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Contents / Contenu

J_ID: ART NO: Date: 16-April-21 Page: 4 Total Pages: 8 Comments:

J_ID: ART NO: Date: 16-April-21 Page: 5 Total Pages: 8 Comments:

J_ID: ART NO: Date: 16-April-21 Page: 6 Total Pages: 8 Comments:

J_ID: ART NO: Date: 16-April-21 Page: 7 Total Pages: 8 Comments:

J_ID: ART NO: Date: 16-April-21 Page: 8 Total Pages: 8 Comments:

J_ID: ART NO: Date: 16-April-21 Page: 9 Total Pages: 8 Comments:

J_ID: ART NO: Date: 16-April-21 Page: 10 Total Pages: 8 Comments:

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ABSTRACTS

Developing a nutrient profiling model to align with the healthy eating recommendations of the Diabetes Canada Clinical Practice Guidelines

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An unhealthy diet is a critical modifiable risk factor for chronic diseases. The Diabetes Canada Clinical Practice (DCCP) Guidelines encourage healthy eating by recommending consumption of certain foods or nutrients (e.g., fruits and vegetables, fibre), while limiting the intake of others (e.g., high salt/sugar foods). However, many consumers find it challenging to interpret these recommendations. Nutrient profiling (NP) models are interpretative tools that set nutrient thresholds aligned with dietary guidelines, which can be used to guide consumers towards healthier food choices. To develop a NP model based on the healthy eating recommendations in the DCCP guidelines. A systematic methodology to assess foods in alignment with DCCP guidelines was developed, using the University of Toronto Food Label Information Program database 2017 (n=17,360 packaged foods and beverages). The DCCP-NP model categorizes individual food and beverage items into two categories (i.e., 'in alignment' and 'not in alignment') with the guidelines, based on specific nutrient thresholds (i.e., high-sodium, high-fat, high-sugar) or recommended food groups (e.g., whole grains). Products were categorized according to Health Canada's Table of Reference Amounts. The DCCP-NP model requires a 'pass' on all four steps to be considered 'in alignment' with this model: 1) exclude processed product (i.e., choosing whole and less refined foods); 2) lean animal protein (≤10% of total fat) and more vegetable protein; 3) low glycemic-index foods; and 4) foods without excessive saturated fats (≤9% daily value). Overall, 10% of packaged foods were 'in alignment' the DCCP-NP. Specifically, 77% of nuts/seeds, 46% of legumes, 31% of cereals, 23% of vegetables 17% of fruits, 13% of eggs, 12% of beverages, 11% of marine, 3% of dairy, 3% of potatoes, 2% of salads and 1% of processed meat were 'in alignment' with the DCCP-NP. This study developed the first NP model specific for an at-risk population. This indicates that very few packaged foods and beverages meet the standards in the DCCP guidelines, suggesting an overall low nutritional quality of the packaged food supply. People with diabetes can choose very few packaged foods and still follow the DCCP guidelines. (Sanofi Pasteur University of Toronto – Université Paris-Descartes Pilot Feasibility Collaborative Grant.)

Methionine and betaine as supplements to parenteral nutrition in neonatal pigs enhance phosphatidylcholine synthesis, while preventing hyperhomocysteinemia

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Parenteral nutrition (PN) is an effective way to deliver essential nutrients to patients who cannot meet nutritional requirements orally. However, in neonates, prolonged exposure to PN is associated with liver disease characterized by fat accumulation, possibly because of low phosphatidylcholine (PC) synthesis. Methionine is required to synthesize protein, PC, creatine, methylated DNA, as well as >50 other transmethylation reactions. Methionine can be remethylated from homocysteine using betaine or folate. However, supplementation of methionine to PN leads to hyperhomocysteinemia, so we hypothesized that betaine can be used to remethylate methionine to enhance PC synthesis, while reducing homocysteine levels. Therefore, we compared the effectiveness of PN supplemented with methionine and/or betaine on partitioning of methionine to PC, creatine and protein. Thirty-two Yucatan miniature piglets (8-12 days old) were fed complete PN for 8 d supplemented with: control (no betaine, 0.25 g/kg/d; methionine), betaine (235 mg/kg/d betaine), excess methionine (0.5 g/kg/d methionine), or betaine+excess methionine (235 mg/kg/d betaine; 0.5 g/kg/d methionine). On day 8, piglets were infused with [methyl-3H]-methionine for 6 h and tissues collected to measure [methyl-3H] incorporation into products. There was no significant effect among treatment groups for body weight or growth weight. Although fractional synthetic rates for protein, creatine or DNA were not affected by treatment, betatine+methionine increased PC synthesis. Moreover, plasma homocysteine was higher in the excess methionine group, but was normalized when betaine was added to the high methionine diet. In conclusion, adding betaine and excess methionine to PN increases PC synthesis, while limiting the accumulation of homocysteine during PN feeding; this novel strategy could help prevent PN-induced fatty liver. (CIHR.)

Diet quality, eating behaviours, and body weight status of newcomer Manitoba youth

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Diets that lack adequate variety, diversity, and nutrient content are linked to negative health outcomes including increased risk for chronic disease. Adolescents do not consume a nutritionally adequate diet and newcomer adolescents are at even greater risk due to sociodemographic, social, and individual factors. This research describes the diet quality, eating behaviours, and body weight status of newcomer adolescents. 1,587 grade nine students in 37 Manitoba schools completed a web-based survey that collected data on a 24-hour diet recall and food behaviours (Waterloo Eating Behaviour Questionnaire) and additional self-reported health questions. A sub-set of participants was defined as newcomers if they moved to Canada within seven years of their last birthday (n=302). Canada's Food Guide 2007 (CFG) and an adapted Healthy Eating Index – Canada were used to assess diet quality. BMI z-scores were calculated according to World Health Organization Growth Charts for Canada using self-reported height and weight. Descriptive statistics were used to determine frequencies and proportions. Chi-square tests were used to compare sex and gender differences. Results show that newcomer adolescents did not consume nutritionally adequate diets. Of newcomers in the study, 1.4%, 83.5%, and 15.1% ate a diet quality categorized as 'good', 'needs improvement', and 'poor', respectively. Except for grain products, newcomer adolescents did not meet minimum CFG serving recommendations. A greater proportion of males than females did not meet recommendations for vegetables and fruit and meat and alternatives. However, a greater proportion of females than males did not meet recommendations for milk and alternatives ($p<0.001$). BMI z-scores show that one fifth of females and almost one third of males were in the overweight and obese categories. Fewer newcomer participants (2.8% females; 6.9% males) were in the underweight category. However, more than one third of females and one quarter of males reported eating less than usual to try to lose weight. About one sixth of females and one third of males reported eating

more than usual to try to gain weight. Results from the study may be used to justify the need for and development of nutrition-related programming and policy intervention measures designed for newcomer youth. (CIHR.)

Investigating the mechanistic roles of oligofructose-enriched inulin in reducing body fat of overweight and obese children

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Prebiotics, which consist mostly of dietary fibre, are known to mitigate several metabolic diseases, including obesity. They stimulate the growth of beneficial gut microbiota and normalize metabolic reactions. A specific prebiotic known as oligofructose-enriched inulin demonstrated reduced body weight and improved fat metabolism in overweight and obese children. In this study, we aim to investigate novel mechanisms by which oligofructose-enriched inulin improved fat metabolism. Serum samples of overweight and obese children treated with oligofructose enriched inulin (n=22) or placebo group (n=20) from our previous clinical trial study underwent 1-Proton Nuclear Magnetic Resonance (1H-NMR) –based metabolomics. Raw 1H-NMR data were profiled using MagMet, a web system that automatically identifies and quantifies metabolites. We used MetaboAnalyst 4.0 for other bioinformatics and statistical analyses. A Partial Least Square Discriminant Analysis (PLS-DA) showed significant separation between the treatment groups (R2Y = 0.438, Q2 = 0.219 and p-value = 0.037). We identified ten significant metabolites based on the Variable Importance in Projection (VIP) score >1, including D-glucose, L-Lactic acid, L-Serine, L-Asparagine and Aspartate. Furthermore, pathway analysis revealed six metabolic pathways such as, Aminoacyl-tRNA biosynthesis, Arginine biosynthesis and Nitrogen metabolism, which might have been affected due to the prebiotic treatment. Thus, our data provide potential metabolic reactions involved in improving fat metabolism due to dietary fibre supplementation.

Associations between muscle dysmorphia and both eating disorders and exercise addiction among men in competitive bodybuilding in Atlantic Canada: a pilot study

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Evidence of an overlap between eating disorders, muscle dysmorphia, and exercise addiction is available, however this research has not traditionally included competitive bodybuilders. Since bodybuilding culture seems to encourage behaviours that are characteristic of these conditions/domains (e.g. bulking and cutting), there may be negative physiological and psychological health implications. The objective of this study was to explore the prevalence of, and associations between, eating disorders, muscle dysmorphia, and exercise addiction among competitive bodybuilding men in Atlantic Canada. We employed a novel content-validated online questionnaire, to screen for risk of select eating disorders (questions designed from the Diagnostic and Statistical Manual of Mental Disorders [DSM-5] criteria) and muscle dysmorphia (proposed DSM-5 criteria). Content validity included participants from the fields of dietetics and psychology (content validity index of 0.83 indicated acceptability for use). We also screened for exercise addiction using the validated Exercise Addiction Inventory. Men ≥19 years living in Nova Scotia, New Brunswick, Prince Edward Island, or Newfoundland and Labrador who had competed in bodybuilding in the past 3 years, were recruited via convenience sampling. On average, participants (n=28) were aged 34 ± 11 years, were in Newfoundland and Labrador (n=12) and Nova Scotia (n=10), were of Western European descent (n=20), had completed college or university (n=16), and had a total annual household income was between $50,000-$99,999 (n=12). Spearman's bivariate correlations were used to assess risk across domains. Of the 28 Atlantic Canadian bodybuilding men who participated in this study, 21%, 21%, and 100% were at risk for an eating disorder, muscle dysmorphia, and exercise addiction, respectively. Moderate positive correlations were identified between muscle dysmorphia and: anorexia nervosa (rho=0.519, p=0.005), bulimia nervosa (rho=0.453, p=0.015), and exercise addiction (rho=0.444, p=0.018). No other significant associations were found. Given the correlations between muscle dysmorphia and both eating disorders and exercise addiction, continued exploration is warranted. Monitoring this population post-competition may be an effective recovery strategy as participants transition back into regular diet and exercise behaviours. In addition, comparison of behaviours during competition preparation and non-preparation periods may illuminate potential risk of these related conditions. (Funding: Mount Saint Vincent University New Scholars Grant 165428.)

Carbon footprint of Canadian self-selected diets: comparing intake of food groups, nutrients, and diet quality among low- and high-GHGE diets

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Individuals' dietary choices are critical determinants of human and planetary health. Although the environmental impact of animal-based foods typically exceeds that of plants, trade-offs among nutritional outcomes and environmental sustainability in the context of self-selected diets are less understood. The objectives were to estimate the carbon footprint of Canadian self-selected diets and to compare low- and high-GHGE diets in terms of intake of food groups, nutrients, and diet quality. 24-h recalls from the 2015 Canadian Community Health Survey (CCHS) – Nutrition were used to determine dietary intake among adults ≥19 y (n = 13,612). Estimates from the database of Food Impacts on the Environment for Linking to Diets were used to link foods and beverages reported in the CCHS to their greenhouse gas emissions (GHGE). The study sample was divided into quintiles based on their dietary GHGE expressed per 1,000 kcal. Intake of food groups, nutrients, and diet quality based on the Alternative Healthy Eating Index – 2010 were compared between low- and high-GHGE diets (lowest and highest quintiles). Dietary GHGE (mean±SE) was 3.98±0.06 kg CO2-equivalents (eq) per person per d or 2.15±0.03 kg CO2-eq per person per 1,000 kcal. Animal-based foods contributed three-quarters of Canadians' total dietary GHGE, with red and processed meat alone accounting for 47.05±0.82%. Other top contributors were dairy (13.94±0.24%), miscellaneous foods and beverages (11.32±0.23%), poultry and eggs (9.15±0.30%) and vegetables and fruit (8.06±0.0.23%). High-GHGE diets contained more animal-based foods, but also more vegetables and fruits and miscellaneous foods and beverages; low-GHGE diets contained more cereals, grains, and breads. High-GHGE diet respondents had higher intakes of nutrients of public health concern (iron, potassium, calcium, and vitamin D), but also higher intakes of nutrients to limit (saturated fat and sodium). Moreover, low-GHGE diets had higher diet quality scores compared to high-GHGE diets (55.31±0.49 vs. 47.27±0.46 points; p<0.0001). Self-selected Canadian diets with the highest GHGE contained more animal-based foods and were characterized by higher intakes of nutrients of concern but a lower overall diet quality. These trade-offs warrant attention in shaping future food policy and dietary guidance in Canada aimed at meeting global targets for climate change.

Metabolism of omega-3 fatty acids in apolipoprotein E epsilon 4 carriers

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The main genetic risk factor for Alzheimer's disease is carrying the apolipoprotein E epsilon 4 allele (APOE4). Omega-3 fatty acids (FA) such as docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA) consumption has been shown to prevent cognitive decline. This is not seen in APOE4 carriers. Additionally, a study found the brain can take-in FA in the free fatty acid (FFA) and lyso-phosphatidylcholine (LPC) compartments. Our hypothesis was after omega-3 FA supplementation for six months, the concentration of DHA and EPA will not rise in APOE4 carriers in FFA and LPC lipid compartments. To test this, plasma total lipids in 25 APOE4 carriers and 25 non-carriers were extracted, then separated into different lipid compartments using thin-layer chromatography and analyzed using gas chromatography. Post-supplementation, DHA and EPA concentrations increased by 67-260 % in FFA and 93-380 % in LPC with no significant difference between genotypes although DHA and EPA concentrations tended to be greater in APOE4 carriers. To understand this trend, APOE4 carriers and non-carriers were split into low BMI (<25.2 kg/m^2) and high BMI (>25.2 kg/m^2) groups and Δconcentration (post – pre concentration) of DHA and EPA were calculated. There was a BMI effect for DHA and EPA in LPC. Individuals in the high BMI group had a smaller increase post-supplementation than the low BMI group for DHA and EPA in the LPC compartment ($p=0.0209$ and $p=0.0041$, respectively). For ΔDHA in FFA, there was a genotype by BMI interaction trend ($p=0.0816$). APOE4 carriers in the high BMI group had a greater increase in DHA concentration than APOE4 carriers in the low BMI group and non-carriers in both BMI groups. Based on our results both APOE4 carriers and non-carriers' omega-3 FA levels increase post-supplementation leading us to reject our hypothesis. However, based on the BMI by genotype interaction seen, APOE4 carriers with a high BMI seem to not utilize their omega-3 FA efficiently. (Funding: CIHR, Chaire CRMUS sur le métabolisme des acides lors du vieillissement, CdRV.)

Comparing nutritional science students scientific literacy skill development through literature critique activities in traditional in-class versus online course formats due to COVID-19

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Scientific literacy (SL) skill development is important in undergraduate nutritional science education and includes comprehension of scientific literature, problem solving using scientific knowledge, interpretation of scientific data, and integration of information. In a traditional in-person course (Fall 2019), we showed that students' SL skill perceptions and critical thinking capabilities were improved in response to an instructional emphasis on scientific literature critique activities and assessments. Due to the COVID-19 pandemic, the Fall 2020 course transitioned to an online format; however, it maintained the same instructional emphasis as the in-class course format. The objective of this study was to compare SL skill capability perceptions and practical skill acquisition in the traditional in-class format (Fall 2019, n=148) and online asynchronous format (Fall 2020, n=178) in a fourth-year nutritional science course. Two surveys were administered, one at the beginning and one at the end of the semester assessing students i) SL skill perceptions, ii) practical SL skills using the validated Test of Scientific Literacy Skills (TOSLS) questions, and iii) comprehension of the nutritional science primary literature. Students in both course formats showed significant improvements in their perceptions of their SL skill capabilities during the semester ($P<0.05$), although the magnitude of these improvement did not differ between course formats ($P>0.05$). Moreover, the overall TOSLS score (a test of practical SL skills) did not differ between course formats ($P=0.24$). Students perceptions of their ability to think critically about the content of a primary nutritional science paper was increased in both course formats; however, these improvements were significantly greater in the online format ($P=0.02$). Additionally, only students in the online course format reported an improvement in their comprehension of the methods used in primary nutritional science paper ($P=0.05$). Conversely, only students in the in-class course format reported a change in their approach to accessing the scientific literature by reading the entire paper versus only relying on the content in the abstract ($P<0.05$). Overall, these data demonstrate the similarity in nutritional science students' perceptions of SL and critical thinking skill competency in online learning versus in-class course formats due to the COVID-19 pandemic. (COESP, University of Guelph.)

Impact of COVID-19 on dietetics trainee perceptions of stress and anxiety in the emergency shift to online competence-based practicum training

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The COVID-19 pandemic impacted students in training to become Registered Dietitians who are still required to obtain the Partnership for Dietetic Education and Practice (PDEP) integrative competencies. As a result of the pandemic, an emergency shift from in-person to online practicum training and attainment of PDEP competencies was enforced. In the summer 2020 semester, students (n = 12) enrolled in the Master of Applied Nutrition (MAN) program at the University of Guelph were asked to complete an anonymous online survey. The survey inquired about i) their experiences with online dietetics practicum training, ii) the impact of COVID-19 on their acquisition of PDEP integrative competencies, and iii) their mental health and wellness. COVID-19 increased the workload of 83% of students in the program. The move to online practicum training was necessary for 92% of the students (67% entirely online, 33% a hybrid of online and in-person experience). In the new virtual placement/online training environment, 73% of students felt they were able to adequately gain PDEP competencies, and 67% of students agreed that virtual placements should be continued in dietetics training after the pandemic ends. Interestingly, 58% of students indicated that the pandemic would adversely impact their future job opportunities upon graduation, however, 42% saw a growth opportunity in private practice with virtual counselling. All students identified clear and critical roles for dietitians as frontline healthcare workers during the pandemic, however, 33% perceived that the contributions of dietitians during the pandemic are not recognized. With respect to mental health status, 92% indicated that their i) stress levels, ii) overall mental health, and iii) feelings of social isolation were adversely impacted by the pandemic. Furthermore, students perceived weekly stress levels were negatively correlated with their time management skills ($r=-0.61$, $P=0.023$), thereby indicating that students who were better able to manage their schedules in the online practicum training environment experienced less stress. These pilot data highlight the perceptions of online/virtual practicum placements and the mental

health challenges experienced by dietetic trainees during the COVID-19 pandemic.

Paracellular absorption across the colon is required for optimal calcium balance

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Calcium (Ca2+) is a vital dietary mineral with homeostasis maintained by interactions between intestinal absorption, renal reabsorption and bone mineralization. Intestinal and renal (re)absorption occurs via transcellular and paracellular pathways. Paracellular intestinal Ca2+ absorption occurs primarily in the small intestine while the colon has been postulated to contribute a negligible amount to overall homeostasis. Claudins are tight junction proteins which confer paracellular permeability properties to epithelia. Claudins-2 and -12 mediate Ca2+ permeability to intestinal and renal epithelial cell models. Deletion of either claudin gene in a mouse model does not result in a negative Ca2+ balance. We hypothesized that claudin-2 and claudin-12 form independent cation permeable pores in intestinal and renal epithelium, thereby enabling the maintenance of Ca2+ homeostasis. We generated claudin-2 and claudin-12 double knockout mice (DKO), which displayed a decreased Ca2+ balance due to reduced intestinal absorption and further increased urinary excretion than single knockout mice. Calcium permeability was not different across the small intestine but was significantly lower across the colon of DKO mice compared to wild-type. These perturbations resulted in lower serum ionized Ca2+ and markedly decreased bone mineralization. Consistent with each claudin forming an independent Ca2+ pore, claudin-2 and claudin-12 did not co-immunoprecipitate in cell culture, and colonic Ca2+ permeability of double knockout mice was further reduced than the individual knockouts. Together this data is consistent with claudin-2 and claudin-12 independently mediating paracellular colonic Ca2+ absorption, which is critical to maintaining Ca2+ homeostasis. (Funding: This work was funded by grants from the Women and Children's Health Research Institute, which is supported by the Stollery Children's Hospital Foundation, and the National Sciences and Engineering Research Council to RTA, who is the Canada Research Chair in Renal Epithelial Transport Physiology.)

Consumption of pulse-based meals improves lipid profile among sedentary office workers: a randomized clinical trial

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Sedentary office workers are at risk of developing health-related problems associated with long periods of sitting. Previous studies have shown that pulse-based meals (i.e., meals containing chickpeas, lentils, beans, or peas), which are low in glycemic index, are effective for alleviating cardiovascular disease risk factors. To date, no nutrition-based interventions have been carried out examining approaches to alleviate risk factors for diabetes and cardiovascular diseases, specifically targeting office workers exposed to long periods of sitting. Our objective was to determine whether improvements in cardiometabolic health occur when providing pulse-based meals to office workers. Using a randomized, single-blind, crossover design participants (n=26) were assigned to either: A pulse-based diet to replace their regular workplace meals OR their regular diet for 2 months, followed by a one-month washout and then crossed-over to the other diet for 2 months. Body composition (DEXA), waist circumference (WC), body weight, BMI, blood pressure, blood lipids (i.e., TC, LDL-C, HDL-C, TG, TC/HDL-C, LDL-C/HDL-C and TG/HDL-C) were measured before and after each of the two diet phases. Differences between the pulse-diet phase and the control phase were body weight (-0.2 kg), BMI (-0.1 kg/m^2), WC (-0.5 cm), systolic blood pressure (-0.3 mmHg), diastolic blood pressure (-0.5 mmHg), fat mass (-0.5 kg), trunk fat mass (0.2 kg), % fat (-0.6), lean tissue mass (0.4 kg), TC (-0.1 mmol/L), LDL-C (-0.2 mmol/L), HDL-C (0.1 mmol/L), TG (0 mmol/L). No statistically significant differences were apparent for any of these changes between diet phases; however, the pulse-based diet significantly decreased TC/HDL-C (-0.21, p=0.01), LDL-C/HDL-C (-0.2, p=0.03) and TG/HDL-C (-0.3, p=0.03) compared to the regular diet. These ratios (particularly TC/HDL) are better predictors of cardiovascular risk than the isolated parameters. Ready-to-eat packaged pulse-based meals can easily be incorporated as part of a healthy lifestyle to lower risk of CVD. (Funded by Weston Foundation, Saskatchewan Pulse Growers, and Saskatchewan Agriculture Development Fund.)

Using a group work contracts to reduce anxiety and facilitate collaborative learning in traditional face-to-face versus online distance education nutritional science course formats

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Group work (GW) is a critical component in undergraduate education to facilitate the development of communication and collaborative skills, which are required for the success of nutritional science students post-graduation. However, dysfunctional group dynamics and inequitable distribution of the workload between members can have adverse effects on skill development, leading to increased student anxiety. This research sought to determine the effectiveness of a Group Work Contract to facilitate the GW process in the traditional face-to-face lecture (In-Person Course; n=168) and online distance education (Online Course; n=105) formats of a third year nutritional science course. Changes in students' attitudes and approaches towards GW were assessed via online surveys before (semester week 4) and after (semester week 12) completion of the Group Work Contract and group assignment. Student anxiety was divided into two types of anxiety, the first being academic anxiety, which was experienced by 87% of the students in the In-Person Course and 95% of students in the Online Course. Over 75% of students in both course formats identified that the major sources of academic anxiety were unequal distribution of effort between group members and a lack of control over the influence of other group members on the final assignment grade. Secondly, social interaction anxiety was experienced by 45% of In-Person Course and 54% of Online Course students, with the predominant identified sources being not knowing their group members prior to the outset of the assignment and not knowing how to address the scenario of group members not completing their assigned tasks. Overall, the Group Work Contract reduced student anxiety and improved group dynamics and communication between group members, resulting in an improved learning experience overall in both course formats ($P<0.05$). The results in both course formats were similar, which is relevant given the shift to online learning due to the COVID-19 pandemic. This data demonstrates the benefits of formally structuring the GW process to optimize the student learning experience in nutritional science education. (COESP, University of Guelph.)

Evaluation of the Healthy Food Choice Index 2019 reflecting adherence to recommendations on food choices in Canada's Food Guide 2019

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Canada's Food Guide (CFG) 2019 includes dietary guidance on food choices and food-related behaviours. The Healthy Food Choice Index-2019 (HFCI-2019) is a scoring tool developed to measure adherence to the recommendations on food choice in CFG. The HFCI-2019 has 10 components, 5 based on the intake of foods, 1 on beverages, and 4 on nutrients, with the total score ranging from 0 to 80 points. Examination of the index's psychometric properties will inform its appropriate implementation. Accordingly, our objective was to evaluate the construct validity and internal consistency of the HFCI-2019. Data from the Canadian Community Health Survey (CCHS) – Nutrition 2015 were used to evaluate the performance of the HFCI-2019. Dietary intakes were measured using 24-hour dietary recalls. The distributions of usual (i.e., long-term average) total HFCI-2019 and its component subscores were estimated using the National Cancer Institute's Markov Chain Monte Carlo method. The mean HFCI-2019 was compared between smokers and non-smokers. The association between the total HFCI-2019 and energy intake was assessed using Pearson correlations. Multidimensionality was examined using principal component analysis. Cronbach's alpha assessed internal consistency. Associations between component scores and the residual HFCI-2019 (total HFCI-2019 minus the component assessed) were examined using Pearson correlations. The estimated mean HFCI-2019 for individuals 2 years and older living in Canada was 43.0 (95%CI, 42.6 to 43.5). The 1st and 99th percentiles were estimated to be 21.9 and 62.9 points, respectively, indicating sufficient variability among individuals. The estimated mean total HFCI-2019 for smokers was 7.1 points lower than for non-smokers (95%CI, 5.8 to 8.4). The HFCI-2019 was weakly correlated with energy intake (r=-0.13; 95%CI, -0.21 to -0.06). The principal component analysis revealed the first 4 dimensions accounted for 69% of the score variance. Cronbach's alpha was 0.66 (95%CI, 0.63 to 0.70). The correlations between each component subscore and the residual HFCI-2019 ranged from r=0.02 (sodium component; p=0.58) to r=0.52 (vegetables and fruit component; $p<0.0001$). The properties of the HFCI-2019 support its use to assess adherence to recommendations on food choices in CFG 2019. (Health Canada.)

COVID-19 pandemic's impact on an evaluation of the clinically managed weight loss program at the Wellness Institute at Seven Oaks General Hospital

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Obesity is a global health problem requiring evidence-based solutions. Many weight loss programs have been created to combat the obesity epidemic. However, in Manitoba, there are few evidence-based programs for individuals living with overweight or obesity. Thus, the Wellness Institute at Seven Oaks General Hospital created a personalized program based on a behavioural lifestyle modification approach, known as the weight loss clinic (WLC). Given the gap in evidence-based, professionally delivered clinical weight loss services in Canada, an evaluation was conducted to determine the effectiveness of the WLC at the Wellness Institute. The program is 17 weeks in duration and is delivered by an interdisciplinary team (physician-oversight, registered dietitian, Canadian Society for Exercise Physiology (CSEP)-certified personal trainer, and a cognitive behavioural therapist). Participants were recruited from January 2019 to August 2020. A total of 43 participants consented to participate with 22 participants included at the time of analysis in December 2020. Participants who completed the program (n=22) lost an average of 5.15 + 6.18 kg (p=0.0008) with a 1.97 + 2.33 reduction in percent body fat (p=0.0007). The impact of COVID-19 pandemic and lockdown restrictions impacted the in-person delivery and required pauses and unplanned transitions to virtual delivery. This resulted in a greater body weight loss in participants who completed the program before COVID-19 compared to those who completed during the pandemic (7.51 + 6.24 kg n=13 versus 1.75 + 4.43 kg n=9, p=0.020). As well as greater body fat percentage lost with 6.34 + 4.25 percent n=13 versus 2.33 + 5.08 percent n=9, p=0.09, respectively. The COVID-19 pandemic has created additional barriers to weight loss, including but not limited to, inconsistent in-person program delivery. Virtual weight loss support systems need to be created and evaluated, these would provide access to evidence-based clinical weight loss services in Canada that fill a gap in access to lifestyle services and are pandemic proof. (This evaluation was funded by the Mitacs Accelerate Program and the Chronic Disease Innovation Centre.)

Individual short chain fatty acids exert differential effects on inflammatory mediator gene expression in lipopolysaccharide and palmitic acid stimulated skeletal muscle cells

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Short chain fatty acids (SCFA) are produced by microbial fermentation of non-digestible carbohydrates (soluble fibre, oligosaccharides, resistant starch) and to a lesser degree from non-digested protein. Once absorbed into the host blood stream, SCFA have been shown to exert metabolic effects, including the suppression of lipid accumulation in adipose tissue and modulation of glucose transporter expression in skeletal muscle. Additionally, SCFA have been shown to downregulate the expression of inflammatory transcription factors within various immune cell populations, thereby suggesting anti-inflammatory effects; however, this has not been examined in skeletal muscle cells. Furthermore, SCFA differ in carbon number [(acetate (2 carbons), propionate (3 carbons) and butyrate (4 carbons)] and may exert differential effects, despite being frequently assumed to all function similarly. Therefore, we examined the effect of individual SCFA at a physiologically relevant levels on inflammatory mediator gene expression in skeletal muscle cells. To recapitulate obese skeletal muscle conditions (inflammation and fatty acid induced insulin resistance), rat L6 myotubes were stimulated with either lipopolysaccharide (LPS; 10 ng/mL) or palmitic acid (PA; 500 μg/mL) ± 2.5 mM of acetate, propionate or butyrate for 24 hours. As expected, LPS and PA stimulation increased inflammatory mediator gene expression compared to unstimulated control cell cultures. In response to LPS, the magnitude of the anti-inflammatory effects of each SCFA was related to carbon number, wherein butyrate reduced mRNA expression of TNF-α, IL-6 and MCP-1 compared to control-LPS stimulated cultures ($P<0.05$). Propionate exerted an intermediate effect, reducing mRNA expression of TNF-α and MCP-1, whereas acetate had no effect on inflammatory mediator expression. Additionally, both propionate and butyrate reduced mRNA expression of the LPS receptor TLR4 compared to control. In response

to PA stimulation, butyrate and propionate exerted similar anti-inflammatory effects by reducing mRNA expression of TNF-α, IL-6 and MCP-1, whereas acetate only reduced mRNA expression of IL-1β compared to control PA-stimulated cultures. Collectively, these data demonstrate that individual SCFA exert differential anti-inflammatory effects in response to LPS and PA stimulation in skeletal muscle cells. (NSERC.)

Intakes of nutrients and food categories in Canadian adolescents across levels of sugars intake: results from the Canadian Community Health Survey 2015 public use microdata file

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Dietary recommendations to reduce intake of sugars may influence choices of sugars-containing foods and therefore affect the intake of key micronutrients. The objective of the study was to compare the intakes of nutrients and food sources stratified by different intakes of sugars in Canadian adolescents. The first-day 24-h dietary recalls from young adolescents (aged 9-13 years, n=1,842) and older adolescents (aged 14-18 years, n=1,753) in the 2015 Canadian Community Health Survey-Nutrition Public Use Microdata File were used to compare intakes of nutrients and food categories across quintiles of total sugars [by %energy (%E)], after adjusting for misreporting and covariates. The average total sugars intake was 23.9 %E among Canadian young adolescents (13.5 %E for free sugars, 11.0 %E for added sugars), and 22.0 %E among older adolescents (12.9 %E for free sugars, 10.7%E for added sugars). In both age groups, those with moderate sugars intakes (quintile 3, Q3) had higher intakes of fruit, milk and fruit juice compared to those with low sugars intakes (Q1), reflecting higher intakes of vitamin C, as well as higher calcium and dietary fibre in older adolescents. Those with higher sugars intakes had higher potassium intakes in both groups. Adolescents in Q3 had higher intake of niacin, folate and zinc compared to Q5, possibly associated with higher intakes of pasta, rice, cereal grains and flour. Young adolescents in Q3 also had higher iron and phosphorus intakes compared to Q5, while older adolescents also had higher thiamin. Further, those with greater sugars intakes had lower intakes of sodium and cholesterol in both age groups, and saturated fat in young adolescents. In conclusion, Canadian adolescents with moderate intakes of sugars generally had greater intakes of key nutrients such as vitamin C, calcium, phosphorus and fibre and lower intakes of sodium and cholesterol relative to adolescents with either low or high intakes of sugars, which may principally result from greater intakes of fruit and milk. Therefore, a dietary pattern including a moderate sugars intake in adolescents may result in a more balanced nutrient profile compared to a diet with either low or high intakes.

Profile changes in the feline fecal metabolome with exposure to ambient temperature

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The feline fecal metabolome can provide key insight into the status of gastrointestinal and microbial health. Procedures for storing, handling, and analyzing fecal samples have not been standardized and are currently unclear, which may potentially impact results. This study's objective was to investigate the changes in the feline fecal metabolomic profile when fecal samples are exposed to ambient temperature over time. Eleven fecal samples were collected from 11 cats housed at a local boarding facility in Guelph, Ontario. Obtained samples were then manually homogenized and aliquoted in a laboratory. The first aliquot was frozen at -80°C within the first hour post-defecation while remaining samples were exposed to ambient temperature for 2, 4, 6, 8, 12, and 24 hours before being stored at -80°C. Fecal metabolites were quantified using proton nuclear magnetic resonance spectroscopy and grouped into six categories (27 amino acids, 8 fatty acids, 6 sugars, 2 alcohols, 2 nitrogenous bases, 4 miscellaneous). Repeated measures ANOVA and Bonferroni post-hoc paired t-tests were used to detect differences over and between each time point using $p \leq 0.05$. Twenty of the fifty metabolites showed significant differences in concentrations with exposure to ambient temperature. The earliest detected changes occurred six hours post-defecation. The exposure of fecal samples to ambient temperature altered the composition of the feline fecal metabolomic profile, but not all metabolites are affected uniformly. Changes in metabolites were not detected up to 4 hours post-defecation, further suggesting that exposure to ambient temperature short-term may have little effect on the metabolomic profile of feline feces up to this time point. Potential implications to study application may be temperature variance, particularly in areas with higher heat indexes and less optimal storage and handling methods.

The effects of supplemental arginine and citrulline in parenteral nutrition on structural and functional parameters of the intestine

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Parenteral nutrition (PN) is a lifesaving nutritional strategy used when infants cannot tolerate oral feeding, thus requiring an intravenous infusion of nutrients. Prolonged PN results in reduced blood flow to the gut, gut atrophy and reduced protein synthesis. Gut atrophy hinders the intestinal synthesis of arginine, a conditionally essential amino acid in neonates required for increasing blood flow to the gut via the synthesis of the vasodilator nitric oxide, further exacerbating the issue. Supplemental arginine to PN has some beneficial effects, but does not prevent gut atrophy or dysfunction. Albeit somewhat beneficial, supplemental arginine is rapidly broken down in the liver for the urea cycle. Therefore, we propose supplementing citrulline, an arginine precursor that is not extracted by the liver and a novel ingredient for PN, as a means to increase arginine availability. We hypothesize that citrulline supplementation to PN will enhance arginine availability, thereby increasing NO synthesis and gut blood flow, as well as improving gut protein synthesis and function, compared to arginine supplements. 7-10 day old Yucatan piglets received one of three nutritional interventions: control PN, arginine supplemented PN, or citrulline supplemented PN for six days. Blood flow to the gut was assessed using an ultrasonic probe surgically placed on the superior mesenteric artery and tissue specific protein synthesis was assessed using phenylalanine isotope kinetics. PN resulted in reductions in blood flow to the gut over time (p=0.009 control diet, p=0.04 arginine diet, p=0.039 citrulline diet), however, blood flow did not differ among treatments. Supplementing arginine to PN resulted in greater intestinal villus height than control (p=0.0032), suggesting that additional arginine in PN improved gut protein synthesis, thus leading to less PN-induced atrophy. This hypothesis will be confirmed by ongoing tissue-specific protein synthesis analyses. Supplemental citrulline in PN did not seem to improve arginine availability and associated outcomes. (CIHR, Janeway Research Foundation.)

Plasma free choline, betaine, and dimethylglycine do not differ following supplementation with folic acid or 5-methyltetrahydrofolate in Canadian pregnant women

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Requirement for folate and other methyl-nutrients (choline, betaine) increase during pregnancy to support accelerated growth and one-carbon metabolism. Both folate (as 5-methyltetrahydrofolate; 5-MTHF) and betaine act as methyl donors for the remethylation of homocysteine to methionine. Folic acid (synthetic folate) is recommended during pregnancy for prevention of neural tube defects, but the body's capacity to metabolize it is limited. Thus, it has been hypothesized that high intakes of folic acid may result in greater use of betaine for remethylation (and enhanced decline in plasma betaine levels). Whether the form of folate (folic acid vs. 5-MTHF) consumed during pregnancy alters maternal plasma concentrations of free choline and its metabolites (betaine and dimethylglycine) has yet to be investigated in humans. Pregnant women (n=30) were randomized to prenatal vitamins with 0.6 mg/day folic acid or 5-MTHF for 16-weeks, starting at 8-21 weeks gestation. Due to COVID-19, endline visits for n=12 participants were moved forward or postponed. The mean ± SD duration of supplementation for all was 16 ± 1.2 weeks. At baseline and endline, 3-hr fasting blood was collected and plasma free choline, betaine, and dimethylglycine quantified by HPLC-MSMS. Linear regression, adjusting for baseline values, weeks gestation at baseline, and duration of supplementation, was used to predict marginal means (95% CI) for endline concentrations of plasma biomarkers in each group. These analyses are part of an ongoing trial, thus folate groups have not yet been unblinded; groups are presented as "A" and "B". Baseline characteristics (ethnicity, pre-pregnancy BMI, age) were similar between groups. All participants consumed a standard prenatal vitamin prior to commencing the study, and adherence to supplementation was ≥80%. Marginal means (95% CI) at endline in group "A" and "B" were: free choline 9.8 (8.5-11.0) and 10.1 (8.8-11.4) μmol/L; betaine 14.7 (13.1-16.3) and 14.7 (13.0-16.4) μmol/L; and dimethylglycine 1.4 (1.2-1.6) and 1.5 (1.3-1.7) μmol/L, respectively, and were not different between folate groups (P>0.05). In this exploratory analysis among 30 Canadian pregnant women, folate form at the dose tested did not differentially alter maternal plasma concentrations of these one-carbon biomarkers. (Funding: Healthy Starts Catalyst Grant, BC Children's Hospital Research Institute, Vancouver, Canada.)

Are machine learning algorithms more accurate in predicting adequate vegetable and fruit consumption than traditional statistical models? An exploratory analysis

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Machine learning (ML) algorithms may help to better understand the complex interactions among factors and variables that influence dietary choices. The aim of this study was to test the hypothesis that ML algorithms are more accurate than traditional statistical models in predicting adequate vegetable and fruit (VF) consumption. A large array of variables (525) encompassing individual and environmental information related to dietary habits and food choices in a sample of 1147 French-speaking adult men and women was used for the purpose of this study. Adequate VF consumption, which was arbitrarily defined as 5 servings/d or more, was measured by averaging data from three web-based 24h recalls and used as the outcome to predict. Nine ML algorithms suited for classification were compared to two traditional statistical models, logistic regression and penalized regression (Lasso). Additionally, a series of adjustments were implemented and tested to improve the performance of the predictive ML algorithms, including normalizing the data, removing average consumers of VF (between 4.5 and 5.5 servings/d, n = 151) and using VF consumption obtained from a web-based food frequency questionnaire. Logistic regression and Lasso predicted adequate VF consumption with an accuracy of 0.64 (95%CI: 0.58-0.70) and 0.64 (95%CI: 0.60-0.68) respectively. Among the ML algorithms tested, the most accurate models to predict adequate VF consumption were the support vector machine (SVM) with either a radial basis kernel or a sigmoid kernel, both with an accuracy of 0.65 (95%CI: 0.59-0.71). The least accurate ML algorithm was the SVM with a linear kernel with an accuracy of 0.55 (95%CI: 0.49-0.61). Adjustments of the ML algorithms through different approaches did not increase their performance. In summary, ML algorithms did not perform better than more traditional statistical models to predict adequate VF consumption among adults. These results suggest that additional research is needed to explore further the true potential of ML in predicting dietary behaviours that are determined by complex interactions among several individual and environmental factors. (Fonds de recherche du Québec - Santé, IRSC.)

Changes in residential care dining practices due to the COVID-19 pandemic

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The COVID-19 pandemic has substantially impacted older adults living in residential care. Regulations and infection control protocols to limit the spread of COVID-19 have been implemented, which may have directly influenced many care practices, including mealtimes. This study examined residential care staffs' reported changes in dining practices from pre-pandemic to those initiated during the pandemic. An online survey was available from July to September 2020 and was disseminated through stakeholder networks and social media. The survey was completed by 1,036 respondents, primarily in food services or direct care (e.g., personal support worker, nurse, dietitian), from Canada (n = 645) and the US (n = 130). Respondents reported task versus relationship-focused dining practices that occurred in their home pre-pandemic (11 items; e.g., tray delivery in the dining room, volunteer/family mealtime support) and practices initiated during the pandemic (20 items; e.g., volunteer/family mealtime support, reduced meal choice). Descriptive statistics determined the prevalence of these dining practices. Pre-pandemic, most respondents reported pre-plated service to table from a servery or stationary steam table (64%). However, during the pandemic, many participants reported residents eating in their rooms (54%). Tray delivery to residents' rooms increased from 22% pre-pandemic to 53% during the pandemic.

Most commonly reported pandemic-initiated dining practices included: decreasing the number of residents in dining rooms (77%), keeping a 2-meter distance between residents (74%), and spacing residents throughout common areas for meals (69%). A large increase in disposable dishes, cups/glasses, and cutlery was reported from approximately 3% pre-pandemic up to 40% during the pandemic. Slightly more one-on-one staff-to-resident support was reported during the pandemic (33%) than pre-pandemic (27%); however, respondents' reports of family/volunteer mealtime support decreased from 75% pre-pandemic to 1% during the pandemic. Many respondents reported pandemic-initiated dining practices that involved physical distancing and other measures mandated to control infection spread. Assessing changes to dining practices is important to identify the impact of COVID-19 in residential care, and possible implications on residents' dining experiences and quality of life. Attention should be given to balancing safety measures and relationship-centered dining even during the pandemic. (Funded by Social Sciences and Humanities Research Council.)

Stakeholders' perspectives on relationship-centred and task-focused practices during mealtimes in residential care settings

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Mealtimes are highly anticipated events for residents in residential care settings and offer opportunities for staff to foster pleasant experiences and support food intake through relationship-centered care practices. However, task-focused practices that can negatively impact meal enjoyment and food intake may result from staff feeling pressured to complete multiple tasks during mealtimes. This study examined stakeholders' perspectives on mealtime practices in residential care settings. An online survey available in both English and French was developed by a team of researchers and clinicians and distributed between July and September 2020 through numerous stakeholder networks and social media. A total of 1,036 participants responded from Canada and the US, with the majority of respondents from Canada (83%). The survey provided a list of mealtime practices to examine common relationship-centered and task-focused practices at mealtimes, however, it was not explicitly stated whether a practice was task or relationship-centered to reduce potential social desirability bias. Descriptive statistics determined the prevalence of each relationship-centered and task-focused practice, and the sum of relationship-centered (max. = 15) and task-focused (max. = 11) dining practices. Respondents reported an average of 9.69 $\pm$ 2.96 relationship-centered and 4.89 $\pm$ 1.99 task-focused practices, respectively. Most commonly reported relationship-centered mealtime practices included: addressing residents by their preferred names (90%), making the dining room available outside of meals (80%), ensuring residents were well-positioned before providing eating assistance (79%), and encouraging family/friends' involvement during meals (79%). Respondents reported the most commonly occurring task-focused practices as: staff not eating or drinking at the table with residents (82%), residents having assigned seating (81%), and medication distribution during the meal service (70%) This data demonstrates that there is opportunity to improve relationship-centered activities and further decrease task-focused practices in residential care, as demonstrated by the moderate-low average numbers of both relationship and task-focused practices. Future studies investigating how to promote and sustain relationship-centered care during meals while considering influences at the home and policy level could further support positive meal experiences and resident food intake. (Funded by Social Sciences and Humanities Research Council.)

The effects of dairy and plant-based substitutes on glycemic regulation and satiety in healthy young adults

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Obesity continues to be one of the most prevalent health concerns over recent years. In Canada, obesity rates have continued to rise with 63.5% of Canadians being either overweight or obese. The 2019 Canadian Food Guide aims to combat these rising numbers and includes recommendations to reduce consumption of animal products and increase intake of plant-based foods. This has led to the development of plant-based substitutes for meat and dairy. However, regular consumption of dairy associates with improved body composition, as well as lowered T2D and obesity incidence. Experimental studies show that dairy proteins reduce glycemic responses and satiety more than plant proteins. The present study aims to compare dairy cheese and yogurt with their plant-based substitutes consumed immediately before a fixed size pasta meal on premeal and post-meal glycemia, insulin and appetite. In a randomized, crossover single-blinded experiment 12 healthy young adults (23.4 $\pm$ 2.5 y old; BMI 21.3 $\pm$ 1.9 kg/m^2) consumed one serving of Oikos Greek yogurt (175 g), Armstrong cheddar cheese (30 g), Daiya brand plant yogurt (175 g) or plant cheese (30 g) after a 12 h fast on 4 separate sessions. Blood glucose levels and subjective appetite were measured at baseline, post-treatment and every 15-30 min for 2 h after a fixed pasta meal. Blood glucose concentrations were lower after dairy consumption compared to plant-based substitutes at 40, 55, and 70 min post-meal ($P<0.001$, 0.007 and 0.03). However, the lower post-meal subjective appetite reflected an interaction ($P=0.035$) between dairy and plant substitutes with plant yogurt the lowest ($P=0.024$). The latter is low in protein but highest in calories, fat, and binders as well as many additives. These results indicate that premeal consumption of dairy improves glycemic regulation but while the effect of plant-based substitutes on glycemia is less, appetite was reduced most by plant-based yogurt. We conclude further exploration of the physiological functionality of dairy in comparison to their substitutes is required to add clarity to public health advice. (Funding: Supported by a contribution from the Dairy Research Cluster Initiative (Dairy Farmers of Canada, Agriculture and Agri-Food Canada, and the Canadian Dairy Commission).)

Femoral and abdominal subcutaneous exhibit more cellular senescence and stress than visceral adipose tissue in women with obesity and type 2 diabetes

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Introduction: Cellular senescence, cell growth cycle arrest, is a marker of cellular aging that has been associated with type 2 diabetes (T2DM). In obesity, different regional adipose tissue (AT) depots may have distinct effects on T2DM risk. Therefore, it is conceivable that different regions of AT have different senescent profiles which contribute uniquely to T2DM status. Objective: To determine regional differences

in markers of cellular senescence and how these compare in T2DM. Methods: Pre-menopausal females undergoing bariatric surgery were recruited as metabolically healthy (OB, n=5) or T2DM (DM, n=5). AT biopsies were acquired by needle aspiration (abdominal subcutaneous AT (abSAT) & thigh (thSAT)) or excised during surgery (visceral (V)AT). After AT digestion with collagenase, pre-adipocytes were isolated and cultured. Once confluent, cells were stained for senescence associated-β-galactosidase (SA-β-gal) activity, or immunofluorescence staining for quantification of H2AX (marker of DNA damage) and p53 & p21 (markers of committed senescent state). Results: In both groups, compared to VAT, abSAT had greater percent of positive cells for H2AX (OB: $p<0.01$, DM: p=0.28), number of p53 foci/total cell (OB: p=0.05, DM: p=0.01), and number of p53 foci per positive cells (OB: p=0.01, DM: p=0.05). Additionally, in the OB group, both abSAT and thSAT had more (abSAT: p=0.01, thSAT: p=0.02) p53 positive cells than VAT. In the DM group, abSAT had more (p=0.01) p53 positive cells than VAT. Regional differences in SA-β-gal activity were observed in the OB group only, where thSAT had greater activity than abSAT ($p<0.01$) and VAT (p=0.05). In the DM group only, both abSAT and thSAT had more (p=0.05) H2AX foci than VAT. Between groups, OB thSAT had greater ($p<0.01$ & $p<0.01$) p53 and p21 mean fluorescence than thSAT from the DM group. Higher (p=0.03) p53 fluorescence was also observed in abSAT from the OB vs. DM group. Conclusion: Preadipocytes from ab and th SAT depots appear to be more affected by cellular senescence and DNA damage than those from VAT. Though regional patterns of senescence and DNA damage were similar, more SAT preadipocytes from the OB group were in a committed senescent state than the DM group.

Effect of one cup and half cup of canned beans on fasting serum glucose, insulin and HOMA-IR in adults with hypercholesterolemia: a randomized controlled trial

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Beans are well known for their low glycemic index and nutrient-dense properties; however, the effect of daily consumption of canned beans on fasting glucose and insulin is not well studied. The objective of this study was to determine the effect of daily intakes of one cup (OCB) and half cup (HCB) of canned beans (black, navy, pinto, red kidney, white kidney) on secondary outcomes fasting glucose, insulin and estimated insulin resistance compared to a white rice (WR) control in hypercholesterolemic adults without diabetes. This study used a multi-centred, randomized, crossover study design (NCT03830970). A total of 73 adults (41 females, 32 males; 48.1±14.2 years old; body mass index: 25.9±4.2 kg/m^2; baseline fasting serum glucose: 4.89±4.1 mmol/L; baseline fasting serum insulin: 48.4±1.2 pmol/L; baseline HOMA-IR: 1.75±1.2; mean±SD) were randomized to consume OCB, HCB and WR for 28 days each, separated by ≥28-day washout periods. Participant flow through study completion was n=66 for OCB, n=68 for HCB and n=64 for WR. Fasting serum insulin and glucose were measured before (study day 1) and after (study day 29) each treatment period and the homeostasis model assessment of insulin resistance (HOMA-IR) was used to assess fasting insulin resistance. Data were compared on study day 1 using repeated measures ANOVA and on study day 29 using repeated measures ANCOVA including variation in study day 1 as a covariate and controlling for study centre. Results showed no significant differences in fasting serum glucose, fasting serum insulin or HOMA-IR on study day 1 between the OCB, HCB and WR treatments. Similarly, there were no significant differences in fasting serum glucose, fasting serum insulin or HOMA-IR on study day 29 (after controlling for variation in study day 1) between the OCB, HCB and WR treatments. These results suggest that canned beans do not affect fasting serum glucose, insulin or HOMA-IR in adults without diabetes; however, their effects in adults with prediabetes and diabetes warrants research. (Funded by the Canadian Agricultural Partnership Pulse Science Cluster Program.)

Nutrition care pathways: consensus-based guidance for adult patients transitioning from hospital-to-community and community-dwelling older adults

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Background: Malnutrition is prevalent among adult patients (≥18 years) transitioning from the hospital to the community and among community-dwelling older adults (≥65 years). Guidance on how to prevent, detect, and treat malnutrition in primary care and the community is limited. The purpose of this study was to develop evidence- and consensus-based nutrition care pathways that are feasible in diverse primary care and community models. Methods: An environmental scan of guidelines and a literature review of best-practice evidence published between 2009-2019 was performed using PubMed and CINAHL. Evidence was summarized into a background document and two draft pathways were created for: i) hospital-to-community transitions and ii) community-dwelling older adults. Materials were evaluated at a national stakeholder meeting with a group of diverse healthcare and social service providers (n=21). Notes from the stakeholder meeting were reviewed by the Primary Care Working Group of the Canadian Malnutrition Task Force (n=18) and used to revise the pathways. An online survey was developed to determine the relevance and importance of nutrition care practices, and to establish consensus for which practices should remain in the pathways. Consensus on relevance and importance of practices was set at ≥80%. Results: One hundred and twenty-eight resources were identified and used to develop the draft pathways. Two hundred and ninety-one Canadian participants completed the survey, including hospital providers (n=15), primary care and community providers (n=21), and dietitians from hospital, primary care, and community settings (n=255). Survey participants assigned ratings of ≥80% for relevance and importance for all practices, except for having community service providers monitor patient weight and appetite. As a result, these practices were removed from the final versions of the pathways. Conclusion: Two evidence- and consensus-based nutrition care pathways were developed to prevent, detect, and treat malnutrition among adult patients transitioning from the hospital to the community and community-dwelling older adults. The nutrition care practices were considered relevant and important by Canadian providers from diverse geographic settings, demonstrating their potential feasibility. Future research will focus on implementing and evaluating the nutrition care pathways in practice. (Funded by the Canadian Malnutrition Task Force and Canadian Nutrition Society.)

Glutathione supplementation to parenteral nutrition lowered markers of inflammation in the lungs of neonatal piglets

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Parenteral nutrition (PN) is a frequently used clinical strategy that provides nutrients to preterm infants who cannot tolerate enteral nutrition. However, PN is associated with increased oxidative stress and impaired immune function. In the NICU setting, nutrients in

PN solutions produce free radicals when exposed to light and ambient temperature. Furthermore, preterm infants typically require oxygen therapy, which contributes further oxidative stress in addition to that caused by PN. Newborns, particularly preterm infants, have limited endogenous antioxidant protective capacity. Therefore, adding antioxidants such as glutathione to PN may be beneficial to enhance antioxidant capacity. We hypothesized that supplementing glutathione to PN would reduce markers of inflammation, oxidative stress and would lead to greater protein synthesis in the lung. Yucatan miniature piglets (n=29, 8-12 days old) underwent surgical implantation of venous catheters; a gastric catheter was implanted to include an enterally-fed control group used to study the effect of the route of feeding on oxidative stress. Piglets were randomly assigned to either 1) control PN (C-PN, n=10), or 2) control PN supplemented with 10 μM glutathione disulfide (GSSG, n=9), or 3) control PN diet given enterally (EN, n=10). On day 7, thirty minutes before the necropsy, a flooding dose of D5-Phe was given to measure tissue specific protein synthesis. Oxidative stress markers in lung tissue (MDA level, ferric reducing antioxidant power (FRAP)), myeloperoxidase activity (MPO) and lung protein synthesis were determined. As predicted, MPO activity was significantly lower in the GSSG group compared to the C-PN group ($p<0.05$) but was not different from the EN group. This suggests that GSSG supplementation prevented neutrophil infiltration and inflammation that occurred with PN feeding. MDA levels ($p<0.05$) were significantly lower in the EN group compared to both PN groups. There were no differences in FRAP or protein synthesis among groups. Our data suggest that PN feeding induces neutrophil infiltration and lipid peroxidation in the lung, and that glutathione supplementation may protect against neutrophil-mediated inflammation. Glutathione could be a beneficial adjunctive therapy to PN, particularly for infants requiring supplemental oxygen. (Janeway Children's Hospital Foundation.)

Individual and environmental determinants of healthy diet among children exposed and unexposed to gestational diabetes mellitus

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Adopting a healthy diet during childhood could be a promising strategy to prevent obesity among high-risk children born from mother with gestational diabetes mellitus (GDM). However, there is a gap regarding determinants of diet quality among this population. Aim of this study was to identify individual and environmental determinants of diet quality among children exposed (GDM+) and unexposed (GDM-) to GDM in utero. Potential individual and environmental determinants of diet quality were selected based on the social ecological model. Mothers completed self-administered questionnaires to collect data on infant feeding practices, socioeconomic status, parity, food environment at home and perceived accessibility to healthy food. Dietary intake of children was assessed using two 24-hour dietary recall questionnaires. The Healthy eating index score adapted for the Canadian population (HEI-C) was calculated to evaluate diet quality of children. Weight and height were measured at the research center for both mother and child and body mass index (BMI) was calculated. Univariate regression models were computed to evaluate the association between potential determinants and the HEI-C score, with interaction term for GDM status and adjustment for children's age and sex. Multivariable model including all potential determinants was also conducted.A total of 142 children (104 GDM+ and 38 GDM-) were included. Mean age was 6.2 ± 2.5 years. Number of meals taken in family per day was associated differently with the HEI-C score between groups (p for interaction=0.02), with a positive association among GDM- but not among GDM+ children (β=9.97 and β=-0.41, respectively). Children's age (β=-1.45, 95%CI: -2.19, -0.72) and maternal education level (β=3.92, 95%CI: 0.35, 7.49) were determinants of the HEI-C score among all children, irrespective of the GDM exposure status. Meals taken in family are associated with higher diet quality among GDM- children but not among GDM+ children. Ultimately, post-partum follow-up reinforcing the importance to establish a healthy lifestyle environment at home for all members of the family should be considered by stakeholders and clinicians. (Danone Institute of Canada, Diabetes Canada and Fonds de recherche du Québec - Santé.)

Understanding the links between diet and food insecurity and mental health among immigrants

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There is a growing body of evidence that diet and nutrition influence individuals' mental health and psychological well-being. The diet-mental health relationship is understudied and is worth a thorough investigation among immigrants whose dietary practices and mental health can be impacted by various socio-economic, cultural and environmental factors, such as language and literacy issues, poverty and cultural practices. A systematic scoping review of 58 studies was conducted to explore the impact of diet quality, nutrition composition of diet and food insecurity and associated hunger on mental health and well-being of immigrants in the Western world (Canada, the US, Australia, New Zealand and Europe). The goal of this review is to inform the development of tailored, evidence-guided nutrition interventions and food policy that enhance nutritious eating and positive mental health outcomes amongst immigrants. Fruit/vegetable, unsaturated fat foods, whole grains and calcium/vitamin D rich food consumption was significantly associated with reduced depression, anxiety and psychological distress symptoms among immigrants through various pathways, including enhanced ability to stay physically active and improved self-esteem. Energy-dense foods and sugar-sweetened beverages were significantly associated with increased symptoms of anxiety, depression and psychological distress via multiple mechanisms, including tiredness, feelings of guilt and worry about acquiring diet-related chronic diseases. Food insecurity and associated hunger were significantly and positively associated with anxiety and depression among immigrants, with reported pathways including loneliness, insomnia, homesickness, family conflicts and being compelled to consume low-nutrient, poor-quality foods that did not meet their cultural dietary preferences and requirements. Community-engaged, mixed-method studies of immigrants are needed to comprehensively understand the links between diet, food insecurity and mental health of immigrants. This will help inform effective, culturally acceptable dietary interventions and nutrition programs that promote nutritious eating and improve mental health and well-being among immigrants. (This research was supported by the Social Sciences and Humanities Research Council of Canada.)

A higher frequency of pre-pregnancy yogurt intake is associated with a lower risk for poor maternal mental health symptoms at 24 weeks postpartum

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The consumption of dairy foods has been a prominent dietary recommendation before and during pregnancy to support optimal maternal health and infant development. However, specific recommendations

for dairy intake are largely absent in Canada's new Food Guide. The objective of this project was to determine the relationships of maternal dairy consumption before, during and after pregnancy with important maternal health outcomes. The Alberta Pregnancy Outcomes and Nutrition (APrON) study followed a cohort of nearly 2,200 pregnant women from 2009-2012 and collected dietary and health information, including anthropometric, mental health and pregnancy-related complication data. Food frequency questionnaires before pregnancy and 24-hour dietary recalls at each trimester and 3 months postpartum were used to estimate maternal dairy intake before, during and after pregnancy. Maternal complication scores were created by summing the occurrence of any pre-existing or pregnancy-related health conditions, including gestational diabetes, gestational hypertension and pre-eclampsia. Additionally, Edinburgh Postnatal Depression Scale (EPDS) scores from mothers at 12 and 24 weeks postpartum were included. Multivariate regression models, which controlled for potential confounding factors, were developed for statistical analysis. The average maternal intake of dairy increased by half a serving between the first (2.3 servings/day $\pm$1.5) and third (2.8 servings/day $\pm$1.7) trimesters ($p<0.001$). There were no significant relationships between milk, yogurt, cheese or total dairy intakes and gestational weight gain and maternal health complication scores. However, scoring lower on the EPDS at 24 weeks postpartum, which reflects having less symptoms consistent with postpartum depression and anxiety, was associated with a higher frequency of pre-pregnancy yogurt consumption (p=0.009). There was also a trend towards this relationship at 12 weeks postpartum (p=0.055). Results show that there was an association between increased self-reported pre-pregnancy yogurt intakes and a lower risk for poor maternal mental health symptoms at 24 weeks postpartum and that dairy intake was not significantly associated with the other included maternal health variables. These and future findings may guide pre-pregnancy, gestational and postpartum dairy recommendations. (Funded by Dairy Farmers of Canada, Summer Studentships from NSERC USRA and WCHRI; the APrON study was funded by Alberta Innovates.)

An examination of the effect of protein source on protein and nutrient quality of the diets of Canadian children

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Introduction: Dietary guidance and Canada's 2019 Food Guide encourages increased consumption of plant-based foods as a source of dietary protein. However, there is an absence of recent data on protein and nutrient intakes and quality of Canadian dietary patterns that might occur with increased plant protein intakes. The objective of this study was to examine and compare food sources and nutrient intakes reported by Canadian children within groups of increasing plant protein containing diets. Methods: The CCHS 2015 Public-Use Microdata File of single 24-hour dietary recalls of males and females 9 to 18 years (n=2,324) were examined to estimate total protein intake and protein intake from animal and plant-based foods. Respondents were allocated into four groups defined by their protein intake percentage coming from plant-based food sources (i.e., Group I: 0 – 24.9%, Group II: 25 – 49.9%, Group III: 50 – 74.9%, Group IV: 75 – 100%). Nutrient intakes, macro- and micronutrient amounts (g or μg/day), were identified within each plant protein consumption group and expressed as absolute values and amounts per 1000 kcal. Results: Protein intake in all children averaged 63.3% animal and 36.7% plant protein. In groups where plant protein contribution to total daily protein intake increased (groups 3 and 4) higher intakes of carbohydrate, dietary fibre ($p < 0.001$) and magnesium ($p < 0.05$) and lower intakes of protein, cholesterol, vitamin B12, zinc and saturated fat ($p < 0.0001$) as well as phosphorus, and riboflavin ($p < 0.001$) were recorded. In group 3 alone lower intakes of niacin ($p < 0.01$) and in group 4 lower intakes of total fat, vitamin D and MUFA ($p < 0.01$) and greater intakes of folate, iron and thiamin ($p < 0.01$) were reported. Nutrient intakes relative to specific age DRIs for males and females 9 to 13 and 14 to 18 years old as well as the top 10 foods consumed within each of the plant protein groupings will be reported. Conclusion: Balancing plant- with animal-based protein foods in children's diets result in favourable nutritional properties when compared to diets based on either high animal or high plant protein content. (Funding supported by the NSERC-PFSNRA.)

Parenteral nutrition supplemented with arginine and citrulline to improve systemic creatine availability

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Creatine is a key nutrient during infancy, as the creatine phosphate energy system is relied upon by the brain to rapidly restore energy pools and promote neurological development. In neonates, the vast majority of accrued creatine is endogenously synthesized from arginine, a conditionally essential amino acid dependent on gut metabolism. However, newborns with intestinal dysfunction may not tolerate oral feeding and must be fed total parenteral nutrition (TPN). Since TPN bypasses the gut, the infants are prone to gut atrophy which diminishes arginine synthesis, placing a strain on arginine and creatine availability. Unfortunately, supplemental arginine is rapidly catabolized by the liver and not available for the first step in creatine synthesis—arginine to guanidinoacetate in the kidney. However, supplemental citrulline, an arginine precursor, bypasses liver extraction and may lead to increased arginine availability to the kidney. The study's objective was to investigate supplemental citrulline's ability to increase creatine availability in TPN-fed neonates. We hypothesize that citrulline supplementation will facilitate creatine synthesis and availability to a greater extent than arginine supplementation during TPN. Yucatan miniature piglets (7-10 d old) were fed control TPN or TPN supplemented with arginine or citrulline. After 7 d on TPN, creatine concentration was measured by HPLC in portal, renal, and jugular veins, and the carotid artery to assess organ creatine balance across the small intestine, kidney and brain. Citrulline TPN reduced creatine levels in the carotid artery compared to other treatments ($p<0.0007$). Further, supplemental arginine resulted in higher creatine levels in the portal vein compared to the control treatment (p=0.0135), suggesting the gut can extract arterial arginine to make creatine. A net positive creatine balance across the gut and kidney was observed in the control and arginine treatment. Conversely, the citrulline treatment resulted in a net negative balance in the gut, suggesting citrulline is not an effective precursor for creatine synthesis by the gut. Creatine and guanidinoacetate status will also be assessed in the liver, kidney and brain to further understand creatine metabolism. Overall, it appears that citrulline is not an effective precursor for gut creatine synthesis when supplemented to TPN. (CIHR, Janeway Research Foundation.)

Western-diet induced dyslipidemia is attenuated by cranberry proanthocyanidins in C57BL/6 mice

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BACKGROUND & OBJECTIVE: Dyslipidemia, as a cardiometabolic complication resulting from a sedentary lifestyle and poor nutritional habits, is highly associated with the onset of cardiovascular disease, including insulin resistance, the metabolic syndrome,

diabetes and atherosclerosis. Both tissue-specific and circulation-wide dysregulation of the lipid metabolism are thus main points of interest for alleviating these cardiovascular complications. Presently, lifestyle modification and pharmacological agents constitute the recommended measures of intervention; yet functional foods represent a promising strategy for improving associated risks. APPROACH AND RESULTS: The aim of this present study was to examine the ability of cranberry proanthocyanidins (PC) to modulate dyslipidemia and improve related cardiometabolic complications. To this end, C57BL/6J mice were fed either a chow or a high-fat, high-sucrose (HFHS) diet. HFHS-fed mice were gavaged daily either with vehicle (water) or PC (200 mg/kg) for 12 weeks. PC prevented diet-induced obesity without any change in energy intake, while significantly improving blood lipids (triglyceridemia, total cholesterolemia and Non-HDL-c), lipoprotein composition (Chylomicrons, VLDL, LDL and HDL), glucose homeostasis and insulin sensitivity. Concomitantly, circulation-wide reduction of oxidative stress (malondialdehyde, isoprostanes) and inflammation (lipopolysaccharides) was observed. Liver composition was beneficially affected, as PC prevented both lipid lipogenesis and accumulation while stimulating markers of beta-oxydation (PGC1-a, PPARa and CPT1A). CONCLUSIONS: These findings suggest that PC are efficient phenolic phytochemicals, which are capable of blunting metabolic disorders associated with a wester-type diet in mice. Further studies are warranted in order to determine whether these beneficial effects are mediated by dysbiosis reversal and/or epigenetic modulation. (Supported by the Research Centre of the Sainte-Justine University Hospital, INAF and CIHR.)

Supplementation with 60 mg ferrous sulfate is superior to 18 mg ferrous bisglycinate in increasing ferritin concentrations in Cambodian women

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The WHO recommends 60 mg daily iron supplementation for 12 weeks in women where anemia prevalence is >40%, such as in Cambodia. However, if iron deficiency is not a significant cause of anemia, iron supplementation is unnecessary and high doses may be harmful. We aimed to determine if a newer, highly bioavailable iron amino acid chelate (ferrous bisglycinate) was as effective as the standard, commonly used form of iron (60 mg ferrous sulfate) in increasing ferritin concentrations, as compared to placebo. A 12-week double-blind, randomized controlled non-inferiority trial was conducted in Kampong Thom, Cambodia. A total of 480 non-pregnant women (18–45 y) from Kampong Thom, Cambodia, were randomized to receive one of three daily interventions: 60 mg elemental iron as ferrous sulfate, 18 mg ferrous bisglycinate, or placebo. Non-fasting blood samples were collected at baseline and endline. A complete blood count was performed using an automated hematology analyzer (Sysmex XN-1000), and serum ferritin was measured with ELISA and adjusted for inflammation. A mixed-effects generalized linear model was used to assess the effect of the interventions on ferritin concentration at 12 weeks. Trial retention at 12 weeks was 88% (n=421) and 62% (n=272/421) of women were ≥80% adherent to supplementation. Mean ± SD baseline hemoglobin (Hb) concentration was 129±12 g/L; anemia prevalence was 17% (n=80, Hb<120 g/L), with 69% of women (n=55) with mild anemia (Hb 110-119 g/L) and 71% (n=57) with microcytic anemia (MCV<80 fL). Median (IQR) ferritin concentration was 81 (43, 117) μg/L; iron deficiency prevalence was 6% (n=30, inflammation-adjusted ferritin<15 ug/L) and decreased to 2% (n=10) at 12 weeks. Marginal mean [95% CI] serum ferritin concentration at 12 weeks was significantly higher in the ferrous sulfate group (98.6 [94.7,102.6] μg/L, p<0.001) than in the ferrous bisglycinate (84.0 [79.9, 88.2] μg/L) and placebo groups (77.8 [73.9, 81.7] μg/L). Women in our study had a surprisingly low prevalence of anemia (17%) and iron deficiency (6%). The WHO standard 60 mg dose of ferrous sulfate was superior to 18 mg ferrous bisglycinate in increasing ferritin concentrations, in our population of predominantly iron-replete non-anemic Cambodian women. (Funding source: CIHR project grant.)

How many diet related NCDs deaths could be averted or delayed if Canadians would reduce their calorie consumption derived from free sugars intake? A macrosimulation modeling study

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Background: Free sugars are a major source of calories in diets and contribute to the burden of many noncommunicable diseases (NCDs). The World Health Organization (WHO) recommends reducing free sugars intake to less than 10% of energy. Canadians' overall mean free sugars intake was estimated at 12.1% of total calories in CCHS 2015. Reducing intakes to the recommended levels (10%), through a systematic 20% reduction of free sugars content of foods and beverages would lead to 3.2% reduction in calorie intake. However, the potential health impact of such reductions in calorie intake from lower free sugars intake has not been determined in Canada. Objective: This study aimed to estimate how many diet related NCD deaths could be averted or delayed if Canadians were to reduce their calorie intake, as a result of a systematic 20% reduction of the free sugars content of food and beverages in Canada. Methods: The Preventable Risk Integrated ModEl (PRIME) was used for this study. Inputs for the model included Canadian age- and sex-specific data on actual calorie intake (baseline scenario), calorie intake after modelling a systematic 20% reduction of free sugars content in foods and beverages (counterfactual scenario), body mass index (BMI), mortality data from diet related NCDs, and population demographics for the year 2019. Results: An estimated 6,770 (95% CI 6,184-7,333) deaths per year could be averted or delayed due to diet related NCDs, mostly from cardiovascular diseases (66.3%). This estimation represents 7.5% of the total number of deaths from the diseases under study that could be prevented as a result of reducing Canadians' calorie consumption. More lives would be saved for men than women. Conclusion: A 20% reduction of free sugars content in foods and beverages led to only a 3.2% reduction in calorie intake, yet 7.5% of diet related NCD deaths could have been prevented in Canada. A cost-effectiveness analyses could provide further evidence to support the implementation of policies aimed at reducing Canadians' free sugars intake, such as proposing target levels for free sugars content in key food categories, front-of-pack labeling and sugar-sweetened beverages taxes. (Funding: CIHR.)

The bioprotective effects of glycomacropeptide, a milk-derived peptide, in a mouse model of metabolic syndrome

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INTRODUCTION: Metabolic syndrome (MetS) has reached epidemic proportions worldwide and constitutes frightful threats to health

as it increases the risk of type 2 diabetes, non-alcoholic fatty liver disease and cardiovascular diseases. Inflammation and oxidative stress (OxS) are well-known processes associated with excess body weight and insulin resistance (IR). On the other hand, adiponectin, a beneficial adipose tissue adipokine, attenuates IR via its action on inflammation, OxS and lipid accumulation in metabolic tissues. The objective of the present work is to evaluate whether glycomacropeptide (GMP), a bioactive milk-derived peptide, may serve as an effective agent to fight MetS. HYPOTHESIS AND OBJECTIVES: As our group recently revealed GMP ability to exert powerful anti-inflammatory and antioxidative activities in an in vitro model, we hypothesize that GMP exerts protective effects against MetS components in a preclinical model. We also postulate that GMP may trigger insulin-sensitizing mechanisms, including transcription factors and adiponectin status. METHODS: C57BL/6J mice were fed either a chow or a high-fat, high-fructose (HFHF) diet. HFHF-fed mice were gavaged daily either with vehicle or GMP (200 mg/kg) for 12 weeks. Plasma and liver were collected to evaluate IR, hepatic lipid accumulation and high molecular weight (HMW) adiponectin levels. RESULTS: GMP supplementation attenuated IR as demonstrated by decreased plasma blood glucose and insulin levels, leading to a lowered HOMA-IR index. In the liver, GMP enhanced AKT phosphorylation and phosphoAKT/AKT ratio, indicating greater insulin sensitivity. Lipid peroxidation estimation revealed a decrease in malondialdehyde in plasma and an elevation of glutathione peroxidase in liver, suggesting reduced OxS in HFHF+GMP group. Furthermore, GMP administration counteracted liver inflammation as noted by the diminution of the gene expression of COX-2, TNF-alpha, IL-6 and NF-κB. Moreover, GMP limited hepatic lipid accumulation by reducing triglycerides and total cholesterol content. Importantly, GMP upregulated HMW adiponectin concentration in plasma. CONCLUSION: Our findings demonstrate preventive effects of GMP on IR via its actions on OxS, inflammation and hepatic lipid accumulation. Additional efforts are needed to elucidate the mechanisms of action, including the metabolic behavior of transcription factors and adipokines. (Dairy Farmers of Canada & JA deSève Research Chair in nutrition.)

Exploring dietary intake and perception of muscle loss among cancer survivors: a preliminary analysis

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Optimal nutrition can help prevent muscle loss, a prevalent condition in cancer leading to morbidity and mortality. Muscle mass assessment is not yet standard of practice; therefore, perception of muscle loss is emerging as an important patient-reported outcome. Our objective was to characterize macronutrient distribution and determine if dietary intake was different by, and presence of nutrition impact symptoms was associated with, perceived muscle loss. People diagnosed with breast or colorectal cancer within the past 18 months completed the online Diet History Questionnaire III as part of a larger study. Oncology recommendations for minimum protein and energy intakes were translated to protein as a percent of total energy (19% kcal from protein). Participants reported nutrition impact symptoms from the Patient Generated Subjective Global Assessment (PG-SGA) Short Form and perceived muscle loss over the preceding month. Descriptive analysis (mean±SD) and robust ANOVA based on 20% trimmed means or Cramér's V were used. Preliminary data included N=32, age=62±13 years; 81.2% females. Breast was the predominant tumor site (65.6%), 56.3% reported stage 1 disease, and 40.6% felt they had lost muscle. Mean protein, carbohydrate, and fat intakes were 16±3%, 47±6%, and 35±5% kcal, respectively. Protein intake (% kcal) was significantly lower than oncology standards ($p<0.001$) but not different by self-reported muscle loss ($p=0.994$) or tumor type ($p=0.102$). Carbohydrate intake (% kcal) was higher for those that reported muscle loss compared to those who did not ($p=0.045$) and for those with stage 1 compared to stage 3 disease ($p=0.026$). Fat intake (% kcal) did not differ based on muscle loss perception although saturated fat intake (% kcal) was significantly higher in the colorectal cancer group ($p=0.039$). No sex differences were found for dietary intake. Nutrition impact symptoms over the previous month were reported by 43.8%. A medium strength of association (Cramér's V: 0.560) emerged between the presence of nutrition impact symptoms and reported muscle loss. In this preliminary analysis, few measures of dietary intake differed based on perception of muscle loss, although this should be interpreted with caution due to the small sample size. Nonetheless, clinical relevance of these patient-reported outcomes should be considered.

Characteristics of vulnerable women and their association with participation in a Canada Prenatal Nutrition Program site in Toronto

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The federally funded Canada Prenatal Nutrition Program (CPNP) provides support for community organizations to provide maternal-infant health services for socially and/or economically vulnerable women. As part of our research program exploring opportunities to provide postnatal breastfeeding support through the CPNP, we investigated the sociodemographic and psychosocial characteristics of clients enrolled in a Toronto CPNP site and explored associations with participation. Data were collected retrospectively from charts of 339 women registered in one southwest Toronto CPNP site from 2013-2016. Maternal characteristics that were investigated included: age, number of years in Canada, refugee status, history of mental illness, education, marital status, number of children, food deprivation during pregnancy, Ontario Health Insurance Program coverage and household income. Multivariable regression analyses were used to assess associations between these 10 maternal characteristics and three dimensions of program participation: initiation (gestational age at enrollment, weeks), intensity (number of times one-on-one supports were received) and duration (number of program visits). The mean (SD) age of clients was 31 (5.7) years, 80% were born outside of Canada and 65% had household incomes below the Statistics Canada Low-Income Cut-Off. Overall, household income was the only characteristic associated with all three dimensions of program participation. Clients with household incomes below the Low-Income Cut-Off (versus above) enrolled 2.85 weeks earlier (95% CI: -5.55 to -0.16), had 1.3 times higher incidence of one-on-one supports (95% CI: 1.03 to 1.61) and 1.3 times higher incidence of program visits (95% CI: 1.02 to 1.63). Our findings suggest this CPNP site is serving vulnerable women, with few differences in participation based on maternal characteristics. This research contributes evidence to guide service provision and ongoing monitoring decisions at this program site. Further research is needed to explore new program delivery models as a means to enhance perinatal services for vulnerable women. (Funding: The Sprott Foundation, Joannah & Brian Lawson Centre for Child Nutrition, Ontario Graduate Scholarship and Peterborough K. M. Hunter Charitable Foundation Graduate Award.)

An assessment of the food and beverage content of nutrition-themed apps intended for children

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Background: Children increasingly use mobile apps, many of which use gaming features or food themes to maximize engagement. However, the type of food and beverage content that children are exposed to while using these apps is unknown. It is also unclear if different types of nutrition-themed apps (i.e., games vs non-games) influence the presence of food and beverage content not recommended by Canada's Food Guide (CFG). Objectives: To investigate whether nutrition-themed food game apps intended for children display food and beverage content not recommended by CFG compared to nutrition-themed non-game apps. Methods: Between May 2018 to June 2019, nutrition-themed apps intended for children (≤12 years) were systematically identified and screened (n=2,575) in the Apple App and Google Play stores, and evaluated and classified (n=259) into food game (n=162) and non-game apps (n=97, i.e., nutrition guide, habit tracker, other). Food and beverage content displayed was classified into sixteen food and beverage categories; and, as recommended (n=8) and not recommended (n=8) by CFG. Food and beverage content was calculated by app type using descriptive statistics. A binomial logistic regression assessed whether game-based apps were associated with foods and beverages not recommended by CFG. Chi-square tested for differences in proportions of content in food game apps and non-game apps by food and beverage category. Results: Nutrition-themed apps included a median of six (IQR=3) foods and beverages, with 76% of apps displaying at least one food or beverage not recommended by CFG. Within app types, 94% (n=152/162) food game apps and 65% (n=46/97) non-food game apps showed at least one food or beverage not recommended. Food game apps were strongly associated with content not recommended by CFG vs. non-game apps (β=2.8, $p<0.001$). At category level, sugary foods such as chocolates/candies and desserts were more often displayed in food game apps compared to non-game apps (67% vs 26%, $p<0.001$; and 46% vs 29%, p=0.008, respectively). Conclusion: Findings suggest nutrition-themed apps intended for children displayed food and beverage content not recommended by CFG, with gaming apps more likely to display content not recommended by CFG than their non-game counterparts. (Funding: Ontario Research Fund – Research Excellence.)

Does the provision of dairy foods affect snacking patterns in adolescent girls with overweight and obesity undergoing a lifestyle modification intervention?

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Dairy food consumption is beneficial for musculoskeletal health and nutrient intake in adolescent girls with overweight and obesity (OW/OB). Nonetheless, adolescent girls typically under-consume dairy foods. Snacks can be a large contributor to daily energy and nutrient intakes in adolescents. Thus, consuming dairy foods as snacks may be a beneficial strategy to improve snacking quality and increase dairy consumption in this population. The objective of this study was to examine how the provision of dairy foods versus no dairy foods, with healthy eating advice, influences snacking behaviours (i.e., frequency, size, food type) in female adolescents with OW/OB. Seven-day food records were analyzed at weeks 0 and 12 from participants in the IDEAL for Adolescents Study: a diet and exercise parallel randomized intervention trial for weight management. Female adolescents with OW/OB were randomly allocated to a low dairy group (LDa; n=23; 14.9±2.3 years) or a recommended dairy group (RDa; n=24; 14.7±2.2 years). Both groups received dietary advice from a registered dietitian and exercised 3x/week. RDa was provided with 4 servings/day of mixed dairy foods, while LDa maintained their habitually low dairy diet. RDa was not specifically instructed on how to consume dairy products. RDa consumed more absolute energy (kcal) from snacks at both timepoints (p=0.03), with no change in energy intake in either group over time (p=0.23). Snacking frequency (snacks/day) increased and energy intake per snack (kcal/snack) decreased at week 12 in both groups ($p<0.05$). RDa increased percent of snack energy intake from dairy (RDa: +56±32%; LDa: -4±9%), and decreased sugar-sweetened beverages (RDa: -18±24%; LDa: -3±15%) intake more than LDa ($p<0.05$). LDa increased percent of snack energy intake from meat and alternatives (LDa: +21±29%; RDa +3±14%), and fruits and vegetables (LDa: +15±29%; RDa -3±26%) and decreased processed food (LDa: -12±20%; RDa: –3 ± 10%) intake more than RDa ($p<0.05$). In conclusion, dietary advice with (RDa) or without (LDa) dairy provision increased snacking frequency, decreased energy per snack, and improved snack food type. Dairy provision can be an effective way to improve snacking behaviours during a monitored lifestyle intervention for adolescent girls with OW/OB. (Supported by Dairy Management Inc., Dairy Farmers of Canada.)

Measuring children's knowledge of Canada's Food Guide: Nutrition Attitudes and Knowledge Questionnaire

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Background: Few engaging digital tools to support children's understanding of the 2019 Canada's Food Guide (CFG). While our research team developed a mobile serious game application (Foodbot Factory) to teach children about the CFG healthy eating principles, there are no measurement tools to assess children's knowledge of the CFG after using Foodbot Factory. Objective: To develop and validate a Nutrition Attitudes and Knowledge (NAK) questionnaire for assessing nutrition knowledge and nutrition attitudes. Design: Questionnaire items were created based on the 2019 CFG content and aligned with the four thematic subcomponents in Foodbot Factory (Drinks, Whole Grain Foods, Vegetables and Fruits, Protein Foods). Knowledge questions were multiple choice (20 points total, 5 points per subcomponent). Attitudes were evaluated using four 5-point Likert scale questions. Face and content validation of the NAK questionnaire were conducted among experts in nutrition and education. Experts rated the validity of questionnaire items on a 5-point Likert scale and provided narrative comments highlighting suggested modifications. Construct validity was assessed through a single-armed pre-post study among children 9-10 years of age who were in the same Grade 4 classroom. The NAK questionnaire was administered before and after using Foodbot Factory. Overall composite scores and individual scores for each subcomponent were assessed using paired t-tests. Results: Seven nutrition and education experts provided feedback on the face and content validity of the NAK questionnaire, which resulted in minor wording modifications, question conversion and the addition of two questions. After students (n=23) used Foodbot Factory there were statistically significant increases in overall nutrition knowledge (11.1 ± 2.6 to 14.3 ± 2.4, $p<0.001$), Whole Grain foods (2.6 ± 1.6 to 3.4 ± 1.0, p=0.013), Vegetables & Fruit (2.7 ± 1.2 to 3.6 ± 1.1, $p<0.001$) and Protein foods (2.1 ± 1.0 vs 3.2 ± 1.2. p=0.003). Knowledge of Drinks remained unchanged; however, baseline knowledge was high. There were no nutrition attitude changes, which were not expected given the short time period. Conclusion: The NAK questionnaire can be a useful and valid tool for assessing baseline and

changes in nutrition knowledge related to the 2019 CFG guidelines. (Funding: Ontario Research Fund – Research Excellence grant.)

Changes in infant feeding among Nova Scotian caregivers of infants ≤ 6 months old during the COVID-19 pandemic

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In response to the novel coronavirus pandemic, the COVID-19 State of Emergency, declared in Nova Scotia on March 22nd, 2020 has impacted access to goods and services such as healthcare and social supports. To explore the resulting impacts on infant feeding, we conducted an online mixed-methods survey among Nova Scotian caregivers of infants < 6 months old. Qualitative data was analysed using textual interpretation informed by thematic network analysis. The survey was available between April 17-May 15, 2020 (4 to 8 weeks after the State of Emergency began). Depending on the caregiver's responses about feeding modality, they received questions about breastfeeding (60%), feeding infant formula (21%), or both (19%). Participants (n=335) were 99% female, 87% self-identified as white, and 71% had a household income above the median Nova Scotia income of $60,000. 59% experienced no COVID-19-related economic changes, although 77% were receiving monetary parental benefits before the emergency. Overall, participants made minimal changes to their feeding practices or their infant's diet, and there were no significant differences in feeding changes across socioeconomic status or feeding modality. However, individual caregiver experiences differed considerably. Of those who were breastfeeding, 13% described feeling grateful for the ability to provide a reliable and safe source of nutrition, reporting more skin-to-skin contact, and less pressure to perform than if visitors were allowed. However, 27% reported facing breastfeeding challenges, and of those, 59% experienced barriers to accessing breastfeeding support specifically due to COVID-19 restrictions. Among formula-feeders, 13% listed access to formula as their primary concern, noting financial constraints and/or retail stockouts, particularly for specialized formula (e.g., hydrolyzed). Similarly, without postpartum support and growth tracking opportunities, caregivers were anxious about infant intake, growth, and development. In limited cases, these concerns led to risky feeding practices (e.g., using additional water to conserve formula). Overall, participants reported very few infant feeding changes. Although, results suggest that implementing a system to prevent stockouts, and enhanced lactation and postpartum supports may be necessary to reduce the barriers to optimal infant feeding faced by caregivers in Nova Scotia during a State of Emergency. (Nova Scotia COVID-19 Health Research Coalition Grant.)

Concurrent and predictive validity of a portfolio diet score assessed by a food frequency questionnaire

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The plant-based Portfolio Diet (high in plant protein, viscous fibre, nuts, phytosterols, and monounsaturated fat, and low in saturated fat) has been shown to significantly reduce several cardiovascular disease (CVD) risk factors in randomized controlled trials (RCTs), including low-density lipoprotein cholesterol (LDL-C), blood pressure and inflammation. It is currently not known if these beneficial effects translate to lower incident CVD risk. To support examinations between Portfolio Diet adherence and incident disease outcomes, a Portfolio Diet score (PDS) was created. The objective of this study was to assess the predictive and concurrent validity of the PDS as measured by a food frequency questionnaire (FFQ). This validation study was conducted within the Toronto Healthy Diet Study, a six-month RCT in over 600 overweight adults (mean body mass index=31.3 kg/m^2). Predictive validity was assessed using changes in the PDS measured by a 184-item modified Willet FFQ and concomitant changes in LDL-C (the main target of the Portfolio diet) from baseline to six months using multiple linear regression, adjusted for potential confounders. Concurrent validity was assessed in a subset of participants (n=50) who completed both the FFQ and a 7-day diet record (7DDR) at baseline. The PDS determined from each diet assessment method was used to derive Pearson correlation coefficients (energy-adjusted, deattenuated) and a Bland-Altman plot to assess the between-method agreement. The change in PDS was inversely associated with the change in LDL-C (β coefficients: -0.01 mmol/L (95% confidence intervals (CIs): -0.02, -0.002; P=0.02) over six months. The correlation between the PDS from the FFQ and 7DDR was 0.69 (95% CIs: 0.48, 0.85) overall, with values for the single PDS components ranging from 0.36 to 0.54. The Bland-Altman plot showed good agreement between the score from the FFQ and 7DDR. These findings indicate predictive validity of the PDS with lower LDL-C, and good concurrent validity of the PDS as assessed by an FFQ against a 7DDR, among overweight adults. Future studies are needed to examine whether the PDS can reliably predict disease outcomes such as incident CVD. (Banting & Best Diabetes Centre, Peterborough K.M. Hunter Charitable Foundation, Ontario Graduate Scholarship, Diabetes Canada, and CIHR.)

Dietary choline increased serum metabolite concentrations of one-carbon metabolism in growing, post-gonadectomy kittens using NMR spectroscopy

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Choline's use as a methyl donor for methionine re-methylation may have positive implications on energy metabolism and growth in kittens susceptible to obesity from major risk factors including gonadectomy and ad libitum feeding. Nuclear magnetic resonance (NMR) spectroscopy was used in the present study to investigate changes in serum metabolic profiles in growing, post-gonadectomy kittens with or without additional dietary choline. This study was approved by the University of Guelph Animal Care Committee (AUP#4118). Fifteen intact male kittens (3-months old) were fed an extruded dry food base diet formulated for growth (3310mg choline/kg DM) over an 11-week acclimation. Gonadectomy was performed at week 0 and kittens were assigned to base diet (CONTROL) (n=7) or base diet with additional choline (CHOLINE) (n=8) of 300mg/kg BW0.75. Both groups were provided a food amount mimicking ad libitum feeding (thrice daily energy requirements over 3 meals) for 12-weeks. At weeks 0 and 12, fasted serum samples were obtained, and all samples were analyzed for 51 metabolites by quantitative NMR spectroscopy. The proc GLIMMIX procedure via SAS was used to analyze differences between groups as a repeated measure. Serum concentrations of L-serine, methionine, L-threonine, betaine, dimethylglycine, and D-mannose were higher, and hypoxanthine concentrations were lower, in CHOLINE, 12 weeks post-gonadectomy, compared to CONTROL ($p<0.05$). No significance was found for the remaining metabolites. Interestingly, additional choline did not result in higher serum concentrations of choline, however, its derivative betaine was higher in the choline group. One-carbon metabolism was evidently increased in the choline group by the higher serum concentration of methionine and the cofactor, L-serine. Higher serum concentration of dimethylglycine is further evidence of this increase as it is a product of the betaine-

mediated methionine methylation. Additional choline did not appear to impact markers for glycolysis or lipolysis, likely because kittens would be in an anabolic state during growth. However, the observed increase in one-carbon metabolism may aid in supporting growth and energy metabolism in kittens in a positive energy balance. Future research should aim to further understand the role of choline in energy metabolism and macronutrient partitioning. (NSERC-CRD; Elmira Pet Products.)

Soy beverage consumption, but not dairy consumption, is inversely associated with fatty acid desaturase activity in humans

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Background: Endogenous production of long-chain polyunsaturated fatty acids (LC-PUFA) is regulated by delta-5 and delta-6 desaturases (D5D, D6D). Previous research using hepatic rat microsomes showed that soy protein consumption suppressed desaturase activity compared to casein (a dairy protein). The effects of soy and dairy consumption on desaturase pathway activity have not yet been described in humans. Objective: We investigated the association between soy beverage, milk, and total dairy consumption with plasma fatty acids and desaturase pathway activity in a multiethnic Canadian population of young adults (20-29 years). Methods: Data from participants in the Toronto Nutrigenomics and Health Study (men n=319; women n=764) was analyzed. Dietary intake (by food frequency questionnaire) and plasma fatty acids (by gas chromatography) were analyzed. The relationships between daily servings of soy and dairy with estimated desaturase pathway activity were assessed by Pearson's correlation and multivariate linear regression. Participants were then grouped according to soy beverage, milk, and/or total dairy intake to further investigate desaturase pathway activity. Results: Significant inverse associations ($p<0.05$) were found between soy beverage consumption and various markers of desaturase pathway activity, but no associations were found with milk or total dairy intake. The associations with soy remained highly significant in multivariate models accounting for known covariates. When participants were grouped based on soy and dairy consumption habits, plasma levels of γ-linolenic acid (GLA), di-homo-γ-linolenic acid (DGLA) and arachidonic acid (AA), as well as various estimates of desaturase pathway activity (20:4n-6/18:2n-6, 20:5n-3/18:3n-3 and 18:3n-6/18:2n-6), were significantly lower in individuals consuming soy (with or without dairy) compared to individuals consuming only milk and dairy products. Conclusion: Soy beverage consumption, but not dairy intake, is inversely associated with desaturase pathway activity. These findings warrant further investigation but suggest that high soy beverage consumption may impair the endogenous production of biologically important LC-PUFA. These findings may have considerable importance for public health nutrition. (Funding: MGS is supported by a CONACyT [Consejo Nacional de Ciencia y Tecnología] scholarship.)

Choline content in the gestational diet and fat content of the offspring diet interact to program food intake and metabolism of male Wistar rats

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Choline is an essential nutrient for fetal development and plays an important role in energy regulation and lipid metabolism. We have previously shown that a high maternal choline diet increases long-term food intake and body weight-gain of male rat offspring weaned to a normal fat diet. However, the offspring's response to an obesogenic post-weaning environment remains unexplored. Objective: To describe the interaction between choline content of the gestational diet (GD) with the fat content of the post-weaning diet (PWD) on long-term food intake, body weight and associated metabolic biomarkers of obesity in male Wistar rat offspring. Methods: Wistar rat dams were fed an AIN-93G diet with either recommended choline (RC, 1g/kg diet choline bitartrate) or high choline (HC, 2.5-fold recommended) only during pregnancy. Male pups (n=10-12/group) were weaned to either a normal fat diet (RC-NF and HC-NF) or a high (45%) fat diet (RC-HF and HC-HF) for 17 weeks. Body weight, food intake, visceral adiposity, plasma glucoregulatory hormones and hepatic free fatty acids (FFAs) were measured. A 2-way ANOVA was performed to test the GD and PWD interaction effect followed by a student's T-test comparing groups stratified by PWD. Results: At 17-weeks post-weaning, there was a significant GD and PWD interaction effect ($P<0.05$) on all dependent measures. HC-NF offspring had 8% higher food intake ($P<0.01$) and 6% higher final body weight ($P<0.05$), but similar adiposity ($P>0.05$) compared to RC-NF. HC-NF offspring also had 22% higher plasma leptin adjusted for adiposity ($P<0.05$) but not insulin ($P>0.05$) compared to RC-NF. In contrast, HC-HF offspring had 7% lower final body weight ($P<0.05$), and 15% lower adiposity ($P<0.05$), but no difference in food intake ($P>0.05$) compared to RC-HF. HC-HF offspring had no difference in leptin ($P>0.05$) but 18% lower plasma insulin ($P<0.05$), and 30% higher total hepatic omega-3 FFAs ($P<0.05$) and a lower omega-6/omega-3 ratio ($P<0.01$) compared to RC-HF. Conclusion: HC gestational diets associated with improved metabolic regulation compared to RC diets in male Wistar rat offspring fed a HF, but not a NF diet. Thus, an increase in choline in gestational diets may protect offspring from an obesogenic environment. (Funding: Supported by CIHR-INMD.)

Predicted expression of the DRD4 gene in the prefrontal cortex interacts with retail food exposures on dietary outcomes

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Background: The dopamine D4 receptor gene (DRD4) is associated with sensitivity to reward and eating behaviour. Plasticity genes like DRD4 are responsive to the environment and thus are candidates for gene-environment interaction studies on obesity-related outcomes, such as diet. Objective: To investigate interactions between the genetically predicted expression of DRD4 in the prefrontal cortex (pDRD4) and exposures in the retail food environment on dietary outcomes using geotemporally linked biobank (CARTaGENE) and marketing data for the retail food environment in Quebec (Nielsen Corporation). Methods: Genetic, dietary, lifestyle, and anthropometric data were obtained from CARTaGENE, comprised of men and women who are representative of middle-aged adults in Quebec (n=2,044). A ratio variable of vegetables to soft drink data was calculated for retail categories (in-store displays, price/discount, and variety) to estimate the relative healthfulness of retail exposures. Diet quality was assessed using the 2010 Canadian Healthy Eating Index (HEI-C), calculated from food frequency questionnaire data. High and low (median split) pDRD4 was estimated using genome-wide genotyping data and the PrediXcan method. Dietary outcomes included HEI-C score and intake of its eleven dietary components. Sex-stratified generalized linear models were used to evaluate main and interactive effects between pDRD4 and retail exposures on dietary outcomes. Models were adjusted for both individual-level (age, first three components of ancestry, household income, marital status, education, smoking status, physical activity, energy misreporter status, language, season of participation) and neighborhood-level socio-demographic factors (population density, immigration rate, employment rate, high school completion). The Benjamini-Yekutieli method was applied to adjust for multiple-testing with the false discovery rate.Results: Male-specific interactions were observed between pDRD4 and in-store display of vegetables in relation to soft drinks. With increasing exposure (more healthful), participants with high pDRD4 had significantly higher

intake of fruits and vegetables (estimate: 0.41 servings/day, 95% CI (0.22, 0.59); p<0.0001) and lower intake of empty calories (-2.2% kcal/day, 95% CI (-3.1, -1.1), p<0.0001) compared to those with low pDRD4.Conclusion: Among men, predicted expression of prefrontal DRD4 interacts with retail exposures on dietary outcomes. Plasticity genes should be further considered in research that evaluates genetic contributors to obesity-related outcomes. (Funding: Banting Research Foundation.)

Knowledge mobilization for the development of feasible, acceptable and appropriate nutrition education strategies for increasing dairy and/or plant-based dairy alternative intake in preschoolers

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Consuming adequate calcium and vitamin D early in life is important for growth and development, bone health and the prevention of chronic health conditions in adulthood. Ensuring children have an adequate intake of fortified dairy/plant-based dairy alternatives (PBDA), key sources of these nutrients, is critical to consuming enough calcium and vitamin D. However, interventions targeting dairy and PBDA intake in preschoolers have been largely ineffective. This study explored whether a knowledge mobilization (KMb) approach could create strategies that are feasible, acceptable and appropriate to parents for increasing the dairy/PBDA intake of their preschool-aged children (1.5-5 years). KMb is a rigorous implementation science approach that involves user, or target population, knowledge to identify knowledge gaps and barriers to knowledge use. This information helps to create targeted messaging that fits the needs of users, improving the likelihood of sustainable behaviour change. Consistent with the knowledge-to-action cycle, this study applied three methodological steps to strategy development. First, previously published interventions were systematically reviewed to identify effective characteristics such as under 6 weeks of contact, using multiple formats, environmental restructuring and prompts/cues. Second, barriers and facilitators to dairy/PBDA provision in focus groups with families were reviewed from previous research. Barriers included low-income, gastrointestinal issues, environmental/ethical concerns and believed risks. Facilitators included knowledge of benefits and the convenience, taste and variety of dairy/PBDA. Third, KMb theories and literature-based techniques were applied to develop novel strategies. For example, the Family Ecological Model was used to target the family unit, active learning strategies were emphasized and plain language principles were applied to the materials. As a result of using the KMb process, the following materials were proposed; weekly newsletters and podcasts for parents, colouring pages, crafts, a song, book and taste-testing activity for kids, and a health educator meeting and goal tracking calendar for the family. It is hypothesized incorporating KMb in the conceptualization and development of novel strategies will create more feasible, acceptable and appropriate strategies for increasing the dairy/PBDA intake of low-consuming preschoolers. (This research is funded by the James Alexander Campbell Nutrition Education and Knowledge Translation Fund at the University of Guelph.)

How does adhering to the recommendation to opt for foods high in unsaturated fats instead of foods high in saturated fats impact dietary fat quality in Canada?

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The 2019 Canada's Food Guide (CFG) recommends that foods containing mostly unsaturated fat (UFA) should replace foods that contain mostly saturated fat (SFA) to reduce SFA intakes and, concurrently, cardiovascular risk. The objective of this study was to model the population-level changes in SFA intakes if all Canadians adhered to that recommendation.Dietary intakes from a single 24-hour recall from the nationally representative Canadian Community Health Survey 2015 – Nutrition were used for these analyses. Foods identified as high in SFA based on Health Canada's criteria (>2g of SFA per reference amount and/or >15%E of the food's content from SFA) were replaced with similar foods that were lower in SFA and had a higher UFA:SFA ratio. The nutrient profiles of replacement foods were created by averaging the nutrient profiles of all similar foods within each lower-SFA/higher UFA:SFA food category. The substitution analyses were conducted by replacing all foods high in SFA consumed on a given day by an equal amount of their corresponding lower-SFA/higher UFA:SFA replacement foods. Among Canadians 2y or older, mean (95%CI) SFA, polyunsaturated fats (PUFA) and monounsaturated fats (MUFA) represented 10.7% (10.5, 10.8), 6.8% (6.6, 7.0) and 11.9% (11.6, 12.3) of total energy intake on a given day, respectively. Replacing all foods high in SFA by equivalent lower-SFA/higher UFA:SFA foods decreased SFA intakes to 4.64%E (4.6, 4.7) at the population-level. Changes in predicted PUFA (from 6.8%E (6.6, 7.0) to 7.9%E (7.5, 8.2)) and MUFA (from 11.9%E (11.6, 12.3) to 11.3%E (10.9, 11.7)) intakes were also observed post-substitution. Predicted changes in SFA, PUFA and MUFA intakes were similar among males and females. This food-based substitution modeling analysis suggests, for the first time, that the recommendation included in the 2019 CFG that foods containing mostly UFA should replace foods that contain mostly SFA is an effective strategy to reduce dietary SFA intakes at population-level. Such changes in the population's dietary SFA intakes remain hypothetical and are unrealistic. The extent to which less extreme scenarios lead to smaller, but still beneficial, reductions in total SFA intakes needs to be documented. (Chair of nutrition, NUTRISS, Université Laval.)

A dietary strategy to increase daily vitamin K (phylloquinone) intake

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Despite the arrival of new oral anticoagulants, warfarin remains a commonly prescribed drug to treat and prevent thromboembolic diseases. Warfarin has a narrow therapeutic range and a considerable proportion of patients fail to stay in the therapeutic range despite close monitoring, exposing them to life-threatening complications such as bleeding and thromboembolic events. Vitamin K (VK) is a key element of anticoagulation stability as warfarin interferes with its metabolism. Observational studies have provided evidence that warfarin-treated patients with higher usual VK intakes have more stable anticoagulation. A dietary intervention was developed as part of a clinical trial that aimed to compare the clinical impact of a VK enriched (experimental group) versus a standard diet (control group) on anticoagulation stability, over a 24-week period. Specifically, patients allocated to the experimental group were guided to increase their intakes of phylloquinone, the main dietary source of VK, by 150 μg per day. Phylloquinone is found in highest concentrations in green leafy vegetables, soybean and canola oils. Significant amounts are also found in olive oil, mung beans, pistachio nuts, avocado and fresh or dried herbs. The dietary intervention focused on three groups of phylloquinone-rich foods namely green vegetables, fats and herbs. The intervention consisted in five 1.5-hours dietary counselling sessions (weeks 0, 4, 8, 12 and 18) conducted in groups of 6-8 participants. Sessions were provided by nutrition specialists previously trained to deliver harmonized presentations. Educational material and tools were developed to help participants implement recommendations and monitor their VK intakes. When assessed between weeks 6 and 24 of the trial mean VK intakes (mcg/d, [95% CI]) was statistically higher in the experimental

(n=23) than in the control group (n=22) (154.8 [115.5-207.5] vs 67.5 [50.0-91.3]; P<0.001). Higher daily VK intakes can help improve anticoagulation stability. Here we describe a dietary intervention focusing on strategic VK food groups that enabled to more than double daily VK intakes in warfarin-treated patients. Although pertinent to this context, increasing daily VK intakes could prove beneficial for general health, in light of the emerging protective role of this vitamin in inflammation and cognitive function. (Funded by CIHR.)

PTSD and insomnia: does ketone supplementation work?

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Insomnia is a sleep disorder commonly characterized as a chronic symptom of PTSD. Ketone bodies may improve insomnia as they directly inhibit sympathetic nervous drive and thereby reduce anxiety. Therefore, the purpose of this study was to determine if 6-weeks of ketone salt supplementation alters insomnia in individuals diagnosed with PTSD. A randomized, triple-blinded, placebo-controlled design was used to examine the effects of chronic ketone salt consumption on insomnia and PTSD severity in adults diagnosed with PTSD. Twenty-one participants, ages 21-65 years old, diagnosed with PTSD started the study and 16 completed the study. Participants were familiarized and visited the laboratory twice for data collection. During familiarization, participants signed the informed consent document and completed a health history questionnaire. The first data collection visit included baseline questionnaires assessing insomnia (Insomnia Severity Index) and PTSD (PTSD Checklist-5; PCL-5) severity. The second data collection occurred 6 weeks later after consuming either the placebo or ketone salts twice daily and included the same two questionnaires. The changes in both the PCL-5 and insomnia severity index from visit 1 to visit 2 were calculated and analyzed to examine differences between placebo and ketone salt groups for those two questionnaires. All change scores for each group were normally distributed and free of outliers, therefore an independent samples t-test was used to analyze these differences between groups. There was no difference in PCL-5 change scores between the ketone salt group (-7.5 $\pm$ 7.25) and placebo group (-8.166 $\pm$ 15.75), p = .917, d = -.058. Similarly, there was no difference in insomnia severity index change scores between the ketone salt group (-0.15 $\pm$ 4.67) and placebo (-2.33 $\pm$ 4.13), p = .393, d = -.49. Chronic ketone salt supplementation did not alter the severity of insomnia or PTSD in a small sample size of individuals diagnosed with PTSD according to two questionnaires. (Financial support was provided by Augusta University's College of Education and Center for Undergraduate Research, and Pruvit Ventures, Inc.)

Nutrigenetics: A systematic review of the impact of genetic factors on the plasma lipid/lipoprotein response to dietary omega-3 fatty acids

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The scientific study of nutritional genomics continues to develop. At the same time, nutrigenetic testing through direct-to-consumer services and healthcare professionals are available on the market. However, systematic reviews providing the basis for personalized nutrition and evidence-based clinical decisions are limited in the field of nutrigenomics. The objectives of this study were to: retrieve, synthesize and assess the quality of evidence for nutrigenetic approaches related to cardiometabolic risk factors, specifically the effect of genetic variations on the plasma lipid and lipoprotein response to dietary and supplemental omega-3 fatty acids. A systematic review was conducted using three search engines: Embase, Web of Science and Medline OVID. After summarizing individual studies, statistically significant and replicated nutrigenetic interactions were selected for evidence grading. The National Institutes of Health Study Quality Assessment tools were used to assess risk of bias. Evidence was evaluated using the GRADE approach, with further consideration of biological plausibility and functional SNPs in the evidence grading process. Two independent researchers evaluated the studies. Out of 1830 published articles screened, a total of 65 articles met the inclusion criteria (n=23 observational, n=42 interventional); of these, 25 studies met the criteria for evidence evaluation using GRADE. Most of the evidence in this area is currently weak (GRADE rating: 'low' or 'very low' quality). However, there is strong evidence (GRADE rating: 'moderate' quality) for male APOE-ε4 carriers (rs429358, rs7412), who exhibit significant triglyceride reductions in response to 0.7-3.7 g/day EPA and/or DHA with evidence of a dose-response effect. Additionally, there is strong evidence (GRADE rating: 'high' quality) for a 31-SNP nutrigenetic risk score (nutriGRS) for predicting triglyceride responsiveness to 3.0 g/day EPA+DHA in adults with overweight/obesity, where a lower nutriGRS results in greater triglyceride reductions. Clinical practice guidelines for these gene-nutrient interactions with strong evidence should be developed. Special consideration of ethical aspects of APOE testing will be important given the well-established association between APOE (rs429358, rs7412) genetic variation and Alzheimer's disease risk. (Funding: Postdoctoral fellowships from CIHR, NUTRISS and INAF (JRH); Junior 2 Research Scholar from FRQ-S (IR); Tier 1 Canada Research Chair in Genomics Applied to Nutrition and Metabolic Health (M-CV).)

Low informational support is associated with higher obesity in gendered ways: secondary analysis of the Canadian Longitudinal Study on Aging cohort

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Poor social support is postulated to be a mechanism linking social isolation to increased mortality, but there is scant evidence on different types of support and markers of aging and whether this differs by gender. We used baseline Canadian Longitudinal Study on Aging data (2012-15) from 28,779 adults (45-85 years) to determine which support type was associated with measured obesity by gender, accounting for known confounders. Multivariable models stratified by gender showed that all four types of social support were associated with adjusted mean levels of body mass index (BMI) in women, while only the lowest level of belonging support was linked to average BMI in men. Compared to the highest level of support, women with the lowest had higher average BMI though the size of differences varied across types: informational support (+0.75 kg/m^2 (95%CI: 0.49, 1.01), p<0.001), emotional support (+0.55 kg/m^2 (0.29, 0.81), p<0.001), belonging support (+0.54 kg/m^2 (0.29, 0.80), p<0.001), and tangible support (+0.46 kg/m^2 (0.21, 0.71), p<0.001). In contrast, in men, the lowest level of belonging support was associated with lower average BMI (-0.31 kg/m^2 (-0.51, -0.10), p<0.01). The odds of general

obesity (BMI≥30 kg/m^2) were higher in women reporting the lowest levels of informational, tangible, emotional and belonging support (OR range: 1.21-1.28, p<0.001), compared to highest; whereas the odds were higher only in men reporting the lowest levels of informational support (1.14 (1.03, 1.26), p<0.01). All forms of social support appeared to be associated with obesity in women, but only certain supports appeared linked to obesity in men. (This secondary analysis study is funded by the Canadian Institute of Health Research grant (#162987) and acknowledges data/biospecimens collected by CLSA which is led by Drs. Parminder Raina, Christina Wolfson and Susan Kirkland. CLSA funding is given by the Government of Canada through the Canadian Institutes of Health Research under grant reference: LSA 94473 and the Canada Foundation for Innovation. We used the CLSA Baseline Comprehensive Dataset version 4.0, Baseline, under Application Number 19CA003.)

Home sweet home: does family stress increase children's sugar intake?

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Parenthood is challenging and many families experience chronic stress. Children in stressed homes tend to have poorer overall diet quality and health-related behaviours. Stress can modulate dietary choices, especially cravings for sugary and processed foods. Stressed children may crave more sugary foods, and stressed parents may inadvertently increase children's access to sugar through processed convenience foods. Excessive sugar intake is a well-documented precursor for childhood cardiometabolic, dental, and behavioural concerns, however, less is known about upstream factors that may affect children's access to sugary foods. This study explored cross-sectional associations between family environment and children's sugar intake among a sample of preschoolers (n=134 girls, n=127 boys) from 207 families participating in the Guelph Family Health Study. Parents reported via online surveys their household chaos (levels of disorganization and noisiness; Confusion, Hubbub, and Order Scale) and family functioning (interpersonal dynamic and communication; McMaster Family Assessment Device general functioning subscale). Added sugars (i.e., during processing or tableside), free sugars (i.e., added sugars plus sugars naturally present in syrups, fruit juices, etc.), and total sugar (i.e., free sugars and natural sugars) were assessed using ASA24, an online dietary assessment tool, and adjusted for total caloric intake (grams/1000 kcal). Mean total sugar intake was 78 grams for girls and 87 grams for boys, which both exceed recommendations. Preliminary results indicate that family stress was associated with sugar intake in a sex-dependent manner, as indicated by significant stress-sex interaction terms. Compared to girls in well-functioning (<2.17 points) families and controlling for age and family income, girls in low-functioning (>2.17 points) families had significantly lower energy-adjusted total sugar (β=-17.12, 95%CI: -29.40, -4.84, p=0.01), added sugar (β=-7.65, 95% CI: -12.88, -2.43, p=0.004), and free sugar intake (β=-8.91, 95%CI: -14.80, 3.03, p=0.003). No associations were seen for household chaos. No associations were found between boys' home stress and sugar intake. These early cross-sectional findings support the need for additional research into the relationship between children's sugar intake and factors within the home environment that may cause stress. (Funding for this project provided by the Heart and Stroke Foundation of Canada and the Canadian Institutes of Health Research.)

Eating behaviour traits mediate the association between satiety responsiveness and energy intake among individuals with overweight or obesity

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Individuals with a low satiety responsiveness exhibit eating behaviour traits that increase their risk of overeating. However, whether eating behaviour traits represent factors that could potentially explain the susceptibility to overeating in these individuals has never been examined. The aim of this study was to assess if eating behaviour traits mediate the association between satiety responsiveness and energy intake. Baseline data from individuals with overweight or obesity (n=304; age=38.7±8.4 years; BMI=33.2±3.4 kg/m^2, 55.3% women) who participated in four weight loss studies were used in this cross-sectional study. Satiety responsiveness was determined by the satiety quotient (SQ) based on fullness sensation measured by visual analogue scales in response to a standardized breakfast. Energy intake was measured by an ad libitum buffet-type lunch meal and a three-day food record. Eating behaviour traits were assessed with the Three-Factor Eating Questionnaire, the Binge Eating Scale and the State and Trait Food Craving Questionnaire. Mediation analyses adjusted for sex were performed using a regression-based approach and bootstrapping with the Process Macro. The association between SQ and energy intake at the buffet meal was mediated by susceptibility to hunger (βindirect=-2.76±1.16, 95% CI, -5.68 to -1.00) and its subscales, internal and external locus for hunger (βindirect=-1.85±0.95, 95% CI -4.32 to -0.42 and βindirect=−3.44±1.33, 95% CI, -6.69 to -1.38, respectively) and by state-craving as a physiological state (βindirect=−4.26±2.47, 95% CI, -10.61 to -0.61) and cue-dependent eating (βindirect=−5.46±2.97, 95% CI, -13.18 to -1.05). Susceptibility to hunger (βindirect=-3.57±1.55, 95% CI, -7.71 to -1.30) and its subscales, internal and external locus for hunger (βindirect=-2.41±1.30, 95% CI, -5.57 to -0.47 and βindirect=-3.98±1.71, 95% CI, -8.52 to -1.39, respectively) and cue-dependent eating (βindirect=-5.19±3.65, 95% CI, -14.82 to -0.11) partly mediated the association between SQ and self-reported energy intake. These results indicate that susceptibility to hunger and food cravings partly explained the susceptibility to overeating among individuals with low satiety responsiveness. They also suggest that interventions targeting hunger and food cravings may be helpful to prevent overeating among these individuals. (Funded by the Ministère de l'Enseignement supérieur, de la Recherche, de la Science et de la Technologie du Québec and the Canadian Institutes of Health Research.)

The therapeutic effect of immunomodulatory nutrients on SARS-CoV-2: A scoping review

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The recent pandemic has warranted the urgent need for exploring potential therapies or prophylaxis against Covid-19. There is evidence about the potential role of nutrients on Covid-19 in conjunction with medications. This scoping review aims to explore the literature evaluating the effect of immunomodulatory nutrients on

individuals infected by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). A literature search of the databases including Medline, EMBASE, CINEHAL, Web of Science, Cochrane, Scopus, PubMed, and hand searching in Google scholar in two-time points (Jun 23rd and Sep 7th, 2020) retrieved 885 unique studies. Any kind of studies on humans without limitation on year range and setting were included except non-English language and review articles. Ten studies met the inclusion criteria for this scoping review. Three studies examined the impact of vitamin C, three studies zinc, two studies vitamin D, and two studies the combination of the two (Zinc and vitamin C) and the three nutrients (vitamin D, B12, and magnesium). Although the results were not conclusive because of the insufficient and or inconsistent evidence, the potential therapeutic synergistic impact of high dose vitamin C, D, and Zinc has been identified. Our results showed that the effectiveness of vitamin C, D, and Zinc on Covid-19 was different based on baseline nutrients status, the dosage used in nutrient therapy, duration of the nutrient therapy, time of administration, and severity of the SARS-Cov-2 disease at the time of nutrient therapy. The main finding of this review is that high dose vitamin C, D, and Zinc improves the complications caused by COVID-19, including inflammatory markers, need for oxygen therapy, length of hospitalization, and mortality. However, further randomized clinical trials (RCTs) are needed to explore the most effective nutrients and the safe dosage to combat against SARS-CoV2.

Plant-based dietary patterns and cardiometabolic risk: a systematic review and meta-analysis of prospective cohort studies

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Plant-based diets with limited animal food consumption have been extensively associated with cardiometabolic health benefits. Diet indices have been increasingly used to distinguish the protective characteristics of plant-based diets at different levels of adherence. We synthesized the evidence evaluating associations between adherence to plant-based diet indices and cardiometabolic risk. A plant-based diet index (PDI) is hypothesized to be inversely associated with type 2 diabetes (T2D) and cardiovascular disease (CVD) with a stronger association with the healthful index (hPDI) that emphasizes higher-quality plant foods. MEDLINE, EMBASE, and CINAHL databases were searched through January 2021. Prospective cohort studies of plant-based diet indices and risk of T2D and CVD in adults were included and appraised for risk of bias and quality (NutriGrade). The protocol followed the PRISMA-P, Cochrane, and MOOSE guidelines. Random and fixed-effects meta-analyses were conducted to pool risk ratios (RR) of extreme quantiles. Dose-response meta-analyses were conducted after harmonizing all diet index scales. I2-values of 30-60%, 50-90%, and 75-100% denoted moderate, substantial, and considerable heterogeneity respectively. From 5927 retrievals, we identified 10 studies to be included. Across 6 studies there were 22,135 total cases of T2D over a total 4,817,308 person-years. Across 7 studies there were 15,077 total cases of CVD over a total 6,117,016 person-years. The PDI was associated with a lower risk of T2D (RR = 0.82, 95% CI [0.75, 0.91], I2 = 55.4%), and CVD ((RR = 0.88, 95% CI [0.8, 0.96], I2 = 16.2%). The hPDI had a stronger inverse association with T2D (RR = 0.73, 95% CI [0.68, 0.77], I2 = 84.3%) and CVD (RR = 0.8, 95% CI [0.77, 0.88], I2 = 55.9%). All dose-response relationships were linear (except hPDI with CVD). All studies had acceptable risk of bias and the quality of evidence was moderate. Adherence to a plant-based diet was inversely associated with T2D and CVD with a stronger association for a healthful plant-based diet pattern. Since highest quantiles of the index still included moderate meat consumption, linear dose-responses emphasized potential benefit on T2D and CVD risk of any incremental progression towards a plant-based diet. (Funding: Nora Martin Fellowship, Ontario Graduate Scholarship.)

Food purchasing and food values in Quebec, Canada during the COVID-19 pandemic

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Background: The COVID-19 pandemic has disrupted daily life globally, including impacts on food procurement. Evaluating household food purchasing and related outcomes will provide insight into food procurement considerations in the event of future public health emergencies. Objective: To evaluate patterns of in-store and online grocery shopping, and reported changes to the importance of food values among Quebec households at different points of the pandemic. Methods: An opt-in online household survey was conducted during the spring lockdown period (n=1955). Participants were recruited using online advertising. A summer follow-up survey was conducted during the period of provincial reopening (n=658). The surveys probed for frequency of in-store and online grocery shopping, food purchasing, and importance of the Lusk and Briggeman food values. Descriptive statistics and logistic regression analysis were performed. Results: During the spring lockdown period, the most commonly reported frequencies of in-store grocery shopping were once per week and 1-3 times per month (86%). In the summer follow-up, the most commonly reported frequencies increased to once per week and 2-3 times per week (69%). Respondents who commonly used online grocery methods (at least once per week) were significantly more likely to have reported never/rarely going in-store grocery shopping during the spring lockdown period (odds ratio: 6.34 (95% CI: 4.63, 8.67)). At the summer follow-up, 60% of respondents reported that their household food spending had increased compared to 2019 and the mean reported increase in spending was 28%. The top food values that respondents indicated had become more important to them during the pandemic as compared to 2019 were purchasing food from local retailers (76%), country of origin of food product (67%), and food product safety (48%). The top food product categories that respondents reported purchasing more of during the pandemic as compared to 2019 were local food products (65%), canned or dried goods (40%), and baking products (37%). Conclusion: These findings suggest that Quebec households reduced their in-store grocery shopping frequency during the spring lockdown, and that food spending and support for local food products has increased since the start of the pandemic. (Funding: SSHRC Institutional Grant and MI4 ECRF Program.)

Validation of the 25-point portfolio diet score used in the PortfolioDiet.app

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The Portfolio Diet is a therapeutic dietary pattern that combines cholesterol-lowering foods to manage dyslipidemia for the prevention of cardiovascular disease. To translate the Portfolio Diet for primary care, we developed the PortfolioDiet.app as a patient and physician engagement tool for personal computers and smartphones. The PortfolioDiet.app is based on a 25-point Portfolio Diet Score that allows individuals to assess their adherence to the Portfolio Diet. The PortfolioDiet.app uses this score to provide the individual with personalized feedback through dashboard displays, nudging, and gamification components such as leaderboards. Our

objective was to assess the validity of the 25-point Portfolio Diet Score. We conducted a secondary analysis of a completed multicentre randomized trial (n=108) of the Portfolio Diet in participants with hyperlipidemia (ClinicalTrials.gov identifier, NCT00438425). We used data from the Toronto site collected at baseline and 6-months. Concurrent validity was assessed by the correlation of the Portfolio Diet Score (range, 0 to 25-points) with the overall percent adherence to the targets for the Portfolio Diet components using 7-day weighed diet records. Bland-Altman analysis was used to assess the limits of agreement between the two methods. Predictive validity was assessed by the correlation of the 25-point Portfolio Diet Score with a biomarker of adherence, LDL-C (the main target of the Portfolio Diet). Linear regression was used to assess the change in LDL-C per 1-point increase in the score. Data were available from 98 completers. The score was positively correlated with adherence assessed by the 7-day weighed diet records (r=0.94, $P<0.0001$). Bland-Altman analysis showed narrow limits of agreement. The score was negatively associated with change in LDL-C (r=-0.43, $P<0.0001$) with each 1-point increase in the score associated with a 1.07% (0.044 mmol/L) decrease in LDL-C ($P<0.001$). These results indicate good concurrent and predictive validity of the 25-point Portfolio Diet Score in people with hyperlipidemia. This research will contribute to the rationale for using the PortfolioDiet.app to mount a large cardiovascular outcome trial in primary care. (CIHR, Loblaw Companies Limited, Solae, Unilever, Federal Government of Canada through the CRC Endowment, Province of Ontario, Diabetes Canada.)

Determining glycemic index of commercially available nutrition bars

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Nutrition bars provide a compact and practical source of carbohydrate with variable amounts of protein to meet fuel needs pre, during and post exercise. While there are several nutritional factors involved in making an informed choice about sport nutrition bars, glycemic index is commonly overlooked as it is not part of the nutrition facts of the products. Endurance athletes may benefit from low glycemic index bars as they provide a longer-lasting source of energy during practice or a race. Therefore, the purpose of this research was to determine glycemic indexes of commercially available sport nutrition bars. Using a randomized counter-balanced experimental design, we determined the glycemic index (GI) of four commercially available nutrition bars (i.e., Clif, Lara, Vector, and Kind) in 10 healthy participants (8 females, 2 males, 23±6 y, 68.6±11.4 kg, 168±10 cm). Participants consumed nutrition bar on each occasion to provide 25 g of available carbohydrate, eaten with 250 mL water within 15 minutes. The four nutrition bars were assessed one week apart. Finger-prick blood samples were collected before beginning and at 15, 30, 45, 60, 90, and 120 minutes after consumption and assessed for glucose in duplicate using an Accu-Chek Aviva glucose meter. Blood glucose following consumption of each nutrition bar was compared to a standard condition of 25 g glucose dissolved in 250 mL water. The GI was classified as "low" (≤55), "moderate" (56-69), or "high" (≥70). The results showed that the GI of the Clif bar (38.76±23), the Kind bar (39.7±30.93), the Lara bar (48.37±29.33), and the Vector bar (40.45±24.95) were not significantly different. All of the tested bars fell into the "low-GI" category. While all the bars were categorized as low-GI, the Lara bar had the highest GI, which may be attributed to its highest amount of sugar (20g) and the least amount of protein (3g) given that these two are the contributing factor affecting glucose responses. In conclusion, when compared to higher-GI carbohydrates, consumption of these nutrition bars before exercise may result in lower insulin level and lower carbohydrate oxidation during exercise. (Funding: Acadia University article 25.55 grant.)

Investigating the frequency and motivation of supplement consumption amongst varsity athletes, focusing on supplement contamination

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Sports Supplements (SS) are Natural Health Products (NHP) that are frequently used by many athletes worldwide to enhance sport performance and recovery. Various reasons for supplement use amongst athletes include, to improve performance, speed recovery, prevent injuries, as well as meet individual nutritional needs. The purpose of this study was to investigate athletes' motivation, knowledge and frequency of use of sports supplements (SS). A questionnaire was designed to answer the research questions, "What, if any, knowledge do University athletes have on SS regulation and contamination?", "What motives, if any, influence athletes to use SS?", and "How, if at all, frequent do athletes use SS?". A final questionnaire consisted of 40 questions grouped into categories including, unidentifiable participant information, common SS used, knowledge-based questions pertaining to the regulation of SS, and athletes' opinion regarding SS education. Participants (N=118) included three varsity teams at Acadia University. Descriptive analysis was calculated using Microsoft Excel. Most athletes (87.2%, N=118) reported using SS in the past six months. Participants reported using SS to speed muscle recovery, meet nutritional needs, and to delay muscle fatigue. Rationale varied among athletes depending on the type of supplement they consumed. Results showed that athletes (75.8%) were aware that supplements may contain banned substances, while 28.2% were unsure that SS may promote false certification claims. Athletes obtain their information regarding SS from unknown internet sources (69.4%), personal trainers (55.9%), and coaches (46.6%). Athletes (87.2%) used protein powder containing whey (75.7%), protein bars (51.4%), and protein powder containing casein (45.6%) to enhance energy expenditure, meet nutritional needs, and speed muscle recovery in the past six months. Majority of the athletes (68.1%) reported that education regarding SS prior to consumption is very important for effective sport performance and recovery. In conclusion, athletes were subjectively knowledgeable on supplement regulation. Thus, athletes may benefit from nutrition educators with reliable information regarding the use of SS. Future research should investigate how effective, if at all, nutrition educational interventions are for athletes' knowledge on supplement use, performance, and recovery.

Do feeding practices of Black francophone mothers living in Canada influence their child's diet quality?

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Introduction: Parental feeding practices are known to influence children's diet quality. Parental monitoring of children's food intake has been associated with a higher diet quality, while restrictive practices and pressure to eat have been associated with a higher consumption of sugary and unhealthy foods, and a lower consumption of nutritious foods (e.g., vegetables or meat), respectively. This study aimed to assess the association between feeding

practices of Black francophones mothers and their 6-to-12 years old child's diet quality. Methods: Between 2014-2015, 118 Black francophones mothers of African and Caribbean descent and their 6-to-12 years old child living in Ottawa were recruited. Maternal feeding practices (monitoring, restriction and pressure to eat) were assessed with the Child Feeding Questionnaire. Children's food intake was estimated with a 24-hour dietary recall. Diet quality was assessed with the NOVA food classification system which classifies foods into four categories: unprocessed or minimally processed foods, processed culinary ingredients, processed foods, and ultra-processed foods. Spearman correlations were computed in SPSS IBM to assess the association between maternal feeding practices and the proportion of their child's daily energy intake coming from each NOVA category. Results: Children consumed about 58% of their daily energy intake from ultra-processed foods. Maternal feeding practices were not associated with children's daily energy intake from processed culinary ingredients, processed foods, and ultra-processed foods NOVA categories. Restrictive practices and food intake monitoring were positively associated with children's daily energy intake from unprocessed or minimally processed foods (r=0.21, p=0.02 and r=0.21, p=0.02, respectively), while pressure to eat was not. Conclusion: These results suggest that certain feeding practices used by participating Black francophones mothers positively influenced their school-age child's diet quality. Parental feeding practices should be considered when developing interventions and programs promoting healthy eating among Black francophone families in Canada. (Funding: CNFS-Volet Université d'Ottawa.)

Impact of dairy intake on plasma F2-isoprostane profiles in subjects with hyperinsulinemia

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Introduction: F2-Isoprostanes (IsoPs) are major biomarkers of oxidative stress associated with inflammation among patients with type 2 diabetes (T2D). Dairy products may contribute to the maintenance of balance between inflammation and glycemic parameters. Objective: The primary objective is to investigate the modification of IsoPs level after consumption of a high-dairy diet (HD) compared with an adequate-dairy diet (AD) in subjects with hyperinsulinemia. Furthermore, to examine the association between the level of IsoPs and glycemic parameters. Methods: In this crossover study, participants were randomized in two phases: HD (≥4 servings/day) or AD (≤2 servings/day) for 6-week. Fasting blood glucose (FBG), fasting insulin, homeostatic model assessment of insulin resistance (HOMA-IR), and F2-IsoP were measured before and after each intervention. Six isomers of F2-isoPs, derived from the oxidation of arachidonic acid were extracted from plasma using solid-phase extraction after alkaline hydrolysis and quantified by HPLC-MS/MS. Statistical analyses were done by using paired t-tests and generalized linear mixed models. Results: This study included 27 subjects with hyperinsulinemia (mean age; 55 ± 13 years, BMI; 31.4 ± 3.3 kg/m^2). Fasting insulin and glucose, HOMA-IR were not affected after consumption of either, HD or AD. The Wilcoxon analysis indicated that intake of energy (+13.9%), carbohydrates (+13.5%), proteins (+21.44%), total fat (+25.7%) were significantly increased after HD compared to AD. Furthermore, the total level of F2-IsoPs, 5-F2t-IsoP, 8-F2t-IsoP, 15-epi-15-F2t-IsoP, 5(RS)-5-F2c-IsoP, 5-epi-5-F2t-IsoP were significantly higher in men than women. Moreover, by using a generalized linear mixed model, adjusted for sex and BMI, total level of F2-IsoPs (p = 0.03), 5- F2t-IsoP (p = 0.002), 8-F2t-IsoP (p = 0.004), and 15-F2t-IsoP (p = 0.059) decreased after HD compared to AD. Moreover, a positive correlation was observed between 15-F2t-IsoP and FBG (p = 0.08, r = 0.39) after HD intervention. Conclusions: Intake of HD decreased plasma levels of F2-IsoP isomers but have no effect on glycemic parameters when compared to AD intake. Also, F2-IsoP levels are associated with the sex of the participant. Registration number: NCT02961179. (Financial support: Canadian Institutes for Health Research, Fonds de Recherche du Québec – Nature et technologies, Fonds de Recherche du Québec - Santé.)

Supplementation of citrulline lowered proinflammatory cytokines in the small intestine during the initiation of enteral refeeding in neonatal piglets with TPN-induced intestinal atrophy

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In preterm infants, poor arginine status during the transition from intravenous to enteral feeding may increase the risk of developing necrotizing enterocolitis (NEC). However, arginine extraction by the intestinal cells and the liver limits its availability for NO synthesis. Citrulline, a non-proteinogenic amino acid, is not removed from portal blood by the liver; therefore, it may serve as a precursor for arginine and NO. We previously reported that supplementing citrulline resulted in greater NO synthesis and blood flow to the intestine, compared to equimolar arginine. The objective of this study was to determine the effect of citrulline on markers of inflammation in the gut. Piglets (7-10 days, n = 20) underwent surgical implantation of venous and gastric catheters and a probe to measure superior mesenteric artery (SMA) blood flow. Parenteral nutrition was provided for four days to induce intestinal atrophy. On day 4, piglets were randomized to enteral refeeding of an elemental diet with arginine concentration equivalent to sow milk (Low Arg), or 2.5 times the arginine in sow milk (High Arg), or Low Arg plus citrulline (Cit) in which the arginine plus citrulline was equimolar to High Arg. On day 5, NO synthesis was measured with tracers. On day 6, after 2 days of enteral feeding, the piglets were sacrificed, and tissue samples were collected. Mucosal inflammatory markers such as myeloperoxidase activity (MPO), TNF-α, INF-γ and malondialdehyde (MDA) were determined. Interestingly, TNF-α was lower ($p<0.05$) in the Cit group compared to the Low Arg group, and a similar trend was observed in INF-γ. In contrast, MPO activity was higher ($p<0.01$) in the Cit group than in the Low Arg group. Furthermore, mucosal MDA level was higher ($p<0.01$) in the High Arg group compared to Low Arg, which suggests that high arginine may have increased the lipid peroxidation in the gut. In summary, citrulline not only enhanced NO synthesis and blood flow to the intestine, it also reduced the pro-inflammatory cytokine production in the gut. Therefore, adding citrulline to an enteral diet may reduce the risk of developing NEC during the introduction of enteral nutrition. (CIHR, InnovateNL.)

Dietary red kidney beans fed prior to and during weight-loss, beneficially improves intestinal and metabolic health in obese C57BL/6 male mice

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Dietary interventions that target intestinal microbial dysbiosis and barrier integrity, prior to weight loss, may be an effective strategy to attenuate metabolic disorders and inflammation in individuals with obesity. The objectives of this study was to determine the

impact of cooked dark-red kidney (DK) beans (rich in fermentable fibre and polyphenolics) on biomarkers of intestinal and metabolic health in obese male mice when supplemented first into a high-fat (HF) diet (Phase 1: intestinal priming), followed by supplementation into a low-fat (LF) diet (Phase 2: weight-loss). In phase 1, 6-week old C57BL/6 male mice were fed a HF diet (60% fat as kcal) for 14 weeks to induce obesity and then randomly assigned to 2 groups to consume their respective diets for 8 weeks: 1) HF obesity control (n = 22); and 2) HF + 20% DK (HF+DK; n=14). At the end of Phase 1, a subset of mice in the HF group were switched to a LF diet (13.5% fat as kcal; weight-loss controls) (n=13), while HF+DK were switched to LF+DK for an additional 8 weeks. Diet intake (DI), body weight (BW) and composition by EchoMRI, fasted blood glucose (FBG) and hormones, and cecal short-chain fatty acid (SCFA) concentrations were measured. BW and DI did not differ between groups; however, HF+DK-fed obese mice gained more total lean mass compared to HF. Switching mice to LF and LF+DK diets attenuated BW gain compared to HF however LF+DK mice had higher total lean mass and less epididymal fat mass compared to LF. Moreover, FBG decreased and anti-inflammatory adiponectin increased in LF+DK mice during Phase 2 while there was no difference observed in LF mice. Additionally, cecal SCFA concentrations were increased in LF+DK indicating increased microbial activity. The present findings demonstrates that consumption of beans prior to and during weight loss, improves intestinal and metabolic health in obese male mice, more so than LF diet alone. These findings highlight the importance of diet composition in weight management to optimize intestinal and metabolic health. (Funding: Ontario Research Fund; School of Nutrition Sciences. uOttawa, Nutrition and Mental Health Post-doctoral Fellowship.)

Mealtime experiences in a pandemic: perspectives from early childhood educators

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Positive mealtime experiences in early childhood promote autonomy and self-regulation that supports the development of healthy eating behaviours. Best practice recommendations to achieve these goals include eating and visiting together during mealtimes, engage in conversation, offer new foods multiple times, let children serve themselves, and trust children to self-regulate intake. Early childhood educators (educators), as part of the essential COVID-19 pandemic workforce, follow new government guidelines aimed at preventing the spread of the virus, some of which govern food provision and interaction at mealtimes. The purpose of this study was to gather educators' perspectives on how COVID-19 guidelines have impacted mealtime experiences within their early childhood education and care (ECEC) environment. A qualitative description approach was used to explore a purposive sample (n=17) of educators working full time in ECEC centres interviewed between July and August 2020. One-on-one semi-structured interviews were audio-recorded, transcribed verbatim, and analyzed using thematic analysis. Educators noted that general pandemic guidelines, such as physical distancing and hand hygiene, as well as food service guidelines prohibiting family-style meal service, preventing children to serve themselves, and physical distancing during mealtimes negatively impacted the healthy eating environment in ECEC settings. Two key themes for educators were the negative impact on relationship connections and educator role modeling aimed at supporting healthy eating. Distress at the loss of eating family-style with children was notable. Two key themes for children were the negative impact on child food engagement and peer modeling with other children during mealtimes. Concern at the loss of peer modeling as a strategy for new food introduction was notable. The look and feel of mealtime experiences have changed during COVID-19 and best practice mealtime recommendations do not align in this context. Public health guidance on how to support positive mealtime experiences in the context of pandemic government guidelines is needed to promote the healthy development of children in child care environments. (Study funded by Government of Alberta.)

Meeting Canada's Food Guide Recommendation of "Cook more often": Parent perceptions of challenges and strategies

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Objective: Explore perceived challenges and strategies of meeting the 2019 Canada's Food Guide recommendation of "cook more often" at households of parents of children aged 0-12 years. Methods: From October 2019-January 2020, 8 focus groups were conducted with 40 parents (72.5% mothers) from the Wellington County region, Ontario, Canada. Parents were selected if they have children in the age of 0-12years old. Sessions were audio-recorded and transcribed in verbatim. Data analysis was conducted by three independent researchers using NVIVO12. Results: The most common barrier to "cook more often", appearing in all focus groups, was the time constraint parents face due to having a busy schedule including work and parenting duties. Parents expressed facing difficulties cooking healthy meals everyday due to difficulties managing family's varying preferences and different needs due to allergies and food intolerances. Some parents also perceived their cooking skills and knowledge to be lacking, thus cooking different recipes every day was not possible. Outside of the home, parents perceived prices of some fresh ingredients, including meats and fruits, to be too high. The strategies parents used to mitigate these difficulties included using technology or services that make meal planning and grocery shopping more convenient, using devices and kitchen instruments, such as crockpot or rice cooker, that make cooking faster. For everyday habits, planning and preparing meals and shopping ahead of time, cooking large quantities, being or having a partner who is a stay-at-home parent or having flexible work hours, having children or a spouse help in cooking, and accepting imperfections in the diet in moderation (e.g., eating takeout once a week or using an ingredients perceived as processed in cooking) were all additional strategies. Conclusion: These findings can help inform interventions and educational campaigns to support increased meal preparation among families with young children.

The implementation and impact of school-based nutrition program in physical education class

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Childhood and adolescent obesity are ongoing problems in Canada due to factors such as unhealthy eating and low physical activity participation. While there are many school-based nutrition interventions, few have combined both nutrition and physical activity (PA) in a same activity, particularly in physical education classes. The objective of this study was to assess the implementation and impact of a nutrition education program on nutrition knowledge, attitudes towards healthy eating, and self-reported eating habits in elementary school students (grades 3 and 4) during a physical

education class. The intervention was designed specifically for physical educators (PEs) and integrated nutrition concepts while students participated in PA to be active while learning. Classes were randomly assigned to the control (n=9) or intervention (n=10) group for four months. PEs (n=7) and students (n=284) completed questionnaires before (PRE) and after (POST) the intervention. Program appreciation was assessed in students and PEs and compliance (reported and measured) with the program was assessed in PEs. Nutrition knowledge, attitudes towards healthy eating, eating habits and program appreciation were assessed in students. Analyses of variance for repeated measures were used to analyze changes in nutrition knowledge, attitudes towards healthy eating and eating habits. Pearson's correlations were used to assess the associations between changes in students' nutrition knowledge and compliance (reported and measured). There was a significant group by time interaction for nutrition knowledge in both grades (grade 3, $F=20.33$, $p<0.0001$; grade 4, $F = 6.05$, $p<0.015$) which was higher after the intervention compared to control. No significant difference in attitudes towards healthy eating and eating habits were observed between groups. PEs and students reported appreciating the program and it was well implemented (100%). PEs' reported and measured compliance were good but were not associated with student's nutrition knowledge. In conclusion, an innovative school-based nutrition education program specifically designed for physical educators in elementary schools improved students' nutrition knowledge and may be a feasible approach to promote nutrition education and healthy food choices into a physical education curriculum. (This research was funded by Dairy Farmers of Canada.)

Effects of multimodal prehabilitation on muscle size, myosteatosis, and dietary intake of surgical patients with lung cancer – a randomized feasibility study

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Many patients with lung cancer undergo surgery, which can increase the risk for muscle loss, leading to worsened outcomes and shorter survival. A multimodal prehabilitation intervention integrating nutritional assessment and muscle imaging may help clinicians better understand changes in these outcomes. This pilot study assessed the feasibility of multimodal prehabilitation incorporating muscle imaging by peripheral quantitative computed tomography (pQCT) in early-stage surgical lung cancer patients. The study explored relationships between body composition, muscle characteristics and dietary intake, as well as muscle changes in response to prehabilitation. Lung cancer patients scheduled for surgery were randomized to receive either multimodal prehabilitation incorporating nutritional supplements (fish oil with vitamin D3 + whey protein with added leucine) and exercise (aerobic and resistance training plan, 1x/week supervised) or standard care for 4 weeks. Physical function, dietary assessment using 2-day food diaries and foreleg muscle characteristics were evaluated at 0 and 4 weeks pre-operatively. Of the 87 patients assessed for eligibility, 34 patients (39%) were randomized and 3 (9%) were lost to follow-up. Due to the COVID-19 pandemic stopping surgeries and closing the clinic, 9 patients did not receive pre-operative assessments. The median age was 69 y (37-86 y, 47% female) and baseline protein intake was 1.0 g/kg body weight/d. Self-reported adherence to exercise (86%) and nutritional supplements was high (93%) however, 3 patients (16%) stopped taking the supplements due to side effects. In the INT group, supplements significantly increased protein, omega-3 fatty acid, leucine and vitamin D intake. Partial correlations corrected for weight showed no significant relationships between dietary intake and muscle characteristics. There were no significant changes in muscle size or myosteatosis in this limited sample size. Multimodal prehabilitation with dietary and muscle analyses proved to be feasible. An adequately powered randomized controlled trial is warranted to support potential improvement of personalized care. (This study was funded by the MUHC-Peri-Operative Program Foundation and CIHR.)

The availability and the quality of nutrition-related information on leading Canadian grocery websites

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Although prepackaged foods and beverages in Canada must follow the standardized food labelling regulations, there are no e-commerce food labelling regulations to ensure consumers have the necessary product information to make informed purchasing decisions. Little is known about the availability of standardized food labelling information on online grocery websites. The objective of the present study was to evaluate the availability and the quality of nutrition-related information on the websites of 6 leading grocery stores in Canada (by 2019 total company sales or 2018 online food sales). A random sample of fresh and prepackaged products (n=85) was selected using the Health Canada's Table of Reference Amounts categories. Two research assistants evaluated the availability and the quality of nutrition-related information (i.e., Nutrition Facts table (NFt), ingredient, and allergen information) and other key labelling components (e.g., product images, nutrition or health claims, date marking, packaging material) presented in the websites. Out of 85 products reviewed, 63 unique products, available on at least 5 of the 6 websites, were used for analysis. All included products were accompanied by product images (range: 1-11) with 1 website offering high-quality images with zoom features. All mandatory nutrition information were available 58.0% of the time (range: 6.5-74.6%): NFt (75.1%, range:6.7-93.3%), ingredient (85.5%, range: 65-100%), and allergen information (57.1%, range: 28.1-68.8%). Nutrition and health claims were included in 46.5% of the available products (range: 21.0-96.7%), with 3 websites using symbols to indicate various product characteristics. All 6 websites presented price per item, while 5 websites presented price per reference amount or unit to allow consumers to easily compare prices between products of different sizes. Date markings were not available on any of the products and only 1.6% of the available products included packaging material information. In conclusion, the wide variability and inconsistencies in the presentation of nutrition information and other key labelling components of foods and beverages in online grocery websites can be potential barriers for Canadians to make informed purchasing decisions. Standardized e-commerce food labelling regulations are needed to ensure consumers have access to consistent product information, regardless of grocery shopping method. (Funding: Banting & Best Diabetes Centre.)

Perceived benefits and barriers as predictors of apple consumption underpinned: Comparison of high vs. low healthy eating motivation

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Healthy food choice behaviour is the result of a complex interplay between sociodemographic and psychosocial factors, yet knowledge of choice determinants for specific foods with unique health

properties is lacking. Regular consumption of whole apples (with the bioactive-rich peel) mitigates health detriments, thus evidence supporting targeted apple consumption promotion strategies is warranted. An online survey was conducted in a representative sample of 800 Ontario adults including 647 self-defined regular whole apple consumers and 153 non-consumers receptive to apple consumption, to explore apple consumption behaviours and perceived benefits (taste/texture, health, nutritional value, convenience, versatility) and barriers (cost, accessibility, digestibility) towards apple consumption. To assess the impact of healthy eating motivation (HEM) on these outcomes, HEM was quantified using a published scale (Naughon et al., Int J Behav Nutr Phys Act, 2015) and classified as strong, moderate or weak using tertile values. Data were analyzed by chi-square analysis, ANOVA and linear regression with $P \leq 0.05$ considered statistically significant. Apple consumers were more likely to be female, have a normal vs. obese BMI (<25 vs. ≥ 30 kg/m^2) and have strong vs. weak HEM, but did not differ in age, education, employment status or income. HEM was predictive of apple consumption frequency (β=0.138) and consumption with the peel (β=0.094). Apple consumers with strong HEM ate a greater number of 19 proposed apple varieties compared to those with weak HEM. Perceptions predictive of apple consumption included their convenience (β=0.203), taste/texture (β=0.203), versatility (β=0.098) and nutritional value (β=0.098). Amongst apple consumers, convenience and health benefits were the top-rated benefits of apple consumption. Meanwhile, amongst non-consumers, price was the top-rated barrier. Overall, participants with strong HEM more strongly agreed with all benefits, and those with weak HEM with all barriers, compared to the counterpart. These findings provide insight into reasons for differing apple consumption behaviours amongst Ontario adults, which may be underpinned by HEM. Increasing exposure to apple varieties of differing tastes/texture and costs, and increasing awareness of the convenience, versatility and nutritional benefits of apples may be strategies to increase regular apple intake in Ontario. (Ontario Ministry of Agriculture, Food & Rural Affairs; Ontario Apple Growers.)

A randomized crossover trial to explore the effects of consuming whole raw apples on postprandial lipemia in healthy yet overweight and obese adults

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Elevations in blood triacylglycerol (TAG) concentration after consuming a lipid-containing meal is termed postprandial lipemia (PPL), and is a clinically significant and independent predictor for cardiovascular diseases (CVD). Phytonutrients like pectin and polyphenols contained in apples have potential to modulate PPL. This study aimed to explore if whole Gala apple consumption attenuated PPL induced by an oral fat tolerance test (OFTT) providing 1 g fat/kg body weight. A randomized and crossover trial was conducted in twenty-six generally healthy but overweight or obese adults (BMI: 34.1 ± 0.2 kg/m^2) because this population is at risk of CVD. The dairy-based OFTT meal was consumed with and without three small apples (with skin, ~200 g edible parts) and 1500 mg acetaminophen blended in the OFTT to estimate gastric emptying. Blood samples were collected for 6 hours post-meal for plasma TAG, apolipoprotein B48 (apoB48, indicating the number of chylomicrons – a carrier protein of TAG from the bloodstream to liver), chylomicron-rich fraction particle size and fatty acid composition, glucose, insulin, and acetaminophen analyses. A repeated-measure ANCOVA model was utilized to identify the differences in postprandial responses with and without apples. Participant characteristics (sex, age, body weight, and BMI) and baseline values of each endpoint were considered in the model for their potential effects on each endpoint, but only baseline values reached significance and were thus included as covariates in the analyses. Consumption of the OFTT meal with apples led to a higher apoB48 peak concentration than without apples (40.8 ± 3.5 versus 32.7 ± 1.9 mg/L, p=0.007), without influencing any other postprandial changes in chylomicron properties. Apple consumption also exaggerated the insulin response between 20 and 180 min post-meal ($p<0.05$). There were no significant differences between with and without apples in postprandial TAG or glucose response, or gastric emptying. The increased insulin secretion with apples may have contributed to the higher peak concentration of apoB48 particles, while it did not translate to any changes in postprandial TAG. In summary, whole Gala apples stimulated insulin secretion and increased apoB48 peak concentration, but did not modulate PPL in healthy overweight and obese adults. (Study funded by OMAFRA and Ontario Apple Growers Association.)

The impact of calorie restriction diet supplemented with white and dark red kidney beans on intestinal and metabolic health in obese male mice

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Obesity-associated microbial dysbiosis is linked to increased metabolic abnormalities (e.g. insulin resistance (IR)) and systemic and adipose tissue inflammation. Weight-loss by calorie restriction (CR) can improve obesity-associated metabolic abnormalities and reduce inflammatory mediators, however, limited research has investigated the impact of CR and diet composition on biomarkers of intestinal health. Thus, the objective of this study was to determine if CR diets supplemented with cooked white (WB) and dark kidney beans (DB) would improve intestinal and metabolic health in obese male mice. C57BL/6 male mice (5 weeks of age, n=48) were fed a high-fat diet (HFD, 60 kcal % fat) for 10 weeks to establish obesity. Mice were then randomly assigned to four groups: 1) HFD control; 2) CR control (13.5 kcal % fat) 3) CR + 15% (w/w) WB; and 4) CR + 15% (w/w) DB for 8 weeks. Cecal microbial composition (16S rRNA gene sequencing) and short-chain fatty-acid (SCFA) concentrations were measured, as well as body composition and fasted serum hormones. Cecal microbial diversity (weighted-Unifrac metrics, $p<0.01$), composition, and activity was altered significantly by CR+WB and CR+DB mice as indicated by reduced Firmicutes: Bacteroidetes Phylum ($p<0.01$), increased relative abundance of SCFA-producing bacteria, (e.g., Prevotella genus ($p<0.01$)), and SCFA concentrations compared to HFD and CR. Epididymal adipose tissue (EAT) mass and serum leptin levels were significantly reduced in all the CR groups compared to HFD ($p<0.01$) but did not differ significantly from each other. There was a significant inverse correlation between EAT mass and total SCFAs ($r=-0.4$, $p<0.01$) suggesting a potential role of SCFAs in regulating adipose tissue metabolism. Also, a significant negative correlation was found between serum adiponectin/leptin ratio, and insulin concentrations and HOMA-IR index ($r=-0.3$, $p<0.05$, for both) indicating this ratio as an estimator of adipose tissue dysfunction. The results of this study confirm that CR improved biomarkers of metabolic health and inflammation compared to obese control mice, while WB and DB supplementation additionally altered the microbial composition and function that may beneficially improve intestinal health. (Funding: Ontario Research Fund and the School of Nutrition Sciences, Nutrition, and Mental Health Ph.D. Scholarship.)

Vitamin D homeostasis in obese and diabetic groups, potential backdoor for a SARS-COVID third wave in next 2021 spring

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Introduction: Beyond its role in calcium and bones metabolism the Vitamin D and lipo-soluble micronutrients (LM) are influencing the immunity, insulin sensitivity, glucose homeostasis and overall metabolism. We and others, found the serum retinol (ROL) and its' transporter (RBP4) specifically altered in obesity, insulin resistance (IR) and diabetes (T2DM), all high risk co-morbidities for COVID-19. Recent studies have documented up-to 78% higher CoV2 incidence and issues in Vitamin D deficient (≤ 25 nmol/L), deprived (25-49 nmol/L) or insufficient (50-74 nmol/L) patients. Northern Latitudes being another lowering vitamin D factor, we sought to perform a vitamin D evaluation in Montréal obese & diabetic populations. Hypothesis: Circulating vitamin D concentration might be deficient and/or specifically altered with obesity, metabolic syndrome (MS) and diabetes. Objective: Perform a snap random vitamin D3 (cholecalciferol) evaluation in obese, MS & diabetic populations from Montréal (45°N Lat). Methods: Subjects (n=60) were divided in 4 groups: A-lean healthy; B-obese diabetics/HbA1c > 7%; C-obese diabetics/HbA1c < 7%; D-obese non-diabetics. Serum concentrations of Vitamins D and E (lipo-solubility witness) measured by HPLC. Transthyretin (TTR), a metabolic state witness, measured by immune-detection. Results: Vitamin D: A(59.1 ± 22.4 nmol/L), B(53.8 ± 17.8 nmol/L), C(80.3 ± 30.9 nmol/L), D(44.3 ± 18.4 nmol/L); Vitamin E: A(30.9 ± 8.2 μmol/L), B(30.9 ± 11.7 μmol/L), C(39.3 ± 10.1 μmol/L), D(30.8 ± 6.0 μmol/L); TTR: A(5.0 ± 0,7 μmol/L), B(5.3 ± 0.9 μmol/L), C(5.4 ± 1.0 μmol/L), D(4.9 ± 0.7 μmol/L). Conclusions: After adjustment for some Vitamin D supplements, found in the group C, all groups' serum vitamin D were lower (insufficient-A, B, C and deprived-D) than normal minima (75 nmol/L), healthy controls (A) including. Vitamin E and TTR concentrations were normal (13.9 to 47 μmol/L and 3.6 to 7.2 μmol/L respectively) with no inter-groups significant differences. Insufficient vitamin D thus couldn't be explained by diabetes only, impaired lipids absorption, the catabolic state, or by Canadian food insecurity, N Latitudes sunlight low exposures are to be considered. Following this research, the 2020 CoV2 lockdowns, and the winter, could only decrease the vitamin D status in obese & diabetic groups, increasing a CoV2 3rd-Wave risk for the 2021 Spring.

Retinoic acid influences retinoid genes, normalises retinyl esters and RBP4 and prevents abnormal remodeling, in obese-diabetic mice liver

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Introduction: We have already demonstrated that retinoic acid (RA) treatment reduces serum vitamin A (ROL) and its transporter (RBP4), fasting glycaemia, insulin resistance (IR), body weight (bw) and visceral adipocytes diameter, preventing apoptosis and fibrosis in obese-diabetic mice heart (Manolescu DC et al. 2010, J. Nutr. 140(2):311-316; Manolescu DC et al. 2014, Applied Physiology Nutrition Metabolism 39(10):1127-1136) Hypothesis: We now hypothesized that our RA treatment will improve hepatic retinyl esters (RE) and RBP4 storage, preventing abnormal hepatic remodeling, fat and collagen accumulation in obese-diabetic ob/ob mice liver. Objective: Investigate the RA impact on: A) The vitamin A metabolism genes expression for uptake, transport, storage, oxidation and catabolism; B) RE and RBP4 concentration C) Expression of mitochondria genesis marker PGC1α genes; D) Hepatic tissues morphology. Methods: Female 9-week-old B6.V-Lep/J ob/ob mice (n = 16), were divided in two groups, a group (n = 8) treated with 100 μg atRA (~2μg/gbw) in 100 μL corn oil (vehicle) delivered daily by stomach intubation (gavages) for 16 days and a group (n = 8) receiving the vehicle alone. Eight lean mice served as healthy controls. Genomics transcriptome (mRNA), metabolomics (HPLC), proteins (WB) and histology staining analyses were performed. Results: A) Diabetic mice hepatic tissue expressed higher levels (mRNA) of LRAT, RDH10, RALDH1;2, CRABP1;2 and CYP26A1;B1 and decreased RE and RBP4 concentrations. The RA treatment increased CRBP1, RALDH1;2 and CYP26A1;B1 expressions, and normalized the LRAT, RDH10 and CRABP1;2 ones B) Raised the RE and RBP4 concentrations back to normal; C) Increased the PGC1α expression; D) Shown light signs of lipidosis' and fibrosis' reduction. Conclusions: The RA treatment contributed in restoring the liver RE and RBP4 storage and to mitochondrial protection. Higher expression of CRABP1;2 and CYP26A1;2 suggests higher endogenous RA instability in diabetic mice, thus justifying some of the RA treatment benefits. Our preliminary investigation suggests hepatic steatosis and fibrosis prevention.

Systematic review of nutrient profiling models with applications in government-led nutrition policies and regulations - an update

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Nutrient profiling models (NPMs) draw up an overall picture of the nutritional quality of food since they take into account multiple nutritional components. Such models are useful for characterizing the overall nutritional quality of the food supply, and for underpinning various nutrition-related public health strategies (e.g., front-of-package labelling, regulations surrounding the marketing of food and beverages to children). Recently, there has been a rapid increase in the number of NPMs developed by different organizations worldwide. A systematic review (SR) summarizing the key characteristics of NPMs with applications in government-led nutrition policies was carried out in 2016 and published by Labonté et al. (Adv Nutr, 2018). Given the continuous proliferation of NPMs worldwide, the present project aimed to update this SR. A systematic search was performed in databases of both the scientific literature (n=6) and grey literature (n=2) to identify publications related to the topic of nutrient profiling published between June 2016 and September 2020. The full text of all relevant publications was assessed independently by two reviewers to build a list of potential NPMs. Each NPM was first classified as "already identified in the 2016 SR" or as "newly identified". The main characteristics of the "newly identified" NPMs were then extracted. Results show that a total of 186 potential NPMs were identified from the full-text assessment of 315 publications. Among these, 78 NPMs (42%) corresponded to "newly identified" models. The most common applications of these new NPMs are the regulation of food advertising to children and front-of-package labelling. All of the new NPMs include nutrients to limit, with sodium, saturated fats and sugars being the most commonly considered. A next step will consist in establishing the eligibility of each new NPM according to various inclusion criteria, comprising the fact that a model has specifically been developed or endorsed by a governmental or intergovernmental organization. As NPMs are increasingly used by government entities around the world to support different public health strategies, it is important to have an up-to-date resource listing them and detailing their characteristics. (Funding: FRQS Young Investigator Establishment Grant in conjunction with FRQS Chercheurs-boursiers Junior 1 Salary Award.)

Consumption of red rooibos herbal tea supports the partial recovery of bone mineral and structure in rats following pregnancy and lactation

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During pregnancy and lactation in humans, bone mineral density (BMD) is reduced as calcium is mobilized to support offspring bone development. Studies suggest that BMD returns to pre-pregnancy levels shortly after delivery, shifting from a high rate of bone resorption during pregnancy and lactation, into a rapid phase of bone formation post-lactation. This rapid phase may provide an opportunity to stimulate a greater gain in BMD and stronger structure than was present pre-pregnancy. Providing polyphenols that are present in red rooibos herbal tea may promote such a recovery. In vitro, these polyphenols stimulate osteoblast activity, reduce osteoclastic resorption, and increase mineral production. The objective of this study was to determine if consuming red rooibos resulted in higher BMD and improved bone structure following pregnancy and lactation. Female Sprague-Dawley rats (n=42) were randomized to one of the following groups: Tea (~2.6 g of red rooibos/kg bodyweight/day in water), Water (drinking water), or Control (age-matched non-pregnant control) from 2 weeks prior to pregnancy (age 8 weeks) through to 4 months post-lactation. All groups received AIN-93G diet ad libitum. A strength of the design was measuring BMD and structure at the proximal tibia by micro-computed tomography in the same mother at pre-pregnancy, end of lactation and at monthly intervals until 4-months post-lactation. Litter characteristics were also measured. BMD and trabecular structure (bone volume fraction, trabecular number, trabecular separation) were improved ($p < 0.05$) by 1- or 2-months post-lactation when comparing Tea to Water, though neither group recovered to the level of Control. Cortical outcomes (cortical area fraction, cortical thickness, tissue mineral density) for Tea and Water were reduced ($p < 0.05$) following lactation but returned to the level of Control by 2-months post-lactation, with the exception of cortical thickness. There were no differences for litter size, weight or sex ratio between Tea and Water groups. Consumption of red rooibos supports partial recovery of trabecular BMD and 3-dimensional structure following pregnancy and lactation. The findings also provide insight into timing and dose of polyphenols for future interventions. (Funding: NSERC DG, CFI and CRC to WE Ward.)

The Development and Evaluation of Food Sensory Three-Elemental Screener for Children

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The food development for the school breakfast programs requires a balanced approach to meet the dietary guidelines and ensure acceptable sensory characteristics. While the sensory testing using a controlled laboratory facility may not reflect the school environment and not be accessible for the meal programs, the study's objective was to develop a fast, easy to use and reliable screener to evaluate food acceptance in children. The hypothesis was that the combination of pictorial, verbal and chromatic elements would be sufficient to discriminate between the acceptance, neutral perception and rejection of food by children. Methods: 43 children (21girls and 22boys) 12.4y (2.1y SD) completed a randomized trial assessing the pleasantness of three dairy treatments with similar milk fat content: yogurt with no added sugar (Y-NS) or with 5.5% added sugar (Y-S), or chocolate milk (CM) using a new three-elemental screener (TES), 9-point Peryam-Kroll hedonic scale (9-PK) and 100mm visual analogue scale (VAS). The data analysis was performed using Friedman's test with Dunn's post-hoc test to evaluate the effect of a treatment on the pleasantness, and Spearman's correlation to test the relationship between TES and 9-PK and VAS. Results: TES included a traffic light with embedded sad, neutral and happy faces in the red, yellow and green circle with verbal descriptors "It is not pleasant," "It is ok," and "It is pleasant," respectively. There was an effect of treatment on pleasantness assessed with TES ($P<0.0001$). Y-NS resulted in lower palatability than Y-S and CM ($P<0.0001$). There was no difference between Y-S and CM ($P=0.6$). There was a strong relationship between TES and 9-PK for Y-NS ($r=0.74$, $P<0.0001$), for Y-S ($r=0.71$, $P<0.0001$), for CM ($r=0.74$, $P<0.0001$), and between TES and VAS for Y-NS ($r=0.68$, $P<0.0001$), for Y-S ($r=0.69$, $P<0.0001$), but not for CM ($r=0.28$, $P=0.07$). Discussion: TES demonstrates a strong agreement with 9-PK, while the relationship between TES and VAS is determined by the type of food being tested. Conclusion: TES is a fast and reliable tool to test food acceptance in children and may be used in school breakfast programs, hospitals, and other settings. (Supported by Dairy Farmers of Canada and Medavie.)

The perception of yogurt by older adults: the role of added sugar

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Older adults may have a higher risk of developing sarcopenia and osteoporosis due to insufficient intake of protein and calcium. Yogurt is a rich source of complete protein, calcium, and vitamin D; however, its consumption might be limited to its sourness. The commercial sweetened yogurts may contain a significant amount of added sugar, contributing to excessive sugar and energy intake. The objective was to determine the least content of added sugar in plain unflavoured yogurt associated with the acceptable sensory characteristics in older adults. Methods: a single-blinded randomized cross-over trial was conducted. Each participant evaluated yogurt treatments varying in added sugar content (0%, 1.1%, 2.2%, 3.3%, 4.4% and 5.5%). The pleasantness, taste, sweetness, sourness, mouthfeel, flavour and aftertaste were measured with a 9-point hedonic scale, and the intensity of sweetness, sourness, bitterness and creaminess were measured with a 100mm visual analogue scale (VAS). Forty-one participants, including 20 males, 78.1 years$\pm$6.10(SD), and 21 females, 74.8 years$\pm$6.23 (SD), evaluated the samples prepared using 2% m.f. plain yogurt, table sugar, and filtered water, and served in random order. Data were analyzed using Friedman's test. Results: there was an effect of treatment on pleasantness, taste, sweetness, mouthfeel, flavour, sourness, and aftertaste acceptability ($P<0.0001$). The hedonic perception was increasing proportionally to added sugar content (0-4.4%); however, there were no differences between the treatments with 4.4 and 5.5% added sugar. There was an effect of treatment on the intensity of sweetness, sourness, creaminess, and bitterness ($P<0.0001$). Participants could discriminate the sweetness in all treatments (0-5.5%), while for the sourness, bitterness, and creaminess, they could not discriminate between the treatments with 4.4 and 5.5% added sugar. Conclusion: the reduction of added sugar content from 5.5% to 4.4% does not affect the organoleptic perception of yogurt by older adults. (Sponsors: Dairy Farmers of Canada, Agropur Dairy Cooperative.)

Effects of increased protein consumption with Greek yogurt during an intense training camp in female adolescent soccer players

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During periods of intensified training (e.g., training camps), recovery duration may be insufficient and maintaining peak performance can

become challenging due to an accumulation of fatigue. This study examined the effects of increased protein consumption with plain non-fat Greek yogurt (GY) on performance recovery, muscle damage, and inflammation during a simulated soccer training camp in competitive adolescent female soccer players. Thirteen players (14.3 ± 1.3 years) participated in two 5-day soccer-specific training camps, where they received 3 daily servings of either GY (per serving: 115 kcal, 17 g protein, 11.5 g carbohydrates) or an isoenergetic carbohydrate control (per serving: 115 kcal, 0.04 g protein, 28.6 g carbohydrates), using a randomized, double blinded cross-over design. A battery of performance tests were used to assess explosive power (counter-movement jump [CMJ] and broad jump [BJ]), aerobic capacity (beep-test), sprinting (10 and 20 m) and agility (modified 5-0-5), both at the beginning and end of each of the 5-d training camps. Fasted resting plasma levels of creatine kinase (CK), insulin like growth factor-1 (IGF-1), C-reactive protein [CRP]) and inflammatory cytokines (interleukin 6 [IL6], interleukin 10 [IL10], tumor necrosis factor-α [TNFα]) were assessed pre- and post-training during each camp. Training led to decrements in CMJ ($p=0.001$), BJ ($p=0.04$) and beep-test performance ($p=0.01$), with no effect of GY ($p>0.05$). A significant increase in anti-inflammatory cytokine IL10 was observed from pre- to post-training in GY (+26% [$p=0.008$]), which was not evident in CHO (-1% [$p=0.90$]). CRP and CK increased (+65% [$p=0.005$] and +119% [$p=0.002$], respectively), while IGF-1 decreased (-34% [$p\leq0.001$]) from pre- to post-training with no difference between conditions. These results demonstrate that the consumption of GY did not offer any added recovery benefit with respect to measures of performance and in the attenuation of exercise-induced muscle damage above that achieved with energy-matched carbohydrates. However, regular consumption of GY may assist with the acute-inflammatory response during periods of intensified training.

Nutritional risk in naturally occurring retirement communities in Ontario, Canada

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Background: Older adults are the fastest-growing demographic group in Canada. Most older adults want to age-in-place within their communities. Many of these community-dwelling older adults in Canada are at nutritional risk, which is associated with increased morbidity and mortality. Objectives: The objectives of this study were to examine correlates of nutritional risk among residents in seven different naturally occurring retirement communities in the province of Ontario, Canada. Methods: Participants were recruited from seven different naturally occurring retirement communities in the cities of Kingston, Belleville, Hamilton, and London. Demographic data, including age, gender, marital status, and household income were collected. Individuals were screened for nutritional risk using Seniors in the Community: Risk Evaluation for Eating & Nutrition (SCREEN) II, a valid and reliable tool for screening for nutritional risk in community-dwelling older adults. Scores can range from 0 to 64. Scores less than 54 indicate nutritional risk whereas scores under 50 indicate high nutritional risk. Descriptive statistics were calculated for SCREEN II score and for demographic variables. Spearman's rho and Pearson's correlation coefficient were calculated where appropriate. Results: In total, 127 individuals were screened; 80.3% were female and the sample ranged in age from 51 to 97 (mean=77, SD=9.16).45% were widowed, 38% were married or in a domestic partnership, and 17% were single. SCREEN II scores ranged from 19 to 62, with a mean score of 45 (SD=7.90).87.4% of these older adults were at nutritional risk and 70.9% were at high nutritional risk. Age was significantly associated with SCREEN II score ($r=.29$, $p=.001$) as was household income ($\rho=.255$, $p=.009$). Gender and marital status were not associated with the SCREEN II score, nutritional risk, or high nutritional risk. Conclusions: Many older adults living in these seven naturally occurring communities in Ontario are at nutritional risk and would likely benefit from nutrition intervention. Participants who were younger and who had lower incomes had lower SCREEN II scores, indicating that these individuals were at increased nutritional risk. Further investigation will aim to explore additional correlates of nutritional risk in this population so that they can be effectively addressed.

Fecal metabolites associated with the prevention of atherogenesis in LDL-receptor knockout mice

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We have previously reported that various dietary agents can effectively prevent atherogenesis in cholesterol-fed low density lipoprotein (LDL)-receptor knockout mice. These studies have highlighted significant beneficial alterations in the diversity and population of fecal bacteria with changes in lipoprotein metabolism and inflammatory markers in mouse animal models. Here, we aimed to investigate the underlying mechanisms that explain these associations. Fecal samples from our previous study were used to estimate the levels of metabolites using standard biochemical methods. Treatment of male LDL-receptor knockout mice with Kgengwe seed powder over 20 weeks of experimental course resulted in the prevention of the atherosclerotic lesion development in the aortic roots of the animals. This anti-atherogenic effect was associated with significant ($p<0.05$) increases by 136% in the fecal levels of citrulline, as well as significant decreases by 17%, 43%, 26%, 23%, 66%, 30%, 32%, 15%, and 21% in the levels of propionic acid, propionylcarnitine, butenylcarnitine, tiglylcarnitine, caprylic acid, hydroxyhexadecenoylcarnitine, hydroxyhexadecanoylcarnitine, vaccenic acid, and linoleic acid, respectively, in the treated animals as compared with those in the control group. Our data suggests an association between fecal bioactive metabolites and atherogenesis in LDL-receptor knockout mice. Additional studies in this and other animal models are needed to understand the mechanisms by which these bioactive compounds may impact the development of atherosclerotic lesions. (Dr. Moghadasian's research program is supported by NSERC.)

Plasma anti-atherogenic metabolites in LDL-receptor knockout mice

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We have frequently reported that various dietary agents can effectively prevent atherogenesis in cholesterol-fed LDL-receptor knockout mice. Our previous studies highlighted significant beneficial alterations in lipoprotein metabolism and anti-inflammatory mechanisms for such effects. In this study, we aimed to expand our investigation to establish other mechanisms. Plasma samples from our previous study was used to estimate the levels of metabolites of macronutrients using liquid chromatography-mass spectrometry methods through The Metabolomics Innovation Centre (University of Alberta, Edmonton, CA). Treatment with 10% (w/w) Kgengwe seed powder over 20 weeks of experimental period resulted in the prevention of the atherosclerotic lesion development in the aortic roots of the animals. This anti-atherogenic effect was associated with significant ($p<0.05$) increases by 104%, 96%, 103%, 109%, 146%, 95%, 88%, 80%, and 98% in the levels of proline, tyrosine, tryptophan, leucine, beta-hydroxybutyric acid, alpha-ketoglutaric acid, indole acetic acid, propionic acid,

and ornithine, respectively, and a significant decrease by 83% in the concentration of succinic acid in the treated animals as compared with control values. Our data suggest that beyond cholesterol-lowering and anti-inflammatory mechanisms, alterations in macronutrient metabolism may alter the process of atherogenesis in LDL-receptor knockout mice. Additional studies in this and other animal models are needed to understand the role of these metabolites in the prevention of atherosclerosis. (Dr. Moghadasian's research program is funded by NSERC.)

Plasma anti-atherogenic oxylipins in LDL-receptor knockout mice

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Various functional foods have shown anti-atherogenic effects in LDL-receptor knockout mice under cholesterol-feeding protocols. Our previous studies highlighted significant beneficial alterations in lipoprotein metabolism and anti-inflammatory mechanisms for such effects. In this study, we aimed to expand our investigation to establish the relation between anti-atherogenic effects of Kgengwe (Citrullus lanatus) seed powder with plasma fatty acid metabolites called oxylipins. Briefly, plasma samples from our previous study were utilized to estimate the levels of oxylipins using high performance liquid chromatography - tandem mass spectrometry and multiple-reaction monitoring techniques. Treatment with 10% (w/w) Kgengwe seed powder over 20 weeks of experimental course resulted in the prevention of the atherosclerotic lesion development in the aortic roots of the experimental mice. This anti-atherogenic effect was associated with significant ($p<0.05$) increases by 62%, 77%, 254%, 304%, and 308% in plasma levels of 15,16-epoxyoctadecenoic acid, 13-hydroxyoctadecadienoic acid, 12,13-epoxyoctadecenoic acid, 9,10-epoxyoctadecenoic acid, and 9,10,13- trihydroxyoctadecenoic acid, respectively, in the treated animals as compared with the control values. Furthermore, a significant decrease in the levels of 12-hydroxyeicosapentaenoic acid and 20-hydroxyeicosatetraenoic acid by 51% and 48%, respectively, was also observed in the treated mice in comparison with the control group. This study highlights the importance of these bioactive lipid mediators in the pathogenesis of atherosclerosis in LDL-receptor knockout mice. Additional studies warrant a better understanding of the mechanisms by which these oxylipins impact atherogenesis. (Dr. Moghadasian's research program is supported by NSERC.)

Osteopenia prevalence and its association with body composition and biochemical parameters in non-dialyzed chronic kidney disease

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Introduction: Chronic kidney disease (CKD) impairs bone metabolism, leading to reduced bone mineral density (BMD) and osteopenia. As BMD is associated with muscle mass, non-dialysis dependent CKD (NDD-CKD) patients are more susceptible to muscle, and hence lean soft tissue (LST) losses, as they follow a low protein diet. Objective: We evaluated the association of BMD and osteopenia with renal function and body composition in NDD-CKD patients. Methods: This is a single center, cross-sectional study of patients with CKD stages 2-5. Body composition was assessed by dual energy x-ray absorptiometry (DXA). Biochemical parameters analyzed included glucose, insulin, lipid panel, urea, creatinine, and mineral metabolism variables: parathormone, calcium, phosphorus and vitamin D. Glomerular filtration rate was estimated (eGFR) by CKD-EPI equation. Excessive body weight was defined as body mass index (BMI) >25 kg/m^2 and high fat mass as $\geq$32% in females and $\geq$25% in males. Osteopenia was defined as t-score < -1.0. Comparison analyses were performed by t-test and chi-square, all correlations were adjusted by sex, age and eGFR. Results: Two hundred and fifty-six patients were included (57.4% females; 42.6% males); 39.1% had osteopenia (versus without osteopenia; $p=0.0006$) with similar sex distribution ($p=0.310$). As expected, patients with osteopenia were older (70.54 ± 11.02 versus 60.98 ± 12.71; $p<0.0001$). The majority presented with excessive body weight (61.3%) and with high fat mass (81.6%). Patients with osteopenia presented with lower values of trunk fat (%; kg), BMI, LST (trunk and total), fat-free mass and appendicular skeletal muscle (ASM), glucose and triglyceride, all $p\leq0.01$. No differences were observed for eGFR and variables of mineral metabolism. T-score was strongly and significantly correlated with LST ($r=0.50$) and ASM ($r=0.46$), both $p<0.0001$; and with phosphorus ($r=-0.15$) and calcium, ($r=0.16$), both $p<0.01$. A significant but lower correlation was observed for % fat mass ($r=0.13$, $p=0.04$). Conclusion: Prevalence of osteopenia was high in NDD-CKD patients independent of renal function and sex. LST is an important body composition compartment related to bone mineral health. Thus, efforts should be made to preserve LST, and hence prevent osteopenia in NDD-CKD patients. (Funding: Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro.)

Does greater adherence to a diverse diet reduce adverse neuro-metabolic outcomes: a systematic review

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Objectives: Dietary diversity, an essential component of healthy eating, has been systematically reviewed in relation to insulin resistance outcomes such as obesity. However, the role of dietary diversity in relation to insulin resistance outcomes in the brain is still controversial. This review aimed to answer whether adherence to a diverse diet is linked to neuro-metabolic outcomes. Methods: We systematically searched three bibliographic databases (Medline, Scopus, and Web of Science) until June 2020 using MeSH and thesaurus terms, supplemented by handsearching relevant reviews and retrieved papers. Longitudinal studies from high- and upper middle-income countries that reported on original research after 2008 were eligible. Data extraction and quality appraisal were conducted using predefined criteria by 3 independent researchers; findings were synthesised narratively. Results: Out of 4,950 records screened, five studies (6,181 participants) were eligible. These were conducted on Anglo-American or Asian populations; follow-up duration ranged from 8 months to 11 years. Except one study on pregnant women, all included older adults and combined results for both genders. Total dietary diversity was conceptualised as the count or proportion of food groups or single items in the diet, while diversity within food groups was defined as count of food subtypes within a food group. Three studies showed that total dietary diversity and particularly diversity of healthy foods reduced odds of poor cognitive function in older adults. In one study total dietary diversity across 9 food groups was associated with reduced odds of depression in pregnancy. Conversely, when diversity within food groups was examined in a study, diverse vegetable subtypes did not show any association with cognitive decline in older adults. Results should be interpreted cautiously since four studies were of

medium quality due to lack of completeness, comparability issues, and the use of screening (not diagnostic) tests for outcome assessment. Conclusions: Total diversity of a diet, particularly across healthy foods, was consistently associated with lower cognitive decline and depression. More robust longitudinal research should focus on diversity within food groups, increase follow-up duration, account for quantity of intake and chewing ability in particular for older adults, and use diagnostic tests for assessment. [Funding: None.]

Lobbying related to Bill S-228 and marketing to kids in Canada

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Lobbying can be highly influential to nutrition-related policies and may have contributed to the failure of Bill S-228, which would have mandated the restriction of marketing to kids (M2K) for certain foods. The objective of this study was therefore to examine the extent to which stakeholders lobbied related to M2K and Bill S-228 in different government institutions and with varying ranks of government. Canada's Registry of Lobbyists, which reports activities of paid lobbyists, was searched for lobbying communications related to Bill S-228/M2K that occurred while Bill S-228 was under consideration (2016/09/01–2019/09/30). Lobbyists were categorized according to stakeholder type (industry/non-industry). The government institution with which lobbyists communicated was extracted (e.g., Health Canada, House of Commons). Communications were categorized (parliamentarians/civil servants) and ranked based on the level of decision-making power of the individual the lobbyist met with (e.g., Prime Minister, Minister, etc.). The number and proportion of lobbying communications were analyzed by stakeholder type, government institution and rank. From 3418 analyzed lobbying communications, 83.9% (n=2866/3418) were with industry lobbyists. Lobbying related to Bill S-228/M2K occurred in 39 government institutions, with the House of Commons (n=1226 communications), Health Canada (n=371) and Agriculture and Agri-Food Canada (n=331) being most lobbied. In any institution, 60-100% of lobbying was by industry. Parliamentarians were lobbied more often than civil servants (n=2519 vs. n=699 communications). More than 71% of communications in any government rank were with industry, rising to greater than 88% in the ranks with the highest decision-making power. Industry stakeholders lobbied government more often, more broadly, and in higher ranking offices than non-industry stakeholders on subjects related to M2K and Bill S-228. While efforts to increase the transparency of the lobbying registry are needed to enable further analyses on the nature of the lobbying discourse that occurred, it is apparent that industry viewpoints were more prominent than those of non-industry stakeholders over the course of Bill S-228's consideration in parliament. (CIHR Frederick Banting and Charles Best Canada Graduate Scholarships Doctoral Award.)

An exploration of the factors impacting uptake of dietary sodium research into dietary sodium policies in five Latin American countries

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Background: Diets high in sodium is a risk factor to cardiovascular disease (CVD) morbidity and mortality. Sodium consumption in Latin American countries (LAC) is more than double the recommended levels. Yet, the application of dietary sodium-related research into public health policies, to address these important public health issues, is inconsistent across LAC and factors impacting research use and uptake are largely unknown. Objective: To describe the barriers and facilitators to the uptake of research findings generated under a coordinated, 3-year dietary sodium research program into public health policies in five LAC (Argentina, Brazil, Costa Rica, Paraguay and Peru). The research program was funded by the International Development Research Centre (IDRC). Methods: A qualitative study using a case study methodological approach was conducted. Participants included five researchers and four Ministry of Health officers from the funded countries. Dimensions of Actors, Content, Context, and Process from Trostle's et al. (1999) conceptual framework informed the semi-structured interview guide and data analysis. One-on-one interviews were completed from November 2019 to January 2020. Transcribed interviews were validated by participants. Transcripts were coded by two researchers and thematically analyzed using NVivo software. Results: Key barriers included food industry and some government actors, where conflict of interests impeded policy advancements; unavailable data on sodium consumption levels in the food supply; government turnover resulting in policy and personnel changes; a lack of human and financial resources; and communication gaps among key actors. Principal facilitators were the content and quality of health economics and qualitative data that led to advances of policies, regulations, and alliances with key actors. The government, non-governmental organizations and international experts provided support and technical assistance to researchers. Additionally, researchers enhanced their skillsets which enabled communication and dissemination processes. Conclusion: There are several barriers and facilitators faced by researchers and policymakers that impact adoption of research into sodium reduction policies and programs in LAC. Several IDRC-funded research program components positively influenced and advanced sodium reduction policies. Future LAC studies can draw from the insights of this research to continue the efforts on policy nutrition to promote healthy eating and reduce CVD risks. (Funding: IDRC.)

Validity and reproducibility of a brief dietary assessment tool measuring three markers of diet quality in a university community

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The importance of diet quality as a predictor for metabolic health has resulted in an emergence of different dietary assessment methods, which have both strengths and limitations. Although the goal is not to replace existing tools and indices, using a cost-effective and simple tool that provides a brief evaluation of diet quality may be a feasible approach to dietary assessment, particularly in larger populations or the clinical setting. The aim of this study was to assess the validity and reproducibility of a university-based questionnaire evaluating three markers of diet quality, namely fruits and vegetables (FV), dairy products (DP) and sugar-sweetened beverages (SSB) in adults in the university community. Sixty participants [(n=29 men and n=31 women); mean age: 37±14 y; BMI: 25.1±4.5 m/kg^2)] completed a questionnaire assessing FV, DP and SSB consumption followed by completion of a three-day food record over a two-week period. After two weeks, the questionnaire was completed a second time to assess reproducibility. Other measures included physical activity (PA), sleep and stress. Pearson's correlations between the markers, Nutrient-Rich Foods (NRF9.3) Index, an indicator of diet quality, PA, stress and sleep were

performed to determine validity while intraclass correlations (ICC) and 95% confidence intervals (CI) were conducted to evaluate the reproducibility of each marker. A hierarchical multiple regression model was used to determine predictability of the markers with NRF9.3. Pearson's correlation coefficients for the reported consumption of FV, DP and SSB between the questionnaire and food records were 0.41 ($P<0.001$), 0.49 ($P<0.001$) and 0.65 ($P<0.001$), respectively. Fruits and vegetables, as assessed by the questionnaire, were positively associated with PA and negatively associated with stress. SSB consumption was associated with poor sleep quality, lower diet quality and higher stress. There was good reproducibility for FV (ICC=0.86; 95% CI=0.80-0.93) and SSB (ICC=0.84; 95% CI=0.76-0.91), while moderate to good reproducibility was observed for DP (ICC=0.80; 95% CI=0.70-0.89). Among the three markers assessed by the questionnaire, FV and SSB were the best predictors of NRF9.3 (β=0.23, $P<0.05$; β=-0.41, $P<0.01$). This university-based questionnaire showed good validity and reproducibility for assessing three markers of diet quality in adult men and women.

Gestational 5-methyletetrahydrofolate and folic acid differ in their effects on the long-term programming of energy regulation in female Wistar rat offspring when intakes exceed requirements

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Folic acid (FA, synthetic folate) is recommended in maternal diets but must first be metabolized into the biologically active folate form, 5-methyletetrahydrofolate (MTHF). In North America, FA intakes exceed recommendations and high levels of unmetabolized FA have been detected. Thus, MTHF is recommended as a supplement. We have compared the dose (recommended 1X vs high, 5X) and form (FA vs MTHF) of folate consumed during pregnancy on long-term metabolic health of Wistar rat mothers (Nutrients. 2021;13:48). Mothers fed 5X-MTHF gained 75% more weight post-partum and ate more food than those fed the 5X-FA diets and showed evidence of leptin dysregulation. RNAseq identified candidate hypothalamic genes that associated with their phenotype. The objective of this study was to identify the long-term effects of gestational FA and MTHF diets on female offspring metabolic health and hypothalamic gene expression. Methods: Wistar rats were fed an AIN-93G diet with 1X (2mg/kg diet, control) or 5X FA or equimolar MTHF only during pregnancy. From weaning to 19-weeks post-weaning female offspring (n=10-12/group) were fed a high-fat diet. Body weight, food intake, plasma leptin, and hypothalamic gene expression of leptin signaling and previously identified candidate genes involved in neurotransmission were measured up to 19-weeks post-weaning. Results: 5X-MTHF offspring had higher weight gain (15%, $P<0.01$) and food intake (8%, $P<0.01$) than 5X-FA offspring but similar to the 1X groups. At birth and at 19-weeks post-weaning, 5X groups had higher plasma leptin (40%, $P<0.05$) then 1X groups. While hypothalamic mRNA of signal transducer and activator of transcription-3 (Stat3) was up-regulated in both 5X groups, 5X-MTHF offspring had lower expression of leptin receptor (Ob-rB) and higher expression of suppressor of cytokine signaling-3 (Socs-3) suggestive of leptin resistance. In contrast, 5X-FA offspring had up-regulation of candidate genes including dopamine, GABA- and glutamate receptors that associated with their phenotype. Conclusion: As with the mothers, folate form and dose during pregnancy affects long-term metabolic phenotype and hypothalamic energy-regulatory genes in female offspring. Differences in responses to FA and MTHF were observed only at the high doses, suggesting neither should be consumed at high intakes. (Funding: Supported by CIHR-INMD; EP supported by NSERC-CGS.)

Baseline hemoglobin, hepcidin, and ferritin concentrations are equally strong diagnostic predictors of a hemoglobin response to 12 weeks of daily iron supplementation in Cambodian women

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Background: The WHO recommends daily iron supplementation for all women in countries where population-level anemia prevalence is ≥40%. Although anemia prevalence is used to guide recommendations for untargeted iron supplementation, hemoglobin concentration is generally considered a poor prognostic indicator of iron status. It is assumed that approximately 50% of anemia cases are due to iron deficiency; however, the causes of anemia are multifactorial including other micronutrient deficiencies, infection/disease, and genetic hemoglobin disorders. Objective: Our aim was to investigate the predictive power of several hematological biomarkers of iron status towards a 12-week hemoglobin response to iron supplementation. Methods: Data were obtained from a randomized controlled trial of daily oral iron supplementation in 407 non-pregnant Cambodian women (18-45 years), pre-screened as anemic by HemoCue, who received 60 mg/d elemental iron as ferrous sulfate for 12 weeks. Nine baseline biomarkers were included: hemoglobin (measured with HemoCue and a hematology analyzer), inflammation-adjusted ferritin, soluble transferrin receptor, reticulocyte hemoglobin content, hepcidin, mean corpuscular volume, total iron binding capacity, and transferrin saturation. Receiver operating characteristic (ROC) curves from fitted logistic regression models were used to make diagnostic performance comparisons. Variable selection methods were applied in constructing a multi-biomarker prognostic model. Results: Of the 383 women who completed the trial, 25% (n=95) experienced a 12-week hemoglobin response ≥10 g/L. The strongest univariate predictors of hemoglobin response were hemoglobin as measured by a hematology analyzer, inflammation-adjusted ferritin, and hepcidin (AUC=0.81, 0.83, and 0.82, respectively). These three biomarkers also had the best combined predictive ability (AUC = 0.86). Interestingly, hemoglobin measured with the HemoCue portable device had poor discrimination ability (AUC=0.65). Optimal cut-offs of hemoglobin, inflammation-adjusted ferritin, and hepcidin to identify women likely to experience a hemoglobin response were 117 g/L, 17.3 μg/L, and 1.98 nmol/L, respectively. Conclusions: Baseline hemoglobin (measured with a hematology analyzer) was as strong a predictor of hemoglobin response to iron supplementation as inflammation-adjusted ferritin and hepcidin. This is positive given that the WHO currently uses population-level anemia prevalence to guide recommendations for untargeted iron supplementation. (Funding information: This trial was funded by the Micronutrient Initiative, Sight and Life Foundation, and the Canadian Institutes of Health Research.)

The influence of information about nutritional quality and environmental impact of food on consumer perceptions and purchasing behavior

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While food and dietary patterns are major determinants of a population's health, our daily food choices also put pressure on the environment. In that context, logos represent a widely used and

potentially promising tool to communicate relevant information and promote healthier and more sustainable choices when eating out-of-home. The purpose of this study was to assess the impact of information about sustainable and nutritious meal options on consumers food perceptions, choices, and consumption, through a greenhouse gas (GHG) emissions score (in kg CO2 eq.), a nutritional quality score, and an eco-efficiency score (i.e. combination of the GHG and nutritional quality scores). We recruited 80 men and 80 women, who were students or employees at Université Laval (Québec, Canada). Participants were randomly assigned to one of four experimental conditions, i.e. menus displaying: 1) GHG scores, 2) nutritional scores, 3) eco-efficiency scores or 4) no information (control). Participants had to choose between two meals (e.g. beef burritos or chicken with lemon sauce) showing one of above-mentioned conditions. They then had to consume the chosen meal. The two meal choices were previously determined based on the results of life cycle assessments and nutritional profiling of different meals already offered by the campus cafeteria. Preliminary results indicated that nutritional and environmental information had an overall impact on meal choice and food consumption. More specifically, participants exposed to such information tended to choose more frequently the meal with the most favorable score for the related condition (e.g. the chicken meal; p-value = 0.0001), and tended to eat a smaller amount in both grams and calories (p-values <0.0001). These effects on intake were greater in the group exposed to the eco-efficiency scores as compared with the control group (mean +/- SD: 340.0 +/- 90.5 g vs. 432.2 +/- 90.7 g, respectively; p-value <0.0001). These preliminary findings suggest that communicating information about sustainable and nutritious menu choices to consumers within institutional settings could be relevant to improve food choices and intakes. (The project received financial support from the Government of Quebec as part of the implementation of the 2013-2020 Climate Change Action Plan.)

Eating away from home in Canada: impact on dietary intake

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BACKGROUND: Public health measures to contain the COVID-19 pandemic, such as stay-at-home orders and restrictions on indoor dining, have upended the way Canadians eat and shop for food. Preliminary reports indicate that since the pandemic, some Canadians report cooking at home more and consuming less food prepared away from home. Away-from-home foods tend to be less healthful than foods prepared at home. Surprisingly little is known about patterns of Canadians' away-from-home food consumption pre-pandemic. This study used the most recent available nationally-representative nutrition data to characterize the frequency of eating out at restaurants (of any type) and selected markers of dietary intake according to eating out status. METHODS: National-level food intake data came from the first 24-hr dietary recall collected as part of the 2015 Canadian Community Health Survey–Nutrition. The analytic sample comprised 20,475 individuals aged 1 or older. Mean daily intakes of selected food groups and nutrients per 1,000 kcal of total daily energy intake were compared between those who consumed any food in a restaurant on the previous day vs. those who did not. Estimates were generated for the overall population and for eight age-sex groups. RESULTS: Overall, about one in five Canadians (21.5%) reported having consumed food in a restaurant on the previous day. Eating out in a restaurant was most common among males aged 19-54 (27.7%) and least common among young children (8.4%). Compared to Canadians who did not eat out the day before, those who did reported consuming, on average, fewer servings of whole fruit, whole grains, dark green and orange vegetables, "other" vegetables (not including potatoes), milk and fortified soy-based beverages, and legumes, nuts and seeds during the previous day. Those who ate out consumed, on average, less fibre and total sugar, and more total fat and saturated fat. Few differences were found for meat/poultry, fish/seafood and protein intake. IMPLICATIONS: These results can serve as valuable baseline data to compare with estimates from future studies of any changes in Canadians' eating-away-from home habits and diet quality since 2015, including post pandemic.

Intrauterine growth-restricted piglets developed obesity and dyslipidemia in adulthood when fed with parenteral nutrition in the neonatal period

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Total parenteral nutrition (TPN) is a non-normal nutrition regimen; however, it is a life-saving feeding method during the neonatal period. Dyslipidemia and obesity are common complex metabolic disorders with increased incidences around the world. Studies have shown that feeding TPN during the neonatal period can permanently alter metabolism. Consistent with developmental origins of adult disease, intrauterine growth restricted (IUGR) neonates have higher risk to develop metabolic diseases in later life. A larger proportion of IUGR or premature neonates require TPN as a life-saving measure in early life. However, whether these metabolic effects of feeding TPN in early life are exacerbated by IUGR and persist into adulthood is unknown. We hypothesized that feeding TPN to IUGR neonates will exacerbate the risk of developing metabolic diseases in adulthood. Sixteen normal weight female piglets (7 d old) were randomized to sow-fed (SF) or TPN (TPN-CON); eight (IUGR) (i.e., runt) piglets were fed TPN as a third group (TPN-IUGR). After 2 weeks of TPN or suckling, all pigs were fed a grower diet for 10 mo (adulthood). At 9 mo, central venous catheters were implanted to conduct metabolic tests. The metabolic effects of feeding TPN persisted into adulthood, as signified by slower postprandial triglyceride (TG) clearance after a fat bolus ($p<0.05$), higher fasting plasma non-esterified fatty acids (NEFA) ($p<0.001$) and lower TG in cardiac muscle ($p<0.05$) in TPN-CON piglets, compared to SF. Moreover, IUGR exacerbated TPN-induced risk for diseases by worsening obesity outcomes and dyslipidemia with greater backfat thickness ($p<0.05$), higher cholesterol in fasted LDL ($p<0.05$), slower postprandial TG clearance ($p<0.05$), higher fasting plasma NEFA ($p<0.001$), compared to the TPN-CON. Accumulation of ectopic deposition of TG in the liver ($p<0.05$), muscle tissue ($p<0.05$), and higher plasma dimethylglycine ($p<0.05$) of TPN-IUGR may have contributed to these adverse metabolic effects. These data collectively suggest that although TPN is a necessary life-saving measure in IUGR neonates, it has long-term metabolic consequences predisposing the individual to develop metabolic disorders in adulthood. By understanding the mechanisms, we hope to modulate TPN formulations that will reduce this programmed metabolic burden in adulthood from early TPN therapy. (CIHR.)

The lipotropic effects of graded doses of dietary choline in overweight cats at maintenance energy requirements

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Severe energy restriction, aimed at weight loss, predisposes overweight cats to hepatic lipidosis. Choline is linked to lipid metabolism

in numerous animal species, however the data in cats remains scarce. This trial aimed to investigate the minimum effective dose of dietary choline necessary for lipotropic effects in overweight cats at maintenance. This study was approved by the University of Guelph Animal Care Committee (AUP#4118). Fourteen overweight (body condition score [BCS]:≥6/9) adult male neutered cats were used in 5x5 latin square design. Cats were fed a commercial extruded cat food (3620 mg choline/kg diet) once a day at maintenance energy requirements (130 kcal/kgBW0.4). Each cat received one of the five individual choline chloride supplementation doses added to their daily food allotment, during a three-week period. Doses were based on the cats' body weights and the published daily recommended allowance (RA) for dietary choline for adult cats (63 mg/kg BW0.67). The doses were: 2xRA (126 mg/kg BW0.67), 4xRA (252 mg/kg BW0.67), 6xRA (378 mg/kg BW0.67), 8xRA (504 mg/kg BW0.67), and control (no additional choline). Body weight and BCS were assessed weekly. At the end of each three-week period, fasted blood samples were taken, and indirect calorimetry was performed. Serum was analyzed for cholesterol (CHOL), high-density lipoprotein CHOL (HDL), triglycerides (TG), non-esterified fatty acids (NEFA), glucose, creatinine (CREAT), urea, alkaline phosphatase (ALP) and alanine aminotransferase (ALT). Very low-density lipoprotein CHOL (VLDL) and low-density lipoprotein CHOL (LDL) were calculated. Data was analyzed via SAS using proc GLIMMIX, with group and period as the random effects, and treatment as the fixed effect. Statistical significance was considered at $p<0.05$. Body weight and BCS did not change ($p>0.05$). Serum CHOL, HDL, TG, and VLDL increased with 6xRA ($p<0.05$). Serum ALP and UREA decreased with 8xRA ($p<0.05$). There were no differences in fed or fasted respiratory quotient and fed or fasted energy expenditure ($p>0.05$). These results suggest that high levels of choline supplementation may assist in feline hepatic health maintenance, through increased hepatic fat mobilization. Future studies that pair these results with existing knowledge of feline weight loss are warranted. (Funded by NSERC and Elmira Pet Products).

A novel multi-level food classification system including level of processing: potential applications for dietetics research and practice

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Dietary assessment on an individual and population level encompasses more than nutrient intake and food groupings and should include indicators of diet quality. Current national recommendations promote a limited consumption of highly processed foods. However, existing food classification systems limit the ability of researchers and dietitians to explore the level of food processing in addition to assessing diet quality. A need was identified to develop a multi-level integrated food classification system. From the literature, 6 existing classification systems related to the level of food processing and 13 specific to food classification were identified and considered to develop a unique, multi-level system. This novel approach classified basic food items from the Canadian Nutrient File (CNF) and United States Department of Agriculture's (USDA) Food Data Central across 4 major and 6 minor categories. The major categories include: Food and Agriculture Organization's (FAO) CODEX, What We Eat In America (WWEIA), NOVA and the 2019 Canadian Food Guide. Minor categories apply to select food items and were categorized based on nutrient content or processing method, including: isoflavone, fiber, fat and sugar content, frying and fermentation as defined by Health Canada and USDA guidelines. Additionally, each food item was assigned a standard portion size based on Canada's Reference Amounts for Food. With this system, the food item "skim cow's milk" is part of the following categories: (1) primary food commodity of animal origin, (2) dairy, (3) fluid milk, (4) fat free, (5) unprocessed and minimally processed, (6) protein food and (7) serving size (mL). This classification system can be used to relate diet quality to disease outcomes in nutrition research with indices such as: Healthy Eating Index, Mediterranean Diet Score, Dietary Approaches to Stop Hypertension, and Diet Quality Index. Additionally, dietitians may use the system as a method to quantify and evaluate diet quality of individual eating habits. The nature of this system is compatible with machine-learning algorithms and has the potential to be integrated into artificial-intelligence technologies in dietetics research and practice. (Funding: none received.)

Association between biomarkers of key micronutrients and male reproductive hormones

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Infertility affects about 16% of Canadian couples, with the male factor contributing to ∼35% of the cases. Reproductive hormones play an integral role in regulating the reproductive system and consequently, in fertility. Although prudent dietary patterns have been associated with improved male fertility, the role of specific micronutrients remains unclear. Few studies have examined the association between biomarkers of key micronutrients and male reproductive hormones. The objective was to assess the association between serum micronutrient concentrations and male reproductive hormones. We conducted a cross-sectional study involving infertile men (n = 188) recruited from Mount Sinai Hospital. Serum was analyzed for nutritional biomarkers (ascorbic acid, cobalamin, vitamin D, ferritin and iron) and the primary outcomes of interest, serum hormones (luteinizing hormone, total testosterone, follicular stimulating hormone and prolactin). Statistical analysis included, general linear regressions, analysis of variance and post-hoc Tukey HSD tests. After adjusting for covariates, no linear associations between micronutrients and reproductive hormones were observed. Adjusted analysis of variance models with post-hoc Tukey HSD test indicated that mean ($\pm$SD) total testosterone concentrations were significantly higher for the highest compared to the lowest tertile of serum ascorbic acid (14.2 $\pm$ 6.4 vs 11.4 $\pm$ 6.1 nmol/L, p = 0.04). Mean luteinizing hormone concentrations were significantly lower in the highest compared to lowest tertile of serum ascorbic acid (6.13 $\pm$ 3.26 vs 8.74 $\pm$ 6.48 IU/L, p = 0.03). Mean luteinizing hormone concentrations in the lowest tertile of ascorbic acid were above the acceptable reference range, which can be indicative of insufficient testosterone production. Our study is the first to examine the association between micronutrients and male reproductive hormones in humans. Our findings suggest that ascorbic acid (vitamin C) is associated with favourable hormone profiles that impact fertility in men, emphasizing the need for nutritional assessments and interventions by dietitians as standard part of care for male infertility. (Funded by the Allen Foundation.)

Examining tri-council funding support for nutrition research in Canada

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There has been increased attention to equity, diversity, and inclusion within research, including issues of both representation and excellence in research by valuing diverse perspectives. Discipline-specific explorations are needed. We sought to describe tri-council funding awarded within the nutrition discipline according to institution type, academic rank, gender, dietitian status, and primary research methods used. Faculty members with research appointments were identified from nutrition departments offering accredited dietetic

programs and/or at U15 universities. All data regarding faculty members, their institutions, and funding were collected through publicly available websites and Scopus. Tri-council funding from a 5-year period, 2013/14-2017/18, was extracted, regardless of whether the grant start date preceded 2013. Data were entered into Microsoft Excel and SPSS was used for descriptive analysis. Binary logistic analysis was used to test for predictors of receiving any tri-council operating funds within the 5-year period. Faculty members (n=245) from 21 institutions were identified for inclusion. Of 274 grants awarded during the eligible period, 2.9%, 53.3%, and 43.8% were from SSHRC, CIHR, and NSERC, respectively, with 78.1% of the total amount of funding attributed to CIHR. Those from U15 institutions, at the full professor rank, non-dietitians, men, and those who engaged in primarily quantitative research methods (vs. qualitative or mixed-methods) were significantly more likely to receive any funding during the eligible period. While dietitians are more likely to be at institutions outside the U15 and utilize qualitative or mixed-methods, being a dietitian was negatively associated with receiving funding, independent of institution, gender, and primary research methods utilized. Health and basic science research dominate the nutrition field. The apparent under-funding of dietitians and those who engage in qualitative- or mixed-methods requires exploration. While certain methods may be costlier to carry out, this analysis did not factor in amount, only whether funding was awarded. (Funding support: MK and HD received a University of Manitoba, Undergraduate Research Award (2019 and 2020, respectively). MK is the recipient of a CIHR Canada Graduate Scholarship, Masters-level. NDR is the recipient of a CIHR Early Career Investigator Award (2018-21). This study was partially funded through start-up funds to NDR from the UofM.)

Dietary white and dark red kidney beans improve intestinal microbiota diversity and intestinal inflammation during the development of high-fat diet induced obesity in C57BL/6 male mice

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Obesity is a gut-associated disease wherein the intestinal microbiota becomes imbalanced, or dysbiotic, leading to increased intestinal barrier inflammation. This disruption can produce increased systemic inflammation and worsen obesity-associated co-morbidities. A dietary strategy worth investigation is high-fibre foods, such as common beans, whose consumption is associated with reduced risk of obesity, cardiovascular disease, and diabetes. Bean consumption can affect health through improvements in intestinal microbiota composition and function such as short-chain fatty acid (SCFAs) production, glycemic response, and changes in hormones associated with obesity and diabetes management. The objective was to determine if cooked white kidney (WK) or dark red (DK) beans supplemented into a high-fat diet (HFD) would attenuate microbial dysbiosis, increase microbial function and improve systemic hormones during obesity development. 5-week-old male C57BL/6 mice consumed either a HFD (60% kcals from fat, wt/wt), or isocaloric HFD supplemented with either 15% cooked WK (HF+WK) or DK (HF+DK) bean powder for 9 weeks. Body weight (BW) and diet intake (DI) were measured bi-weekly. Body composition was measured by EchoMRI. Cecal microbiota composition was assessed by 16S rRNA gene sequencing. Cecal and fecal SCFAs were assessed by gas chromatography. Intestinal inflammation was assessed in the proximal colon by mRNA gene expression. Fasting blood was collected for blood glucose and serum hormone concentrations. There were no significant differences in BW, DI, or fat mass, however lean mass in body composition was significantly increased in HF+WK and HF+DK groups at weeks 2 and 6 ($p<0.05$). Bean consumption increased alpha-diversity and beta-diversity in the cecal microbiota compared to HFD ($q=0.0015$). There were no significant differences in cecal SCFAs between HFD and bean diets, however fecal SCFAs were significantly increased in bean-fed mice. Only HF+DK consumption led to improvements in intestinal barrier inflammation, by significantly decreasing proximal colon TNF-α gene expression. No differences in fasting blood glucose or serum leptin, ghrelin, insulin, resistin, adiponectin, GLP-1, GIP, PAI-1, glucagon were observed ($p>0.05$). When consumed as part of a HFD, cooked WK and DK beans increase lean mass, improve microbiota composition, but only DK improved intestinal barrier inflammation in mice during obesity development. (Funding: Ontario Research Fund.)

The effect of parenteral nutrition containing supplemental arginine and citrulline on intestinal oxidant status

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Total parenteral feeding (TPN) is a therapy commonly used in neonates with intestinal dysfunction. TPN reduces blood flow to the gut and induces gut atrophy. Because arginine synthesis is dependent on gut metabolism in the neonate, gut atrophy reduces arginine synthesis making arginine conditionally essential in neonates. Arginine and citrulline are critical for synthesis of nitric oxide (NO) synthesis, an important vasodilator responsible for regulating blood flow to the gut. NO can also act as an antioxidant by quenching reactive oxygen species. However, supplemental arginine is rapidly broken down by the liver. Conversely, citrulline, a precursor to arginine, is not broken down in the liver, so could be an alternative means to increase arginine availability for NO synthesis. This study aims to determine whether TPN supplemented with either arginine or citrulline has an effect on oxidant stress markers in the gut. We hypothesized that diets supplemented with arginine and citrulline will show less oxidative stress than unsupplemented control TPN, due to higher NO production. 7-10 day old Yucatan piglets received one of three TPN diets: control TPN, TPN containing high arginine, or TPN containing citrulline. Blood flow to the gut was measured by ultrasonic probe on the superior mesenteric artery (SMA). Oxidative effects on the gut were determined via the myeloperoxidase (MPO) assay, an assessment of neutrophil infiltration, and the ferric reducing antioxidant power (FRAP) assay, an assessment of the gut's antioxidant capacity. SMA blood flow, MPO activity and antioxidant capacity of the gut did not change among treatment groups. However, there was a positive correlation ($r=0.7127$, $p=0.0312$) between blood flow to the gut and MPO activity, suggesting stimulation of blood flow enhances MPO activity. However, there was a negative correlation ($r=-0.7042$, $p=0.0342$) between blood flow and antioxidant capacity within the arginine treatment, suggesting there were responders and non-responders to arginine's effects; additional assays of antioxidant capacity are needed to understand these outcomes. The results indicate that enhancing SMA blood flow improves the immune response in an atrophied gut, but supplemental arginine or citrulline do not consistently enhance blood flow during TPN. (CIHR, Janeway Research Foundation.)

Eating patterns and coronary artery calcification among individuals with heterozygous familial hypercholesterolemia: preliminary results

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Heterozygous familial hypercholesterolemia (HeFH) is the most prevalent genetic disorder causing premature coronary events and deaths worldwide. Conclusive data on the cardioprotective potential of diet in the management of HeFH remain unavailable. The

objective of this study was to evaluate, in a cohort of adults with HeFH, the associations between dietary scores for five eating patterns and coronary artery calcification (CAC) prevalence - the most discriminant risk factor associated with the incidence of cardiovascular events in HeFH. A total of 116 adults with genetically defined HeFH and without history of cardiovascular disease were recruited for this cross-sectional study. All participants completed a validated food frequency questionnaire from which the five following dietary scores were calculated: healthful Plant-Based Diet Index (hPDI), unhealthful Plant-Based Diet Index (uPDI), alternate Mediterranean Diet Index (aMED), Alternate Healthy Eating Index (AHEI), and Dietary Approach to Stop Hypertension index (DASHi). Each score reflected distinct eating patterns. All participants also underwent a noncontrast computed tomography scan to measure CAC. Of the 116 participants (women, n=56; men, n=60; mean age: 45.9 ± 13.2 years), 71 (61.2%) had prevalent CAC (i.e. CAC score >0 Agatston units). After adjustment for sex, age, the LDL-receptor genotype, family history of cardiovascular disease, smoking status, prevalent type 2 diabetes, body mass index as well as alcohol and energy intakes, a 25-percentile increment in the dietary scores reflecting healthy eating habits was associated with lower odds of prevalent CAC, ranging from 9% to 27% [odds ratios (confidence interval of 95%), hPDI; 0.91 (0.49-1.69); aMED: 0.78 (0.48-1.27); AHEI: 0.72 (0.44-1.16); DASHi: 0.83 (0.51-1.34)]. Conversely, a 25-percentile increment in the uPDI, reflecting a provegetarian dietary pattern rich in unhealthy processed plant foods, was associated with 2.1 higher odds of prevalent CAC [uPDI: 2.10 (1.00-4.50)]. For each eating score, further adjustment for plasma LDL cholesterol and lipoprotein(a) levels year-scores had no major impact on the mean odds ratios. These preliminary results suggest that diet quality is inversely associated with CAC prevalence in adults with HeFH and support the importance of dietary counseling in HeFH management.

Prevalence of iron deficiency and supplementation practices for patients on home parenteral nutrition

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Background: Iron deficiency (ID) is common in patients receiving parenteral nutrition (PN), likely due to a lack of iron in the PN formula. Within the Hamilton Health Sciences (HHS) home PN (HPN) program, the prevalence of ID or iron deficiency anemia (IDA) is unknown. This knowledge will contribute to better iron prescribing practices with ultimate benefit on patient's health. Aims: To assess the prevalence of ID and IDA in patients enrolled in the HHS-HPN Program. The secondary aim was to assess supplementation practices for patients enrolled in the HPN program according to gastrointestinal (GI) diagnosis and duration on PN. Methods: We conducted a retrospective study including consecutive adult patients enrolled in the HHS-HPN program from January 2015 to November 2020. We collected data on demographics, iron supplementation, and information related to iron-deficiency at pre-set intervals. ID was defined as ferritin ≤45μg/L or serum iron ≤9μmol/L. IDA was defined as hemoglobin <130g/L in men or <120g/L in women with ID. Data were expressed as median(IQR) for continuous variables and n/N (%) for categorical variables. Chi2 was performed to assess differences between groups and logistic regression to assess predictors of ID and IDA with SPSS-software (v26). Results: The analysis included 125 HPN patients (50 males, median age of 55 years). Patients received PN for a median of 195 days. The most common diagnoses were malignancy (36.8%) and inflammatory bowel disease (23.2%); the most common indications for HPN was short bowel (29.6%) and bowel obstruction (27.2%). Iron profiles were measured in 77% of patients. At enrollment, 42.2% of patients had ID and 38.9% had IDA. Only 13% of patients with ID and 22.8% with IDA had iron supplementation. A total of 38 patients received iron either oral or IV (oral=44.7% vs IV=55.3%; p=0.66). There was no correlation between low levels of serum iron or ferritin with iron supplementation and age, sex, diagnosis, or reason for PN did not correlate with ID or IDA. Conclusions: Iron-deficiency and IDA are common in patients enrolled in the HHS HPN program independently of age, sex, diagnosis, and reason for PN. Prospective studies are needed to implement the most effective way to ensure proper monitoring and treatment of iron deficiency.

The inclusion of folic acid in weekly iron-folic acid supplements confers no additional benefit on anemia reduction in Malaysian women

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The WHO recommends weekly iron-folic acid supplements (WIFAS) for all menstruating women in countries where anemia prevalence is >20%. However, the global prevalence of folate deficiency anemia is low and it is not known if the inclusion of folic acid in WIFAS is beneficial for anemia reduction. Our objective was to determine if the inclusion of folic acid in WIFAS confers any additional benefit on hemoglobin concentration, anemia reduction, or iron status [ferritin and soluble transferrin receptor (sTfR)], over iron alone. Non-pregnant Malaysian women (n=331) were randomized to receive 60 mg iron with either 0, 0.4, or 2.8 mg folic acid once-weekly for 16 weeks. Fasting blood was collected at baseline and 16 weeks. Generalized linear models were used to assess continuous and binary outcomes. At baseline, 84% of women had low folate status (plasma folate <14 nmol/L). At 16 weeks, marginal mean (95% CI) hemoglobin was 131.4 (130.1, 132.7), 130.6 (129.3, 131.9), 131.6 (130.3, 132.9) g/L; ferritin was 58.2 (53.9, 62.5), 56.5 (52.2, 60.9), 58.0 (53.7, 62.3) μg/L; and sTfR was 5.8 (5.5, 6.1), 5.8 (5.5, 6.1), and 5.9 (5.6, 6.2) mg/L in the 0, 0.4, and 2.8 mg groups, respectively, with no differences detected between groups (P>0.05). Baseline plasma folate concentration did not modify the effect of treatment on hemoglobin concentration at 16 weeks (interactions: P=0.931 and P=0.300 for 0.4 and 2.8 mg groups, respectively). Among all women, the risk of anemia (risk ratio [RR] 0.65; 95% CI: 0.45, 0.96, P=0.03) and iron deficiency based on ferritin (RR 0.30; 95% CI: 0.20, 0.44, P<0.001) were lower at 16 weeks than at baseline. The mean (95% CI) increase in hemoglobin across all women was 2.6 (1.0, 4.3) g/L and ferritin was 20.7 (15.4, 26.1) μg/L, after controlling for inclusion of folic acid. Despite the low folate status of this population, the inclusion of folic acid in WIFAS did not reduce anemia or improve iron status, over iron alone. Although the inclusion of folic acid in WIFAS is beneficial for neural tube defect prevention, it does not prove to be an effective option for further anemia reduction. (Funding: Nutrition International.)

Most frequently consumed red/processed meat dishes and plant-based foods and their contribution to the intake of energy, protein, saturated fat, sugars, and sodium among Canadians

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According to the new Canada's food guide, nutritious foods to encourage should not contribute to excess consumption of saturated

fat, free sugars, or sodium. While many animal-based foods are nutritious, new Canada's food guide places a major emphasis on the consumption of more plant-based foods. Using nationally representative data from the Canadian Community Health Survey–Nutrition 2015, we aimed to identify and characterize the top 10 most frequently consumed red meat dishes and plant-based foods in the Canadian population (≥1 year). Red/processed meat dishes and plant-based foods categories included 265 and 659 unique food codes, respectively, from the Canadian Nutrient File. Our results revealed that "cooked regular long-grain white rice" was the most frequently consumed plant-based food in the Canadian population, followed by "canned red ripe tomatoes." Cooked regular long-grain white rice made a significant contribution to energy (12.1 ± 0.3%) and protein (6.1 ± 0.2%) intake among the consumers of this food item. Among the top five most frequently consumed plant-based foods, "smooth type peanut butter, fat, sugar, and salt added" made the most significant contribution to saturated fat (13.3 ± 0.05%), protein (8.1 ± 0.3%), sodium (4.8 ± 0.2%), and sugars (3.8 ± 0.2%) intake. "Cooked lean or extra lean ground beef or patty" was the most frequently consumed red meat mixed dish in Canada. The next four highest-ranked red meat mixed dishes were made of processed meat, including ham and frankfurter (wiener/hot dog). Among red meat mixed dishes, "ham and cheese sandwich with lettuce and spread," made the most significant contribution to the intake of energy (21.8 ± 0.7%), saturated fat (31.0 ± 1.0%), sodium (41.8 ± 1.3%), and sugars (8.2 ± 0.5%) among the consumers of this food item. White rice was the most frequently consumed plant-based food and ground beef was the most frequently consumed red/processed meat dish among Canadians. Red/processed meat dishes are major drivers of the excessive intake of nutrients-to-limit.

Genetic modifiers of caffeine and anaerobic performance in athletes: a randomized controlled trial

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Caffeine is commonly used as a supplement to improve athletic performance; however its effects vary across individuals and sport disciplines. The effect of caffeine on anaerobic performance is unclear and may differ depending on an individual's genetics. The rate of caffeine metabolism, determined by an individual's CYP1A2 genotype, appears to modify caffeine's effects on endurance performance. Genetic variability in caffeine metabolism or response may also explain caffeine's inconsistent effects on anaerobic performance. The objective is to determine whether caffeine influences anaerobic performance in a 30 second Wingate test, and if 14 single nucleotide polymorphisms (SNPs) in 9 genes associated with caffeine metabolism or response to caffeine, modify any such effects. Competitive male athletes (n=100; 25 ± 4 years) completed the Wingate Anaerobic Test under three conditions: 0, 2, or 4 mg of caffeine per kg of body mass (mg/kg), using a double-blinded, placebo-controlled design. Using saliva samples, subjects were genotyped for the 14 SNPs. The outcomes were peak power (Watts [W]), average power (Watts [W]), and fatigue index (%). There was no main effect of caffeine on Wingate outcomes. However, two significant caffeine-gene interactions were observed for ADRB2 (rs1042717, p=0.0009) on peak power, and CYP1A2 (rs762551, p=0.004) on average power. Caffeine improved peak power only in those with the AA genotype of ADRB2 (rs1042717) at the 4 mg/kg dose, compared to the placebo and 2 mg/kg dose (mean ± SD; 1204 ± 524 W vs. 986 ± 178 W and 989 ± 213 W, p=0.002, p=0.004, respectively). Post hoc analysis found no difference in caffeine's effects within CYP1A2 genotypes for average power performance. No significant caffeine-gene interactions were observed for the remaining 12 SNPs. In conclusion, athletes may want to consider their genotype and response to caffeine prior to using caffeine during anaerobic exercise. This study was registered with clinicaltrials.gov (NCT 02109783). (Funding was provided by the Canadian Foundation for Dietetic Research, Canadian Institutes for Health Research, The Coca-Cola company, Mitacs and Nutrigenomix Inc.)

The Nutrition in Cirrhosis Guide: Potential beneficial effects in cirrhotic patients and caregivers

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Liver disease affects over 9 million Canadians and kills 2 million people annually worldwide. One of the most prevalent complications of chronic liver disease (cirrhosis) is malnutrition, which greatly affects the quality of life of patients and their caregivers. The Nutrition in Cirrhosis guide was developed by a national team of hepatology and nutrition experts. Objectives: 1) To assess the impact in cirrhotic patients, in the short and long term, of the Guide on: i) nutritional status; ii) nutrition knowledge; iii) quality of life; iv) liver function; and, in the long term, v) complications; vi) number and duration of hospitalization. 2) Determine the impact on the quality of life and the perceived burden of caregivers. 3) Survey the appreciation of the Guide by patients and their caregivers. Method: A randomized controlled study targeting 100 cirrhotic patients at the Centre Hospitalier de l'Université de Montréal (CHUM) divided into 2 groups: Intervention (Guide) and Control (without Guide). Nutritional status, nutrition knowledge, quality of life and liver function are assessed at t = 0, 3 and 6 months, and hospitalizations after 6 months. The quality of life and perceived burden of caregivers is evaluated at t = 0 and 6 months. Three focus groups of 10 patients and their caregiver, randomly chosen from the intervention group, will be created to assess their appreciation of the Guide. Results (pilot study): 26 patients completed the 3-month pilot study (67% men, mean age = 60 years and etiologies: 30% non-alcoholic hepatic steatosis, 25% alcoholic, 12.5% hepatitis C, hepatitis B and mixed etiologies, and 4% other etiologies). The results show that the patients in the intervention group (n=20) have better knowledge of nutrition than the controls (n=5) (79.5 ± 7.7% vs 68.4 ± 7.9%; p=0.02) after 3 months. The control group also displayed an improvement in their quality of life after 3 months compared to t = 0 (5.10 ± 1.15 vs 5.61 ± 1.08, $p<0.0005$). Conclusion: The Guide seems to offer a beneficial effect on the quality of life and nutrition knowledge of cirrhotic patients after 3 months.

Cross sectional study of ethnic differences in cardiometabolic risk in children

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Introduction: Cardiometabolic risk (CMR) differs in adults according to ethnicity. In particular, South Asians (SA) develop cardiometabolic conditions more frequently, at younger ages, and lower body mass index (BMI) values than Europeans. Whether these differences arise as early as childhood remains narrowly explored. Objective: To examine whether children of parents who report SA, East Asian (EA), African, Southeast Asian (SEA), Latin American (LA), and Middle-Eastern (ME) ethnicity display different CMR scores than children of parents who report European ethnicity. Methods: A cross-sectional analysis was conducted among 4,155 children (ages 3-11 years)

that participated in The Applied Research Group for Kids (TARGet Kids!) study in Toronto, Canada. Multivariable linear regression models were used to estimate mean differences in continuous CMR outcomes between children of parents of European ethnicity (reference group) and children of parents of SA, EA, African, SEA, LA, and ME ethnicity. Models were adjusted for age, sex, child z-BMI, family history of CMR, maternal education, self-reported income, and median neighbourhood income. The primary outcome was a continuous CMR score, calculated as the mean of age- and sex-standardized waist circumference, systolic blood pressure (SBP), glucose, log-triglycerides, and inverse of high-density lipoprotein cholesterol (HDL-C), divided by $\sqrt{5}$. Differences in diastolic blood pressure (DBP; mmHg), SBP (mmHg), non-HDL-C (mmol/L), and waist-to-height ratio (WHR) were also explored. Results: The mean CMR score was -0.019 (SD= 1.15). Lower mean CMR scores were observed among children of EA (β= -0.43, 95% CI: 0.69, -0.16, P<0.01) and African parents (β= -0.62, 95% CI: -0.92; -0.32, P<0.001) in comparison to children of European parents. In comparison to children of European parents, children of SA parents had significantly higher SBP (β=2.45, 95% CI: 1.47; 3.44), higher non-HDL-C levels (β=0.19, 95% CI: 0.10; 0.29, P<0.001), and lower WHR (β=-0.0048, 95% CI: -0.0084; -0.0013, P<0.01). In adjusted models, no significant differences in DBP were observed between children of European parents and children with parents of other ethnic groups. Conclusions: These findings suggest that ethnic differences in CMR may be present in early and middle childhood. (Funding Sources: The Canadian Institutes of Health Research.)

Patient and hospital characteristics associated with patient perceptions of meal quality as measured with the Hospital Food Experience Questionnaire

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Poor meal quality perceptions and dissatisfaction with hospital meals may contribute to low food intake, increasing the risk of poor patient outcomes and increased hospital costs. Meal quality perceptions may vary depending on patient or hospital characteristics. This study tested if patient and hospital characteristics were associated with patients' food priorities and meal quality perceptions as measured by the valid and reliable Hospital Food Experience Questionnaire (HFEQ).The HFEQ was completed by 1,087 patients (65.18 ± 18.03 years, 51.1% female) from sixteen Ontario hospitals. Data were collected on 22 food priorities and ratings of a single meal using 5-point Likert scales which were summated into a total score (min. = 0, max. = 110). Patient (e.g., diagnosis, gender) and hospital characteristics (e.g., size, foodservice model) were elicited through questionnaires. Multivariable linear regression assessed which hospital and patient characteristics were associated with HFEQ score. Average HFEQ score was 90.60 ± 10.83. The HFEQ score was significantly associated with patient and hospital characteristics ($F(42, 556) = 2.34$, $p < 0.001$). Women, and patients aged 40-59 and ≥60 scored significantly higher by 3.51, 4.82, and 4.07 points compared to men, and patients aged 18-39, respectively ($t = 4.06$, $p < 0.001$; $t = 2.80$, $p = 0.005$; $t = 2.49$, $p = 0.013$). Patients receiving meals prepared by the cold plated/rethermed model or the hot plated centrally/tray delivery with plate covers model scored 6.45 points lower and 11.03 points higher than patients receiving meals prepared by the bulk delivery/centrally prepared/plated on unit from bulk steam cart model, respectively ($t = 2.43$, $p = 0.016$; $t = 2.01$, $p = 0.045$). HFEQ scores at sites where >10% of the foodservice budget was allocated to local food procurement scored lower by 2.88 points compared to sites spending ≤10% ($t = 1.98$, $p = 0.048$). Patient and hospital characteristics influence patients' perceptions of meal quality as measured by the HFEQ. To support a high-quality meal experience, patient-centred approaches and altering foodservice practices that directly influence sensory traits of foods served are suggested. (Funded by Ontario Agri-Food Innovation Alliance.)

The Hospital Food Experience Questionnaire is reliable, construct valid and predictive of patient meal intake

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Low food intake is prevalent among hospital patients and may be attributable to poor meal quality perceptions and dissatisfaction with sensory traits of meals served. A valid and reliable tool to measure patients' meal quality perceptions, and regulations to collect and act upon such data in Ontario, is lacking. This study assessed the internal reliability, construct and predictive validity of the new Hospital Food Experience Questionnaire (HFEQ) and derived a short version (HFEQ-sv). Sixteen Ontario hospitals recruited 1,087 patients (65.18 ± 18.03 years, 51.1% female) to participate. Patients completed the HFEQ at a single meal which assessed their food (6 items) and food-related priorities (10 items), and food sensory ratings (7 items) using 5-point Likert scales. Food intake at this meal was measured using visual estimation. Cronbach's alpha and principal components analysis (PCA) assessed internal reliability. Convergent validity was determined using ordinal logistic regression with the HFEQ items and a single item rating of overall meal quality. HFEQ items associated with the single item meal quality rating were retained for the HFEQ-sv. Binary logistic regression with HFEQ items and t-tests with the summated HFEQ and HFEQ-sv scores determined predictive validity with food intake. The HFEQ demonstrated good internal reliability ($\alpha = 0.86$) and all but one item uniquely loaded onto the five-factor structure in PCA. HFEQ items were associated with the overall meal quality rating ($LRT(88) = 1{,}258.22$, $p < 0.001$), with 5 priorities, and 6 meal ratings used in the HFEQ-sv. Binary logistic regression testing HFEQ items and meal intake was significant ($LRT(86) = 177.24$, $p < 0.001$), and the summated score of the HFEQ and HFEQ-sv were associated with meal intake, with patients consuming 100% of their meal scoring 2.82 and 2.39 points higher than patients consuming ≤75%, respectively ($t(940) = 4.02$, $p < 0.001$; $t(954.45 = 5.87$, $p < 0.001$). The HFEQ is reliable, construct valid and predicts food intake. The 22-item HFEQ or 11-item HFEQ-sv could be implemented in hospitals to support quality improvement measures to assess and improve the patient meal experience and support subsequent food intake. (Funded by Ontario Agri-Food Innovation Alliance).

The patient meal experience is predictive of patient meal intake when considering other covariates that impact food intake in hospital

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Malnutrition occurs in ∼45% of Canadian medical and surgical patients, often due to low food intake. This study tested the association between hospital and patient characteristics with meal intake and examined whether the patient meal experience, as measured by the valid and reliable Hospital Food Experience Questionnaire (HFEQ), added utility in predicting intake. The HFEQ was completed by 1,087 patients across 16 Ontario hospitals at a single meal. Visual estimation of intake by a trained assessor was the outcome (≤75% vs. 100% of meal). Binary logistic regression determined the effect of gender-stratified patient and hospital characteristics on meal intake followed by the addition of the HFEQ score. Max-rescaled R2

and Akaike information criterion (AIC) assessed if the HFEQ score explained greater variance in intake and improved model fit, respectively. Approximately 29% of patients consumed ≤50% of their meal. Gender-stratified models testing only patient characteristics were nonsignificant (Female: LRT(29) = 22.89, p = 0.78, AIC = 661.43, R2 = 0.06; Male: LRT(30) = 29.04, p = 0.52, AIC = 679.58, R2 = 0.08). Female and male models were significant and marginally nonsignificant after HFEQ score was added, respectively (LRT(30) = 46.90, p = 0.03, AIC = 574.88, R2 = 0.14; LRT(31) = 41.76, p = 0.09, AIC = 612.48, R2 = 0.12). Each one-point increase in HFEQ score was associated with females and males being 1.06 and 1.03 times more likely to consume 100% of their meal (CIs [1.03, 1.09], [1.01, 1.06]). Models testing hospital characteristics without and with the HFEQ score were nonsignificant (LRT(11) = 6.23, p = 0.86, AIC = 960.16, R2 = 0.01; LRT(12) = 16.69, p = 0.16, AIC = 8 72.99, R2 = 0.04), however the odds of 100% meal consumption were 1.06 times higher per one-point increase in HFEQ score (CI [1.03, 1.09]).The HFEQ score resulted in better model fit and explained greater variance in intake than gender-stratified patient and hospital characteristics alone. Regular assessment of the patient meal experience using the HFEQ could improve the quality of meals served in hospital and support subsequent food intake and recovery. (Funded by Ontario Agri-Food Innovation Alliance.)

Prediction of the plasma triglyceride response to an omega-3 fatty acid supplementation using genomic and lipidomic features

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A recent genetic risk score (GRS) of the total plasma triglyceride (TG) response to an omega-3 (n-3) fatty acid (FA) supplementation had a high predictive capacity, explaining 49.7% of the TG variance. Genomic analysis of separate TG species has never been investigated following an n-3 FA supplementation. The objective was to combine genomic and lipidomic features to better predict the TG response than the GRS alone. N-3 FA supplements were given to overweight or obese subjects for six weeks, providing 3g of n-3 FA per day, to induce a change in TG levels. A total of 90 participants were classified into three phenotypes of TG response: 1- positive responders (TG decrease >10%); 2- non-responders (TG change within ± 10%); and 3- negative responders (TG increase >10%). Mass spectrometry was used to quantify TG species. A principal component analysis (PCA) was used to group TG species into factors. Associations between factors and the GRS were tested in a general linear model adjusted for age, sex, body mass index and pre-supplementation factors. Sparse partial least squares discriminant analysis (sPLSDA) was used to determine TG species differing between phenotypes. A classifier combining genomic and lipidomic features was built to discriminate phenotypes. Four factors of TG species were kept following PCA. Factors 1 and 2, mainly containing short-chained, highly desaturated TG, were associated with the GRS ($p < 0.0001$, for both), and the GRS accounted respectively for 17.6% and 21.3% of the TG variance. Pre-supplementation TG levels of factor 1 loadings following sPLSDA were used as lipidomic input data in the classifier with the 31 SNPs composing the GRS. The classifier reached a balanced accuracy of 0.25 (25% of misclassification). This study suggests that lipidomic and genotypic analysis can be efficiently combined for predicting the plasma TG response to an n-3 supplementation, showing the potential of deep phenotyping in clinical practice. (Supported by the Canada Research Chair in Genomics Applied to Nutrition and Metabolic Health. The CT was supported by CIHR (MOP 123494).)

Perceived flatulence and related symptoms in response to canned beans over 1 month in adults with hypercholesterolemia

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Bean consumption in Western society is low despite high nutritional quality and demonstrated health benefits. Perception of flatulence and related symptoms is a barrier to bean consumption; however, the effect of repeated exposure to different amounts is not well studied. This multi-centre, crossover study randomized 73 adults (41 females, 32 males, 48.1±14.2 years, BMI 25.9±4.2 kg/m^2) to consume five varieties of canned beans (black, navy, pinto, red kidney, white kidney) in one-cup (OCB) and half-cup (HCB) daily amounts and a one-cup white rice (WR) control for 28 days each, separated by ≥28-day washouts (NCT03830970). Questionnaires asking about perceived severity rankings (none, mild, moderate, severe) for flatulence, bloating, cramping and abdominal discomfort were completed for 5 days during three phases (BEFORE: days -5 to -1, START: days 1-5 and END: days 24-28) of each treatment (OCB, HCB, WR). Symptom severity rankings (none, mild, moderate, severe) were compared between phases (BEFORE, START, END) within each treatment and between treatments (OCB, HCB, WR) within each phase. Participant study flow was n=66 for OCB, n=68 for HCB and n=64 for WR. Flatulence severity was greater at the START compared to BEFORE for OCB (p=0.002) and HCB (p=0.0005). At the END, flatulence severity for OCB did not differ from the START and was still greater than BEFORE ($p<0.0001$); however, for HCB it decreased from the START (p=0.0009) and was not different from BEFORE. Flatulence severity did not differ among treatments BEFORE, was greater with OCB and HCB compared to WR at the START (p=0.002 and p=0.006, respectively) and the END ($p<0.0001$ and p=0.004, respectively), but was less severe with HCB than OCB at the END (p=0.0008). Bloating severity patterns were similar to flatulence for OCB but did not change for HCB. Cramping severity did not change and abdominal discomfort severity increased with OCB compared to WR at the START only (p=0.01). These results most clearly indicate that perceived flatulence severity increases with bean consumption and over 28 days, it subsides with half-cup but not one-cup amounts. Research on longer durations and different amounts of beans is warranted. (Funding: Canadian Agricultural Partnership Pulse Science Cluster Program.)

Impact of the COVID-19 pandemic on eating and physical activity practices among adults – findings from Alberta's Tomorrow Project

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In March 2020, Alberta enacted emergency measures to slow the spread of COVID-19, which changed accessibility of food and physical activity opportunities. To capture the immediate impact of these measures on eating and physical activities, Alberta's Tomorrow Project, a longitudinal cohort study of urban and rural adults,

implemented a comprehensive COVID-19-focused online survey from June-August 2020 and 19,115 participants (age 62 + 9 y, range 39-85; 33% male) responded. Participants reported their perceived changes in eating and physical activity practices since the pandemic via 6 categories - a lot or little less, about the same, a little or lot more, and not applicable; here, 'lot' and 'little' are combined for each of 'less' and 'more'. Pre-pandemic, 52% of participants reported working full/part-time and 46% were retired. One third reported their monthly household income was somewhat/substantially reduced compared to pre-pandemic, with 10% reporting moderate/major impact in ability to meet financial obligations. Half reported preparing/cooking meals at home more than before the pandemic and 30% reported eating with others more. The majority visited the grocery store (70%) and ate restaurant food (73%, onsite or takeout/delivery) less. The majority also reported meal planning (60%) or budgeting for food (66%) about the same while 33% and 25% reported doing so more, respectively. One third reported snacking and reaching for 'comfort foods' more, but most reported consuming about the same amount of fresh or frozen/canned fruit and vegetables, whole grains, animal protein and plant proteins (73-85% across items). Since the pandemic, 23% of participants walked to destinations (e.g. stores) less, and 57% drove in a motor vehicle less. Over a third reported more neighbourhood walking (30%), being physically active at home (33%), and spending time outdoors (44%). However, almost half reported watching TV (43%) and using screen-based devices (54%) more. These data indicate both negative and positive changes in eating and activity practices resulting from the pandemic, and further investigations will be explored to identify whether certain populations are more vulnerable to negative versus positive changes. (Alberta's Tomorrow Project is supported by Alberta Health, Alberta Cancer Foundation, Canadian Partnership Against Cancer and Health Canada, and Alberta Health Services.)

Reporting stronger voluntary recent actions and commitments concerning product (re)formulation is not associated with greater improvements in the nutritional quality of products offered by the top packaged food and beverage companies in Canada from 2013–2017

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Many major packaged food and beverage manufacturers report voluntary recent actions and/or commitments concerning product (re) formulation, but the extent to which these initiatives translate into actual improvements in the healthfulness of companies' products has not been examined. This study investigated changes in the nutritional quality of products offered by the top 22 packaged food and beverage companies in Canada between 2013 and 2017, in comparison to the strength of their reported actions and commitments concerning product (re)formulation. Data on companies' product (re)formulation actions and commitments were collected from public sources (e.g., corporate websites and reports), validated by company representatives (where possible), and evaluated using the Food Company Reformulation (FCR) scoring tool for quantifying the strength of food companies' recent actions and commitments to reduce energy/portion sizes, sodium, saturated fat, trans fat and/or sugars in their products. Nutritional information for products was sourced from the 2013 (n=6,490) and 2017 (n=8,277) cycles of the University of Toronto FLIP database (n=4,074 matched products). Changes in the healthfulness of companies' products were assessed based on: the Health Star Rating (HSR) system; and calories, sodium, saturated fat, trans fat, and total and free sugars per 100 g (or mL). Generalized estimating equations were used to compare FCR scores with changes in the healthfulness of companies' products. Higher FCR scores were not associated with larger increases in HSRs, or reductions in calorie, sodium, trans fat, total sugars or free sugars levels ($p>0.05$). However, higher FCR scores were associated with decreases in saturated fat ($p=0.006$), while lower FCR scores were associated with increases ($p<0.001$). HSRs, calories, sodium, saturated fat, trans fat and free sugars did not differ significantly between the highest- and lowest-scoring companies' products in 2013 or 2017 ($p>0.05$). Total sugars contents were greater for top-scoring companies' products in 2013 ($p<0.001$) and 2017 ($p=0.004$). Overall, reporting stronger product (re)formulation actions and/or commitments was not associated with greater improvements in the healthfulness of products offered by Canada's top packaged food and beverage companies. These findings demonstrate the limited effectiveness of voluntary industry efforts in creating a healthier food supply, highlighting a need for government intervention. (Funding: CIHR/OGS.)

A Western-type diet, not fructose content, differentially impacts cardiometabolic outcomes in male versus female mice

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In the last 30 years, worldwide dietary sugar consumption has increased drastically and daily energy from sugar in North America is approximately 20% (Marriott, 2009). Fructose comprises approximately half of these intakes – primarily as sucrose and high-fructose corn syrup (HFCS). High fructose intakes have been linked to a dysregulation in hepatic carbohydrate and lipid metabolism, leading to an increased cardiometabolic risk. The objective of this study was to identify fructose and sex-specific changes on different cardiometabolic risk factors in mice; we hypothesized that these phenotypic changes would only present when fructose intake was matched with hypercaloric intakes. To test this hypothesis, adult male and female C57BL/6J mice (18-weeks old) consumed a high-fat, high-sugar, hypercaloric diet consisting of either 0% (n=17), 10% (n=17), or 20% (n=18) of total calories from fructose for 18-weeks. A bolus dose of glucose and stable isotope U-13C-fructose (0.5 g/kg body weight (BW) respectively) was administered by gavage 30-minutes before the animals were killed. The following sex-specific differences were observed: males displayed greater BW gain per week (1.19 g/week, $p<0.001$) and liver weight per gram BW (8.33%, $p<0.001$) than their female counterparts (0.76 g/week, 6.47%), and females displayed higher blood glucose concentrations (20.4 mmol/L, $p<0.05$) at the 30-minute time point in comparison to males (17.8 mmol/L). Amongst treatment groups, no differences were observed for BW gain per week, liver weight per gram BW, or blood glucose concentrations (baseline, 15-min, 30-min post-gavage). In addition, the coronary arteries and the aorta were free of atherosclerotic lesions and appeared normal with intact endothelial lining in all mice. This preliminary data suggests that a diet high in fat and energy, rather than fructose, may differentially impact cardiometabolic outcomes when assessed in males versus females. Current analysis of liver and cardiac lipid profiles (measured by GC) as well as stable isotope U-13C-fructose tracer/tracee ratios (measured by GC-MS) will help to further investigate if fructose intake differentially impacts the carbohydrate or lipid metabolism at the whole-body level and within specific tissues. This research is critical to providing insight into the dysregulation of carbohydrate and lipid metabolism associated with fructose consumption. (NSERC Funded.)

Inhibition of Δ-6 desaturase impairs fatty acid re-esterification in adipocytes independent of changes in n3-PUFA cellular content

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Δ6-Desaturase (D6D) is critical for omega-3 polyunsaturated fatty acid synthesis by catalyzing the conversion of α-linolenic acid (ALA) to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Since EPA and DHA consumption is typically low in Western countries, understanding the outcomes associated with impaired D6D activity is critical because low levels of EPA and DHA are associated with increased disease risk. Previous research showed that D6D knock-out mice fed an ALA-rich diet (deficient in EPA and DHA) had reduced adiposity. The goal of this work was to elucidate how n-3 PUFA and D6D affect adipocyte lipid handling. We first differentiated 3T3-L1 pre-adipocytes in the presence of ALA with or without a D6D inhibitor (ALA+D6Di vs. ALA). D6D inhibition was confirmed by fatty acid analysis by gas chromatography. ALA+D6Di cells had reduced triacylglycerol (TAG) content and impaired fatty acid re-esterification compared to ALA cells. We also detected increased expression of lipogenic genes (ACC1, FASN and SCD1) in ALA+D6Di cells compared to ALA cells, with no change in lipolytic gene expression. However, the increased lipogenic gene expression did not align with the reduced TAG seen in ALA+D6Di cells. Therefore, we hypothesized that D6D inhibition may reduce adipocyte TAG content independent of changes in n-3 PUFA. To test this hypothesis, 3T3-L1 cells were treated with or without D6D inhibitor in the absence of n-3 PUFA treatments. Despite no changes in n-3 PUFA profiles, D6D inhibited cells still showed reduced TAG content and impaired fatty acid re-esterification, but no changes in lipogenic gene expression. To confirm that impaired fatty acid re-esterification was not caused by n-3 PUFA treatments in the context of D6D inhibition, we compared cells treated with EPA and D6D inhibitor (EPA+D6Di) to cells treated with ALA+D6Di. No difference in fatty acid re-esterification was observed, but ALA+D6Di cells showed higher lipogenic gene expression than EPA +D6Di. Our study revealed that n-3 PUFA and D6D conjointly regulate lipid handling in adipocytes, and that the reduced TAG content in D6D inhibited cells was predominantly caused by impaired fatty acid re-esterification independent of changes in n3-PUFA cellular content. (Funded by NSERC.)

Artificial rearing of newborn rats: effects of human milk oligosaccharide supplementation

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Nutritional status early in life fundamentally influences neonatal development and health. Precise manipulation of nutrients is consequently desirable for biomedical research in neonates. Most artificial rearing systems, however, are applicable for short-term intervention in newborns. In this study, we aimed to improve the established rat pup-in-a-cup model for nutritional manipulation during the suckling period to investigate the effects of human milk oligosaccharide (HMO) supplementation on growth, adiposity, brain, and gut microbiota. HMOs are the third most abundant component of human breast milk and support the establishment of a healthy gut microbiota. Whether adding select HMOs to formula is beneficial, is not well understood and therefore the objective of this study. Cheek cannulas were inserted into the lining of the mouth of 4 day old Sprague-Dawley pups (n=54) and then reinforced. Rats were randomized to receive one of four rat milk substitutes delivered by continuous infusion pumps: 1) CTR (basal rat milk substitute); 2) 2'-FL (CTR +1.2 g/L 2'-fucosyllactose); 3) 3'-SL (CTR +1.2 g/L 3'-sialyllactose); 4) 2'-FL +3'-SL (CTR +0.6 g/L 2'- fucosyllactose +0.6 g/L 3'-sialyllactose). The flow speed of milk delivery were adjusted based on age and daily average body weight as: Flow speed =[0.35+ 0.02(Age-4)]*BW/feeding hours. Body weight, bowel movements and food intake behaviors were monitored daily. Oral glucose tolerance test (OGTT), body composition, organ weight and cecal microbiota were measured at weaning. After 18 days of artificial rearing, 36 of 54 (67%) pups successfully survived and grew well until weaning. No significant differences were observed between four dietary interventions in growth performance (daily body gain and body weight at weaning), body composition (Lee index, Lean mass % and fat mass %), organ weight (liver, brain, and cecum) and abundance of dominant cecal microbes. Longitudinal 16S rRNA gene sequencing data demonstrated clear bacterial succession between the facultative anaerobes (weeks 1 and 2) and obligate anaerobes (week 3) in suckling rats. The stepwise succession throughout lactation will provide a valuable timetable reference for the precise manipulation of nutritional interventions targeting certain bacterial species, and for in vivo ecological study of target bacterial species under intestinal conditions.

Exploring perspectives of a sugar-sweetened beverage tax using critical discourse analysis

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Concerns about a global "obesity epidemic" have resulted in the proposition of a sugar-sweetened beverage (SSB) tax to reduce sugar intake. However, such a tax is regressive and may negatively impact health equity. One area of concern for health equity is weight stigma, where SSB taxation could create, or exacerbate existing stigmas around SSB consumption and consumers, which we have previously identified in the Midwestern United States. The aim of this study is to explore the acceptability of a SSB tax and how SSBs and their consumption is perceived among residents of River Heights. We performed a secondary data analysis of 18 qualitative, semi-structured interviews that were previous conducted with River Heights residents. Participants were recruited based on these inclusion criteria: residence in River Heights, age of 18 and over, and English speaking; only white residents volunteered. Critical discourse analysis methods were used for data analysis, which were informed by the theoretical frameworks of critical weight studies and critical policy theory. Preliminary analysis suggests that a SSB tax would be generally supported by River Heights residents. SSB behaviours are subject to judgement. Participants reproduced weight-stigmatizing discourses, such as responsibilization of individuals and parents, and disgust of "excess" weight or weight gain. Additionally, support for, or against SSB taxation is discursively linked with governmental trust, especially in regard to revenue, as well as fairness, and efficacy. SSB taxation has been proposed in Canada and the results of this study can inform policy discussion about potential implementation of a SSB tax. (This research was supported by CIHR Canada Graduate Student-Masters Award, CIHR, Graduate Enhancement of Tri-Council Stipend and University of Manitoba Graduate Studies.)

Perspectives of persons with memory changes and care partners on challenges and preferences for community nutrition programs

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A healthy diet is associated with better health for community-dwelling persons with memory changes, including dementia (PWMC). For care partners (CPs), mealtimes can be a burden due to stress, anxiety, and pressure to provide nutritious meals. It is unknown what PWMC and CPs would like in a community wellness program to support their health. This study explored nutrition challenges and program preferences of PWMC and CPs. PWMC and CPs were recruited from social media and stakeholder networks. Online surveys were available for

eight months in English and French. PWMC responded for themselves, while CPs responded for themselves and their cared-for person with dementia (CPWD). Descriptives and comparisons across key groups (e.g., men vs. women) were completed. A convenience sample of 46 CPs and 24 PWMC participated in the survey. CPWDs, as reported by their CPs, experienced significantly more challenges than self-reporting PWMC, in terms of physical challenges (t42=-2.43; P=0.02), cognitive, mental, emotional challenges (t35=-3.46; P=0.001), and food intake challenges (t39=-6.35; P<0.001). Longer time since dementia diagnosis was also associated with more mealtime challenges (P=0.049). Of respondents, 35% of CPs reported "cooking with a loved one" as their biggest challenge. One in five CPs reported that stress affected their motivation to eat healthfully, and 8% experienced poor appetite. Although preferences for wellness program content were diverse, 39% CPWDs (reported by their CPs) were interested in a community lifestyle program (including nutrition and physical activity). Over half of participants were interested in learning to identify and cook nutritious foods, and over half preferred online program delivery. PWMC and CPs were interested in attending as a dyad. There is interest among PWMC and CPs in community programs to support a healthy eating, but varied needs require flexibility in content and format. The generalizability of these findings is limited, as respondents were mostly digitally literate English speakers who lived in Ontario. Future studies should further explore the needs and expectations for community nutrition and lifestyle programs, potentially through a co-design process to develop programs that meet their needs. (This project was funded by the 2019 Hallman Undergraduate Research Fellowship.)

Assessing the turnover rate of Canadian food and beverage labels – implications for the proposed front-of-package labelling transition period

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Background: Efforts to regulate front-of-package nutrition labelling (FOPL) have been highlighted as a policy priority in Canada, with stakeholder consultations (e.g., on cost estimates, symbols) beginning in 2016; draft regulations were pre-published in 2018 in Canada Gazette Part I. A four-year transitional period (extended to December 2022) was proposed to reduce industry's cost of implementing labelling amendments; however, there is a paucity of impartial data on whether this timeline, and thus cost, is realistic. Objective: To quantify the turnover rate of changes to Canadian food and beverage product labels between 2013 and 2017, to examine the feasibility of industry to meet the proposed transitional period with minimal incremental costs. Methods: The turnover rate of product labels between 2013 and 2017 was analyzed in a large, representative sample of Canadian packaged food and beverages (n=15,285 and n=17,358, respectively) by quantifying: i) the extent of product entry/exit in the market, through assessing changes in Universal Product Barcodes (UPC); ii) the proportion of 'matched' products appearing in both years with changes to their Nutrition Facts table (NFt), as determined by changes in calories or 13 core nutrients, and; 3) the proportion of 'matches' without any changes in their NFt, yet with changes to their principal display panel (PDP). Results: 63.5% (n=11,030) of 2017 products were either newly introduced since 2013 or reformulated foods with a new UPC. Of the 36.5% (n=6,328) of 2017 products matched by UPC, 50.5% (n=3,197) had changes to their NFt. Further, of the 3,131 remaining matched products with no NFt changes, approximately 35.0% had changes to the PDP. Thus, in summary, approximately 88.3% of food labels in 2017 had changes initiated by the manufacturer or were newly introduced products since 2013.Interpretation: The current study presents a unique way of determining the feasibility for industry to meet proposed Canadian FOPL regulations within the normal label turnover cycle. These data suggest that the timeline as proposed in the draft regulations is feasible and would likely not impose substantial additional costs to industry above and beyond those associated with changes in product packaging over a typical four-year period. (Funding: CIHR Grant (2016PJT-378415).)

Homozygous hemoglobin EE disorder and α-thalassemia trait are associated with lower serum folate concentrations in Cambodian women of reproductive age

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Genetic hemoglobin disorders have been shown to affect the majority of women of reproductive age in Cambodia, with α-thalassemia and hemoglobin E (Hb E) variants being most prevalent. Hemoglobinopathies can increase the risk of anemia due to decreased or defective hemoglobin production, and/or increased erythropoiesis. Increased rates of erythropoiesis may also lead to elevated needs for folate and vitamin B-12, B-vitamins that play a crucial role in the development of red blood cells. The aim of this study was to assess the association between common genetic hemoglobinopathies and serum concentrations of folate and vitamin B-12 in women of reproductive age in Cambodia. Fasted venous blood from 369 Cambodian women of reproductive age (18-45y) was analyzed for serum folate using a microbiological assay, serum vitamin B-12 using an immunoassay, genetic hemoglobinopathies using hemoglobin electrophoresis and PCR, and hematological indices using an automated hematology analyzer and sandwich ELISA. Linear regression was used to estimate the association between folate and vitamin B-12 concentrations, alpha-1-acid glycoprotein (AGP), and hemoglobin genotypes. Folate and vitamin B-12 were log-transformed in the analyses, and the regression coefficients represent the geometric mean differences. Hemoglobinopathies were present in 51% of the population, with homozygous hemoglobin EE disorder (Hb EE) and α-thalassemia trait occurring in 11% (n=41) and 12% (n=45) of women, respectively. Folate deficiency (serum folate <6.8 nmol/L) was present in 3% of women (n=10), whereas vitamin B-12 deficiency (serum B-12 <150 pmol/L) was present in 2% of women (n=6). The homozygous Hb EE genotype and α-thalassemia trait were both associated with 19% (95% CI: 3-33% and 95% CI: 4-32%, respectively) lower geometric mean folate concentrations, as compared to women with the normal (wildtype) Hb AA genotype (p<0.05). None of the hemoglobinopathies present in this population were associated with lower vitamin B-12 concentrations. While deficiencies of folate and vitamin B-12 were not prevalent in this sample of Cambodian women, lower serum folate concentrations were observed in women with the homozygous Hb EE disorder and α-thalassemia trait than in women with normal hemoglobin (Hb AA). (Funding: International Development Research Centre and the Canadian Institutes of Health.)

Assessing the serving size, energy content and energy density of Canadian chain restaurant food and beverage items in 2020

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Over 50% of Canadians report eating out regularly. Literature demonstrates poor nutritional quality of restaurant foods. Although there is no federal policy aimed at improving the nutritional quality of restaurant foods, the provincial Healthy Menu Choices Act 2015, implemented in 2017, mandates restaurants with ≥20 outlets in Ontario to display the energy content of food items on menus. An early assessment in 2017 showed no improvement compared to prior to the regulations, and there is limited information on nutritional quality of restaurant foods since then. Our objective was to examine and compare the serving size and energy content of menu items between fast-

food (FFR) and sit-down (SDR) Canadian chain restaurants in 2020. Nutritional information for menu items (n = 12,441) were collected from Canadian restaurants (n=106) with ≥20 outlets nationally in 2020. Restaurants were categorized as FFR (n=73) or SDR (n=33). Items were categorized into 5 major categories (e.g., entrées). Descriptive statistics (median, 95% CI) were calculated for serving size, energy (kcal) per serving and per 100g. Mann-Whitney U-test was used to compare between FFR and SDR. The reported serving sizes were (presented as median [95% CI]): starters 284g [262-290] (n=341), entrées 255g [249-260] (n=6,905), sides 150g [145-150] (n=1,330), desserts 110g [102-115] (n=999) and beverages 433g [410-455] (n=2,866). The median energy/serving was highest in starters, entrées, and desserts (520kcal [460-570], 470kcal [460-480], 300kcal [290-320], respectively). The median energy/100g was highest in desserts, starters and sides (318kcal [310-323], 214kcal [206-223], 196kcal [188-201], respectively). Serving sizes and energy/serving for SDR (307g [298-321], 520kcal [500-531], respectively; n=3,340) were significantly higher than FFR (259g [250-269], 300kcal [290-300], respectively; n=9,101, $p<0.001$), although energy/100g was significantly different, but not meaningfully higher in FFR (185kcal [182-188]) compared to SDR (178kcal [173-180], $p<0.05$).This study indicates that energy levels in restaurant foods are high in comparison to the recommended average daily energy intake (2000kcals). SDR foods have higher amounts of calories than FFR foods, although this is mainly due to larger serving sizes, rather than differences in calorie density. This study demonstrates the need for policy interventions to improve nutritional quality in the restaurant sector. (Funding: CIHR (2016PJT-378415).)

Sugar intake from snacks among Canadian preschool-aged children in the Guelph Family Health Study

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Sugar-dense snacks are sources of empty calories in the diets of preschool-aged children and may displace intake of nutrient-dense foods. Excess consumption of sugars is associated with cardiometabolic risk and dental caries. Canada's new Dietary Guidelines encourage the overall reduction of free sugars by preparing nutritious snacks with little to no added sugars. Understanding snacking behaviours is important to inform strategies to improve dietary intake in young children. This cross-sectional cohort study investigated sugar intake from snacks in children aged 1.5 to 5 years (n=128 boys, n=134 girls) from 207 families enrolled in the Guelph Family Health Study from 2017 to 2020. Parents provided a detailed 24-hour dietary recall for their child (ren) using ASA24-Canada-2016, an online automated dietary assessment tool. Snacks were defined as foods and beverages (excluding water) consumed between parent-identified meals. Added sugar intake from snacks was calculated using the Food Patterns Equivalents Database (FPED) definition of added sugars, from the United States Department of Agriculture. Free sugar intake was then calculated using added sugars combined with sugars from fruit juices, which were determined using the FPED fruit juice variable and a Sugar Per Cup Fruit Juice database. This database was populated using data from the Canadian Nutrient File and supplemented with data from the Food and Nutrient Database for Dietary Studies. Snacks accounted for 26.5±13.7% of total energy, 36.9±29.1% of energy from total added sugars, and 36.2±28.5% of energy from total free sugars. These values are similar to 2005 to 2012 National Health and Nutrition Examination Survey data, which found that the snacks of US preschool-aged children accounted for 28.4% of total energy and 39.4% of energy from total added sugars. Bakery products were consumed as snacks by 55.3% of children. Among these children, bakery products contributed 63.4±35.6% of the free sugar from their snacks. These preliminary data indicate that snacks are a significant source of added and free sugars in the diets of Canadian preschool-aged children and further analyses into the categories of snacks that are most determinant of excess sugar intake are warranted. (This research was supported by the Heart and Stroke Foundation of Canada.)

Consideration of sex-specific responses to maternal exposure with red rooibos polyphenols for programming of bone development in offspring

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Early life is a critical period for bone development and may be influenced by maternal diet. Using rodent models, maternal and/or early life exposure to various polyphenols present in soy or citrus fruits have been shown to influence bone development through young adulthood, and sometimes with sex-specific effects. Red rooibos tea, a caffeine-free beverage, was of interest given the unique polyphenol profile shown to stimulate bone mineralization in vitro, possibly through antioxidant activity. Objectives of this study were to determine whether maternal consumption of red rooibos throughout pregnancy and lactation improved bone development and strength in male and female offspring at young adulthood, and to determine potential sex-specific responses. Two weeks prior to mating, female Sprague-Dawley rats were randomized to control (water) or a supplemental level of red rooibos tea in water (2600 mg/kg bodyweight). At weaning (age 21 days), offspring were fed AIN-93G control diet until age 3 months. Longitudinal assessment of the tibia using micro-computed tomography demonstrated that maternal exposure to red rooibos did not alter the trajectory of BMD or bone structure in male or female offspring compared to sex-specific controls at 1, 2 or 3 months of age. Also, at age 3 months and within each sex, red rooibos intervention had no effect on ex vivo biomechanical strength at the femur midpoint, a surrogate measure of fracture risk. An expected main effect of age on all bone outcomes was observed in this rapid phase of bone development. Sex-specific differences in bone development were observed at 2 and 3 months of age. Female rats had higher tibia BMD and more developed trabecular bone structure, whereas some cortical bone outcomes showed that male tibias were larger and femurs were stronger at 3 months of age. In conclusion, maternal exposure to red rooibos did not result in benefits to bone development in male or female offspring. Measurement of longitudinal changes in BMD and bone structure demonstrated differences in the trajectory of bone development between sexes – these observations can inform future studies when bone may be most responsive to an intervention. (NSERC DG, CFI and CRC to WE Ward.)

Genetics of iron metabolism and premenstrual symptoms: a Mendelian randomization study

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Most women of reproductive age experience adverse psychological and/or somatic premenstrual symptoms. These symptoms may last for a majority of the reproductive years and can adversely impact the quality of life of many women. Although the etiology of premenstrual symptoms is still unclear, hormonal, neural, genetic and dietary factors appear to play a role. Some studies have examined the role of micronutrients in premenstrual symptoms, but the research on iron has been limited. The objective of this study was to determine the effects of genetic predictors of iron overload and low iron status on premenstrual symptoms using Mendelian Randomization. We examined 254 Caucasian females aged 20-29 years from the Toronto Nutrigenomics and Health Study. DNA was isolated from peripheral white blood cells and genotyped for HFE (rs1800562 and rs1799945), TMPRSS6 (rs482026), TFR2 (rs3811647) and TF (rs738584) polymorphisms. Participants completed a General Health and Lifestyle Questionnaire, which

captured demographic data and fifteen premenstrual symptoms and their respective severities. Dietary intake was measured using a 196 item Toronto-modified Willet food frequency questionnaire. The risk of iron overload or low iron status was determined based on combined genotypes. Binomial logistic regressions were used to calculate odds ratios (OR) and 95% confidence intervals (CI) for the risk of premenstrual symptoms associated with genetic risk of iron overload or low iron status. Compared to participants with typical risk of iron overload, those with an elevated risk of iron overload were less likely to experience premenstrual symptoms of confusion/difficulty concentrating (OR: 0.13; 95% CI: 0.02, 1.00), headaches (OR: 0.28; 95% CI: 0.08, 0.98), and nausea (OR: 0.13; 95% CI: 0.02, 0.99) after adjusting for age, BMI, vitamin C and calcium intake. No associations were seen with the other symptoms. There were also no associations between low iron status genotypes and any premenstrual symptoms. Our findings demonstrate that women with an elevated risk of iron overload may have a lower risk of experiencing some premenstrual symptoms (headache, confusion/difficulty concentrating and nausea), suggesting that iron status could impact the risk of certain premenstrual symptoms. (Funded by the Allen Foundation.)

Calcium and vitamin D: dietary sources and eating occasions in young Canadian children

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There is limited research examining the dietary sources of calcium and vitamin D in young Canadian children and their distribution across eating occasions throughout the day. This is important to explore because calcium and vitamin D are required for the acquisition of adequate bone mass, and sufficient consumption of both micronutrients may reduce the risk of chronic health conditions in later life. Thus, this study investigated the dietary sources and intake of calcium and vitamin D across eating occasions in children aged eighteen months to six years enrolled in the Guelph Family Health Study. Parents of 289 children (M=143, F=146) completed 24-hour dietary recalls for their child(ren) via ASA24-2016, an online dietary assessment tool. The greatest dietary source of both nutrients was fluid milk (including whole, reduced fat, flavoured, and breast milks). Lunch contributed the greatest proportion of calcium (27% $\pm$ 17), with non-dairy foods (e.g., fruits & vegetables, plant-based beverages and composite dishes without dairy) being the largest contributors at this eating occasion. Breakfast contributed the greatest proportion of vitamin D (32% $\pm$ 26), with fluid milk being the largest contributor at this eating occasion. Linear regression using generalized estimating equations revealed that age was inversely associated with vitamin D intake (β = -0.32; 95% CI: -0.6225, -0.0089; p = 0.0437). Calcium and vitamin D intake did not differ between sex. While a direct comparison to Dietary Reference Intakes cannot be made, the low median vitamin D intake observed in our sample (4.2 mcg/d; IQR = 3.6) relative to its RDA (15 mcg/d) may still raise concern, considering the many roles this nutrient plays in supporting child health. As fluid milk was the greatest dietary source of both nutrients, with non-dairy foods also contributing substantially to total daily nutrient intakes, public health priorities should further promote fluid milk consumption in children through family-based approaches and increase awareness around non-dairy food sources of both nutrients to increase Canadian children's overall consumption of calcium and vitamin D. (Funding for this project was provided by the Canadian Institutes of Health Research.)