and create a value chain for the process.

Poster Presentation

Development of a high-capacity sorptive extraction (Hi-Sorb) gas chromatrography-mass spectrometry method for the identification of volatiles associated with lipid oxidation in raw beef

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Lipid oxidation (LO) leads to degradation of lipids and development of oxidative rancidity. This process is responsible for the gradual reduction of shelf-life and sensory quality of meat and meat products, thus affecting consumer acceptance. Volatile components arise directly from LO over storage and therefore can be used as indicators for LO. This work aims to assess the changes in LO volatile compounds in raw beef mince over storage that could aid shelf-life prediction. LO volatiles were measured by high-capacity sorptive (Hi-Sorb) extraction coupled with thermal desorption (TD) gas chromatography-mass spectrometry (GC-MS). Twenty one beef mince (18% fat) samples were evaluated after 1, 2, 5, 7, 9, 13 and 15 days of storage at 4°C. Volatiles were extracted from 3 g of sample analysed in triplicate, extraction conditions were 40^{o}C for 120 min. Some definite trends were evident with LO products such as increases in the following compounds over storage: the aldehydes butanal (p=0.045), hexanal (p=0.119), heptanal (p¡0.001), octanal (p=0.002), nonanal (p=0.003), decanal (p=0.004) and furfural (p=0.897); the ketones 2-butanone (p=0.121), 2-pentanone (p=0.425) and 2-heptanone (p¡0.001); and the alcohols 1-hexanol and 3-methyl-1-butanol (both p¡0.001). The greatest increase in LO volatile products occurred after storage at 4°C for 9 days. This study has shown that Hi-Sorb extraction combined with TD-GC-MS is a very effective way to monitor and potentially predict LO in beef samples that has the potential to be applied to other meat products. Further work is required to quantify and validate volatile compounds as predictors of LO in comparison to commonly utilised methods such as thiobarbituric acid reactive substances (TBARS).

Poster Presentation

Effect of bioavailable whey peptides on C2C12 muscle cells

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Introduction: As we age, we lose skeletal muscle mass and strength. Muscle ageing can be reversed or delayed by a combination of exercise and dietary protein [1]. There is a plethora of evidence from intervention trials that consumption of whey proteins have positive benefits on ageing muscle [5]. Bovine whey proteins (β-Lactoglobulin, α-Lactalbumin, Bovine Serum Albumin (BSA) and Lactoferrin) are high quality dairy proteins that are easily digested contain all essential amino acids and are rich in branched chain amino acids. These proteins are also noted for their bioactive peptides [2, 3]. Objective: to investigate the effects of 6 whey peptides on biomarkers of ageing in the murine myoblast cell line C2C12. These peptides were selected (TKIPA, NLPPL, PVPQ, VGIN, VAGT and KVPQ) based on (a) their appearance post gastrointestinal digestion of whey protein isolate and (b) their proven ability to cross the gut barrier in vitro. Results: All 6 peptides protect undifferentiated, differentiated and atrophy induced aged cells from free radical damage compared to controls (P¡0.05). TKIPA resulted in a significant increase in nitrate production in both undifferentiated and differentiated cells but interestingly reduced nitrate production in atrophy induced cells compared to controls (P¡0.05). NLPPL resulted in a significant increase in both catalase and SOD2 mRNA transcript in differentiated cells compared to untreated controls. Conclusion: All 6 of the whey peptides tested reduced oxidative stress of undifferentiated, differentiated and atrophy induced muscle cells in vitro. This provides a mechanistic insight into the 'muscle friendly' attribute of whey proteins.

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Poster Presentation

Maximising productivity and eliminating Campylobacter in broilers by manipulating stocking density using 'biosecurity cubes'.

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Campylobacter is the leading cause of bacterial gastroenteritis worldwide with approximately 250,000 cases reported within the European Union annually. The primary source of human infection is broilers and 38% of broiler carcasses in Europe are contaminated. Poultry farms have been identified as the most effective point for control and enhanced biosecurity has been established as the most appropriate method to achieve this. Previous research in our group established the use of "biosecurity cubes" in preventing Campylobacter contamination in broiler flocks. Our recent aim was to facilitate the upscaling of these cubes and observe additional improvements in broiler growth and wellbeing. Initial trials tested barrier materials (cardboard, wire mesh, polyurethane film and flyscreen mesh) that could be applied to the perimeter of the biosecurity cube effectively preventing Campylobacter colonisation in a sub population of test birds and did not adversely affect airflow to the birds. The experiment was then upscaled to a "biosecurity framework" consisting of 8 biosecurity cubes. During this time the biosecurity cubes were stocked at varying densities: 12, 14, 16, 18, 20 and 22 birds per m2, with the main flock (20 birds per m2) used as the control. Periodically, birds were randomly selected in each cube, weighed and examined. The Campylobacter status of the birds was also determined. The biosecurity framework successfully prevented Campylobacter colonisation of test flocks over two separate rearing periods even when the surrounding flock tested positive after first thin. Additionally, test birds reached their target weight of 2Kg 3-6 days faster than those of the general flock when stocked at the same density (20 birds/m2). It was concluded that biosecurity cubes present a potential solution to the Campylobacter problem, allowing for the production of Campylobacter free broilers. The data provided may also be used to maximise productivity by optimising stocking densities.

Oral Presentation

Breakage behaviour of infant milk formula during production

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Powder breakage significantly affects dairy powder physical properties which in-turn influence powder functionalities, especially the rehydration properties. Meanwhile, particle breakage takes place in many processes wherever there is relative movement between powder particles in contact with each other or against the container wall. Thus, the investigation of powder breakage is very important for the quality control of dairy powders. However, there is currently no research presented in the literature on dairy powder breakage behaviour. The breakage behaviour and the effect of powder properties of a commercial agglomerated infant milk formula were investigated during three processing methods (powder venturi feeder, lab-scale dilute phase pneumatic conveyor, and laboratory high-speed mixer) based on the changes of particle size distributions (PSD) before and after breakage. Powder strength influenced the breakage behaviour, and it increased with the decrease of particle size and porosity, and the expansion of the PSD range. Four breakage mechanisms were found, dispersion, chipping, disintegration, and splitting, corresponding to the increasing degree of breakage and depending on the breakage process conditions and particle characteristics. During the processing, the main breakage mechanisms of samples changed gradually from dispersion until splitting with increasing processing conditions. At low processing conditions, dispersion of particles that exist as clusters held together by cohesive attractions might occur. These clusters were susceptible to breakage, thus small stresses could break the clusters and dispersed them into their original particles and kept initial particles without breakage. When particles were subject to higher external mechanical stress, the main mechanism of breakage was chipping, leading to the production of minuscule particles whilst still retaining the identity of the original particles. Disintegration tended to produce many smaller particles that originate at the points of application of the stress. Splitting resulted in the generation of a small number of coarse fragments, all significantly smaller than the parent. A better understanding of the breakage behaviour of dairy powders and the impact of powder properties will assist efforts in trying to reduce powder breakage and the problems associated with it.

Poster Presentation

Assessment of the in vitro antidiabetic potential of blue whiting (Micromesistius poutassou) protein hydrolysates generated at industrial scale

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Underutilised or low-value fish species contain significant quantities of high quality protein (15-20% wet weight) and are promising candidate raw materials for the generation of high-value biofunctional peptide ingredients. Blue whiting (BW, Micromesistius poutassou) protein, which is present at approximately 17.0% wet weight, contains peptides encrypted within its primary sequences that have health enhancement properties. The aim of this study was to assess the effect of six BW protein hydrolysate samples (BW-SPH-A_F), generated at industrial scale under different hydrolysis conditions, on biomarkers of type 2 diabetes mellitus (T2DM) in vitro. Molecular mass distribution, hydrophobicity, total and free amino acid profiles indicate distinct differences between each of the six hydrolysates. All six hydrolysates were shown to inhibit human-derived dipeptidyl peptidase-IV (DPP-IV) at half maximal inhibitory concentrations (IC50 value) ranging from 2.59-3.60 mg protein/ml. BW-SPH-D was shown to mediate significantly (p¡0.05) higher DPP-IV inhibitory activity than all other samples. When assessed at 2.5mg/ml all samples induced a significant (p¡0.001) increase in the concentration of insulin secreted from pancreatic (BRIN-BD11) cells compared to the 5.6 mM glucose control. BW-SPH-B and BW-SPH-D were shown to have the highest insulin secretory activity with 6.55 and 6.32 fold increases, respectively. This activity was significantly (p¡0.05) higher than that recorded for samples BW-SPH-A and BW-SPH-C. The six hydrolysates were also shown to stimulate a significant (2.5 mg/ml, p¡0.001) increase in the secretion of glucagon like peptide-1 (GLP-1) from murine enteroendocrine (GLUTag) cells compared to the 2 mM glucose control. However, no significant (p¡0.05) difference was observed between the hydrolysate samples. The results presented herein show that all BW protein hydrolysates mediate multi-functional effects on markers of T2DM in vitro and have potential applications as dietary agents for the prevention and management of this disease.

Poster Presentation

Seasonal Variation and Trends in Milk Composition over Time

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The seasonality of Irish milk production systems and its influence on milk yield is well established. However, when coupled with recent breeding strategies, the effect on composition (e.g. protein, fat, lactose, minerals, vitamins, etc.) is less understood. This study correlated changes in milk composition with weather (rainfall (mm) and temperature (°C)) and grass growth (kg DM/ha/day) at Teagasc, Moorepark farms in Co. Cork during the period 2012 to 2020. Milk samples taken on a weekly basis from January to December were analysed for protein, non-protein nitrogen (NPN), fat, lactose and total solids. Analysis of variance (ANOVA) and principle component analysis (PCA) were used to determine statistical differences by both year and lactation. Results indicated that protein (total, true and casein), fat and total solids content increased significantly (p¡0.05) from 2012 to 2020. Non-protein nitrogen (NPN) was negatively correlated with grass growth and temperature. Lactose increased to a peak in 2017 and decreased thereafter to 2020. The time taken to reach a lactose to protein ratio of 1.2 was reduced by one month, i.e. from September in 2013 to August in 2020. The study shows that the nutrient content of milk increased over the evaluated eight year period and it is suggested, that as a consequence, this resulted in increases in milk yield and changes in processability.

Poster Presentation

Aquaculture for sustainable seaweed production in Ireland.

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Seaweed grows in both great abundance and diversity in Ireland, with many coastal towns having long-standing traditions of harvesting and consumption of seaweeds. Alaria esculenta is one of such species and is an excellent source of macro and micronutrients including proteins and bioactives. This study demonstrates the potential of aquaculture for the sustainable production of *Alaria esculenta*, outlining the production process for this aquaculture system, beginning with the seeding of Alaria esculenta spores and the subsequent harvest and various post-harvest operations. Post-harvest methods are vital for preservation of potential products and are dependent on the end-product use of the seaweed. These stages of the aquaculture process usually involve some form of drying, milling and preparation for processing. To produce seaweed flour, fractionation of the dried and milled seaweed may

be carried out in order to yield flours of varying protein and nutritional contents. This study will show the protein content outputs from fractionated Alaria esculenta and discuss the multitude of beneficial compounds within seaweeds. Sustainable seaweed production not only provides a valuable protein source to help stave off demand for alternative proteins but also provides a wealth of benefits for the environment through habitat repair, carbon dioxide reduction and oxygen production. Ireland has a unique opportunity to be a world leader in clean, sustainable seaweed production, and provide support to the local seaweed farmers as they transition from traditional harvesters to commercial producers.

Poster Presentation

The fatty acid profile of common and alternative sward species for consumption by beef cattle.

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Controlling the fatty acid composition of forage for grazing ruminants could lead to animal derived products with higher concentrations of PUFA, omega-3 fatty acids and conjugated linoleic acid. However, a better understanding of forage fatty acid concentrations in a range of pasture species is required before new grazing systems are implemented. The aim of the study was to determine the fatty acid profiles of individual grasses, legumes and forbs (perennial ryegrass (PRG), timothy (T), white clover (WC), red clover (RC), plantain (PL) and chicory (CH)), and of a 2 (PRG/WC) and 6 (PRG, T, WC, RC, PL, CH) species sward mix over a four-month Summer grazing period. Forage was sampled at monthly intervals (June – September) from paddocks of 2 and 6 species sward mixes. Individual forage species were obtained by separation from a subsample of the 6 species sward mix. Samples were freeze dried, ground, and frozen at -20°C. Fatty acid analysis was performed using gas chromatography. Statistical analysis was performed using R with ANOVA followed by Tukey's post-hoc test to identify significant differences (p¡0.05). Significant differences were reported between individual species for the dominant fatty acids C16:0, C18:2n6 and C18:3n3 expressed on a proportion basis. When individual species were compared with the 2 or 6 species mixes of which they are constituents no significant differences were found for C16:0 or C18:3n3. For C18:2n6 the proportion in CH was significantly higher than that in the 6 species mix. SFA proportions were significantly higher in WC and lower in T, while the PUFA proportion was significantly higher in T, compared to the 6 species mix. The study demonstrated that there were minor differences in the fatty acid profiles in individual forage species compared to the mixed swards that contained them.

Poster Presentation

Physicochemical characterisation and biological activity of hempseed protein from different Irish varieties

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The demand for plant proteins as food ingredients is increasing. In this study, the proteins from three samples of hempseed (A, B and C) grown in one location in Ireland were extracted and their properties were characterised. The maximum nitrogen solubility of the hempseed proteins occurred at pH 12.0. The protein from each sample was solubilised at pH 12.0 prior to isoelectric precipitation and spray drying. The total protein content in samples A, B and C was 23.73, 21.93 and 21.18%, respectively. Reversed phase ultra performance liquid chromatography analysis showed similar protein profiles in the three extracts and sodium dodecyl sulphate–polyacrylamide gel electrophoresis showed edestin being the main protein component. Aqueous protein suspensions (5% w/v, protein) for sample A (organically grown) had the lowest mean diameter size (d(0.5) = 89.0 μ m) while sample B (conventionally grown) had the largest d(0.5) value (120.0 μ m). The protein extracts were subjected to in vitro simulated gastro-intestinal digestion (SGID) to evaluate their digestibility. Degree of hydrolysis (DH) analysis showed highest digestion after SGID was associated with sample B (11.0 ± 1.5%) in comparison with samples A and C (8.1±0.9 and 8.7±0.4%, respectively). Antioxidant activity analysis showed that the 2,2´-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) radical (ABTS·) scavenging activity of the SGID digested samples when tested at 1 mg/mL were 85.9±0.4, 83.3±0.3 and 85.2±0.8% for samples A, B and C, respectively, showing that the antioxidant activity of sample B was significantly lower (p¿0.05) than Sample A. The results showed some variations in the properties of hempseed protein extracts grown in the same location.

Poster Presentation

A comparison of the techno-functional properties of blue whiting (*Micromesistius poutassou*) protein hydrolysates in relation to their physicochemical properties

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Enzymatic hydrolysis of fish discards is a promising approach for the generation of value-added protein enriched products with a broad range of applications in the food industry. Six samples of blue whiting soluble protein hydrolysates (designated BW-SPH A to F) manufactured using different proprietary combinations of hydrolytic enzyme activities were compared in terms of their techno-functional properties, i.e., emulsification and foaming, thermal stability and nitrogen solubility. These samples had different degrees of hydrolysis (DH) values ranging from 19.01

to 30.47%. The molecular mass distribution profiles were in accordance with the DH values showing that sample A with the highest DH had the lowest amount of peptides (0.31%) with molecular masses ¿ 10 kDa, while sample C with the lowest DH had the highest amount (2.37%) of peptides ¿ 10 kDa. The techno-functional properties were determined at pH values between pH 2.0-12.0. Nitrogen solubility analyses showed that all samples had ¿ 72% solubility at all pH values tested. The lowest emulsion activity index (EAI, 5.88-10.05 m2/g) was obtained at pH 4.0 while the highest EAI (235.26-247.28 m2/g) was obtained at pH 12.0. The highest emulsion stability (88.31%) were observed for BW-SPH-D at pH 12.0. On the other hand, the highest foam expansion and maximum foam stability were observed at pH 4.0. Increasing the hydrolysate concentration from 5 to 10% (w/v, on a protein basis) led to a decrease in heat coagulation time (HCT) (140°C, pH 7.0) in all samples. The HCT for sample A which was the highest heat stable BW-SPH was decreased from 62.1±3.0 min at a concentration of 5% (w/v) to 19.0±1.0 min at a concentration of 10% (w/v). This study showed that BW-SPH samples with different physicochemical properties had different pH-dependent techno-functional properties. Judicious choice of hydrolysis parameters can lead to a range of BW-SPH ingredients having targeted functionalities.

Oral Presentation

Consumer attitudes to sustainable food choices

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Consumers are increasingly interested in sustainable food (Forbes et al., 2009) due to growing concerns for environmental matters among other issues (Singh & Verma, 2015). Indeed, sustainable food consumption is required to avoid causing significant damage to ecological systems, that is occurring with current food models (Kamenidou et al., 2019) including the 21% to 37% contribution of food production to global greenhouse gases and the loss of biodiversity (IPCC, 2019). Currently, there is no universal definition of what constitutes as sustainable food (Sidali et al., 2016). The most widely used and accepted definition is set out by the FAO which states that sustainable diets are "diets with low environmental impacts which contribute to food and nutrition security and provide a healthy life for present and future generations". By understanding consumers attitudes for sustainable food, an insight can be gained into the likelihood of them choosing these foods and thus contributing to sustainable development. Therefore, this research project proposes investigating what consumers perceive sustainable food to be. Thus, the research proposes the question: "What do consumers perceive to be sustainable food?"

Other facets of sustainable food include food that is of high quality as defined by the EU Commission (2020), food that is ethical in its production and food that is convenient to consume. Furthermore, the following research questions are posed: "Do consumers perceive sustainable food to be of quality?", "Do consumers perceive sustainable food to be ethical?" and "Do consumers perceive sustainable food to be convenient?" Lastly, price and consumers' perception of value for money has an

influence on their purchasing intention. Thus, this research proposes the question "Do consumers perceive sustainable food to be of value for money?"

This study will be beneficial to various food stakeholders to understand consumers' attitudes. From this, food stakeholders can proceed to offer options that consumers would appreciate. In addition, they can develop effective marketing strategies to communicate the benefits and value of sustainable food. Additionally, this study proposes to add real value to the literature as the role of attitudes towards environmentally sustainable food acts as an antecedent or driver of consumer behaviour which has yet to be fully addressed in the literature (Hartmann and Siegrist, 2017). A quantitative survey by questionnaire is proposed to address this research gap. The data will be analysed using factor analysis and Structural Equation Modelling (SEM) to examine if consumer attitudes to sustainable foods, including their attributes of quality, ethics, convenience and value for money, lead to consumers' acceptance of the food and positively influence their purchasing intention. Thus, posing the research question "Do consumers' attitudes to sustainable food positively influence their purchase intention?"

Poster Presentation

Encapsulation of vitamin D in whey protein microgels: stability and foaming properties

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Whey protein isolate (WPI) microgels were used as a carrier to effectively encapsulate and protect vitamin D (VD). Cold-set gelation was used to prepare the VD loaded WPI (WPI/VD) microgels, whereby WPI was heat-denatured, cooled, VD was added followed by the addition of calcium chloride to induce gelation. The WPI/VD microgels were tested for their encapsulation efficiency, stability against temperature (72°C for 15s), UV-light (254 nm), four-week storage (20°C, 4°C and -20°C) and on their foamability. Mechanical whipping was used to prepare the foams which were assessed on overrun and stability. The WPI microgels exhibited high encapsulation efficiency of ¿ 98% and the incorporation of VD did not significantly change the particle size. Moreover, the WPI microgels significantly improved the stability of VD compared to the control (unencapsulated VD) when exposed to environmental conditions. When heated the microgels provided a protective barrier to VD as 97% remained, whereas unencapsulated VD degraded by 25%. UV-light exposure led to complete degradation of VD, however, when encapsulated, 97% VD remained. The microgels could prolong the shelf life of VD as ¿ 92% remained intact at the end of the fourth week compared to 67% for the control, irrespective of storage temperature. Mechanical whipping of the WPI/VD microgels led to slight degradation of VD. There was no significant difference between the foaming properties of the whipped WPI and WPI/VD microgels as overrun and stability were similar for both samples. This indicated that the addition of VD did not affect

the foamability of the microgels. The current work demonstrates that WPI microgels can effectively encapsulate VD, protect against environmental factors while also maintaining the ability to form a stable foam, which has potential applications in food systems.

Oral Presentation

(*Towards Safer Food Delivery and distribution service during and after the COVID-19 Pandemic: the SAFELIVERY Project*)

(Towards Safer Food Delivery and distribution service during and after the COVID-19 Pandemic: the SAFELIVERY Project)

Towards Safer Food Delivery and distribution service during and after the COVID-19 Pandemic: the SAFELIVERY Project

Maria Chiara Leva[1], Marco Gerevini[2], Orla Cahill[1], Lucia Vannini[3], Fintan Moran[1], Sara Boyd[1], Michaela Fox[4], Stephane Durand[4], Micaela Demichela[5], Uma Tiwari[1], Adailton Oliveira[1], Bojana Bjegovic[1]

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The Online Food Delivery segment in EU has projected revenues that amounts to over €19,000m in 2020 and the market is expected to show an annual growth rate of 8.2% by 2024 (Statista Market Report 2020). Both restaurant and catering industries have been negatively affected by the restrictions put in place to manage COVID-19 and it is important to provide guidance to demonstrate that effective COVID-19 controls are in place. SAFELIVERY will revise a HACCP - COVID-19 scheme suited for food delivery & catering sectors to be assessed via a specific audit scheme in order to cover the human factors and equipment risks associated with delivery not currently considered. This paper describes the initial steps of a project aimed at developing an innovative food delivery services and protocols suited to reduce the risk of food surfaces & packaging contamination by COVID-19 virus, and other agents, during preparation and delivery of "Ready To Eat foods" (RTE foods). It will address safety gaps identified on the delivery chain of the RTE foods. This project will provide: i) enhanced HACCP protocols to manage/control risks related to potential human factors and delivery conditions ii) an univocal anti-tampering seals system recognizable through a mobile application iii) anti-tampering boxes with smart locks which can only be opened by a key code communicated to the final client iv) enhanced training package for food handlers and deliverers. Through the above we aim to improve the consumers' confidence on food delivery & collect information on food/diet choices during and after the COVID-19 crisis, to increase market of catering and food delivery operators during the COVID -19 restrictions. This study present the preliminary findings and approach regarding the need to improve the safety of the RTE delivery segment and the techincla solution envisaged to improve it.

Oral Presentation

Assessing the Safety and Legal Requirements for four novel ingredients from Olive, Grape, and Nut by-products

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Consumers are continuously looking for natural, functional, and greener food products to remain healthy. Olive, grape and nut by-products represent a category of under-utilised side streams in the Agro-food industry in Southern Europe. Waste streams generated also have environmental impact and its management is costly. Researches have revealed that the untapped bioactives compounds present in olive, grape and nut by-products has the potential of becoming alternative feedstocks to meet consumer needs for bio-functional food ingredients. For this reason, the UP4Health (Upcycling for health) project aims to develop four new ingredients from olive, grape and nut by-products using greener and environmentally friendly biorefinery techniques. These new ingredients should however comply with geographic-specific legal and safety requirements for pre-market approval to be launched successfully on the market. To fulfil this requirement, the project seeks to provide and monitor regulatory aspects from raw material to finished products. Compositional analysis with compounds of interest would be performed to substantiate possible nutrition and health claims of ingredients developed. In addition, the toxicological analysis would be performed to determine safe thresholds for ingredient usage in finished products and consumer consumption.

Poster Presentation

The prevalence and virulence of *Clostridioides difficile* on farms, in abattoirs and in retail foods in Ireland

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Clostridioides difficile infections (CDI) were usually considered hospital-acquired, however the increase of community-associated cases in the last years suggested there may be a foodborne route. The aim of this research was to investigate *C. difficile* prevalence and virulence on farms, in abattoirs and in retail foods. Culture based methods were used to test 540 samples along the food chain and molecular biology techniques were applied to confirm presumptive positives and to detect virulence (tcdA, tcdB, cdtA, cdtB) and accessory genes (tcdC and tcdR). The overall prevalence on farms and in abattoirs was 32.2% and 43.3% respectively. *C. difficile* was also detected in 9/270 (3.3 %) of retail foods tested at concentrations as high as 6.8

log10 cfu/g in cottage cheese. The tcdA, tcdB, cdtA, cdtB, tcdC and tcdR genes were detected in 41%, 99.2%, 33.6%, 32%, 46.7% and 31.1% of the 122 *C. difficile* isolates. It was concluded that although the prevalence of *C. difficile* decreased along the food chain, their presence in retail foods suggests that this pathogen might be foodborne, perhaps necessitating dietary advice for potentially vulnerable patients.

Oral Presentation

Development of a two-step process for the production of D-tagatose from whey permeate

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Lactose is the most underutilized dairy ingredient. Current applications of lactose are insufficient to use the recovered lactose from the manufacture of dairy products (cheese, Greek yogurt, and protein concentrate). As an ingredient, lactose offers technological challenges (poor solubility and low sweetness strength) and health concerns (malabsorption and digestive problems). It is critical to develop technological approaches that can help to expand lactose utilization. The objective of this work is to develop process for producing a mixture of natural sweeteners derived from lactose using a two-step process. Aqueous lactose was converted into a sweetening syrup via enzymatic hydrolysis followed by catalytic isomerization over MgO/SiO2. Firstly, the enzymatic hydrolysis using β-galactosidase was performed at room temperature, and it converted 95.77 $\pm$ 0.67% of lactose into glucose and galactose. Secondly, the hydrolysed lactose solution was catalytically isomerized at 100°C for 2 h in the presence of MgO/SiO2 containing different MgO loading ratios (10, 20, 30, and 40 wt.%). The prepared MgO/SiO2 catalysts were characterized by BET, XRD, FTIR, CO2-TPD, and TEM. The highest isomerization yield of glucose and galactose to produce fructose and D-tagatose (26.8$\pm$0.5 and 17.5$\pm$0.5%, respectively) was obtained with 20% of MgO/SiO2. The overall process (enzymatic hydrolysis followed by isomerization over MgO/SiO2) converted 99.3$\pm$0.2% of lactose into a sweetening syrup made of glucose (30.48%), galactose (33.51%), fructose (16.92%), D-Tagatose (10.54%), lactulose (3.62%), and unidentified byproducts (¡0.69%). A reaction mechanism for the formation of a sweetening syrup from lactose via two-step process was proposed. The outcomes of this research present an opportunity for expanding the utilization of lactose.

Poster Presentation

Application of Nanofiltration for the Removal of Chlorate from Milk

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Chlorate has been highlighted as an emerging residue of concern within the dairy, food and beverage industries. The presence of chlorate as a residue in products has been associated with the use of chlorine detergents, which are widely utilized for sanitation in industrial food production where they can form a residue on the surface of equipment post CIP, and from chlorination of process and drinking water. Chlorate contamination within the dairy processing chain is of particular concern, due to the adverse health effects associated with chlorate exposure, with infants, in particular, being at risk. To date, there are no documented methods for the removal of chlorate from milk. Work completed herein, using membrane separation technology, a process commonly used within the dairy industry, has been demonstrated to decrease the chlorate content of milk used as an in-process milk concentration step. This study demonstrated that such processing, using a 150-300 Da MWCO membrane, is capable of removing 65.48 ± 0.82% chlorate from milk per unit dry matter respectively when concentrating solutions from 9% to 18% total solids. The loss of other dairy minerals and lactose was also assessed to assess the commercial viability of NF membrane processing as part of commercial chlorate mitigation.

Poster Presentation

25(OH)D response to different lipid delivery systems in older adults: A randomised controlled trial

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Food fortification improves vitamin D intakes in older adults but it is not yet mandated in many countries. Combining vitamin D with different dietary lipids altered vitamin D absorption both in-vitro and in a post-prandial study. However, it's not clear if this effect will impact change in vitamin D status over longer intervention periods. This study will examine the effect of the lipid composition of a vitamin D fortified drink on change in 25(OH)D concentrations over time. This randomised, placebo-controlled trial recruited 63 older adults between October 2019 and March 2020. Participants consumed one of the following treatments daily for 4 weeks: a vitamin D fortified olive oil based drink, a vitamin D fortified coconut oil based drink, a vitamin D pill or a placebo drink. Each active treatment contained

20μ g of vitamin D3. Serum samples were collected at baseline and at 4 weeks. Repeated measures ANCOVA compared changes in 25(OH)D over time. There was a significant in difference in 25(OH)D response between vitamin D sufficient and insufficient participants, therefore the analysis was spilt for baseline vitamin D status. There was a significant time*treatment effect on 25(OH)D in both sufficient and insufficient participants. The lipid containing vitamin D fortified dairy drinks were equally as effective and safe as a traditional vitamin D pill. Therefore, vitamin D fortification of lipid containing foods may be used in lieu of supplementation in older adults when supplementation adherence is low or for individuals who experience swallowing difficulties. These results are particularly important given the new population health guidance for 15μ g vitamin D supplementation for older adults in Ireland

Oral Presentation

The microbiology of beef steaks stored aerobically or anaerobically in vacuum pack films with different oxygen barrier properties

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The objective of this study was to investigate bacterial growth on beef steaks stored under different atmospheric conditions/packaging materials (aerobic, anaerobic and low, medium and high barrier film vacuum packs) at chilled (2°C) and temperature abuse (20°C) conditions while monitoring changes in physicochemical and colour stability. At 2°C, there was no significant difference (P¿0.05) in total viable counts mesophilic (TVCm) and psychrophilic (TVCp), total Enterobacteriaceae (TEC) or lactic acid bacteria (LAB) counts regardless of packing conditions/materials, while Pseudomonas spp. and B. thermosphacta counts were significantly lower in high barrier and anaerobic packages overtime. At 20°C significantly (p ¡ 0.05) lower TVCm, TVCp, TEC, Pseudomonas spp. and B. thermosphacta counts were obtained in the medium and high barrier packs and on steaks stored under anaerobic conditions throughout the experiment. Overall, high barrier packaging (oxygen transfer rate (OTR) of ¡3 cm3/m2·d·bar) and anaerobic storage inhibited the growth of spoilage bacteria while retaining the redness (a*) of the beef for the longest duration.

Oral Presentation, Poster Presentation

Antifungal and antiyeast activity of an extract obtained from white mustard seeds and its potential use as preservative in food industry

Giulia Mignone [1], Laila N. Shwaiki [2], Elke K. Arendt ([2,3], Aidan Coffey [1,3]

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Fungal and yeast spoilage represents a significant problem in the food industries and the use of compounds derived from natural sources as preservative is becoming more and more appealing for consumers. This study focusses on a peptide extract from white mustard seeds (*Sinapis alba*) that shows activity against several fungal strains and evaluate its potential use as food preservative. The extraction protocol includes steps such as cold buffer lysis, ammonium sulphate precipitation, heat denaturation, intense dialysis and one cycle of chromatography on a HiPrep SPHP cation-exchange column in an FPLC system. Eluted antifungal fractions obtained were pooled, desalted, freeze-dried and resuspended in dH2O. The MICs were assessed with a microdilution method following fungal growth in a microtiter plate, against the following strains: *Fusarium colmorum*, *Candida albicans*, three strains of *Saccharomyces cerevisiae* and four yeast strains often associated with food/feed spoilage such as *Zygosaccharomyces bailii*, *Debaryomyces hansenii, Kluyveromyces lactis and Zygosaccharomyces rouxii*. The killing mode of action of the extract was further investigated for membrane permeabilization and reactive oxygen species (ROS) production using fluorescence assays. Tests were performed to evaluate the stability of the extract in a soft drink matrix and under varying pH, salt conditions and heat treatment. To estimate if the extract is consumer friendly, haemolytic and cytotoxicity assays were performed on sheep's erythrocytes and human $CaCO_2$ cells, respectively. Results showed that the extract was able to inhibit the growth of all fungal strains tested, MICs were observed to be between 20 μ g/ml and 80 μ g/ml. The killing mode of action of this peptide solution seems to involve the process of fungal membrane disruption but not ROS overproduction. In addition, the extract was stable under all the conditions tested and did not show haemolytic or cytotoxicity activity. These results support the mustard seeds extract's potential as a food preservative.

Poster Presentation

Antifungal and antiyeast activity of an extract obtained from white mustard seeds and its potential use as preservative in food industry

Giulia Mignone (1)[1], Laila N. Shwaiki (2)[2], Elke K. Arendt (2) (3)[3], Aidan Coffey (1) (3)[4]

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[4]NA

Fungal and yeast spoilage represents a significant problem in the food industries and the use of compounds derived from natural sources as preservative is becoming more and more appealing for consumers. This study focusses on a peptide extract from white mustard seeds (Sinapis alba) that shows activity against several fungal strains and evaluate its potential use as food preservative. The extraction protocol includes steps such as cold buffer lysis, ammonium sulphate precipitation, heat denaturation, intense dialysis and one cycle of chromatography on a HiPrep SPHP cation-exchange column in an FPLC system. Eluted antifungal fractions obtained were pooled, desalted, freeze-dried and resuspended in dH2O. The MICs were assessed with a microdilution method following fungal growth in a microtiter plate, against the following strains: Fusarium colmorum, Candida albicans, three strains of Saccharomyces cerevisiae and four yeast strains often associated with food/feed spoilage such as Zygosaccharomyces bailii, Debaryomyces hansenii, Kluyveromyces lactis and Zygosaccharomyces rouxii. The killing mode of action of the extract was further investigated for membrane permeabilization and reactive oxygen species (ROS) production using fluorescence assays. Tests were performed to evaluate the stability of the extract in a soft drink matrix and under varying pH, salt conditions and heat treatment. To estimate if the extract is consumer friendly, haemolytic and cytotoxicity assays were performed on sheep's erythrocytes and human CaCo2 cells, respectively. Results showed that the extract was able to inhibit the growth of all fungal strains tested, MICs were observed to be between 20 μ g/ml and 80 μ g/ml. The killing mode of action of this peptide solution seems to involve the process of fungal membrane disruption but not ROS overproduction. In addition, the extract was stable under all the conditions tested and did not show haemolytic or cytotoxicity activity. These results support the mustard seeds extract's potential as a food preservative.

Oral Presentation

Investigating the potential for mixed micelles to protect vitamin D3 from degradation during food processing and storage

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Vitamin D deficiency exists globally and increases the risk of developing chronic diseases. Vitamin D has poor oral bioavailability due to its fat-soluble nature and is sensitive to heat, light, and oxygen. Mixed micelles are structures comprising bile salts, phospholipids and free fatty acids which have been shown to improve fat-soluble vitamin bioavailability. This study aims to investigate the stability of mixed micelles and vitamin D3 to standard food processing and storage conditions. Vitamin D3 loaded mixed micelles were prepared with vitamin D3 concentration and mixed micelle size measured before and after (i) shearing (8,000-20,500 rpm for 30 sec) and high pressure processing (600 MPa), (ii) heating (63 °C for 30 min, 72 °C for 15 sec or 10 min, and 90 °C for 0.5 sec), (iii) near UV/visible light exposure at 395 nm for 20 minutes or UV-C light at 254 nm for 1 minute, (iv) storage at 4 °C or -20 °C for 4 weeks. Mixed micelles were stable to shearing and high pressure processing, with no significant change (p ¿ 0.05) in size noted. Mixed micelle suspensions retained significantly more ($P \leq 0.05$) vitamin D3 than control samples following all heat treatments. Under standard pasteurisation conditions mixed micelles retained 18 % more vitamin D3. Following light exposure mixed micelles retained significantly more ($P \leq 0.05$) vitamin D3 than control samples. Mixed micelles protected vitamin D3 from degradation during cold storage at 4 °C and -20 °C compared to control samples. Mixed micelles show potential to protect vitamin D from degradation during food processing and from environmental conditions. By pre-forming mixed micelles loaded with vitamin D outside the body, there is potential for vitamin D incorporation into both water- and fat-soluble foods and beverages to increase the number of foods containing vitamin D and improve vitamin D absorption.

Poster Presentation

Heterogeneity in undissociated organic acid stress tolerance of *L. monocytogenes*

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This study focuses on the response of *Listeria monocytogenes* strains to commonly used organic acids. *L. monocytogenes isolates* (n = 153) were evaluated for their tolerance of acetic, lactic and propionic acid. Additionally, Whole Genome Sequences (WGS) of the strains were grouped using Multi Locus Sequence Typing (MLST) and core genome MLST (cgMLST). WGS were also inspected for the existence of genes previously shown to be linked to acid tolerance in *L. monocytogenes*. A large variation in tolerance profiles was observed amongst strains with respective organic acids. Overall 19.6%, 5.2% and 35.3% of screened isolates exhibited higher tolerance to acetic, lactic and propionic acid, respectively. The isolates with specifically thiT, gadT2, gadD2 and gadD3 genes were linked to higher acetic acid tolerance (P ¡0.05) as well as presence of LisRK was linked to higher tolerance to propionic acid (p = 1×10-11). Absence of plasmid genes in the WGS assemblies was noted in isolates showing higher tolerance for all acids. Strains grouped into one Clonal Complex, CC18, by MLST showed significantly higher acetic and propionic acid MIC values than other groups. Whereas only CC7 type isolates revealed significantly higher (P $\leq$ 0.001) lactic acid MIC values. The results demonstrate that WGS based MLST typing could be linked to acid tolerance phenotypic traits which is important in predicting the persistence of *L. monocytogenes* isolates.

Poster Presentation

Feasibility of vitamin D bio-enriched pork to increase UK consumers vitamin D intakes

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Bio-enrichment is a growing area of research, with particular interest in the use of fortified animal feed and/ or UV animal exposure to naturally increase vitamin D content in meat(1). This exciting enhancement strategy improves the nutritional density of meat and may assist in reducing rates of hypovitaminosis D which is

prevalent worldwide(2). Moreover, the COVID-19 pandemic has re-emphasised the need to avoid vitamin D deficiency to help maintain immune function(3) and the urgent need for food-based strategies to help address this(4). The aims of the current study were to 1) determine any changes to vitamin D intake and status over a 9-year period, and 2) apply dietary modelling to predict the impact of vitamin D bio-enrichment of pork and pork products on population intakes in the UK.

Data from the National Diet and Nutrition Survey (NDNS) Rolling Programme Year 1-9 (2008/09-2016/17) were analysed using SPSS to determine nationally representative mean vitamin D intakes and 25(OH)D concentrations. Subgroup analysis investigating variance in sex, age and season was conducted. Informed by previous studies(5), four theoretical dietary modelling scenarios of vitamin D pork bio-fortification were analysed (vitamin D content +50/100/150/200% vs standard).

Vitamin D intake in the UK population has not changed significantly from 2008 to 2017 yet, over the same period significant gender difference (M 2.66±1.99 and F 2.30±1.66, p¡0.05) and seasonal variation in the mean 25(OH)D concentrations were evident. In 2016/17, across all age groups, 13.2% were considered insufficient (25(OH)D ¡25nmol/L). Across the whole group, theoretical modelling demonstrated an increase of 4.9, 10.1, 15.0 and 19.8% in vitamin D intake when vitamin D concentrations in bio-enriched pork were elevated by 50, 100, 150 and 200%, respectively. Based on the 200% modelling scenario, a greater relative change was observed in males (22.6%) compared to females (17.8%), and although older adults (65+ years) had significantly greater vitamin D intakes compared to other age categories (3.28±2.27μ g/day), this age group observed the smallest relative increase from the dietary modelling scenarios (14.3%). The greatest relative change was observed amongst 11-18 year olds, where 200% vitamin D bio-enrichment of pork and pork products would result in a 25.2% increase in mean daily vitamin D intakes.

Vitamin D intakes have remained stable in the UK across almost a decade, and current results confirm that food-based strategies such as bio-enrichment are required to help the population achieve the RNI for vitamin D (10μ g/d). These findings align with Irish data and provides incentive to pursue bio-enrichment practices. Future on-farm interventions warrant safely maximising UV exposure to produce the optimal natural vitamin D content in meat and thus, maximise consumer impact. Additionally, new product developers should consider the target age group to ensure the enriched product is one widely consumed by population. Specifically, bio-enrichment of pork meat provides a proof of concept, demonstrating that animal-based strategies may offer an important contribution to help to improve the vitamin D intakes of the UK population, particularly adolescents.

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Poster Presentation

The effect of atmospheric cold plasma treatment on the antigenic properties of bovine milk casein and whey proteins

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Food allergens are a global problem and effective control is required in the food production and processing sectors. Milk is one of the fourteen allergenic ingredients identified in European Union food allergen lists. The allergenic proteins of concern in milk include casein and the whey proteins; beta-lactoglobulin and alpha-lactalbumin. Atmospheric cold plasma (ACP) is a novel technology generating reactive oxygen and nitrogen species (RONS), charged particles, and UV photons that has recently been extensively studied by researchers for possible applications in agriculture, medicine and food sectors. Recent studies report that ACP has the potential to modify the protein structures and may therefore be able to control or mitigate the immunoreactivity of allergenic proteins. The objective of this study was to investigate the effect of ACP on reducing the allergenicity of casein and whey proteins. Casein solutions and whey protein solutions were separately dissolved in phosphate buffered saline solutions. A tunable plasma device allowing spark- or glow-discharge treatments was used to treat casein and whey protein solutions directly by discharges in contact with solutions for 10-30 minutes. SDS-PAGE results for spark- and glow-discharge treatments showed noticeable change in gel band intensities for casein, beta-lactoglobulin and alpha-lactalbumin. ELISA analysis of plasma treated samples showed a significant reduction (P¡0.05) in IgE binding values compared to control sample indicating a reduction in allergenicity of casein and whey proteins. The structure of plasma treated samples was modified by comparison with control samples according to SDS-PAGE and HPLC. The developed plasma process elucidated the potential for application in food processing to reduce the risk posed by allergen cross-contaminants [1]. 1. Ng, S.W., et al., The effect of atmospheric cold plasma treatment on the antigenic properties of bovine milk casein and whey proteins. Food Chemistry, 2020: p. 128283.

Poster Presentation

Investigation of combinations of rationally selected bioengineered nisin derivatives for their ability to inhibit Listeria in broth and model food systems

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Listeria monocytogenes is a foodborne pathogen which causes listeriosis and is commonly associated with contamination of ready-to-eat foods. Due to consumer demands, there is an increasing interest in the use of natural food preservatives, an example of which is bacteriocins. Nisin A is a 34 amino-acid peptide which has demonstrated anti-microbial activity against a range of pathogens. In this study, we examined the ability of nisin A and a rationally assembled bank of 36 nisin derivative producing *Lactococcus lactis* strains to inhibit Listeria. We developed a broth-based bioluminescence assay for screening the anti-listerial effect of cell-free supernatants (CFS) obtained from the nisin derivative producing strains, both singly and in combination with each other, with the aim of identifying enhanced combinations of bioengineered nisin derivatives. In this way, a total of 630 combinations of nisin derivative producing strains were screened, with 2 identified as exhibiting enhanced anti-listerial activity when used together compared to when used alone, or to the nisin A wild type strain. Growth curve and kill curve assays were used to confirm the enhanced activity of the combinations using purified peptides, with results showing that one of the double combinations, along with an additional triple peptide combination retained their enhanced activity against *L. innocua* in broth. Significantly, this enhanced activity was also maintained in a model food system (frankfurter homogenate) at both chill and abusive temperature conditions. To our knowledge, this study is the first to report on combining bioengineered bacteriocins and thus warrants further investigation as a potential strategy for the control of Listeria in food.

Oral Presentation

The effects of high heat treatment on physical properties of soy protein isolate solutions

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Soy protein isolate (SPI) is a valuable food ingredient due to its high protein content and amino acid availability. Predominantly cultivated in North America, it is increasingly becoming a popular alternative to dairy as a protein source. However, the low solubility of soy protein at pH 6.9, and high viscosity can limit its use as an ingredient in commercial scale formulations. The aim of this study was to heat-treat

SPI dispersions and characterize their subsequent physical properties. Applying a heat treatment of 140°C for 15 s to SPI dispersions (8%, w/w) at pH 6.9 led to an increase in the protein solubility (95.5%) compared to unheated samples (45.1%). Concurrently, viscosity was significantly lower after heat treatment at 140°C (101 mPa.s) compared to unheated SPI dispersions (14 mPa.s) (measured at a shear rate of 300 s-1 @ 25°C). Heat treatment also reduced particle size, with confocal microscopy images displaying a loss in protein network after heat treatment at 140°C. In conclusion, the solubility, particle size and viscosity of SPI can be significantly altered through high temperature heat treatment.

Poster Presentation

Investigation into the effect of curcumin on microRNA (miRNA) expression and inflammatory cytokine secretion in adipose-derived stem cells (ADSCs).

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Curcumin (diferuloylmethane) is a phytochemical found in Turmeric (Curcuma longa) plants (Hewlings and Kalman, 2017), with anti-obesity, chemoprotective and tumour repression properties (Rahmani et al., 2018). This spice promotes weight loss and reduces incidence of obesity-related diseases as well as demonstrating anti-inflammatory activity (Peng et al., 2019). Studies have suggested that curcumin alters miRNA expression in certain cells, however further studies are required to determine the mechanisms by which curcumin controls the expression of these miRNAs and their target genes (Zhan et al., 2017). The aim of this research was to investigate the effect of curcumin on miRNA expression and inflammatory cytokine secretion in ADSCs, using RT-PCR and ELISA, respectively. Results demonstrated that curcumin caused decreased inflammatory cytokine secretion. Moreover, increased curcumin concentration caused increased specific miRNA expression, whilst the same increase in curcumin concentration resulted in decreased expression of other miRNAs. This study illustrated that the effect of curcumin on the expression of other miRNAs remained inconclusive due to miRNA expression levels being donor dependent. The possible regulation of miRNA expression and inflammatory cytokine secretion by curcumin is a promising step in the development of novel therapeutics. This miRNA-based research will further enhance our knowledge and understanding of curcumin reduced obesity, inflammation and potentially cancer at a molecular level.

Poster Presentation

The Effect of Storage Condition of the Cheddar Cheese Base on Processed Cheese Texture And In vitro Digestibility

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Freezing Cheddar for future use in processed cheese (PC) production could improve economic security of Irish cheese manufacturers, as well as diversifying the cheese market. However, the impact of freezing and thawing on subsequent processing is not well reported. Furthermore, impacts of freezing on the PC matrix and its subsequent digestibility may affect nutrient bioavailability. Therefore, it is important to evaluate the impact of freezing on these parameters. Semi- solid PC matrices made from fresh cheddar (PCFRESH) or PC frozen/thawed cheddar (PCFRZN) were manufactured. Texture Profile Analysis (TPA) was used to determine any differences in textures between PCFRESH and PCFRZN. Both forms of PC as well as natural, unprocessed cheddar were subjected to an in vitro simulated gastrointestinal digestion (SGID) model. Quantification of the Matrix Degradation Index (MDI) followed the gastric phase of digestion, as well as free fatty acid liberation after the intestinal phase, using gas chromatography. PCFRZN had slight, yet significantly (p¡0.05), higher hardness, chewiness, and gumminess relative to the PCFRESH. MDI after the gastric and intestinal phase, as well as FFA release after the intestinal phase were not significantly (p¿0.05) impacted by the freeze and thaw of the cheddar base. Although structural parameters were marginally affected by freezing, a semi-solid PC matrix from frozen and thawed cheddar can be manufactured with the same digestibility as PC made from fresh cheddar. Matrix degradation of the natural cheddar base was significantly higher (10%) than that of its corresponding processed cheese after gastric digestion, regardless of freeze/thaw condition. This suggests that processed cheese maintains its structure to a higher degree throughout gastric digestion. This in turn may indicate a potential to manipulate the level of structure retained during digestion suggesting a potential for PC to act as a protective matrix for sensitive ingredients or bioactives during gastrointestinal transit.

Poster Presentation

What effects does gastrointestinal digestion have on milk Extracellular Vesicles?

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Extracellular Vesicles (EVs) are nano-sized particles present in milk at a concentration ranging from 10^8 to 10^13 particles/mL. They are predicted to play a role in immune modulation of the infant [1]. EVs are composed of an outer phospholipid bilayer and an inner pocket containing proteins and nucleic acids. The objective of this research was to investigate whether bovine milk EVs survives human gastrointestinal digestion. A simulated static in vitro gastrointestinal digestion was performed using a protocol that resembles the human infant gut. A pooled bulk milk sample, that represents milk from 6 months of lactation, was subjected to a 1h gastric phase (pH 5.3 + pepsin at 268 U/mL+ gastric lipase) followed by a 1h intestinal phase (pH 6.6 + pancreatin containing trypsin at 16 U/mL of intestinal content + bile at 3.1 mmol/L). EV isolation was performed using an Iodixanol density gradient. Fractions with a density of 1.05-1.2 were pooled, washed and suspended in phosphate buffered saline. EVs particle size was measured using dynamic light scattering and blots were performed to detect CD9 a membrane protein marker present in EVs. Particles z-average was 169.44 nm for bulk milk and 1356.7 nm for gastrointestinal digested milk. CD9 protein (25 kDa) was detected in bulk milk but was not detected in the digested milk. These preliminary results suggest that infant gastro-intestinal digestion distorts EV size and hydrolyses EV membrane proteins. Future work will include additional blots to detect other EV markers, atomic microscopy to visualize the effect of gastrointestinal digestion on the topography of milk EVs

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Poster Presentation

Study of changes on physico-chemical properties of ultrasound treated food by-products apple pomace and coffee silver skin powder

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Revalorization and utilization of food by-products in various food products as functional ingredients is a growing trend in food research. The development of emerging food-processing technologies like power ultrasound (US), high pressure

processing (HPP), plasma technology, or pulse-electric field (PEF), has provided food scientists a vast opportunity to innovate and improve the quality, extend the range of applications and modify the properties of the food by-products (1). Ultrasound technology is one emerging technology successfully used by food industry to improve the processing efficiency and to modify the properties of food ingredients. Application of power ultrasound cause changes in the physical and chemical characteristics of food molecules, leading to modifications of the functional properties of food ingredients (2). In this study, the aim is to assess the effect of ultrasound on the functionality of two food by-products: apple pomace (AP) and coffee silver skin (CS) powder. In order to characterize the impact of US, changes in key functional properties of application in meat formulations were analysed. In this research work, each ingredient was suspended in aqueous solutions (10% w/v) and then were treated with US (20 kHz, 250 W) in a water bath for 15 or 30 minutes. The treated solutions were then freeze dried and tested for various functional properties as water holding capacity (WHC), oil holding capacity (OHC), viscosity, colour difference (ΔE) and also proximate content. Results showed that there was a significant effect on WHC (p ¡ 0.05) and OHC (p ¡ 0.05) in AP, whereas in the case of CS there was no significant difference observed in WHC (p ¿ 0.05) and OHC (p ¿ 0.05); however, a clear trend was observed where US treatment was found to have beneficial effect on these parameters. Results of colour differences (ΔE) showed that there is a visible colour difference (ΔE¿3) between the control and treated samples, which was due to the changes in L* and a* values of samples. There was no significant difference between the samples in terms of viscosity for both AP and CSS. In general, US treatment has a beneficial effect on physico-chemical characteristics improvement on AP and CSS powders and these results open the door to use the US treated food by-products as an optimised functional ingredients in food formulations, especially meat based products.

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Poster Presentation

Effect of Vibration and Storage Temperature on Respiration and Ethylene Production Rates in Tomato

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Horticultural fresh produce like tomato can be damaged easily, and requires a special care during the postharvest supply chain like packaging, storage, and transportation. Inadequate storage and transportation facilities of fresh produce can produce different physiological changes resulted in quality reduction of tomato. For example, increasing ethylene production and increasing in respiration rates during transportation and storage can accelerate ripening and therefore degrading fresh produce quality. Therefore, the aim of this research was to study the effect of storage temperature, duration, and vibration during transportation on the respiration and ethylene production rates in tomato. A vibration shaker was used to produce vibration on tomato samples box and accelerometer was fixed inside the container. Tomato were divided into 2 groups, where the first one stressed to 2 hrs vibration duration at frequency of 2.5Hz. The other box was experienced no vibration stress and set as control. After vibration, six tomato samples were placed in a sealed container which was used for measuring ethylene (ppm), CO2 and O2 (%). Similar experiments were done for the control group. Tomato with and without vibration were stored at 10 and 22°C for 10 days. Calculations were used to obtain ethylene production rate and respiration rate. The results of the research showed that respiration rate in tomato were significantly affected by storage temperature and duration but not by vibration. Furthermore, ethylene production rate was affected by storage duration. However, no relation was observed between vibration and storage temperature on ethylene production rate. To maintain all physiological quality attributes of tomato during storage, control and modified atmospheric packaging is required.

Poster Presentation

Kinetics of Quality Changes in Tomato during Transportation and Storage

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Stored tomato at refrigerated conditions can maintain its visual quality over time and after being transported at varying distances compared those stored at ambient temperatures. Improvement of tomato storage condition during and after transportation is essential to improve the quality of fresh produce and maintain the shelf life. Controlling produce quality necessitates the ability to control the chemical and physiological changes during fresh produce storage and other postharvest processes. The aim of this research is to apply zero-order and first-order kinetic models to predict the quality parameter changes of tomato transported from different transportation distances and stored at two different storage conditions for

a period of 12 days. To determine the physical (weight loss, color and texture), nutritional (lycopene and carotenoids contents) and chemical (total soluble solids, titratable acidity and sugar: acid ratio) quality changes of transported tomatoes from different locations as a function of storage time, quality change kinetics have been applied using kinetics models. Regression analysis such as reduced chi-square (X2), coefficient of determination (R2) and root mean square error (RMSE) were performed as a primary standard to select the best fit of the tested kinetic model to the experimental data. The model that adequately fitted the quality parameters of tomato was determined with highest R2 and lowest X2, RMSE. Comparing the results gained using zero-order model and first-order model indicated that most of the quality changes in term of distance, storage time and duration were fitted with the zero-order kinetic model.

Poster Presentation

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A major goal of this project (ALGIPRO) is the advancement of the production of state-of-the -art biomolecules derived from sustainable marine sources. Novel marine derived biomolecules and industrial biomaterials will be developed using novel, eco-innovative approaches and technologies to ensure the sustainable exploitation of marine bio-resources. The marine environment makes up more than 70% of the earth's surface and represents a vast, relatively untapped resource for sustainable bio-compound sourcing. Global population growth has put enormous pressure on food production. Specifically, the present need for protein from animal sources to supply global requirements has increased 5-fold since in the past 50 years since 1961. This project is investigating two aspects of bioproduct production using two native seaweed species. Firstly, the optimisation of cultivation through modification of environmental factors to produce higher bioproduct content in the chosen seaweed species. Secondly, the optimisation of bioproduct isolation through the use of efficient, state-of-the-art and environmentally friendly technologies. Recently, new techniques such as microwave-assisted extraction (MAE), supercritical fluid extraction (SFE) and ultrasound assisted extraction (UAE) have been applied to the extraction of functional compounds. In particular, the application of ultrasound as a laboratory-based technique for assisting extraction from plant material is widely published. Compared to MAE, UAE will eventually be simpler, faster, and is not restricted by the solvent and type of matrix used, or by the moisture content. The expected project outcomes are bioproducts, specifically proteins and carbohydrates (polysaccharides) suitable for use as animal feed dietary supplements. This project uses currently underutilised resources of the marine environment to explore the possibilities of harnessing the supply of proteins and carbohydrates from two prolific

seaweed species found naturally on the Irish and New Zealand coast - *Laminaria digitata* and *Macrocystis pyrifera*, to augment the supply of proteins and carbohydrates in the diet of animals.

Poster Presentation

Consumer behaviour towards plant-based dairy alternatives

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Cow's milk is considered as one of the essential parts of the human diet due to its high nutritional value. However, cow's milk consumption is associated with health concerns such as cow milk allergy, lactose intolerance and environmental concerns such as high greenhouse gas emissions. With increasing awareness about problems with dairy milk consumption and production, consumers attention is shifting towards plant-based dairy alternatives. Plant-based dairy alternatives are made from the water-based extracts of soy, seeds, nuts, or cereals and contain health beneficial bioactive components. These plant-based dairy alternatives are a more sustainable option as they have less impact on the environment than cow's milk. The objective of the study is to investigate consumer behaviour and their preference for plant-based dairy alternatives in the EU, UK, and Ireland. The results of the study suggest that an increasing number of consumers are choosing plant-based dairy alternatives. Among the different plant-based milks, soy milk and almond milk are the popular ones. The consumers preferred plant-based dairy alternatives because of health and environmental reasons.

Poster Presentation

Measuring the effectiveness of the Temporal Dominance of Sensations technique to investigate the differences in the texture perception of Oral Nutritional Supplements between older and younger adults.

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The Temporal Dominance of Sensations (TDS) technique has been used increasingly to assess the dynamic sensory perception of food and beverages. However, many of these studies use convenience cohorts of relatively narrow age and demographic profiles, with few in older adults (aged 65+ years). In order to develop nutritional beverages for undernourished older adults, understanding the dynamic

sensory perception is vital. Therefore, this study sought to measure the effectiveness of the TDS methodology to investigate the differences in the dynamic texture perception between older and younger adults across a range of texturally-modified Oral Nutritional Supplements (ONS). Seventy panellists (50:50 18-35 and 65+ years) evaluated four different ONS over one 30-minute session. For each ONS, 45mL was consumed over three sips. Panellists evaluated each sip (15mL) over 40 seconds. After the 120 second TDS evaluation, panellists recorded their liking using a 9-point hedonic scale followed by their hunger, fullness, desire, and thirst using 100mm visual analogue scales. TDS curves with distinct peaks were generated by both age cohorts, with similarities in significantly dominant texture attributes apparent. Both age cohorts found the two low viscosity ONS 'Watery' and the high viscosity ONS 'Creamy', 'Mouthcoating', and 'Thick'. However, age had a direct impact on the performance and behaviour of panellists during the TDS evaluations of all four ONS. The older adults selected significantly less attributes ($P \leq 0.05$), made fewer attribute citations ($P \leq 0.01$) throughout the evaluation period, took significantly longer ($P \leq 0.05$) to select the first attribute, and for each attribute selection generally ($P \leq 0.01$). Results therefore suggest that while the TDS methodology is an appropriate technique to measure the dynamic texture perception of nutritional beverages in both older and younger adult cohorts, the age differences in the use of this technique must be carefully considered in future studies.

Poster Presentation

)Bio-enrichment enhances vitamin D activity in pork meat. (

) Bio-enrichment enhances vitamin D activity in pork meat.

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Bio-enrichment through animal feed and housing regimes provides an innovative solution to enhance the nutritional value of meat, an increasingly important factor perceived by consumers in purchase of meat and animal products. It has been suggested that bio-enriched products may reach a larger proportion of the population than those produced using traditional food fortification methods. Furthermore, bio-enriched animal products may be favoured among consumers owing to the natural appeal of production. Pork meat has been previously reported as a noteworthy vehicle for vitamin D enhancement, containing both vitamin D3 and the 25-hydroxyvitamin D3 (25(OH)D3) metabolite, the latter being more effective at increasing serum 25(OH)D3 (vitamin D status measure) in humans in comparison to other vitamin D metabolites. This study aimed to investigate the effect of daily UVB exposure in swine on vitamin D and its metabolites; vitamin D3, vitamin D2 and (25(OH)D3), and total vitamin D activity in pork meat. Forty-eight boars

were exposed to UVB light (n=24) or standard lighting positioned above pen as a control (n=24). Boars were exposed daily to a vitamin D effective dose (100 J.m-2) for a period of 10 weeks prior to slaughter. Vitamin D metabolites were analysed in raw and cooked (by oven-roasting) back meat by liquid chromatography tandem mass spectrometry (LC-MS/MS). Total vitamin D activity of raw and cooked meat was defined as: [vitamin D3 + vitamin D2 + (25(OH)D3 x 5) + (25(OH)D2 x 5]. UVB light increased vitamin D metabolites; 25(OH)D3 (+14%), vitamin D3 (+13%) and total vitamin D (+14%) compared to standard lighting in cooked back meat (P¡0.05). No significant differences were reported for vitamin D2. Cooked back meat had significantly higher total vitamin D activity (+11%) and vitamin D3 (+14%) (P¡0.001) compared to raw back meat. Cooking did not influence 25(OH)D3 concentrations. This pilot study demonstrated that swine exposed short-term to UVB light can enhance vitamin D content in pork, with the potential upon optimisation of lighting conditions to produce novel bio-enriched meat products for consumers.

Poster Presentation

Extracellular vesicles in skim milk and infant milk formula in:a separation and characterisation comparison

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Many infants are fed Infant milk formula (IMF). IMF production involves harsh treatment and potential consequences on extracellular vesicles (EV) are still unknown. We aimed to optimise and characterise EVs from IMF and skim milk (SM) in accordance with MISEV2018. SM and IMF were either not treated (NT) or treated with acetic (AA) or HCl acid (isoelectric precipitation, IP), to remove caseins before differential ultracentrifugation (DUC) or gradient ultracentrifugation (GUC). For DUC, 38mL samples were centrifuged starting from 12,000 g (12K) to 200,000 g (200K) for 75 min each and re-suspended in 1 mL PBS. For bottom-up GUC, increasing iodixanol gradients with 2.3 mL of samples were centrifuged at 186,000 × g for 18 h. Fractions were then pooled based on densities (1.05 - 1.2 g/mL). Total protein was analysed by BCA and SDS-PAGE, EV specific markers by immunoblotting and particle concentration and size by nanoparticle tracking (NTA) and TEM. IP most efficiently removed casein micelles; BCA showed these samples had lowest total protein, confirmed by SDS-PAGE. Immunoblotting showed CD63 and TSG101 to be detected for all samples apart from IMF_IP. Size distribution of the post-GUC particles from SM samples were 156.13 ± 5.87 nm and from IMF samples were 159.90±12.96 nm; post-DUC of SM_200K were 159.10 ± 5.27 nm and IMF_200K were 175.73±8.44 nm; no significant differences were observed between EV sizes. Post-GUC, SM_IP (2.16×1010±2.47×1009 particles/mL of SM) had significantly (P ¡ 0.05) higher concentration of EVs compared to IMF_IP (3.23×1009±1.45×1009 particles/mL of IMF). Similarly, post DUC, SM_IP_200K (4.66×1007±2.47×1007 particles/mL of SM) had significantly (P¡0.05) higher concentrations of EVs compared to IMF_IP_200K (4.66×1008± 2.02×1008 particles/mL

of IMF). In conclusion, regardless of the method used, IMF has fewer intact EVs compared to SM and to obtain purest SM EVs, IP followed by GUC separation is optimal.

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Oral Presentation, Poster Presentation

Ensuring the safety of extracted proteins and novel food products

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To meet the current protein demands, EU is 95% dependent on imported soy, cereals, or potatoes. However, these current sources of proteins are becoming unsustainable from an economic as well as an environmental point of view. ALEHOOP (Biorefineries for the valorisation of macroalgal residual biomass and legume processing by-products to obtain new protein value chains for high-value food and feed applications) will attempt to reduce EU's dependency on protein imports and contribute to the raw material security ALEHOOP will produce biofunctional and technological proteins from sustainable and under-exploited biomass that do not compete with the traditional food crops for space and resources. Thus, the optimisation of the process along with the recovery of biomass from plant residues will significantly aid in the reduction of the carbon footprint as compared to the conventional process (30% less), production costs by 20% as well as considerable energy sources (20% less). The project will develop two new products, one based on legumes and the other based on seaweed (microalgae). The new proteins will be validated in foods for elderly, sporty and overweight people, vegetarians, and healthy consumers as well as for the animal feed. The legal and safety aspects of the extracted proteins' from raw material acquisition, processing, production, and commercialisation will be determined. A detailed inventory of the relevant National and European regulations will be prepared to assess the legal and ethics requirements. Proteins from algae are considered novel food and have to be appropriately accessed This involves in silico studies for safety & toxicology measurements (i.e. heavy metals, mutagenic potential).

Poster Presentation

Seaweed as a source of novel bioactives for gut and metabolic health

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Hypertension, type-2-diabetes, and obesity are global metabolic health burdens. These metabolic disorders are associated with a dysbiosis of the gut microbiota – an imbalance or decreased diversity of beneficial versus harmful bacterial species. The gut microbiota is regarded as an endocrine organ that exerts an effect on immunity, metabolism, neuroendocrine responses, and synthesises short-chain fatty acids, which have multiple important biological functions. Seaweed is a sustainable source of novel bioactive compounds with potential to treat metabolic disorders and dysbiosis; however, there is limited published data on the impact of seaweed extracts on gut health and the effect of food processing on their bioactivity. This project will screen seaweed extracts for their impact on biomarkers of metabolic health in vitro; assess their potential as prebiotics for gut bacteria; and develop extracts with bioactivity into functional foods. Food-grade enzymes and solvents will be used to extract polysaccharides, peptides and polyphenols from a range of red, green and brown Irish and Australian seaweeds. In vitro assays will measure their ability to inhibit angiotensin-1-converting enzyme to lower blood pressure, α-amylase to improve glycaemic control, lipase to reduce dietary fat absorption, and antioxidant capacity to inhibit free radical damage. IC50 values will be compared to pharmaceutical inhibitors. Protein, fibre, lipids and minerals will be quantified. Physical characterisation of extracts will include viscosity, solubility, interactions with other ingredients, and stability during storage. The impact of seaweed extracts on gut health will be evaluated by simulated in vitro gastrointestinal enzymatic digestion and colonic fermentation with human faecal innocula. Gas chromatography will quantify short-chain fatty acid production by gut bacteria, while the abundance and diversity of bacterial populations will be assessed by 16s rRNA sequencing. Extracts that exhibit bioactivity will be characterised by LC-MS and NMR, and developed into functional foods with enhanced nutritional profiles while maintaining sensory acceptability.

Poster Presentation

Polyphenols incorporated biodegradable active films for food packaging applications

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Incorporation of functionally active natural compound in the food packaging material may increase the shelf life of the food by protecting it from physical, chemical and Biological degradation. By solvent casting method, polyphenols (eg. Ferulic acid (FA)) has been incorporated in a biodegradable polymeric blend of poly(lactide) /poly (butylene adipate-co-terephthalate) (PLA/PBAT). The influence of FA on the morphological, colour, optical, thermostability, and antimicrobial properties of PLA/PBAT composite films were investigated. The composite films depicted a slight yellowish tint after incorporation of FA and showed a high UV-light barrier property. Upon the incorporation of the FA, thickness of the film was increased by 1.5 - 10%. The Tensile strength (TS) of the FA incorporated blend film increased to a value of 10.78 MPa at 10 wt% as compared to the control film which has 5.42 MPa. Water contact angle of the film was observed to decrease significantly with the increase in the FA content in the composite film. All the active film exhibited thermal decomposition in 2 stages, where first stage weight loss of 5% - 12% was observed around 60°C - 80°C and the second stage of weight loss (complete degradation) was observed at 280°C - 400°C. The temperature of degradation of the film was observed to increase by the incorporation of FA in the film and as its concentration increases. A significant increase in the antimicrobial activity has been observed due to the inclusion of the phenolic compound in the composite film against L. monocytogenes and E. coli. The biodegradable composite film has a high potential for its application as an active food packaging due to its antibacterial and UV barrier properties.

Oral Presentation

High throughput analysis of *Escherichia coli* concentrations using fluorogenic substrates via a microplate reader and their application in meat processing

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The demand for plant proteins as food ingredients is increasing. In this study, the proteins from three samples of hempseed (A, B and C) grown in one location in Ireland were extracted and their properties were characterised. The maximum nitrogen solubility of the hempseed proteins occurred at pH 12.0. The protein from each sample was solubilised at pH 12.0 prior to isoelectric precipitation and spray drying. The total protein content in samples A, B and C was 23.73, 21.93 and 21.18%, respectively. Reversed phase ultra performance liquid chromatography analysis showed similar protein profiles in the three extracts and sodium dodecyl sulphate–polyacrylamide gel electrophoresis showed edestin being the main protein component. Aqueous protein suspensions (5% w/v, protein) for sample A (organically grown) had the lowest mean diameter size (d(0.5) = 89.0 μ m) while sample B (conventionally grown) had the largest d(0.5) value (120.0 μ m). The protein extracts were subjected to in vitro simulated gastro-intestinal digestion (SGID) to evaluate their digestibility. Degree of hydrolysis (DH) analysis showed highest digestion after SGID was associated with sample B (11.0 $\pm$ 1.5%) in comparison with samples A and C (8.1$\pm$0.9 and 8.7$\pm$0.4%, respectively). Antioxidant activity analysis showed that the 2,2´-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) radical (ABTS·) scavenging activity of the SGID digested samples when tested at 1 mg/mL were 85.9$\pm$0.4, 83.3$\pm$0.3 and 85.2$\pm$0.8% for samples A, B and C, respectively, showing that the antioxidant activity of sample B was significantly lower (p¿0.05) than Sample A. The results showed some variations in the properties of hempseed protein extracts grown in the same location.

Poster Presentation

'PASS - Plasma assisted sanitation systems' for the inactivation of Covid-19 on food contact materials

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SARS-CoV-2 contamination of external surfaces of food packaging, processing and handling materials represents a novel and crucial issue to consider. Food industries are interested in the use of novel systems able to inactivate viruses and microorganisms on packaging and food processing tools, avoiding the use of chemicals. Plasma assisted treatments exploit the antimicrobial action of several active components (electrons, radicals, ions, excited molecules) and electromagnetic fields,

representing a cheap, green and safe technology. The focus of the PASS project is to develop plasma assisted sanitation systems for food packaging materials, equipment and tools for processing and handling food products. The main goal is the identification of specific parameters able to induce the SARS-CoV-2 inactivation, to be used for the realization of a pre-industrial prototype, whose commercialization will be the final output of the project. Different materials (polyethylene-PE, polypropylene-PP, cardboard, glass and metal) were artificially inoculated with SARS-CoV-2 and subjected to cold plasma treatment. After 10 min of exposure, the virus was successfully inactivated on all the treated surfaces. The main functional properties of treated materials were assessed and only slight modifications were observed. Quality and safety of the packed food during shelf-life was not negatively influenced. This EIT Food activity has received funding from the European Institute of Innovation and Technology (EIT), a body of the European Union, under Horizon2020, the EU Framework Programme for Research and Innovation. EIT Food is Europe's leading agri-food innovation initiative, with the aim to create a sustainable and future-proof food sector. The initiative is made up of a consortium of key industry players, start-ups, research centres and universities from across Europe. EIT Food aims to collaborate closely with consumers to develop new knowledge and technology-based products and services that will ultimately deliver a healthier and more sustainable lifestyle for all European citizens.

Oral Presentation

Impact of Varying Levels of Pasture Allowance on the Composition and Quality of Milk Throughout Lactation

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This study examines the impact of varying levels of pasture allowance feeding systems on the composition, quality and functionality of raw milk throughout lactation. Fifty four spring calving Friesian cows were randomised into three groups (n=18), with each group receiving one of three diets. Group 1 was maintained outdoors and received a high pasture allowance (approx. 95%) consisting of perennial ryegrass (Lolium perenne L.) and supplemented with concentrates (approx. 5% of DM intake) on average over the lactation (GRS), Group 2 was maintained indoors on a total mixed ration diet of grass silage, maize silage and concentrates (TMR) with zero grazed grass, and Group 3 rotated between outdoor grazing during the day and a mixed ration while maintained indoors at night in a partial mixed diet system (PMR) overall consisting of approximately 50% grazed pasture. The impact of each feeding system on the composition and functionality of the milk derived varied between diet and between different stages of lactation. GRS-based milk had lower somatic cell count (SCC) and lactose contents compared to both TMR and PMR. TMR derived milks were highest in protein, fat and total solids content compared to GRS and PMR. PMR-based milks has lowest proportions of fat, protein, total

solids and highest SCC. The heat stability of milk from each diet was measured at 140°C until visual coagulation occurred. GRS milks were the most heat stable in early- and mid-lactation, but demonstrated a lower heat stability that both TMR and PMR in late-lactation. TMR and PMR milks demonstrated similar heat stability characteristics in early-and mid-lactation, however, PMR demonstrated greater heat stability in late lactation and was the most heat stable. A reduction in the average fat globule size was observed in milk from each diet as lactation progressed when measured using light scattering techniques.

Poster Presentation

Overview of the Irish Brewing and Distilling Sectors: Grains Requirements and Utilisation

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The Irish brewing and distilling sector have shown increased sales, number and production output, with a growth rate of 4% between 2014 and 2019. The brewing sector alone has seen a 22% increase in the number of micro-breweries since 2014, and the total output of the sector now stands at 8.3m hectolitres (Beer Market Report, 2019). The distilling sector on the other hand witnessed an increase of four to 32 in the number of distilleries between 2010 and 2019 with a total output of 10.7 million nine litre cases (Spirits Market Report, 2019). Barley is the main raw material for the beer and spirits industry in Ireland. This industry is supported by approximately 300,000 tonnes of grains of which 220,000 is barley (IBEC report, 2019). As a result of the continued growth (number, output and sales) of the brewing and distilling sectors in Ireland, demand for grains has outpaced native production and supplies, with an overall grains self-sufficiency of 88%. Approximately, annual utilisation of imported maize is 115,000 tonnes, and barley importation for the brewing sector was estimated at 65,000 tonnes in 2018 (DAFM). Therefore, a key issue for the Irish brewing and distilling sectors is the utilisation of native grains for beer and spirits production. Grain source and development is a key aspect of the drinks industry, and thus, there is the need for an organised approach to increase the output of the tillage sector to meet the growing demands of these sectors. This will not only have an economic advantage for the sector but also, it will safeguard the demands and requirements of the sector especially as it affects product quality and market demands.

Poster Presentation

Extraction and characterisation of proteins from by products from the shellfish processing industry

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The fish industry produces 851,984 tonnes of matter per year, only 43% of that is consumed, the rest is incinerated which has both an environmental and economic impact. However, these by-products contain valuable proteins that are going to waste. Protein hydrolysates are widely used in food technology for their nutritional and functional properties, having high potential as natural additives and nutraceuticals. The goal of this project is to extract protein from the by-products from the shellfish processing industry and create protein hydrolysates that have marketable value. The waste was divided into three types: water waste (WW), raw meat (RM) and cooked meat (CM). The proteins were extracted from each type of waste using the pH shift method at acid neutral and basic pH. The proteins in each extract were quantified using the Bradford assay and qualified using reverse phase high-performance liquid chromatography (RP-HPLC) and sodium dodecyl sulfate–polyacrylamide gel electrophoresis (SDS-PAGE). They were then hydrolysed using alcalase and the degree of hydrolysis measured with a 2,4,6-Trinitrobenzene Sulfonic Acid (TNBS) assay. It was possible to extract protein from the three types of waste, but the RM waste contains the highest amount of protein overall. The protein extracts coming from the RM waste and WW extracts have more hydrophilic proteins while the CM waste shows more peaks in the hydrophobic phase. Moreover, the WW and RM waste extract show higher and more frequent peaks than the CM waste extract in their RP-HPLC profiles. Protein sizes vary mainly between 250kD and 25kD, as expected the WW and RM waste contain heavier proteins than the CM. Therefore, this project will continue with using only the homogenization of the WW and RM waste. The successful hydrolysis of this homogenate extract shows its potential as a source of peptides that can be further studied for their bio-functional properties.

Poster Presentation

Effect of thermal treatment on cheese milk with reduced serum protein content: an evaluation of rennet coaguability, cheese composition and yield

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Microfiltration (MF) may be applied to milk to remove serum proteins and to manufacture cheese from the micellar casein concentrate (MCC) stream. As MCC is heat stable, the objective of this study was to determine whether heat treatment can be applied to MCC to bind residual denatured serum proteins to the casein micelles to increase cheese yield without compromising rennet coagulability and cheese

composition. MCC was produced from skim milk by MF at 0.10 μ m followed by pasteurization (72°C×15s) or high heat treatment (HHT, 90°C×15s), with unheated MCC as a control. Standardized cheese milks were prepared from MCCs (unheated, pasteurised or HHT treated), permeates and cream for Cheddar cheese manufacture. Levels of serum protein denaturation in MCC and cheese milks were determined by kjeldahl, coagulation properties by rheometry, cheese composition and yield by standard methods. Compared to the control, pasteurization of the MCC stream did not significantly increase denatured serum protein levels or the resultant coagulation properties, cheese making time, composition or yield. However, HHT significantly increased levels of denatured serum protein in MCC by 11.96% and cheese make time by 66 min. Curd firming rate decreased by 4.19 Pa/min but was restored by increasing the casein content of HHT cheese milk from 3.09% to 4.31%. Cheese composition and yield were not significantly affected by HHT. MF was successfully applied to remove the more valuable serum proteins in their native form prior to cheese manufacture while application of HHT denatured and retained residual serum proteins in cheese without excessively impairing rennet coagulation.

Poster Presentation

Effects of extraction conditions on the phenolic, colour and antioxidant activity of white willow (*Salix Alba*) extracts: potential application in functional foods

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In recent years, there has been a growing demand for natural food products with health promoting benefits. White willow (*Salix Alba*) is traditionally used as a medicinal herb due to its anti-inflammatory, antipyretic and analgesic properties. The efficacy of willow is because of its high phenolic content including salicylates, tannins and flavonoids. Therefore, willow extracts could be ideal ingredients for formulation of novel functional food products with potential anti-inflammatory and antioxidant properties.

The objective of this study was to produce polyphenol rich willow bark extracts for incorporation into food or beverages. Willow bark was extracted using various experimental conditions including extraction temperatures, duration and solvent composition. The total phenols, phenolic composition (tannins, non-tannins, simple phenols, flavonoids) and antioxidant activity of the willow extracts were measured.

All extraction conditions had a significant impact on the polyphenols content of the willow extracts. However, solvent composition had the greatest effect on extraction of polyphenols from willow. The solvent composition was varied using ethanol (0-96%) and by modifying the pH (2-6). The highest total phenol (61.06 ± 0.42 mg g-1 gallic acid equivalents) and non-tannins content (36.86 ± 0.42 mg g-1 gallic acid equivalents) as well as antioxidant activity (34.27 ± 0.25% free radical scavenging activity) was observed in the willow bark extracted using 50% ethanol. In the aqueous extracts, he highest total phenolic and non-tannins content was observed at 60°C for 30min with 51.07 ± 0.53 and 27.35 ± 0.23 mg g-1 gallic acid

equivalents respectively, which resulted in the greatest antioxidant properties (25.51 $\pm$ 0.26% free radical scavenging activity) These results demonstrate that willow bark extracts are important dietary source of polyphenols and show great potential as an ingredient for functional foods or beverages.

Poster Presentation

Dynamic interfacial tension and adsorption properties of whey protein isolate at oil/water interface: Effect of bulk protein concentration, pH and heat treatment

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In this study, the adsorption kinetic behaviour of whey protein isolate (WPI) at sunflower oil/water (o/w) interfaces was characterized using a pendant drop tensiometer. The effects of bulk protein concentration Cp, pH (3 and 7) and heat treatment (unheated and 90 °C for 30 minutes) were examined by monitoring changes in the interfacial pressure of WPI adsorbed interfaces. The equilibrium interfacial pressures attained after long-term adsorption increased with Cp. WPI in solutions prepared at higher Cp migrated to, and unfolded faster at the o/w interface than more dilute systems, as a consequence of concentration gradient effects. The rates of diffusion and unfolding of WPI were faster at pH 3 than at pH 7. This may be attributed to increased surface hydrophobicity as a result of dimer dissociation, higher proportions of α-helices and preferential adsorption of α-lactalbumin (with greater rates of unfolding than β-lactoglobulin) at acidic pH. Heat treated WPI had faster diffusion rate and greater equilibrium interfacial pressure than unheated proteins. This suggests that WPI became more surface active following heat treatment, which may be due to unfolding of denatured monomers of β-lactoglobulin in heat treated WPI with increased exposure of previously buried hydrophobic moieties. Enhancement of interfacial activity following heat-treatment was less pronounced at pH 3 compared to pH 7, which may be attributed to less extensive increases in surface hydrophobicity and protein flexibility under acidic conditions. The rate of protein rearrangement was lower for heat treated WPI than unheated samples, which may be associated with the formation of heat-induced aggregation of proteins. The environmental and processing conditions have considerable influence on the dynamic interfacial tension and adsorption behavior of WPI at the o/w interface. The adsorption kinetics of WPI is directly related to it's interfacial activity, which plays an important role in the formation of emulsion-based food products. Our study offers valuable insight into the protein adsorption behaviour of WPI under various external conditions. Such knowledge can be used to better design structured products with improved product quality through accurate control of environmental and manufacturing conditions.

Poster Presentation
