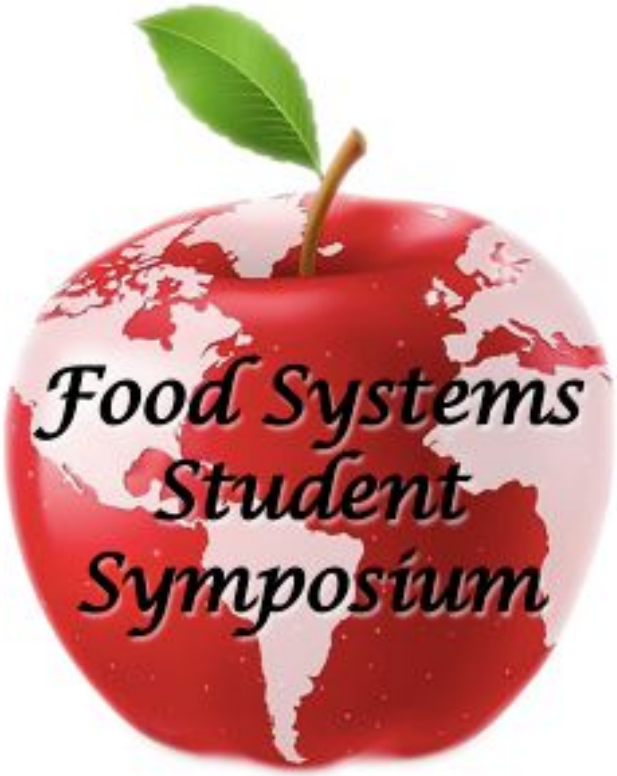
2ND ANNUAL FOOD SYSTEMS STUDENT SYMPOSIUM (F3S)

Presented by Graduate Students from the University of Manitoba in conjunction with the Food Systems Research Group



~ Bridging the Gap ~

Working towards collaborative food systems research at the University of Manitoba

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About Food Systems Research Group (FSRG)

The Food Systems Research Group (FSRG) was developed to create new multi-disciplinary and inter-faculty research collaborations amongst University of Manitoba researchers within the broad area of Food Systems – more specifically – safe, healthy, just, and sustainable food systems. The ongoing focus of the FSRG will be on building research teams, research programs and student training. The overarching long term goal is to amass the necessary research expertise and research performance excellence such that this strategic theme becomes a University of Manitoba Signature Area.

Numerous individual researchers and research programs at the University of Manitoba are already addressing several facets of Food Systems, as represented by the breadth of inquiry encompassed in the strategic research theme title. What is currently lacking is a coordinated approach towards establishing new research partnerships and strengthening existing research collaborations through the exchange of information and pursuit of funding opportunities. FSRG will provide structure, support and defined avenues for exchanging ideas and information, pursuing new research initiatives, and training graduate students in this area.

FSRG is made up of researchers from multiple faculties at the University of Manitoba. The initial founding members represent four faculties – Environment, Earth, and Resources, Agricultural and Food Sciences, Arts and Science. Group members and research group activities will foster engagement with additional researchers, graduate students, post docs, research associates, internal research support personnel, as well as external community stakeholders. It is expected that the number of faculties directly involved, as well as the membership, will grow with time.

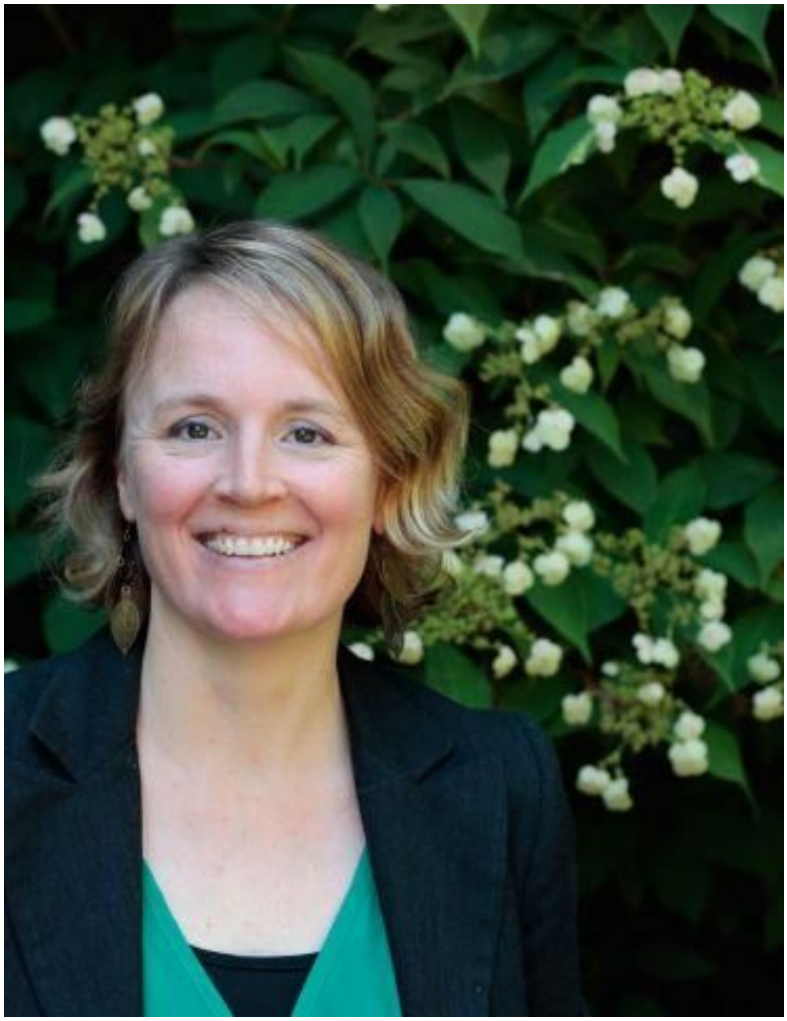
The Interim Director of this group is Iain Davidson-Hunt, Natural Resources Institute. Other founding members include Mark Belmonte and Teresa de Kievet (Science), Annette Desmarais and Derek Johnson (Arts), and Jim House, Martin Scanlon, Joyce Slater and Kim Ominski (Agriculture). Christine Rawluk is the coordinator for the Food Systems research group.

DAY-AT-A-GLANCE

Time	Program	Detail (T = Traditional; PK = PechaKucha)
8:25 - 8:55 am	Registration Opens	Pick up name tags, start poster set up, morning refreshments and snacks available
8:55 - 9:05 am	Opening Remarks	Laura Funk, Master of Arts in Sociology student, F3S organizing committee member *Day hosted by Winnipeg personality, Richard Michael Glade
9:05 - 10:05 am	Keynote Speech: Dr. Tara Moreau, University of British Columbia	Associate Director of Sustainability and Community Programs at UBC Botanical Gardens
10:05 - 10:35 am	Coffee Break & Poster Viewing	Casual poster viewing
10:35 - 12:05 pm	Student Presentations	10:35 - 10:55: Kurtis Ulrich (T) 10:55 – 11:10: Sean Scammell (PK) 11:10- 11:30: Ramandeep Kaur (T) 11:30 – 11:45: Uduak Edet (PK) 11:45 – 12:05: Hannah Bihun (T)
12:05 - 1:05 pm	Lunch & Poster Viewing	Judges circulating posters at this time.
1:05 - 2:35 pm	Student Presentations	1:05 – 1:25: Jess Nicksy (T) 1:25 – 1:40: Kaitlyn Duthie-Kannikkatt (PK) 1:40 – 2:00: Folarin Solademi (T) 2:00 – 2:15: Jeanger Labayen (PK) 2:15 – 2:35: Jeanette Sivilay (T)
2:35 - 3:05 pm	Coffee Break & Poster Viewing	Judges circulating posters at this time.
3:05 - 4:20 pm	Panel Discussion	Members of the Food Systems Research Group and Dr. Tara Moreau discuss their experience with collaborative, transdisciplinary research. Concludes with a question/discussion period.
4:20 - 4:45 pm	Award Ceremony	
4:45 - 5:00 pm	Closing Remarks	Dr. Iain Davidson-Hunt, FSRG Interim Director
5:00 - 8:00 pm	Networking Event	Daily Bread Café, St. John's College, 92 Dysart Rd.

Keynote Speaker

Dr. Tara Moreau – Associate Director of Sustainability and Community Programs at UBC Botanical Gardens



Dr. Tara Moreau is the Associate Director of Sustainability and Community Programs at UBC Botanical Gardens where she oversees educational programs, sustainability initiatives and community outreach. With over 15 years of experience including working as an international consultant for the UN-Food and Agriculture Organization, her goal is to advance local and global food systems and their sustainability. Her publications, presentations and educational programs relate to food systems, sustainability education, agriculture, biodiversity, and food policy across multiple jurisdictions.

Student Oral Presentation Abstracts

Traditional-style Presentations

Folarin Solademi, MNRN, Faculty of Environment, Earth, and Resources - Heavy Metals Pollution in Industrial/Residential Areas, Winnipeg: Implication on Food Safety and Security

Transportation and deposition of airborne heavy metals in soil and subsequent plant uptake have been widely reported in various studies in industrial and urban areas. Similarly, in the city of Winnipeg, the extreme concentration of Group 1-3 carcinogenic heavy metals in soil, notably Lead (Pb) above CCME guideline has been reported in neighborhoods proximate to industrial operations. Airborne heavy metals pollution reduces air and soil quality, low crop yield, soil-plant transfer, and food chain contamination. Consequently, the residents of South St. Boniface (SSB), a neighborhood adjacent to scrap metal recycling operations have raised concerns on the particulate emissions and potential heavy metal deposition in their gardens. This study measured daytime fine particulate matter ($PM_{2.5}$) using a Dylos laser particle counter in the Mission Industrial Area and SSB. Also, atmospheric deposition of heavy metals was measured by snow sampling collection in the industrial, commercial, residential, and background sampling point for ICP-MS laboratory analysis. The fine particulate matter ($PM_{2.5}$) monitoring results showed periods of exceedance two to three times above the CCME guideline (28 $\mu g/m^3$) in the industrial area, while the residential area monitoring result was below the guideline. The heavy metals analysis of the snow samples showed an increasing concentrations of Hg<Ar<Cd<Ni<Cr<Pb in the industrial area above the residential and background snow samples respectively. The findings of this study revealed that industrial emissions are a source of heavy metals soil pollution in a residential area and a threat to the sustainable growth of crops and vegetables in an urban landscape.

Jess Nicksy, MSc, Faculty of Agricultural and Food Sciences – Anthronutrients: Amendments for Closing Nutrient Cycles in Organically Managed Systems

Nutrients in food and human wastes that exit the food system can contribute to environmental problems like eutrophication in waterways and methane emission from landfills. When nutrients leave the system there is an increased need to import nutrients from outside at an additional environmental cost: from mined phosphorus or industrially fixed nitrogen, for example. Many organic growers face nutrient deficiency, especially of phosphorus, and system collapse over time as nutrients are exported from their farms in crops but largely do not return. Diverting more food and human waste products (ie.

"anthronutrients") back to farms will keep nutrients in the food system, reducing environmental harm and improving nutrient status of organic soils. My proposed research will evaluate amendments that contribute to "anthronutrient" cycling for their impact on plant and soil health, and in particular for their viability as phosphorus sources for organically managed soils. The amendments studied will include: struvite, a hydrated magnesium ammonium phosphate mineral that can be extracted from municipal wastewater; black soldier fly larvae frass, the waste product of larvae that have been used to process urban food waste; and anaerobically composted municipal green waste. Cycling anthronutrients back to farms contributes to sustainable food systems by turning the "waste" product of one process into the valuable input to another.

Ramandeep Kaur, MSc, Faculty of Agricultural and Food Sciences – Kgengwe (Citrullus Ianatus) Seeds: A Novel and Sustainable Functional Food with Potential Anti-Atherogenic Properties

Kgengwe, naturally found in the Kalahari Desert, is one of the underexplored fruits possessing cardio-protective potential. This wild fruit grows in desert areas and is consumed as staple in some African countries. Proximate analysis of Kgengwe seed powder (KSP) revealed protein, fat, digestible carbohydrates, total ash, and fiber to be 11%, 16%, 18%, 3% and 44%, respectively. While published data show these ingredients of soft wheat to be 10%, 1.3%, 87%, 1%, and 0.5%. Furthermore, KSP seems to be a good source of iron (139 ppm), zinc (92 ppm) and folic acid (14 mcg/100g) whereas one cup of raw spinach contains 57 mcg of folic acid. Kgengwe seeds could be considered as a staple food with functional potential. We tested the anti-atherogenic properties of KSP in male LDL-receptor knockout (LDL-r-KO) mice over 20 weeks. During the experimental course, body weight, food intake, cytokines levels, and plasma lipid levels were measured; atherosclerotic lesion size in the aortic roots was estimated. At weeks 0, 4, and 16, bacterial 16S rDNA was extracted from the fecal samples of mice to generate an amplified library for Illumina MiSeq sequencing. Our data showed that experimental diet had impacted the number and diversity of fecal bacteria. KSP diet significantly ($p<0.05$) decreased the atherosclerotic lesion size in the treated group. This change was associated with a significant increase in plasma level of Interleukin-10. Our data suggest that this wild melon can be introduced into the local food systems as a promising functional food.

Hannah Bihun, MA, Faculty of Environment, Earth, and Resources – Regenerating Agriculture: Becoming a Young Farmer in Manitoba, Canada

There is a growing crisis of generational renewal on farms in numerous countries. The average age of farmers is rising, many do not have succession plans, and some literature suggests that young people are leaving the countryside in droves. This narrative rings true in many countries of the Global North where agriculture is increasingly dominated by industrial large-scale

farming characterized by farm consolidation, debt economies, and concentration of capital. Since the mid-1980s, Canada, for example, has lost one-third of its farms, while the number of young farmers (15-34 years of age) has declined by 70% (Qualman et al., Under Review). The global trend of disappearing farmers is undeniable and critically important to address, yet little is known about the young farmers who are bucking this trend by choosing to stay in farming and the new entrants (first generation farmers), who have no farming background but opt to become farmers. This paper is part of an international research project on young people's pathways into agriculture in Canada, India, China, and Indonesia. Based on 60 qualitative interviews (with a diverse group of farmers that includes small, medium and large-scale farmers who use conventional, organic or alternative production methods and differing marketing strategies) in rural Manitoba, the paper offers a counter-narrative, that young people actually do want to farm and they are motivated by a variety of factors, including, a love for the work in farming and the lure of a quiet life in close proximity to nature. Our research highlights the different ways that first generation farmers and continuing young farmers get into farming, the factors and forces that helped them along the way, their challenges, and the strategies they adopt to remain on the land. Importantly, the article also examines the gender dimensions of farmers' motivations, challenges, and strategies to better understand the needs and interests of both young men and women. By analyzing the experiences of these young farmers with government policies, programs, and regulations, we conclude by addressing the role of government in supporting or hindering young farmers. As futures in agriculture for young people everywhere are becoming increasingly elusive, this research comes at a critical time, giving voice to those young people currently farming and seeking to inspire and enable future generations of farmers.

Kurtis Ulrich, MNRM, Faculty of Environment, Earth, and Resources – Crafting Sustainability Through Small, Local, Open and Connected Enterprises on the Canadian Prairies: The Case of Manitoban Craft Breweries

Craft beer is the fastest growing network of enterprises in the craft food and beverage sector of Manitoba, Canada. Craft breweries are emerging as a space that potentially links urban consumers to rural producers through ingredient sourcing chains. Our research considers whether craft breweries are resulting in small, local, open and connected (SLOC) craft food and beverage systems.

Through a series of interviews with craft brewers we found that there is a desire to source ingredients locally but that barriers exist. Challenges include a lack of consistent supply of regionally produced quality ingredients and the industrial scale of malting barley, which makes it difficult to preserve the identity of barley produced by small farmers. While craft brewers are supportive of a sourcing network linked to farmers in the region, this transition requires attention to adequately scaled malting enterprises and increased production by farmers of hops and barley in the region.

Jeanette Sivilay, MA, Faculty of Environment, Earth, and Resources – Communities of Resistance in Manitoba and the Potential for Food Sovereignty

Over the past decade, a number of high profile incidents impacting small scale farmers in Manitoba have given rise to vibrant communities of resistance that are developing alternative ways of thinking about and engaging with food and agriculture in the province. This presentation examines these catalytic moments and the conditions under which they form to better understand how they contribute to the creation of an emerging food sovereignty movement in Manitoba. I argue that although not all initiatives were successful in achieving stated goals, they did have positive political and social impacts, mainly through the building of community. By establishing relationships of trust and co-operation between farmers and eater allies, these communities of resistance leveraged opportunities for change and captured the attention of regulators to advance the local food community in Manitoba.

Pechakucha-style Presentations

Sean Scammell, MSc, Faculty of Engineering – Crafting a Local Food Production System with Innovative Technologies for Northern Canada

High food prices and low food quality are two major contributors to the food crisis in northern Canada. One effective method to address both contributors is to grow food locally in Northern communities. Given the harsh climates, remote locations, limited resources, and barren landscapes, growing food locally requires a multifaceted approach that includes innovative technologies, careful planning, and community ownership. This research focuses on integrating various innovations into a holistic food production system that can be modified and tailored for each community. There are five major components to this system: a containerized growing chamber, a solar energy greenhouse, an outdoor garden, a food storage system, and a waste composting system. All components of the system will work together to produce food all year round with minimal energy, water, and other external inputs. The composting system will be an especially crucial component of the system, as it will use waste materials in the community to provide the nutrients and medium needed for growing the food as many communities have very little fertile soil.

Uduak Edet, PhD, Faculty of Agricultural and Food Sciences – Remote Supervision of Autonomous Agricultural Machines: Concepts and Feasibility

As global population increases every year, so does the demand for quality and affordable food. Mobile agricultural machines like tractors, planters, combines, and sprayers have played a major role in ensuring that there is adequate food for this growing population. Due to this growing food demand, increased production cost, and decline in the workforce, agricultural machines have undergone several modifications to increase their productivity and safety. Today, farmers make use of advanced technology to perform various farm operations. Currently, agricultural machine manufacturers and researchers are working toward full automation; meaning that these machines will not require an operator to be physically present in the cabin of the machine. However, it is expected that the farmer will still need to monitor the operation of the machine to ensure its safety and efficiency. Several concepts had been proposed on how the machine will be remotely supervised, however, no consensus has yet been reached. This paper examines the benefits and shortcomings of the various remote supervision concepts gathered through literature and interview with design professional. A conceptual model for remote supervision has been developed based on the needs of the farming community, the scientific literature, and current technology capabilities.

Kaitlyn Duthie-Kannikkat, PhD, Faculty of Environment, Earth, and Resources – Cultivating Seed Sovereignty in Tarija, Bolivia

At the heart of campesino agricultural systems – indeed, all food production systems – is the humble seed. Seeds represent not only a critical input in a successful agricultural system; they also contain the technical and cultural knowledge of farming communities accumulated over generations. When there is autonomous control over a food system, campesino farmers can opt to save and grow their own seeds, thus reproducing those ancestral materials and values while exercising control over the social and economic conditions underpinning their food systems. In spite of the threats posed by historical and ongoing land alienation, many indigenous and campesino communities are actively working to (re)valorize their traditional food and seed systems using a variety of innovative tools as part an assertion of an endogenous vision for community food sovereignty.

This research explores how seed sovereignty is being practiced and articulated by campesino farmers in the community of Laderas Norte in Tarija, Bolivia. We look at how seed use has changed over time, in response to a variety of factors including climate change, personal preference shifts, urbanization, and agricultural development strategies at regional, national, and global scales. We explore the potential for an emerging literature on seed sovereignty to contribute to the broader thinking around food sovereignty and the creative undermining of colonial modernity. Situating community understandings of seed sovereignty within the socio-political dynamics in which they are embedded is critical to supporting the implementation of innovative institutional arrangements that can help communities realize their visions for autonomous seed systems.

Jeanger Labayen, MSc, Faculty of Engineering – Efficacy of Pre-treatments on Improving the Tensile Strength of Unwanted Textile and Paper Waste for Biodegradable Seedling Pots

The global population and industrial growth have caused the expansion of the clothing and textile industry that generates an alarming amount of unwanted textile. Landfilling of textile waste is a prevalent option that is deemed unsustainable. Promoting textile waste diversion from landfill demands options for possible recycling in promoting sustainability. This paper investigates the efficacy of using textile waste in the form of cotton (100% cotton) and polycotton (60% cotton/40% polyester) along with paper waste (corrugated cardboard and newspaper) to create a sustainable biodegradable seedling pot. As part of the study, the effect of pre-treatment on the tensile strength of the homogeneous waste pulp was investigated. Different concentrations of Sodium hydroxide (5%, 10%, and 20% for 5 hours soaked) and Sodium bicarbonate (5% and 10% for 5 hours and 24 hours soaked) were studied. Also, the

effect of compressive loads of 200 N and 500 N during pressing of homogeneous sheets were analyzed. Furthermore, the sheets were subjected to drying under different temperature and duration (40°C for 24 hours and 48 hours; 60°C for 24 hours, 48 hours, and 72 hours; and 105°C for 5 hours) to determine the optimum drying condition to improve the tensile strength. Tensile strength was deemed an important test because the forces exerted on the seedling container during the growing process are more likely tensile forces. A homogeneous sheet was prepared by first soaking the shredded waste into different concentrations of Sodium hydroxide and Sodium bicarbonate. After which, the waste was rinsed thoroughly using D.I. water until a neutral pH was reached. Then, the treated waste was transformed into pulp through hydro-pulping by using 1400 W kitchen blender. The waste pulp was formed into sheets (5 cm x 2.5 cm x 1 cm) by pressing at compression loads of 200 N and 500 N with 1 minute holding time by using Instron instrument equipped with Bluehill software. The tensile strength test was performed by using Lloyd instrument equipped with Nexygen plus software. The result of the study shows that pre-treatment of waste by using 5% NaOH soaked for 5 hours increased the specific tensile strength of homogenous sheets by 20%, 30%, and 37% for polycotton, cotton, and newspaper, respectively. However, the pre-treatment process does not improved the tensile strength for corrugated cardboard sheets. Also, increasing the compression force from 200 N to 500 N improves the tensile strength of sheets by 25-40%. Drying temperature and time suggest that drying of sheets at 105°C for 5 hours shows similar results in terms of tensile strength as with drying at 60°C for 72 hours and 48 hours. These findings were viewed valuable to consider in the preparation of biodegradable seedling pots that promotes sustainability which can be potentially used to germinate seedlings.

Student Poster Presentation abstracts

Emily Boonstra and Sydney Fortier, MSc, Faculty of Agricultural and Food Sciences – Environmental Impacts Associated with Removal of Productivity-Enhancing Technologies from the Canadian Beef Industry

Changes in local and global consumer demand have created both opportunities and challenges for the cattle industry. Canadian consumers and producers share a common value of providing a safe, healthy, nutrient rich diet, that is produced sustainably. Performance enhancing technologies (PETs) are technologies approved for use in the beef cattle industry to improve sustainability by increasing performance and growth efficiency. The use of PETs reduces the inputs required to produce more beef. There has been a shift towards the production of beef cattle without the use of PETs, because of the perceived food safety concerns. While the removal of PETs may allow for more markets to be explored, there could be some environmental consequences associated with the removal of these products. An assessment of the environmental implications of removing these products is necessary to provide science-based information that will assist consumers in making informed decisions about the food they eat.

Brandon hanson, MSc, Faculty of Agricultural and Food Sciences – Within and Between Animal Variation in Supplement Intake with the Use of a Novel Precision Feeding System for Beef Cattle

Survey data suggests that in Western Canada, approximately 62% of forage samples may not meet energy requirements for gestating beef cows in 2nd trimester of pregnancy. Individual supplementation via precision feeders would improve animal productivity and welfare. Over three, 14-d experimental periods, precision feeders were used to deliver and monitor consumption of the following supplements to 24 steers (375 kg; n=8 per pen): 1) supplementation of low protein forage (5.5% CP) with commercial pellets (1 kg hd-1d-1 with and without flavoring); 2) supplementation of low protein forage (5.5% CP) with processed pea screening powder (PPSP), sunflower screenings, and flax screenings provided at 0.57, 1.04, and 1.34 kg hd-1d-1, respectively; and 3) supplementation of low energy forage (41.4% TDN) with wheat screenings, wheat bran, and quinoa dockage all provided at 2.61 kg hd-1d-1. Feeding commercial pellets without flavoring resulted in within animal CVs (15.12% and 13.15%) and between animal CVs (14.78% and 12.68%) similar to pellets with flavoring (13.98% within and 12.85% between animal CV). Steers offered PPSP had significantly higher within and between animal CV (31.05% and 31.41%, respectively) than was observed for animals offered sunflower screenings (14.98% within and 18.30% between animal) and flax screenings (11.19% within and 16.03% between animal). Within and between animal CV was 6.99% and 7.14% for wheat screenings, 10.47% and 11.77% for wheat bran, and 10.07% and 10.42% for quinoa dockage.

Intake CV for almost all supplements was below 30%, indicating that precision feeders are an effective system to deliver supplements to individual animals.

Hannah Oduro-Obeng, PhD, Faculty of Agricultural and Food Sciences – Impact of Extrusion-cooking and Sheet and Cut Processing on Pasta Carotenoid Retention, Cooking Quality and Starch Properties

Pasta consumption has become very popular and is considered a main component of western diets. Quality including carotenoid content (as perceived by colour and appearance) associated with pasta products significantly drives consumer perceptions and purchasing power. However, ahead of this, quality is influenced by raw material composition, processing methods and other chemical components such as starch. Apart from the food matrix or raw material composition, processing plays a critical role in influencing the fate of food bioactives (including carotenoids) as food is cooked and digested to effect further bioactivity. In this study, two batches each of pasta were produced using the extrusion-cooking (E-C) and the sheet and cut (S&C) procedure (a method mostly used when preparing home-made pasta). Total carotenoid content (TCC), carotenoid profile and content (evaluated by peak area absorbance), cooking quality, colour and starch properties of pasta before and after cooking were subsequently evaluated. The two methods differed in some processing parameters including temperature (extrusion-cooking: max 103^{o}C and S&C: max 25^{o}C) whereas drying conditions (high temperature drying: 70^{o}C) were the same. Total carotenoid content (TCC) of pasta was determined spectrophotometrically. TCC did not significantly change ($P>0.05$) with cooking among E-C and S&C produced pasta but was 27.82% and 29.34% respectively lower relative to the control commercial sample. However, cooking significantly reduced all-trans-lutein, all-trans -zeaxanthin and 9-cis-lutein carotenoids among E-C and S&C samples. Further results indicated the S&C method was better at retaining all-trans-lutein, 13 and 13'-cis-lutein whereas E-C promoted the retention of all-trans-zeaxanthin, 9 and 9'-cis-lutein. Average cooking time was higher in E-C compared to S&C method (13 mins vs 9 mins respectively) and cooking loss averaged 33.31% and 10.64% for E-C and S&C, respectively compared to the control (6.49%). The cooking time and solid loss (%) observed with the S&C method likely resulted from the physicochemical changes in starch caused by processing, and hence release of carotenoids from S&C samples. Home-made pasta can be considered a reliable source for carotenoid nutrition in our diets.

Jiaur Rahman, MSc, Faculty of Agricultural and Food Sciences – Utilization of Brewer's Spent Grain through the Characterization of Bioactive Polyphenols

Thermal processing not only disrupts cell membranes and cell walls, but also cleaves covalent bonds releasing low molecular phenolics. This study examined the impact of various oven heat treatments (e.g. 0, 100, 140 and 160^{0}C) on the phenolic acids composition and antioxidant activities of brewers spent grain (BSG) meal. Heating the BSG at 160^{0}C resulted in a two fold increase in the total phenolic content (TPC, 87.0 ± 6.77 mg gallic acid equivalent (GAE)/ 100 g

defatted meal) and total flavonoid content (TFC, 16.15 ± 2.22 catechin equivalents (CE) /100 g defatted meal), respectively than untreated BSG extracts. Antioxidant activities of treated BSG extracts, determined by radical scavenging and ferric reducing antioxidant power (FRAP,) were significantly ($p < 0.5$) higher than the untreated BSG extracts. Eleven phenolic acids were identified and quantified by ultra performance liquid chromatography with photodiode array (UPLC-PDA) with their amounts varying significantly ($p < 0.5$) depending on the degree and length of toasting that the BSG defatted meal was subjected to. Chlorogenic acid was the predominant phenolic acid present in all fractions. This study found significant increases in TPC, TFC and individual phenolic acids as well as antioxidant activities of BSG extracts exposed to increasing oven temperatures. These results indicate that heat-treated processing releases bioactive phenolics from their bound forms due to breakdown of the covalent bonds, which may enhance the digestibility of BSG meal in the intestinal tract.

Rhea Teranishi, MSc, Faculty of Agricultural and Food Sciences – Enteric Methane Emissions from Pregnant Heifers as Affected by Multiple Methane Mitigation Dietary Strategies

The agriculture sector in Canada accounts for 8.5% of total emissions in 2016, and emissions from enteric fermentation, or digestion, accounts for 41% of total agriculture emissions (Environment Canada, 2018). The main greenhouse gas from enteric fermentation is methane, a potent greenhouse gas with a global warming potential 25 times that of carbon dioxide and has a 12-year atmospheric lifetime. Of the emissions from enteric fermentation, it is estimated that 84% are from cow-calf systems, mostly from breeding stock (Beauchemin et al., 2011). This highlights the importance of continued efforts to reduce emissions from this sector, with considerable potential for further reduction.

Strategies to reduce enteric emissions include changes in production practices including diet and manure management. Use of single dietary management strategies have been shown to reduce methane emissions by 10-15%. However, stacking or use of several dietary mitigation strategies that utilize different mitigation mechanisms may result in additive or synergistic benefit. Methane mitigation strategies to be examined include improving crude protein (CP) content, inclusion of a tannin containing hay, and addition of a by-product fat supplement. The outcomes of this research will contribute to the growing body of literature working to improve the environmental sustainability of the beef production system.

Lucien Cayer, MSc, Faculty of Agricultural and Food Sciences – Docosahexaenoic Acid (DHA) Derived Oxylipins are Decreased in the Heart by Dietary Exposure to 2-Monochloro-1,3-Propanediol

Chloropropanols (CP) have been identified as process-induced food contaminants, which occur as by-products of the manufacturing of refined food oils and hydrolyzed vegetable protein. There has been a paucity of research in understanding the hazard of the 2-monochloro-1,3-propanediol (2-MCPD isomer), thus forming a regulatory data gap for risk

assessment. Health Canada conducted a 90-day sub-chronic dietary exposure study in F344 rats and identified 2-MCPD as a cardiotoxin, while skeletal muscle was unaffected. Oxylipins are oxygenated metabolites of polyunsaturated fatty acids that can mediate cellular processes such as apoptosis, inflammation, and cell proliferation; and are emerging as potential biomarkers of toxicity. The main objective of this study was to understand the relationship between dietary 2-MCPD exposure and the oxylipin profile in rat heart and skeletal muscle to determine potential modes of action in these tissues. We conducted oxylipin analyses using HPLC-MS/MS in the hearts and skeletal muscles of male and female rats exposed to control and 2-MCPD (40 mg/kg BW) AIN-93G formulated diets for 90-days (Health Canada study). By comparison to the control, 5 of the 6 docosahexaenoic acid (DHA)-derived oxylipins were significantly lower in the 2-MCPD-treated hearts. In contrast, there were no alterations in oxylipin profiles between control and 2-MCPD-treated skeletal muscle. The DHA derived oxylipins are considered anti-inflammatory, and our results of their lower levels in the 2-MCPD-treated hearts suggests an inability to resolve marcrophage-induced inflammation and thus induce cardiotoxicity. This study provides a detailed profiling of oxylipins (in heart and skeletal muscle) and their potential roles as cardiotoxicity biomarkers of 2-MCPD and other chemical exposures.

Yidi Wang, MSc, Faculty of Agricultural and Food Sciences – Does Energy Dense Diet Affect Birth Outcomes in Rats with Prenatal Ethanol Exposure?

Prenatal ethanol (EtOH) exposure can result in a wide range of birth defects and developmental disabilities. Maternal diet differs in quality and quantity may be a key to alleviate prenatal EtOH effects. The study was designed to evaluate an energy dense diet on birth outcomes in rats exposed to EtOH during gestation. Pregnant Sprague-Dawley rats were assigned into 4 groups: chow, chow + EtOH (20%, v/v in drinking water), energy dense diet, and energy dense diet + EtOH. The energy dense diet was formulated to mimic diet consumption of pregnant women in North America, and had a higher calorie density than chow diet. At postnatal day (PD) 7, dams and pups were sacrificed, and blood and tissues were collected. EtOH groups had a significantly lower food intake ($P<0.0001$) and maternal weight gain ($P<0.05$), as well as a lower offspring body weight and brain weight at PD7 ($P<0.0001$) compared to non-EtOH groups. Dams and pups from energy dense diet with/without EtOH weighed significantly more than dams and pups from chow with/without EtOH ($P<0.05$). Pups from energy dense diet with/without EtOH also had a significantly higher liver weight ($P<0.05$) and plasma ALT level ($P<0.05$) compared to pups from chow with/without EtOH at PD7. Energy dense diet attenuated the loss of body weight but also increased plasma ALT level. This study indicates that pregnant women with poor diet and continue drinking alcohol will cause harm to their children, but the quality of maternal diet impacts birth outcomes. Improving food systems to deliver a healthy and nutritious diet is important.

Nikki Hawrylyshen, PhD, Faculty of Agricultural and Food Sciences – Connecting the Dots: Investigating the Relationship Between Determinants of Health and Food & Nutrition Security in Manitoba Youth

Purpose: Currently, knowledge of nutritional status and food security of Manitoban youth is limited. Although these have been identified as significant public health issues, there is a lack of data to inform program planning and policy development to address these issues in Manitoba. Food insecurity occurs when people do not have enough money to support a consistent food supply. Nutrition insecurity occurs when diets are not of adequate quality in terms of variety, nutrition content, or safety to meet the needs and preferences of an individual. Food security is a necessary but not sufficient condition for ensuring a healthy population; consuming a nutritious diet is equally important. The overlap of these two conditions present a double burden for vulnerable populations including children and youth. Food and nutrition insecurity increase population health inequities and the risk of poorer health and educational outcomes. As part of the Food and Nutrition Security in Manitoba Youth (FANS) research initiative, this study will examine the relationship between food and nutrition security status, social, health and educational outcomes. **Methods:** Manitoba grade nine students will complete the Food and Nutrition Security survey to determine dietary patterns, eating behaviours, and food security status. Data collection is occurring over the 2018-2019 school year. Survey results will be linked to administrative social, education, and health data. Data analysis will be conducted descriptively and using multi-level modelling. **Implications:** This will be the first study to assess food and nutrition insecurity in urban, rural, and northern Manitoban youth. The FANS research initiative includes over fifteen community, government, and academic partners and uses an integrated knowledge translation approach. Results will be used to develop a "report card" illustrating dietary quality, eating behaviours, and food security status of youth in Manitoba to inform future program and policy development. The data will also contribute to the growing body of evidence supporting schools as food systems and the opportunity they hold in preventing and mitigating food and nutrition insecurity in children and youth and the burden on the healthcare system from diet-related diseases.

Ravinder Singh, MSc, Faculty of Agricultural and Food Sciences – Effects of Carbon Dioxide Gas Assisted Extrusion Cooking on Physical Properties of Yellow Pea Puffed Snacks

Puffed snacks with high protein content face several drawbacks in their physical properties such as low extrudate expansion and high extrudate density. However, manipulation of extrusion processing conditions such as the use of blowing agents can provide effective ways to improve these physical properties. This study was undertaken to explore the impacts of carbon dioxide assisted extrusion cooking on physical properties of yellow pea extrudates (~22 % protein). Yellow pea flour was extruded at two moisture contents (16% and 18%) and carbon dioxide gas was injected at five different pressures (1, 2, 3, 4, and 5 bars). The die temperature and screw

speed were kept constant at 150°C and 200 rpm, respectively. The results showed an increasing trend in the expansion index and a decreasing trend in extrudate density with the use of carbon dioxide as a blowing agent. In addition, the cross-sectional microstructure of extrudates showed an increase in the number of air cells and a more uniform structure with carbon dioxide. Further, the increase in moisture content caused a decrease in expansion index and an increase in density of extrudates. Overall, this study demonstrated the effectiveness of the use of carbon dioxide as a blowing agent for the improvement of physical properties and microstructure of protein-rich extruded puffed snacks. Hence, this research can provide new ways to produce nutritionally-dense snack foods with improved physical characteristics and thus increased acceptability.

Navjot Kaur Brar, MSc, Faculty of Agricultural and Food Sciences – A Comparative Evaluation of Processing Yellow Peas (Pisum sativum L.) with Convective Hot Air and Superheated Steam

Canada is the largest producer of the yellow peas in the world. According to FAOSTAT Canada produces 2672895.65 tons of peas in year 2018. Yellow peas are low in sodium, high in protein and are an excellent source of both soluble and insoluble fiber, complex carbohydrates, B vitamins and minerals such as calcium, iron and potassium. Drying is a vital postharvest process for most agricultural products, also an important method of preventing post-harvest agricultural losses. Drying is often used as a final production step before selling or packaging the products. The common methods of drying are microwave drying, oven drying, hot air drying, freeze drying and superheated steam drying. Superheated drying is the type of steam generated by addition of sensible heat to saturated steam. Over the decades, researchers have established that superheated steam (SS) as a possible alternative of other drying methods. The SS drying has many advantages over conventional hot-air drying, such as lower net energy consumption; safe operation; limited oxidation of the dried product; enhanced product color; and the ability to pasteurize, sterilize, and deodorize the dried products especially for pulses, grains and grain products like soybean, oat groats, paddy and distillers spent grains. A comparative study on the functional and nutritional properties of yellow peas was conducted on two processing methods, hot air (HA) and superheated steam (SS). Peas are a good source of plant protein and are marketed as dry/split peas, soups, snack foods and high fiber breads and pasta. The efficacy of the two processing methods (HA and SS) was considered in the present study based on the properties of Manitoba-grown yellow peas. The evaluated properties included moisture content, drying properties, hydration capacity, cooking characteristics, protein content, and post processing pea's microstructure. The processing conditions showed significant effect($p<0.05$) on all the processed peas measured properties. The experiments were carried out at three processing temperatures (120, 135, 150° C) and velocity 1 m/s for both HA and SS with a 10 min processing time. Superheated steam caused a decrease in moisture content from 20% to 8.4 12.6% compared to HA, which was 6.3-9.1% for the selected operating conditions. The range of 12.6-27.7 %t for SS and 5.8-12.3 % for HA found an increase in

hydration capacity. Compared to HA processed peas for all cooking times (5, 10, 15 min), steam processed peas needed less compressive force in the Ottawa compression cage. The amount of protein denatured at 120, 135 and 150° C, respectively, was 1.20, 2.16 and 2.38 % for HA and 0.38, 0.44 and 0.75 % for SS. This study has therefore shown that peas can be successfully processed with the SS.

Acknowledgements

Organizing Committee

Presented by: **The Food Systems Research Group (University of Manitoba)**

Organized by graduate students: **Adam Franczyk, Hannah Bihun, Laura Funk, Roxie Koohgoli, Ajarat Adegun, and Md. Rafiqul Islam**

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